Equipment

User’s Guide.
Prinect Color Management.

HEIDELBERG

Table of Contents

About This Documentation

This documentation gives you a brief introduction to general aspects of color management and an overview of how color management is used in the Prinect workflow. We have deliberately not gone into extremely in-depth, technical relations because the focus is to provide users with the information needed to correctly configure and apply the wide range of color management options of the Prinect workflow. You can find detailed information, for example, in the Online Help of the Cockpit (F1 key) or in specialist literature.

Note: The Prinect Integration Manager represents the Prinect workflow variant with the highest integration level. Because this documentation was written not only for the Prinect Integration Manager but also for the Prinect Prepress Manager, the Prinect Pressroom Manager, the Prinect Postpress Manager, the Prinect Digital Front End (Prinect DFE) and the Prinect Production Manager, the general term "Prinect Manager" will be used in this documentation. A specific variant will be mentioned explicitly only in special cases.

Structure of this Documentation

This documentation describes the range of functions of "Prinect Color Management".

You will find information about the following topics in the various chapters:

- "Introduction" page 7.

  This chapter gives you an overview of the basics of color management, for example, color spaces, ICC profiles, spot colors, etc.

- "Color Management in Prinect Manager" page 25.

  This chapter introduces you to the color management settings of the Prinect Manager, for offset printing and for digital printing.

- "Quality of Color Reproduction in Printing" page 85.

  In this chapter, you will find in-depth information that can help you to make sure you have high-quality reproduction of colors throughout the whole print process. The focus here lies on offset printing with CTP plate production.

What you should already know

We assume that you are familiar with the basic operating procedures in the Prinect Manager and that you know the basics of the prepress workflow.

Symbols and Styles

The following typographical conventions are used in this manual:

- References to other chapters and sections are blue (on the screen) and underlined.

  Example: See "Symbols and Styles", page 6.

Important Information

Important information in the text is marked by symbols at the side which are used as follows:

Warning: Contains information that must be taken into consideration to protect the user from injury.

Caution: Contains information that must be taken into consideration to prevent damage to hardware or software.

Note: Contains important general or supplementary information about a specific topic.

Prerequisite: Lists requirements which must be fulfilled before the steps which follow can be performed.

Introduction

In today's print shop business, the document masters to be printed are usually sent to the print shop as digital data, either on data media or through the Internet (online shop). These master data are often generated without giving any thought to the output process used at the print shop. Within the prepress framework of the Prinect Manager workflow, color management runs between colored data from various sources (digital cameras, media-independent data) and data for various output processes (display on the monitor, color proof, offset printing or digital printing). In this documentation, we will give you an overview of the basics of color management and describe how color management works in the Prinect Manager workflow. In the "Quality of Color Reproduction in Printing" chapter, we will illustrate which points must be remembered in order to ensure that the quality of the colors reproduced is consistent throughout the whole print process from creating the masters right up to printing itself. This chapter also describes factors like dot gain during CTP imaging and the transfer of screen dots from the plate to the printing material, based mainly on offset printing.

What Role Does Color Management Play in the Print Shop Workflow?

The aim of color management is to reproduce the colors of masters as accurately as possible on the target media. The target media is either printing material or, in cross media publishing, a screen (monitor, mobile device). By nature, this aim cannot be met 100% because no target media are capable of fully reproducing the color gamut perceived by the human eye. Instead, it is much more important to keep perceptible color shifts to a minimum despite the reduced color gamut. This simple goal is not always easy to achieve in practice because digital masters from a wide variety of sources and of various kinds (photos, graphic objects, colored fonts) must be matched to a specific output process.

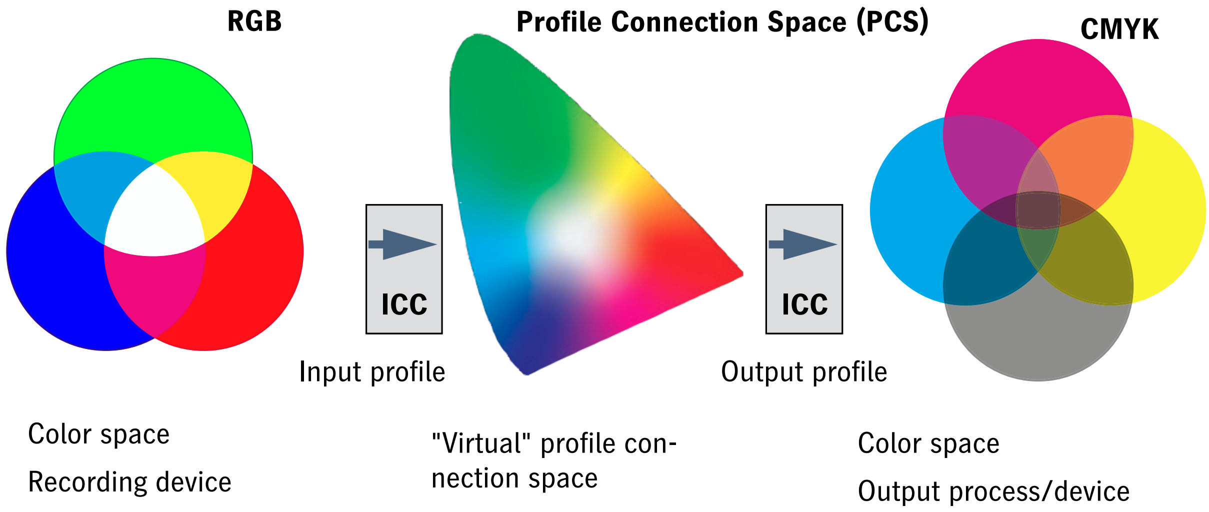
The whole output process must be "standardized" in order to achieve this goal. A key feature of this process of standardization is "color space transformation". The basic concept underlying this term is that different color spaces are converted to each other. You can find more details about color spaces in section "Color spaces". Refer to "Color spaces", page 13. In this context, a difference is made between the input color space, the profile connection space and the target color space.

Based on this approach to standardization, it becomes clear what color management does not do: match color reproduction to certain subjective color perceptions as is done in some automatic modes of modern digital cameras. For example, a slight shift of the primary colors to red is set in the "portrait mode" of some cameras to make skin tones appear more flattering, "warmer". The matching of color settings manually on a printer based on what the operator believes to see is also a process that cannot be standardized numerically. Such manipulations of color have nothing to do with color management but are rather contrary to the aims of standardized, true-to-life color reproduction. Color management is based on measurements and, consequently, on objective, reproducible data.

This does not mean that color images may not be matched by visual criteria. For example, color images captured in a "portrait mode" or similar can be found in master documents, with the special color settings of the camera used. In this case, the generator of the data wanted this camera setting that is then processed as the "original". Likewise, it is possible, for example, in Prinect Digital Front End, to customize the color reproduction of the digital press based on visual assessment. However, such modifications are outside the framework of color management and must be understood as being additional means of customized color matching although they contradict the idea of standardized color reproduction. The result then also does not represent a standardized color management process.

Color space transformations

Color management performs color space transformations from the color space of the image recording devices (digital camera, scanner), generally with an intermediary profile connection space, to the color space of the output process (offset printing, color proofer or digital printing).



It must be remembered that the color space of the recording device and the color space of the output process are device-dependent. In other words, these color spaces describe the color-specific properties of the recording device (digital camera, scanner, etc.) and of the print process used (press, CTP device, color proofer, monitor). To establish a standardized color management process that can handle different input devices and various output channels, a universal, device-independent profile connection space that links the input profile with the output profile is often interposed. The color spaces themselves cannot be influenced by color management because they are determined either by the physical properties of the devices concerned or, in the case of the profile connection space, defined as universal.

Color profiles

This is where the "color profiles" or "ICC profiles" now come in. Roughly, ICC profiles (named after the "International Color Consortium") map the colored objects during the transition from one color space to the other in such a way that the colors of the originals, e.g. original photo scenes, are reproduced as accurately as possible on the output media.

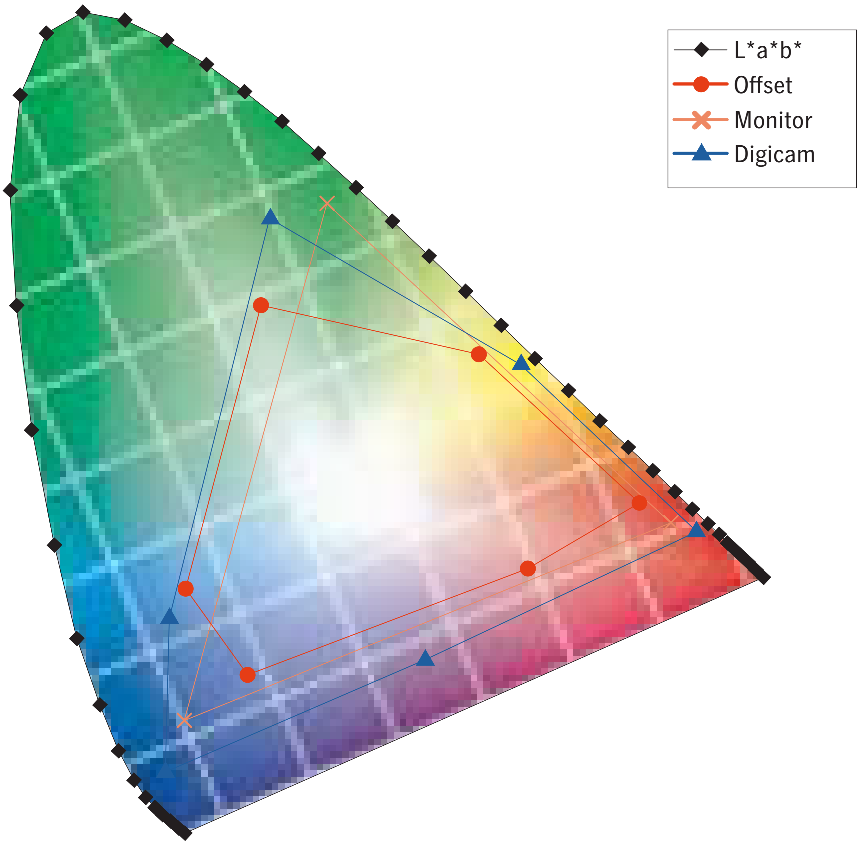
In principle, measurements could now be run on test images for each image source (digital camera) and for each printing material/color combination, with the results saved as "color profiles" in a table of source and target values and written to the color data for each print output. As you can easily imagine, this process would require an extremely large number of profiles and measurements if you had a larger number of input sources and output ways (different presses, printing materials, colors). A profile connection space was introduced for this reason, enabling different profiles that are independent of each other to be used for image source devices and output ways. As a result, only one ICC profile is needed for each input source and for each output process. The number of required output profiles can be reduced significantly if a standardized print process is also used. See "Standardized offset print process", page 12.

Color Gamut

The term "color gamut" refers to the set of all colors that a device (e.g. digital camera, monitor, mobile device, (proof) printer, press) can record or display or that can be reproduced on printing material. The description of the color spaces will also show that the different color spaces can have different color gamuts. The CIEL*a*b* color space contains all colors visible by humans. Therefore some colors of the CIEL*a*b* color space are not contained in RGB or in CMYK.

If a color image (RGB) has intensive colors, these colors may appear significantly less intense on the print medium than in the original that is viewed on a (RGB) color monitor. This is due to the "natural" differences of the color spaces: whereas the RGB color space of a monitor builds up the colors from self-luminous red, green and blue pixels, the colors of a printed image are generated by reflection, in other words, a light source that illuminates the printed image is needed. In this process, this light is partly absorbed by the surface of the printing material and only the portions of light that are not absorbed but reflected reach the eye of the observer. As a result, it is easy to see that a printed image has less color intensity, and consequently a smaller gamut, than a self-luminous monitor. Each monitor has its own color gamut because its color intensity depends on its properties and setting. The same applies to the printed paper: Strictly speaking, each single printout has its own individual color gamut, depending on the nature of the printing material (coated, uncoated, etc.) and on the pigmentation of the inks used. It is these individual differences that make these color spaces device-dependent.

Because the profile connection space is device-independent and was only introduced as a "virtual element" for the purposes of standardization, its color gamut should be large enough to cover the size of the color gamut of all device-dependent color spaces involved. Only then does this ensure that the process of color management itself does not restrict the color gamut on the output media, or if so only very slightly. In this context, the CIEL*a*b* color space has become the generally accepted profile connection space.



The graphic shows an example of the different color gamuts of various color spaces.

What happens during a color space transformation?

ICC profiles are used for color space transformations. These are used by a color management system to influence how colors are applied in the whole print workflow. All the Color Management functions that you use in the Prinect workflow are based, in addition to other options, on the selection and assignment of the suitable ICC profile. You will find more details about ICC profiles in the section "ICC profiles", page 21.

In the printing workflow, the color space of the input data (e.g. digital camera) must be transformed to the color space of the output process (offset printing, digital printing, media-neutral output). Here the image data must be converted from the 3 component RGB color space to the color space of the printing process, e. g. to the 4 component CMYK color space, with as small losses as possible. As can be seen in the graphic above, the CMYK offset color space has a smaller gamut than the RGB color space of digital cameras. This means that in color space transformation the gamut of the camera color space must be fitted to the size of the offset printing color space. This inevitably leads to a loss of possible ways of displaying different colors. These restrictions differ in the way they impact different hues, depending on whether or not the original color lies in a part of the RGB color space that cannot be reproduced in the CMYK color space. In the diagram above, for example, blues in the shadows would no longer be reproduced correctly in the CMYK color space because these color values are out of the displayable range.

Color management can fit the input color space to the color space of the output process in various ways:

- By clipping the input color space:

  All color values that are outside the color space of the output process are not reproduced but are replaced by colors that lie on a corresponding spot on the "edge" of the output process color space.

- By linear scaling of the input color space:

  The gamut of the input color space is converted so that all color values fit into the output process while reducing the gamut evenly at the same time. Color shifts usually occur as a result of this process.

- By special mapping options that are matched to the desired effect that the colors will have when rendered on the output media (non-linear scaling):

Different rendering intents (perceptual, etc.) can be used for mapping.

In the Prinect Manager you can set up these different mapping options using the "rendering intents". See "Rendering Intent", page 28.

Standardized offset print process

In a standardized offset print process, an output route going from the import of customer documents (PDF files) to screening and CTP output up to the press is calibrated in such a way as to always generate the optimal true-color print result without having to customize data for each print job, e.g. ink control of the press. In addition to color management in prepress, process calibration and linearization of the CTP device and press used are a prerequisite for such a standardization . To check the standardized print conditions and, consequently, to ensure consistent quality, inline camera monitoring (e.g. Prinect Image Control) can be used in the press in a standardized print process. This monitoring triggers automatic readjustment of the color settings of the press if necessary.

Process calibration and linearization are required to compensate dot gain of the digital dots when imaging to the plate (for example, caused by scattering of the laser beam) and during printing (for example, resulting from different absorptive capacities of the printing materials). You can find detailed information about this in the section "Screen value", page 86. The "Calibration Manager" or "Calibration Tool" software is available from Heidelberg for process calibration.

The main benefit of a standardized offset print process is that an automated workflow can be set up where no or only occasional manual intervention in the running print process is needed and where colors are still reproduced optimally despite this ("push to stop").

A standard profile, e.g. "ISOcoated_v2_eci.icc", is used as the output profile in a standardized process.

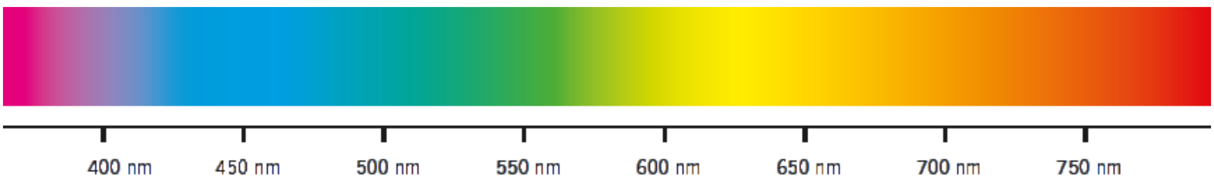
Color spaces

Color spaces are models that are used to depict on a graphic and numeric basis the different ways colors are perceived and reproduced. Numeric means that numeric values are assigned to single colors to make the colors uniquely identifiable and to be able to convert colors, e.g. in color management algorithms. In a color space, each color is given a "color value" that can consist of different components and units of measure, depending on the color space.

Only the color spaces relevant for the printing industry will be presented below. These are the CIEL*a*b* color space, the RGB color space, the CMYK color space and special multicolor color spaces (based on more than four colors). There are also other color spaces, but these are not (or no longer) usual in print or media reproduction.

Spectral color space

A special position is held by the spectral color space where each color is described solely on the basis of the wavelength of light (in nanometers nm). The spectral color space has the largest gamut because all colors from ultra violet (lower than 380 nm) to infrared (larger than 780 nm) may occur.



On principle, this color space is not a "classical color space" as the CIEL*a*b*, RGB or the CMYK color spaces, but it represents the basis of color measurements and color space definitions. For example the colors of the CIEL*a*b* color space are based on the spectral wavelengths of the visible light. In such a way, in the CIE standard colorimetric system, the light wavelengths are noted on the edge of the "sole". See also "CIE standard colorimetric system", page 14. Also the usual color measurement devices are using internally color spectrometers, which measure the light wavelengths of the test forms which are converted to values of the L*a*b* color space.

In the Prinect environment, special color management conversions are based on color values of the spectral color space. An example of this is the conversion of color reproduction usual in flexo printing (label printing) that is based on a combination of different spot colors to the CMYK + n color space that is used, for example, in inkjet label printing. CMYK + n means that one, two or three additional process colors will be added to the CMYK color space if required. Because these two types of color space have completely different structures, all relevant color values occurring in flexo printing are measured with a spectrophotometer and these values are filed to a table. During the conversion to the CMYK + n color space, the spectral color values are assigned to the color values of the CMYK + n target color space as special color profiles.

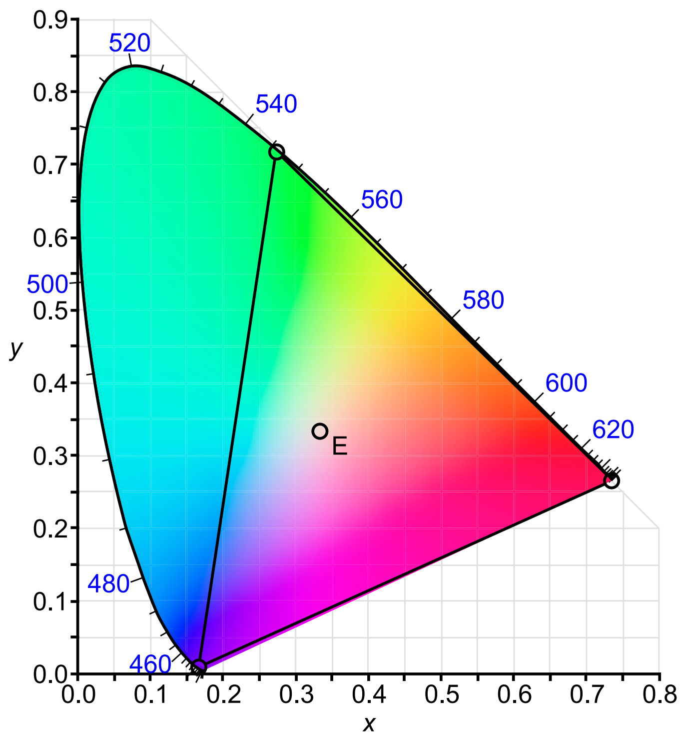
CIEL*a*b* color space

The abbreviation "CIE" stands for "Commission Internationale de l'Eclairage" (International Commission on Illumination). In contrast to the RGB or CMYK color spaces, the CIEL*a*b* color space is always device-independent. This means that a particular spot and its coordinates in the CIEL*a*b* color space are assigned to each distinguishable color, irrespective of a display device (monitor), recording device (digital camera, scanner) or printing device (printer, press). The color gamut of the CIEL*a*b* color space relates to the perception of colors by humans. For that reason, it is especially suited for use as the profile connection space in print color management. Historically, the CIEL*a*b* color space is derived from the CIE standard colorimetric system.

CIE standard colorimetric system

The CIE standard colorimetric system is based on the attempt to record all the colors that can be perceived by the human eye on a numeric basis and to display them in a coordinates system in a diagram. To this end, experiments were run in 1931 on several test persons, where a great number of perceivable or distinguishable colors were simulated by mixing a red, a green and a blue reference lamp with varying lightnesses. A numeric value between 0 (completely dark) and 1 (full lightness) is assigned to the reference colors red (x), green (y) and blue (z), according to the set lightness. This makes it possible to assign a unique reference point P (x, y, z) to each color in a three-dimensional x, y, z coordinates system.

The two-dimensional CIE chromaticity diagram was developed to be able to display this three-dimensional color space more clearly. In this process, the z component (blue) is determined arithmetically for each dot in the chromaticity diagram from the x and y components based on the relation $x + y + z = 1$. The horseshoe-shaped, two-dimensional CIE chromaticity diagram is the result of this.



Each color P (x, y) is uniquely defined in this diagram. The outer edge of the depicted color area represents the total of all possible colors, without taking the light/dark variants into account. The numerals shown in the diagram along the edge of the color area are the wavelengths of light (in nm) related to the colors. The white point E is of crucial importance for each color measurement. This is the point that represents all three colors, each present 1/3 (x = y = z). The position of the white point within the color area depends on the illumination situation. The delineated triangle specifies the colors that can be displayed by technical equipment (DeviceRGB).

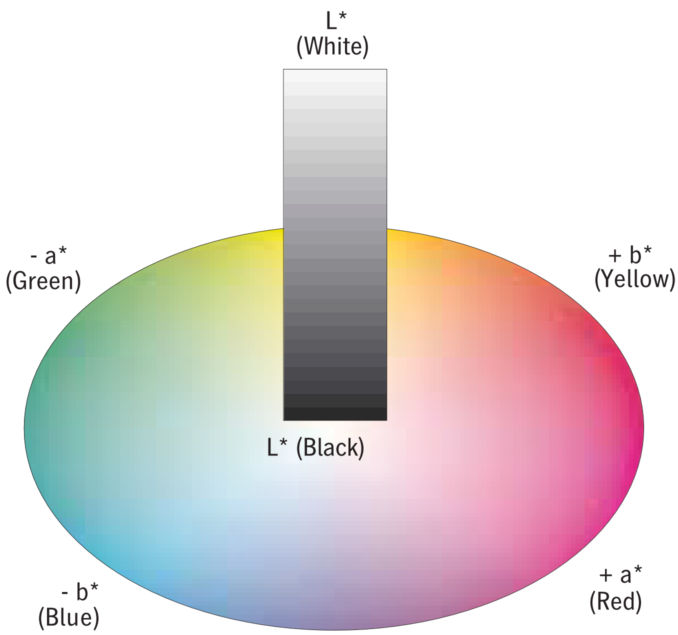
Lightness coefficient

Besides the hue values shown on the x-y plane, a third variable is needed to describe all the colors that can be perceived naturally: lightness coefficient or lightness parameter Y. The term Yxy color space derives from this. The lightness coefficient can vary between 0 and 1.

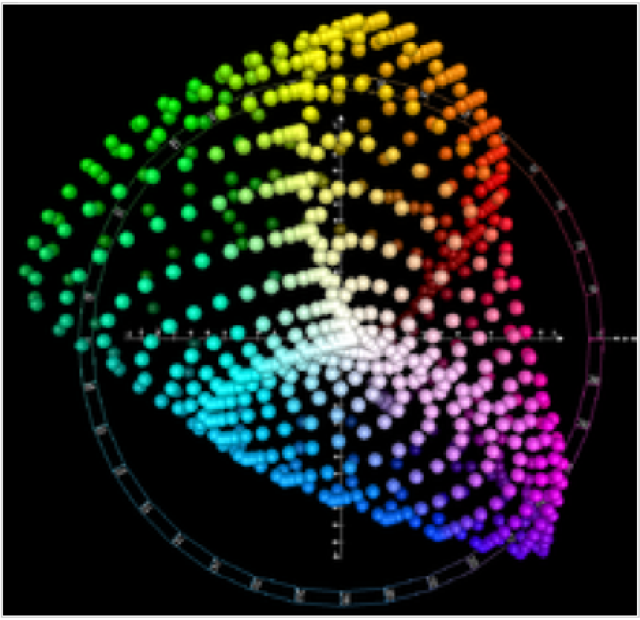
*Transition to the L*a*b* color space*

The L*a*b* color space is derived from the CIE standard colorimetric system. This color space proved to be necessary based on the fact that a reliable and informative calculation of the color distance requires that color distances perceived to be the same also have the same coordinates. This is not the case in the CIE standard colorimetric system. In this system, some colors that are perceived to be different have coordinates that lie very close to each other. Vice versa, there are colors that are perceived to be the same but have noticeably different coordinates. The L*a*b* color model solves this problem by rearranging the x and y coordinates mathematically so as to spread the color distances, enabling appropriate distances also to be assigned as coordinates to the perceivable differences in color (elliptic transformation). The variable L* (luminance) represents the lightness coefficient, while a* and b* correspond to the converted coordinates x (red) and y (green).

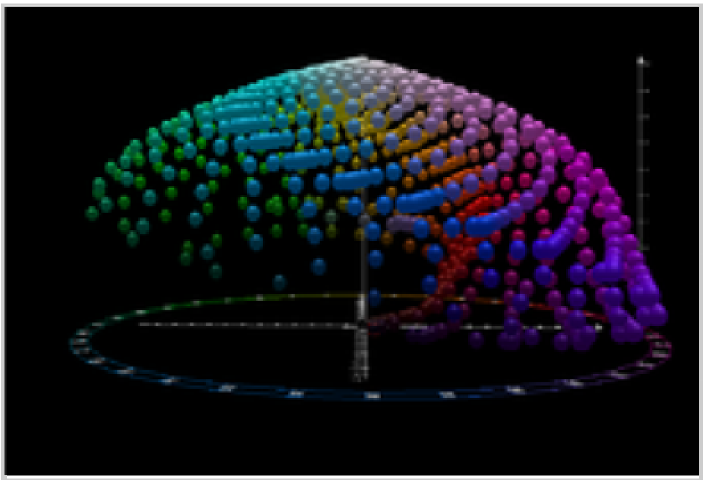
The coordinates system of the L*a*b* color space consists of the color plane that spans the a* and b* axes and the L* (luminance) axis. The values of the a* axis range from approx. -170 to +100, the values of the b* axis range from approx. -100 to +150, while the L* axis ranges from 0 to 100. A color can be portrayed in this way, e.g. by the components L* = 20, a* = 30, b* = 40, in brief L*a*b* 20 30 40.



The L* axis can also be viewed as a neutral gray axis because all achromatic colors (grays) are contained between the termini L* = 0 and L* = 100. The CIEL*a*b* color space is broadest in the middle lightness range. The extent to which the color space expands varies according to the chromatic area.



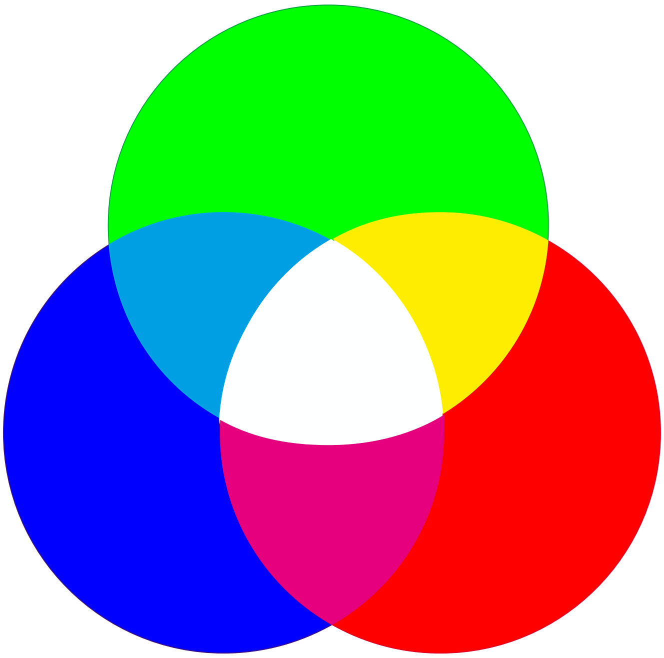
CIEL*a*b* color space viewed from above



CIEL*a*b* color space viewed face on

RGB color space

The RGB color space is composed of the three colors, red, green and blue. These are the primary colors with which the human eye also perceives all visible hues by mixing these colors. Digital cameras, scanners and monitors also register or emit colors as a mixture of these three primary colors. Color mixing is additive, that is the lightnesses of the primary colors add up to form the resulting color. The colors of a monitor are self-luminous (background illumination), with the colors arising from superposing red, green and blue pixels. White as a mixed color results when all primary colors are radiated with the same intensity. This is why we talk about a color model with additive color mixing. The other hues result by varying the intensities of each of the primary colors. Colors are registered in a digital camera in a similar way. In this case, the incoming light arrives at the light-sensitive sensor through red, green or blue color filters. In the majority of camera models, each sensor pixel has its own monochrome filter (red, green or blue) in front of it The camera software converts the recorded red, green and blue light components into RGB images.



RGB colors: Light mixture achieved through additive overlay

The diagram does not show a color space model but how the various colors arise through overlaying the primary colors. White results at those points where all three primary colors overlay with the same luminosity. To be able to calculate colors in the RGB color space, a value between 0 and 255 is assigned to each primary color, according to the lightness in question. These 256 color grades correspond to 8 bits (2^8 lightness levels). We then talk about 8-bit RGB colors. Accordingly, 16-bit RGB colors can be used to display 65536 (2^{16}) lightness levels per color (or color channel). Images in the 16-bit RGB color space consequently have more data (file size!). It only makes sense to record and edit photos in the 16-bit RGB color space if the camera sensors are sensitive enough to be able to register such fine differences in lightness or color graduations.

In general, there are several types of RGB color space. In the digital image processing environment and in the printing industry, commonly the eciRGB, sRGB, and Adobe-RGB color spaces are important. For the Prinect Workflow, the eciRGB color Space is recommended. Premium digital cameras let you set the type of RGB color space needed – mostly sRGB or Adobe-RGB. If this is not possible, the camera probably works in the sRGB color space. The sRGB color space, in 8-bit, has a smaller gamut than the Adobe-RGB color space but is still extremely compatible with many standard monitors, image processing applications and Office printer drivers. Because of their larger gamut, the eciRGB and Adobe-RGB color spaces are more suited to professional image processing.

Device-dependent RGB color space (DeviceRGB)

Normally, the device-dependent DeviceRGB color space is meant when the term "RGB color space" is used. The related DeviceRGB ICC profiles refer to RGB input or output devices (e.g. monitors).

Device-independent RGB color space (CalibratedRGB)

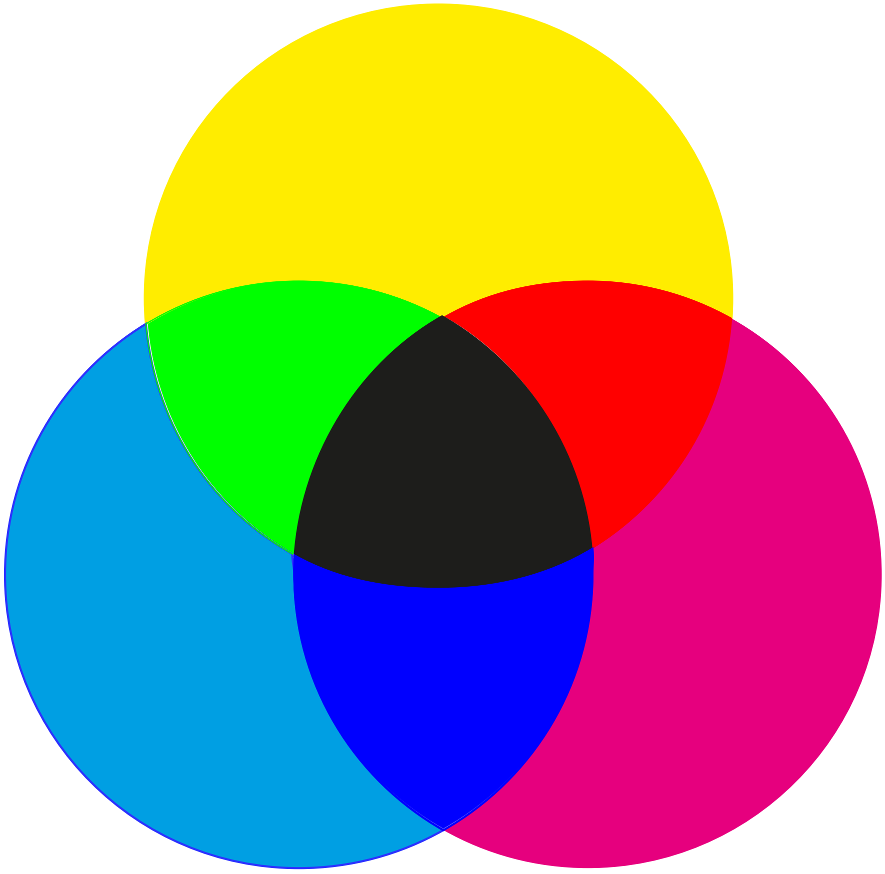
A device-independent color space is designated as "CalibratedRGB" or "CalRGB" color space. Colors described in CalRGB can be mapped directly to CIEL*a*b* colors. In reality the CIEL*a*b* color space also serves as the profile connection space.

CMYK color space

The CMYK color space is not defined through the additive mixing of self-luminous color channels but through the reflection of light on printed surfaces. Strictly speaking, the color pigments of inks are designed so that some wavelengths of light of the incident ambient light are absorbed while all non-absorbed wavelengths are reflected. These reflected wavelengths define the visible color.

The following consequences are the result of this behavior:

- Perception of the inks depends on the printing material. The reflective capacity of the surface of the printing material plays a role in color perception especially in the case of light and transparent colors. White is generated by omitting (subtracting) color. For that reason, we talk about a color model with subtractive color mixing.
- When inks are mixed or printed one on top of the other, the resulting color is darker, going right up to black if all the inks are printed one on top of the other.
- Perception of the colors also depends on the color, i.e. color temperature, of the ambient light because composition of the reflected light is determined by the composition of the incident light. For this reason, visual assessments of color prints should be made only beneath a standard illuminant that emits light with a color temperature of 5000 K.



CMY colors: Light mixture achieved through superposing reflecting colors

The graphic above shows how cyan, magenta and yellow superpose each other. Green results from superposing cyan and yellow, blue from superposing cyan and magenta and red from superposing magenta and yellow. The superposition of all three colors (theoretically) produces black. In practice, however, a dark brown is more likely to be the result. Black (K) is also used as an ink to be able to display black colors properly, without generating an area coverage of 300%. Blacks and grays are printed by means of this additional color, with greater sharpness and differentiation of the darker hues also achieved by enhancing the contrast. The CMYK color space is built on these four colors.

As already mentioned, the CMYK color space has a smaller gamut than the RGB color space (there are exceptions in the turquoise-blue area). This makes itself felt especially when particularly intense colors are to be reproduced in the print.

Multicolor color spaces (NChannel color spaces)

Color spaces with more than the four CMYK colors can be used for very challenging print jobs with particularly intense colors. Multicolor color spaces with six and seven primary colors have become established. These are not CMYK color spaces to which two or three spot colors were added but the six or seven colors are the primary colors of these color spaces. They create their own color space. In this way, a noticeably larger gamut is achieved than in a CMYK color space.

For offset printing, printing in a multicolor color space means that a separate printing unit is used for each color. This makes printing complex and expensive. The Gallus Labelfire and Heidelberg Primefire inkjet digital presses print by default using seven primary colors, achieving an excellent gamut in this process. This makes it possible to approximate spot colors much more accurately than in the CMYK color space.

Grayscale color spaces

Grayscale color spaces consist only of achromatic graduations of black. Documents that consist only of black text and/or black-and-white images or graphics are generally printed in the grayscale color space. Only one (black) printing unit is needed in offset printing, while some inkjet printers, for example, also use portions of chromatic colors or special gray inks for grayscale output.

When preparing grayscale data for output in a print shop workflow, you must remember that black or grayscale components that might be defined in the source data by the superposition of chromatic colors will be converted to pure black components (K separation).

ICC profiles are also needed for grayscales to make sure that the workflow is matched correctly to the print process used.

Device-dependent grayscale color space (DeviceGray)

Normally, the device-dependent DeviceGray color space is meant when the term "Grayscale color space" is used. The related DeviceGray ICC profiles refer to grayscale input or output devices.

Device-independent grayscale color space (CalibratedGray)

A CalibratedGray or CalGray color space can also be used as a device-independent profile connection space if achromatic grayscale documents or objects are to be printed in the print workflow. Device-dependent grayscale data are converted to the CalibratedGray color space with grayscale ICC profiles and then converted to the (grayscale) target color space with grayscale output profiles.

Spot colors

Spot colors can be handled in printing in two ways: either they are printed with their own spot color separations or they are simulated for the color space used. In the first case, they are not a problem for color management: spot color separations are not handled by color management but are output as defined. The matching ink is filled in the appropriate printing unit and printed.

The spot colors must be replaced by the available colors if a separate printing unit is not available for each spot color. Recipes for spot color replacement are used t o do this. In other words, each spot color is represented by an alternative color in the L*a*b*, RGB, or CMYK color space. Frequently, such recipes for replacement by CMYK are already contained in the supplied PDF files because applications like InDesign can automatically generate such replacement recipes and embed them in the created PDF documents. The Prinect PDF Toolbox lets you check such embedded spot color replacement recipes and modify them if necessary.

In the Prinect Cockpit, you can check and edit the settings for spot color replacement in the job settings (in an open job > "Colors"). This is where you can also specify custom spot color replacements (based on CMYK or L*a*b* color spaces). The Prinect Manager color tables also contain spot color replacements.

DeviceN

DeviceN is not a color space. DeviceN can be any combination of color separations, irrespective of whether they are process or spot colors. DeviceN permits any combinations of color channels during composite printing. Such combined color channels contain one of the following color systems:

- the PANTONE® Hexachrome™ six-channel color system
- CMYK and two spot colors or
- black and a spot color.

Only DeviceN makes it possible to display and print images with such color channel combinations as a composite PDF. DeviceN can be used for composite printing and for InRip separations.

The benefit of DeviceN is that you can use a greater number of color combinations with spot colors in composite printing. This is valid especially in the case that the output process physically supports separate color channels.

ICC profiles

ICC profiles play a key role in color management. They describe the color spaces of the input and output devices and allow an optimal conversion of input data to the respective printing process. ICC profiles are often already embedded in the PDF files because ICC profiles can be assigned when the documents are being created, e.g. in InDesign or Photoshop. These ICC profiles describe the color space of the present data and allow a correct transformation to the output color space. In the Prinect workflow, incorrect profiles can be ignored and replaced by better profiles.

DeviceLink profiles

DeviceLink profiles are special color profiles that are used in color management. DeviceLink profiles describe the color transformation that bypasses a profile connection space (CIEL*a*b* color space). If a DeviceLink profile is chosen as an entry profile in the Prinect Color Management, other settings – inclusive the chosen output profile – have no effect anymore.

Prepare Source Data for the Print Shop Workflow

Usually, the source data for printing come from different sources. Each customer has different views of what color management entails, and frequently ICC profiles are embedded into the PDF files that do not match the print process used while ICC profiles that may be needed are missing. Generally, it would be a good idea if customers discussed with their print shop which ICC profiles will be needed and which color output options desired. This is not always possible and consequently the source files must be checked in the print shop and, if found necessary, prepared for printing. One way to avoid or reduce issues with source files is to use the PDF/X format.

PDF/X

The PDF/X format has in the meantime asserted itself as the exchange format (X for "E**X**change") of digital data between customer and print shop. The purpose of different standardizations is to make sure that PDF/X files are suited for professional printing. This means that all elements needed for printing (images, fonts, ICC profiles, etc.) are found in the PDF/X files while elements that have nothing to do with printing and might cause errors (form fields with assigned functions, JavaScript actions, flash animations, etc.) must not be in the PDF/X files. Using PDF/X as the exchange format for digital printing data is fundamentally recommended.

The development of the PDF/X format has seen the following variants emerge to date:

- PDF/X-1a

  Only CMYK and spot colors are allowed in this format. RGB, L*a*b* and ICC-based colors are prohibited.

- PDF/X-3

  RGB, L*a*b* and ICC-based colors are also allowed in this format. Transparency elements and layers are prohibited.

- PDF/X-4

  Transparency elements and layers are also allowed in this format.

Note: The current Heidelberg Prinect Manager variants use the current Adobe PDF Print Engine for rendering the PDF data. This means that the PDF/X-4 format is fully supported. Multicolor color spaces are also supported.

Handling Preseparated Files

Preseparated files were used in former times, for example, to create traps in Quark XPress. Because nowadays generally composite files are delivered, the application of color management on preseparated files is no more supported by the Prinect workflow.

Handling Difficult Source Data

When digital printing data are not created within a print shop environment, it is unfortunately only seldom possible for the print shop to determine the original source of the color data. Ideally, all data should be supplied with the ICC profiles needed for printing. But this is probably something a printer can dream about for some time still. On the contrary, the number of color spaces used is increasingly all the time. Today, it is not unusual to find that one document has at the same time images in the RGB color space of the digital camera, graphics created in CMYK, spot colors with no indication as to whether they are to be printed as a spot color or broken down into the CMYK process colors and finally images with color profiles that do not match the image at all. All the data have only one thing in common: without fail they do not match the color space of the designated (offset or digital) print process. Whereas CMYK data that were already matched to an offset print run can be matched relatively well to the new print process, this is not possible with RGB and L*a*b* data. In almost all cases, the print result will differ noticeably from the color impression of the original.

For the print shop, the easiest thing without doubt would be to send the data back to the person who created them to have them prepared suitably for printing. But this is not possible mainly for two simple reasons: firstly, there is no time for such a step given today's tight deadlines and secondly the creator of the data will often not understand what the printer wants. On the creator's monitor, blue had a really great brilliance. This means that the printer then has no other option than to convert all the data first of all to a device-independent color space like L*a*b*. If the correct profiles are not available, then work goes by the "best guess" method. Different profiles are tried out and the one that looks the best is used for the color transformation. After that, the data are converted to the final print color space using the inhouse press profile. After that, the proof is then output. If the customer is not satisfied, revision work is necessary in prepress. All this makes the print job unnecessarily expensive, something that could have been avoided if better data had been supplied.

How can this scenario be avoided? Intensive and constructive cooperation between the print shop and customer is helpful. It is important that customers tell the printers the methods they used to create the digital data and whether color management was used in this process. Printers can then place their ICC profiles at the disposal of the customers who can use them to check the data and, if necessary, create their own proofs. Vice versa, customers can send the profiles used to create the data to the printers who can then use them to convert the data back to the original color space.

That is why color management always begins with the desired result and works its way up to data preparation. It works its way from the end to the beginning so to speak. A camera profile alone is of no use for viewing the data on the monitor. Just like a monitor profile alone is not enough. What do you want to see on the monitor when you view color retouching and design? Exactly what actually can be printed later on. And that in turn can be displayed only with the help of the press profile.

Check of Digital Documents Supplied by the Customer

The supplied data are not necessarily optimized for the available output processes or it is not clear from the start which process will be used for printing (offset and/or digital printing, with different presses possible depending on the case). For that reason, the supplied data must be checked in prepress and, if necessary, matched to the output process used.

A preflight tool (Prinect PDF Toolbox, Enfocus PitStop, Adobe Professional preflight function, etc.) is generally used to check incoming files. A particularly powerful tool for checking and correcting/editing PDF files is the Prinect PDF Toolbox that is available as an Acrobat plug-in. Among other things, the PDF Toolbox can also be used to check and, if necessary, correct properties of the PDF files affecting color management. For example, embedded spot colors can be converted to CMYK values, unsuitable ICC profiles removed or missing ICC profiles embedded, transparencies flattened, etc. The use of such a preflight tool requires individual processing and, for that reason, costs additional processing time that should be avoided in an automated workflow. In difficult cases, however, using a tool like the PDF Toolbox to correct incoming PDF documents is still recommended and/or necessary.

Note: The Color Management functions of the Prinect PDF Toolbox are also available in the Color Management settings of the Prinect Manager and can be used for the automated document processing.

The Prinect Manager is designed for highly automated operation, where manual intervention into the work process should and can be avoided as far as possible. For that reason, the supplied PDF files representing the content of the print job preferably should not be checked manually, or only in difficult cases, and corrected where necessary. In particular, this concerns checking the color properties of the contents (images, colored fonts and objects, separations, spot colors, ICC profiles, etc.). To avoid additional manual work, it should be clarified in advance, either by consulting the customer or through relevant information in the WEB shop, which output process will be used to process the job and which minimum requirements result for the document files.

An important criterion for this is the type and number of separations desired. The following questions can be asked in this respect:

- Are spot colors to be printed as separations in their own right or do they have to be converted to CMYK values?
- If spot colors are to be printed in the CMYK process: Does the PDF file contain recipes for CMYK replacement or do these recipes have to be defined in the print shop workflow?
- If multicolor printing (printing with five, six or seven colors) is planned: Are the appropriate separations defined correctly in the PDF files?

If it is not possible to make the ICC profiles to be used in the print process available to the customer, it can be advisable to create job files without embedded ICC profiles.

The print buyer should always embed the used profiles. Only this makes correct color management possible. The relevant profiles are then added (automatically) during processing in the Prinect workflow. If necessary, embedded, unsuitable output ICC profiles can be removed from the initial files in the Prinect workflow (Prinect Manager, PDF Toolbox) and replaced by suitable profiles.

Color Management in Prinect Manager

In the Prinect Manager, you can view information about colors and profiles and define settings for color management at the following points:

- In the job settings:
  - in "Colors"
  - in the "Documents" step

    This is where you can view preflight reports where color data about the documents are also listed.
  - in the "Digital Printing" step

    This is where you can set all the parameters that are relevant for digital printing. When the pages to be output arrive at this step, they have already run through the "Quality" sequence at the very least with the preflight process set up there. This process checks, for example, whether L*a*b* colors are defined in the documents and where CMYK colors with an ICC profile are defined. Using the preflight settings, you can check the documents for faulty or error-prone color settings. In this case, you can pause processing. Most of the errors can then be remedied, for example, with the Prinect PDF Toolbox.
- In the subsequent processing sequences:
  - Prepare

    This is where you can enable and set up the "Color Conversion" step. As a result, all documents that run through the Prepare sequence undergo Prinect Color Management.
  - PageProof, ImpositionProof, FormProof, Booklet Proof

    In each of these proof sequences, "Proof Color Management" can be enabled and set up in the "Rendering" step. Besides the color management settings in the Prepare sequence, these color management settings affect only proofing. This is necessary because proofing is to provide you with a true-color preview of the result of the print run but it uses a different print process (proof output device) and other printing materials. Proof Color Management counterbalances the color deviations resulting from this and provides for correct simulation of the print run process and the printing materials used in it.

- ImpositionOutput

  This type of sequence controls output to CTP devices. The color management in this sequence can be applied for a media-neutral workflow or for printing on a screening proofer.

Caution: If a Prepare sequence is used in the workflow, "Color Conversion" may be enabled only in the Prepare sequence or only in the ImpositionOutput sequence to avoid color management functions impacting the output twice! Exception: If a screening proofer is driven by an ImpositionOutput sequence, the profile for the offset printing process is set in the Color Conversion settings of the Prepare sequence, and the adjustments for the foils of the screening proofer are parameterized in the Color Conversion settings of the ImpositionOutput sequence.

- AssemblePDF, SendAssembledPDF

  These sequences lets you merge any number of pages, page lists or layouts to one new PDF document. If you enable and set up the "Color Conversion" option, these color management settings, in addition to those in the Prepare sequence, only affect the generated PDF documents. This "double" color management function can be useful if the generated PDF documents are to be used elsewhere, e.g. at the customers, as proof documents (soft proof on the screen or as a proof output). In this case, the color management settings have to match the sequence generating the PDF for the planned proof output, e. g. by using an RGB monitor profile. Additionally, a conversion to RGB can reduce the file size up to 25%.

- SendBookletPDF

  This sequence lets you merge pages to a booklet and send it automatically by e-mail to customers for proofing. If you enable and set up the "Color Conversion" option, these color management settings, in addition to those in the Prepare sequence, only affect the generated PDF booklets. This "double" color management function can be useful if the generated booklet PDF files are to be used elsewhere, e.g. at the customers, as proof documents (soft proof on the screen or as a proof output). In this case, the color management settings have to match the sequence generating the PDF for the planned proof output.

- PagePrint, ImposedPrint

  These types of sequence are designed for digital printing. These sequences are used as templates for new digital print jobs and are normally set up only very rudimentarily to start with. The color management settings are normally set up in the open print job in the "Digital Printing" step. This is where you can save completed setups as PagePrint templates for further print jobs.

To summarize, color management in the Prinect Manager works by the following rules:

- A basic difference is made between general color management and proof color management. The latter makes sure that the colors to be reproduced in the print run are simulated correctly on the proof media. Proof color management can also be applied to PDF documents that will be generated for proofing, e.g. at the customers. Generally, proof color management is enabled parallel to general color management.
- General color management can be enabled when preparing the PDF files (Prepare sequence) and also just before generating the screening data for CTP output (ImpositionOutput sequence). Fundamentally, general color management may be enabled only at one point in the workflow to avoid a double application of color management functions producing a distorted color reproduction.

Prepare Sequence > "Color Conversion" step

In this section, we will use the settings for general color management to show you how the Prinect Manager runs color conversion in detail. To illustrate this, this section contains excerpts from the Online Help of the Prinect Cockpit.

The settings for device-independent and device-dependent colors are set up in the "Color Management" and "Device Colors / DeviceLink" tabs.

"Color Management" tab

In this tab, you set how device-independent colors will be handled and matched to the target color spaces.

"Device independent Colors" group

In the characterization of a digital image recording device, for example, a digital camera, the device-specific properties are captured as a set of characterization curves. There are standardized templates and measuring processes for this that vary according to the device used. The characterization curves are evaluated and converted with a special software. The result is a device-dependent RGB ICC profile. When such an ICC profile is embedded to a document, it can be used as an "input ICC profile". Through this profile, the RGB data of the device are transformed into the CIEL*a*b* color space. These transformed image data are now "device-independent". The following types of objects defined in device-independent colors exist:

- ICCbased CMYK (this includes also multicolor objects)
- ICCbased RGB
- ICCbased Gray.

The "CIEL*a*b*", "CalibratedRGB" and "CalibratedGray" color spaces as well as the objects defined in these color spaces are device-independent as they are uniquely identified.

"Treat ICCBased CMYK as Device CMYK" option

If this option is activated, all profiles defined by the print buyer are removed. Now the documents are printed without color transformation. But another CMYK profile can be chosen as an input profile for the color space transformation under "Device Colors". This is useful if the print buyer has used improper profiles.

The embedded ICC profiles are used for conversion to the target color space. In other words, there is a "CMYK -> CMYK conversion".

"Treat ICCBased RGB and Calibrated RGB as Device RGB" option

All embedded RGB ICC profiles are removed from the document files if this option is checked. This means: the documents in the device-independent RGB color space are treated as device-dependent documents in the "DeviceRGB" color space with the appropriate settings.

Colors from the device-independent "CalRGB" color space are converted to the device-dependent "DeviceRGB" color space without color management. Afterwards, the colors are converted to the target color space using color management with the ICC profiles set in "RGB Image" or "RGB Graphic".

The embedded ICC profiles are used for conversion to the target color space or colors from the "CalRGB" color space are treated as "sRGB" in compliance with the PDF specification and/or colors are converted from "CalRGB" to the output color space if this option is not checked.

"Treat ICCBased Gray and Calibrated Gray as Device Gray" option

All embedded Gray ICC profiles are removed from the document files if this option is checked. This means: the documents in the device-independent CalGray color space are treated as device-dependent documents in the "DeviceGray" color space with the appropriate settings.

The color is used in the K separation. This setting may for example prevent a "chromatic" gray.

The embedded ICC profiles are used for conversion to the target color space or colors from the "CalGray" color space are converted to the target color space in compliance with the PDF specification if this option is not checked. Remember that the color then contains CMY.

Rendering Intent

In addition to selecting ICC profiles, you can set the rendering intent for the individual graphics/image types. Rendering intent determines how color matching is done: Because color spaces my cover different color areas, it may be useful to preserve the image presentation as good as possible and therefore take into purchase color-shifts. For proofing purposes it is recommended to reproduce the colors as correct as possible, although colors outside of the color space are not presented correctly.

Since losses always occur during a color space transformation, it can be helpful, for example, to retain the photographic perception of a master as true as possible to the original and to accept a limit on the number of color values.

The following parameters are available for rendering intent: "From Document", "Absolute Colorimetric", "Relative Colorimetric", "Saturation" and "Perceptual".

- From Document

  The Color Rendering Intents that were defined for images and graphics in the PDF documents are used.

Note: You should select "From Document" only if you are absolutely sure that the edited documents have a rendering intent setting that can correctly control the color space conversion desired. However, you should not use this setting if at all possible because this is very seldom the case.

- Saturation

  In the output, the colors are rendered in such a manner that the color saturation is retained or even emphasized. The type of color matching is manufacturer-specific, with the user being able to define some settings during profile generation. This option is suitable for business graphics where the color saturation is the most important attribute in color rendering.

- Perceptual:

  When you use the "Perceptual" parameter, you obtain an output, that essentially contains the perceptible impression of the original. This means that the precise, colorimetric rendering of the colors is modified in favor of the retention of the relative color relationships. In a smaller target color space, the color gamut is compressed accordingly. Vice versa, in a larger target color space and with suitable profiles, the color space may be expanded. With this color matching option, the hue in all the natural colors of the original is reproduced for the most part correctly but with restrictions in the contrast. The type of color matching is manufacturer-specific, with the user being able to set some of the aspects such as contrast and chroma change during profile generation. This option is especially suitable for photographs.

- Relative colorimetric:

  Colors are rendered taking solely the light source into account. The rendering intent of the print medium (e.g. the color of the unprinted paper) is not taken into account. For example, the illuminant of a monitor would be correctly rendered on the print medium. That is why the term "relative" is used. All colors that lie within the target color space are rendered identically. All colors that lie outside of the target color space are displayed on the margin of the target color space. That is why the term "colorimetric" is used.

  The advantage of this rendering intent is that different illuminants of different output media are taken into account. The disadvantage is that the color adaptations are not exactly retained when switching from one output medium to another. As a result, very dark or very colorful details in the originals can be lost when they are reproduced. The printing material is not simulated during an output process simulation. If production run paper is used during the simulation, the result is the same as if you used the "absolute colorimetric" rendering intent. This rendering intent is suitable mainly for vector graphics.

- Absolute colorimetric:

  Colors are rendered taking the light source and the medium illuminant (e.g. the color of the unprinted paper) into account. For example, the illuminant of a newsprint paper which is shifted towards yellow compared to the illuminant of illustration printing paper is rendered with a yellowish cast. That is why the term "absolute" is used. That is why "Absolute colorimetric" is the default setting for a proof output. All colors that lie outside of the output color space are displayed on the margin of the output color space.

  The advantage of this rendering intent is that the exact color values are retained when switching from one output medium to another. The disadvantage is that any colors that lie outside of the output color space cannot be distinguished. This rendering intent is especially suitable for logos or monochrome objects which must be reproduced exactly the same way on different output media. You can set a separate rendering intent for spot colors that is independent of the color space of the alternative display color. "Absolute colorimetric" is recommended. This makes sure that the spot colors are simulated as best as possible.

"BPC" option

Black point compensation (BPC) becomes active if you enable the "BPC" option.

In gamut mapping, all luminance shadows that are darker than black ink are mapped to black ink and, as a result, shadow definition is lost. You can enable black point compensation (BPC) for rendering intent "Relative Colorimetric" "Perceptual" and "Saturation" rendering intents. However, the effect of this option can only be seen for the rendering intent "Relative Colorimetric".

Black point compensation is similar to Photoshop's "Use Black Point Compensation" option.

Black point compensation enhances the reproduction area when the "Relative colorimetric" rendering intent is used for color space conversion to the L*a*b* color space or from the L*a*b* color space to the device color space. The L*a*b* color space has more lightness levels for dark image parts than the CMYK color space because the L*a*b* color space is larger than the CMYK device color space. In a color space conversion from the L*a*b* to the CMYK color space with "Relative Colorimetric" rendering intent, the color space is cut off or reproduced without definition in the shadows because they are located outside the displayable range. As a result, details in dark parts of the image are often lost, especially if ICC profiles for uncoated papers are used for color space conversion.

Black point compensation matches the black point during color space conversion, causing the definition in such dark image parts to be kept. This "elongates" the shadows causing color shifts to occur also in the lighter color values. For that reason, this method is not always suited to true-color proofing.

We recommend that you use "Perceptual" rendering intent with black point compensation and not "Relative Colorimetric" rendering intent. This rendering intent makes it possible for the various details in dark image parts to be reproduced, while keeping color shifts to a minimum. In principle, differences cannot be fully avoided because of the different sizes of the color spaces.

"Output" Group

In this group you define an ICC profile for transformation of the color space to the target color space of the printing process and set the related options.

"Press Profile" box

This is where you set a color profile for the output process or the printing press used. You can customize your printing process, e.g. to regionally specific printing processes (SWOP, EURO, etc.), by selecting a suitable profile.

You can assign the press profiles to different target color spaces depending on your output:

- Normally you use a "DeviceCMYK" profile for presses.
- You can also set multicolor profiles like PANTONE® Hexachrome™, Hifi Color, etc.
- You can use a "DeviceGray" profile for a black-and-white output.
- You can use a "DeviceRGB" profile for a monitor output (e.g. a page in the web). However, RGB color spaces in the job settings of the Prinect Manager ("Colors" section) cannot be displayed.

Click "Browse..." to open a dialog where you can select a suitable press profile.

Note: You will find an overview of all the ICC profiles available in the Prinect system in "Administration" > "Resources" > "ICC Profiles". You can also import new profiles, create new profile folders, delete profiles, etc. there. The ICC profiles are filed in "SysConfig\Resources\ICC Profiles". "SysConfig" is the shared configuration folder on the Prinect server.

"Use Press Profile from Job Settings, if Available" option

An output press profile that was assigned to the job in the job settings in the "Colors" or "Printing Process" section is used if this option is enabled.

In the job settings you can check in "Consistency Check" in the "Printing Process" group whether a press profile that you will assign to the job is suitable for this purpose.

- If there is a green dot in front of the selected press profile, you can process the job with the selected press profile.
- There is a conflict if there is a yellow triangle before the selected press profile. If this is the case, you should use a different press profile.

"Use PDF/X Output Intent, if available, as Press Profile" option

- The Prinect Manager behaves as follows if this option is enabled:

  When a PDF/X file with an embedded ICC profile as its Output Intent is processed, the embedded press profile is used for color space conversion. The press profile set in "Press Profile" is ignored.

  If there is no Output Intent, the ICC profile set in "Press Profile" will be used.

- The press profile set in "Press Profile" is used for color space conversion if this option is not checked.

  Any embedded PDF/X Output Intent will not be used for color space conversion during output.

If you wish to process jobs in the Prinect workflow using the PDF/X policies, you must always enable this option.

"Embed Applied Press Profile as PDF/X Output Intent" option

The used press profile is embedded in the PDF file as the PDF/X Output Intent if this option is checked. The embedded ICC profile specified as the Output Intent replaces the profile set in "Press Profile" and is used for output if the "Use Embedded PDF/X Output Intent, if Available, as Press Profile" option is also checked and there is a PDF/X Output Intent in the processed PDF/X file. In addition, this embedded profile will be embedded as the new Output Intent during export. This option can be good policy for data interchange.

In all other cases, the profile set in "Press Profile" is embedded in the PDF file as the PDF/X Output Intent.

The set press profile is not embedded in the PDF file as the PDF/X Output Intent if this option is not checked.

"Use PDF/X Output Intent, if Available, as CMYK Input Profile" option

If you enabled this option, a PDF/X file with a defined Output Intent and embedded ICC profile is always used as the input profile for CMYK images and CMYK graphics if you are going to process such a file. The ICC profiles set for this purpose in the "Device Colors/Device Link" tab will be ignored.

"Device Colors/DeviceLink" tab

In this tab, you set how device-dependent colors will be handled for conversion to the device-independent profile connection space.

"Device dependent Colors" group

In device-dependent color spaces, no ICC profiles are assigned to the colors of the images and graphics. In other words, these images and graphics are available exactly as they were, when they came from the image-producing device (digital camera, scanner) without any gamut mapping. The device-dependent color spaces are: DeviceCMYK, DeviceRGB and DeviceGray ICC profiles are assigned to these color spaces through color management. In this process, each object (images, graphics) is transformed to the device-independent CIEL*a*b* profile connection space. You can assign these profiles and set other options in "Device-dependent Colors".

"ICC/DeviceLink Profile" boxes

You can set an ICC profile for each of the object types RGB images/RGB graphics, CMYK images/CMYK graphics and grayscale images/grayscale graphics.

The following ICC profile types exist:

- Input profiles, for e.g. scanners and digital cameras
- Display profiles, for e.g. monitors
- Output profiles, for e.g. color printers, CTP devices
- Additional profile formats, e.g. DeviceLink profiles, color space conversion profiles, etc.

These ICC profiles determine how color management transforms each object to the device-independent L*a*b* color space (exception: DeviceLink profiles). From the viewpoint of the Prinect Manager, these profiles determine the input behavior of color management, even if the respective profiles were already generated for the output devices. The press profile matches the data to the output process.

A few standard ICC profiles were already installed with the Prinect software; these can be selected from the respective list boxes. If you have generated your own ICC profiles, e.g. with "Prinect Color Toolbox", you can transfer them to the Prinect server. The ICC profiles are saved in their subfolders in a folder below the path "PTConfig\SysConfig\Resources\ICC Profiles\Printer" (PTConfig is the shared configuration folder of the Prinect server).

This is where you can add custom ICC profiles and create appropriate folders if required. DeviceLink profiles describe color transformation bypassing the L*a*b* color space and overwrite the set output profile. Doing without the L*a*b* interim color space gives you controlled transformation especially of the K separation.

"RGB images" / "RGB graphics" option

If this option is checked, RGB images or RGB graphics are clearly identified as "DeviceRGB" when an ICC profile is specified. The RGB images/graphics in the documents are transformed to the L*a*b* profile connection space with the help of the set ICC profile.

There is no transformation to the profile connection space and the images/graphics remain in the DeviceRGB color space if this option is not enabled. There is a standard RGB-CMYK conversion to the CMYK target color space during output. It is very likely that this output does not produce a satisfactory quality!

The ECI-RGB profile of the default becomes active when this option is enabled. However, you can also select a different profile.

Click "Browse..." to open a dialog where you can select a suitable ICC profile.

"CMYK images" / "CMYK graphics" option

If this option is checked, CMYK images or CMYK graphics are clearly identified as "DeviceCMYK" when an ICC profile is specified. Checking this option produces a CMYK > CMYK conversion. A CMYK image or a CMYK graphic is converted to the L*a*b* profile connection space with the profile specified here and then to the CMYK target color space. You should leave this option unchecked if you don't want any CMYK -> CMYK conversion.

On the other hand, a document must be matched to the target color space if the document was generated with a different process standard to the output process, for example, if the document was separated for uncoated paper but is to be printed on coated paper. A profile for coated paper is already set by default. In this case, a CMYK -> CMYK conversion must be made and this option must be checked.

After you enable this option, you must select an ICC profile from the pool of DeviceCMYK ICC profiles available in the Prinect system. However, you can also select a suitable output profile to confine the maximum print density.

Click "Browse..." to open a dialog where you can select a suitable ICC profile.

"Multicolor images" / "Multicolor graphics" option

To convert the multicolor images or multicolor graphics in the PDF document, select an ICC profile that is defined for a certain DeviceN color combination, e.g. Hexachrome. See "DeviceN", page 21. In rare cases, a document can have several different multicolor color spaces. In such cases, you can only convert the images/graphics of one of these color spaces. The profile you select determines which type of multicolor images or graphics will be converted.

Click "Browse..." to open a dialog where you can select a suitable ICC profile.

Note: Inverse gamut mapping was not optimized for multicolor profiles ("perceptual" rendering intent for Multicolor -> CIEL*a*b*) because the ICC profile files would become very big due to the large number of color channels in multicolor color spaces. For that reason, we do not recommend setting a Multicolor -> CMYK conversion with "perceptual" rendering intent. This doesn't affect proofs because "absolute colorimetric" or "relative colorimetric" rendering intents are used for them. Multicolor profiles are optimized especially for proofing.

"Grayscale images" option

Normally, Color Management should not be applied to grayscale images and grayscale graphics when they are output (option is deselected). In certain cases, it may make sense to use ICC profiles for the output of grayscale images, for example, if you are going to output grayscale images with CMYK offset that are otherwise prepared for a newspaper process. Generally, such grayscale images have very little contrast when output without any matching. In this case, you can enable the "Grayscale Images" option and select a CMYK output profile matching the offset process as the profile (e.g. Offset Euro or Offset SWOP). As a result, a chromatic gray showing slight color is produced.

The use of special grayscale profiles ("Gray") instead of the CMYK profiles is a better alternative in this case. In this case, contrast is also improved without any color shifts. Some grayscale profiles are included in the Prinect software shipment.

Click "Browse..." to open a dialog where you can select a suitable ICC profile.

"Grayscale graphics" option

What was described for "Grayscale images" applies basically to grayscale graphics as well.

Rendering Intent

Note: The "Rendering Intent" and the "BPC" parameters as well as the "Preserve Black" and "Preserve Secondaries" options are dimmed if you select a "DeviceLink" profile in the "ICC/DeviceLink Profile" box because these parameters are already contained in the DeviceLink profile. See "ICC/DeviceLink Profile" boxes, page 32.

The information about rendering intent and black point compensation as described in the "Color Management" tab is applicable for other profiles. See Rendering Intent, page 28 and "BPC" option, page 30.

"Grayscale Images: Apply CMYK Profile" option

You can enable this option only if "CMYK images" is enabled and if "Grayscale images" is not enabled.

If this option is enabled, images in the device-dependent "DeviceGray" color space are transformed to the target color space with the ICC profile that is set for "CMYK images".

Checking this option produces a chromatic gray if the "Preserve in CMYK Images: K" option is not checked at the same time.

The original gray values are used without any conversion if this option is not checked.

"Grayscale Graphics: Apply CMYK Profile" option

What was described for "Grayscale Images: Apply CMYK Profile" applies accordingly to grayscale graphics as well.

"Preserve in CMYK Images/Graphics:" parameter

This parameter lets you keep black and, if necessary, also the chromatic colors in CMYK images or CMYK graphics:

- You keep black by checking the box next to "K" (separately for images and graphics).
- The chromatic colors are kept if you also check the box next to "CMY".

Note: We recommend that the "Preserve Black in CMYK Images/Graphics" option is always enabled, even if the jobs take slightly longer to calculate.

Preserve Black (K) in CMYK Images/Graphics

Jobs are often created deliberately with a "long" or "short" black, for example, with a short black to improve the impression of smooth screening in skin tones or with a long black to stabilize gray balance when reproducing black or metallic-colored technical equipment. If a job involves a process conversion (Color Management from CMYK to the CMYK of the planned output device), the length of the black channel in the output normally depends only on the makeup of the press profile. However, Heidelberg Color Management is able to modify black in the press profile during process conversion in such a way that it is similar to black in the input profile. This only works if the original black in the press profile is longer than black in the input profile.

This option affects the black portions in CMYK graphics and images. If the option is activated, black generation is retained as far as possible so that it matches that in the job. Color Management makes adaptations only when they are required to retain the visual impression of the black tone.

"Special", "Basic" and "K=K" options:

- Special (default)

  This is a special setting that works as follows:

  - C, M, Y are converted to the target CMY color space for mid-range and light hues. K is converted by means of a gradation curve.
  - A special four-dimensional model keeping K is used for dark hues.

Extensive test series have shown this process to be the best. The "Special" parameter eliminates most of the problems in complex documents. This parameter is available only in Heidelberg's color management. This setting is suitable for documents with text, color and gray images.

- Basic

  C, M and Y are converted to the target CMY color space, K is converted to the target density with the help of a gradation curve. The gradation curve solves any problems you may have with differing black ink densities. This setting is suitable for documents with grayscale images.

- K=K

  Only C, M and Y are converted to the target CMY color space, K is not converted. Black remains identical. This setting is ideal for documents with a large amount of text and line art.

Note: The "K=K" setting can cause problems during an output if the black inks have different densities in the original and target color spaces.

Preservation of primary and secondary colors (Preserve CMY in CMYK Images/Graphics enabled)

This option keeps solid tint single-color or two-color image parts. You enable this option by checking the box next to "CMY" (separately for images and graphics).

Note: You can enable the preservation of primary and secondary colors regardless of the preservation of black.

Primary colors and secondary colors are preserved for CMYK images and graphics when you enable this option.

Normally, if color management is used, C=100, M=0, Y=0, K=0 becomes, for example, C=96, M=12, Y=8, K=2. In other words, "dirtying elements" creep in. These elements are fully correct if you have a true-color display. However, this behavior may not be wanted in technical diagrams because color margins occur at the mainly clearly defined edges, for example, due to register errors or if the maximum color of the original printing process is to be retained for this color area.

Secondary colors are colors that result from mixing two primary colors (100% in each case). C, M, Y and K are the primary colors in the CMYK color model. Secondary colors are "red" (C=0, M=100, Y=100), "green" (C=100, M=0, Y=100) and "blue" (C=100, M=100, Y=0). These colors are not "real" RGB colors but result from superposing the respective pairs of CMY colors. See "CMYK color space", page 18.

When secondary colors are preserved, blue (C=100, M=100, Y=0, K=0), for example, doesn't change. The influence of color management causes C=100, M=100, Y=0, K=0 to become C=97, M=94, Y=3, for example. The selection of "+secondaries" makes sure that this blue stays C=100, M=100, Y=0, K=0. The preservation of secondary colors is always in addition to the preservation of primary colors. This is highlighted by the plus sign.

Breaks can occur at edges if objects where primary and secondary colors are kept and objects affected "normally" by color management are printed side by side. To avoid this, you can select the **"Primaries, smooth"** or **"+ Secondaries, smooth"** options. Then the objects affected by the preservation of primary/secondary colors are smoothened at the edges so that there are no breaks.

Caution: You should enable the preservation of primary / secondary colors only if, for technical reasons, the colors really have to be kept and not be influenced by color management. You should never enable these options by default as otherwise you can have results that you may not want in your printing.

"Color Management for Overprinting Device CMYK Graphics" option

The overprint property of some CMYK channels can be lost as a result of enabling color management. When this option is checked, color management is enabled for overprinting device CMYK graphics. This option should be disabled if it is more important to keep the overprint property than use color management.

"Color Management for Subsets of Device CMYK" option

If this option is checked, a CMYK input profile is used also on subsets of device CMYK images or smooth shadings Example: Multi-channel color combinations (DeviceN) with cyan and magenta.

"Color Management for Device CMYK with Active Color Blending" option

In rare cases, visible color deviations result when Color Management is applied to objects in Device CMYK with active color blending.

You can disable this option to avoid color deviations in such cases. Color Management is then not applied to such objects.

"Color Management for CMYK Spot Colors Mapped to CMYK" option

This option lets you control whether and how Color Management will be applied to spot colors that are present in their CMYK equivalents. The following options are given:

- The option is disabled: Color Management is not applied to spot colors converted to CMYK.
- The option is enabled and "All Colors" is set in the list box: Color Management is applied to all spot colors converted to CMYK.
- The option is enabled and "Colors from PDF" is set in the list box: Color Management is applied only to spot colors converted to CYMK whose ink recipes for CMYK replacement are defined in the PDF and not in the job settings.

Color Management for Digital Printing

Because the color management settings for digital printing are different to the general color management settings, they will now be explained separately in this section with excerpts taken from the Online Help of the Cockpit. Reference will be made to settings that are identical or comparable.

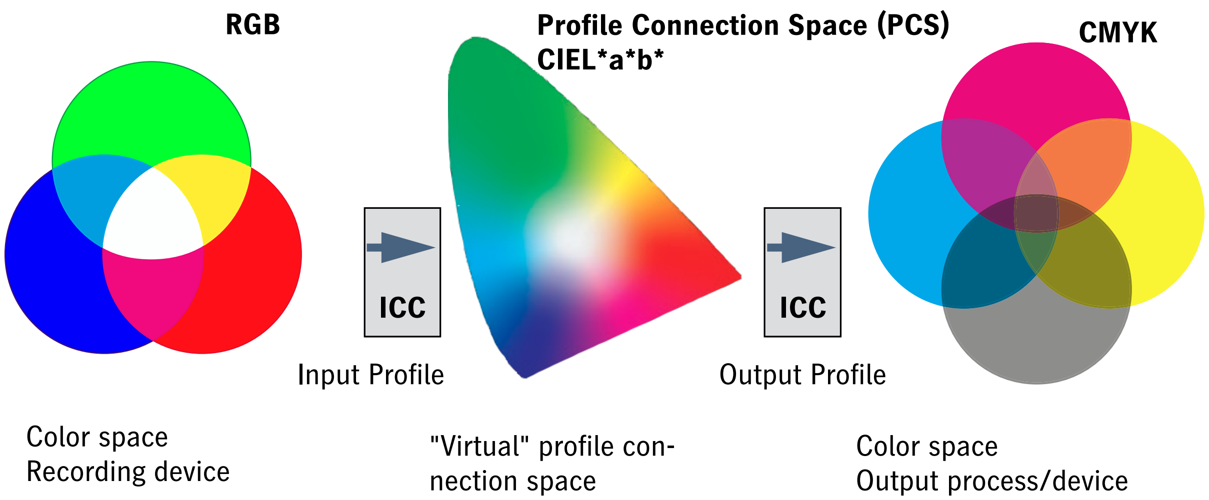
You set up color management for digital printing in the "Color settings" tab. Because these settings vary according to the type of digital press used, the parameters will be described separately:

- "Color settings" tab for toner-based digital presses (Heidelberg Versafire CP, CV), page 39
- "Color settings" tab for Primefire 106 presses, page 53
- "Color settings" tab for Labelfire 340 presses, page 63
- "Color settings" tab for CTP devices driven as a "Digital Platesetter", page 73

General information about color management:

The goal of Color Management is to standardize the color reproduction of digital image data throughout the entire editing process. Color space conversion was introduced to achieve a standardized color representation. Color space conversion basically matches the image or graphic data from the creator color space (e.g. color space of a digital camera) to the color space of the output device or process (e.g. color space of a press or color printer).

The diagram below shows the basic principle of a color space conversion:



It must be remembered that the color space of the recording device and the color space of the output process are device-dependent. In other words, these color spaces describe the color-specific properties of the recording device (digital camera, scanner, etc.) and of the print process used (press, CTP device, color proofer, monitor). To establish a standardized color management process that can handle different input devices and various output channels, a universal, device-independent profile connection space that links the input profile with the output profile is often interposed. The color spaces themselves cannot be influenced by color management because they are determined either by the physical properties of the devices concerned or, in the case of the profile connection space, defined as universal.

- First of all, the data are in the color space of the input device (scanner, digital camera, etc.) (device-dependent color space).

- The data are converted to the device-independent profile connection space (CIEL*a*b* color space) when the input ICC profile is enabled. The input ICC profile is selected and configured in the "Enable CMYK Color Management" option or in the case of RGB objects is taken from the PDF documents. See "Enable CMYK Color Management" option, page 40.
- For the output, an output ICC profile suitable for the printing press or the output process is activated. This profile adjusts the image data to the color space of the output device. As a result of this, the image data are again device-specific. The output profile is selected in the "Output Profile" area. See "Output Profile" area, page 50.

The ICC profiles can be present in different ways for the color space conversion:

- Embedded ICC profiles: The ICC profiles are contained in the document file and are used during the respective transformation steps.
- ICC profiles that are not embedded: The ICC profiles must be available as separate files on the Prinect server and/or in "Administration > Resources > ICC Profiles". See also "ICC profiles", page 21. They are selected in the Color Management settings and then used for conversion.

Machine setup using output conditions

The basic settings for color handling and finishing are filed in "Output Conditions" for the Primefire 106 and Labelfire 340 inkjet digital presses Output conditions are files containing the appropriate output parameters. Output conditions are created and saved using the Prinect Color Center. To be able to use the output conditions, the related files must be filed on the Prinect server and must be accessible from the Cockpit.

Because the output conditions also contain the finishing parameters, there is no "Print and finishing settings" tab for these machines.

More details about creating output conditions can be found in the Online Help of the Prinect Color Center.

"Color settings" tab for toner-based digital presses (Heidelberg Versafire CP, CV)

The setup parameters for the color settings are divided up into various groups that you can open by clicking the small triangles.

"Trapping" group

"Enable Trapping" option

This is where you can enable trapping for output. This trapping function creates simple trap lines with fixed parameters. For more complex trapping, you can use the "Trapping" option in a Prepare sequence if you have a license for it. In this case, you should disable "Enable Trapping" in this group.

"Source Profiles" group

This is where you set up your input profiles for color management.

Color management settings for CMYK colors.

This is where you define the source profiles solely for documents that contain CMYK colors.

"Enable CMYK Color Management" option

Use this option to specify that a CMYK input profile will be used for color conversion.

Note: Except for the selection of the input profile, the parameters for CMYK color management are also applicable for grayscales.

If this option is not selected, the documents are not processed with color management. This option is necessary, for example, if the digital print outputs are to be used for color calibration (e.g. with the Prinect Color Toolbox). In this case, the output documents may not be processed with color management. Neither a CMYK input profile nor an output profile will be used.

Note: Color management for documents with RGB and grayscale colors remains enabled even if "Enable CMYK Color Management" is disabled.

"Use Embedded Profiles" option

If documents containing colored objects or images are to be output, these objects are automatically converted so that they can be output in the CMYK or grayscale color space. The input profiles required for the input color space -> profile connection space transformation are usually included in the PDF documents and are used by color management. If the PDF documents do not have an input profile, you can use the standard input profile set by default or select a different one using the Browse button.

You use the "Use Embedded Profiles" option to define which CMYK input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the PDF documents, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the CMYK ICC profile selected in **"If no profile is known"** will be used for color management.
- If this option is not enabled, the CMYK ICC profile selected in **"If no profile is known"** will always be used for color management.

You can create input ICC profiles – unless appropriate device profiles are already available – for example with the "Prinect Color Toolbox" and place them on the Prinect Server. The ICC profiles are saved in their subfolders in a folder below the path "PTConfig\SysConfig\Resources\ICC Profiles" (PTConfig is the shared configuration folder of the Prinect Server). This is where you can add custom ICC profiles and create appropriate folders if required.

Note: In "Administration" > "Resources" > "ICC Profiles" you can see an overview of all ICC profiles available in the Prinect workflow. See also "ICC profiles", page 21. You can also import new profiles, create a new profile folder, delete profiles, etc.

Separate input profile settings for image and text elements or graphic elements

By default, the "Input Profiles", "Rendering Intent" and "BPC" (black point compensation) parameters are available for CMYK and RGB colors for image, text and graphic objects. This means that the set parameters (input profile, rendering intent, black point compensation) are valid for image, text and graphic objects.

Click the plus sign beside the "Images" icon to display the same parameters for image elements and for text/graphic objects separately. In this way, you can set up the input performance of color management separately for image/text objects and for graphic objects.

The settings that currently can be seen always affect color management.

- Collapsed (plus sign displays): joint settings for image, text and graphic objects.
- Expanded (minus sign displays): separate settings for image objects and text/graphic objects.

Rendering Intent (RI)

In addition to selecting ICC profiles, you can set the rendering intent for the colored objects. Rendering intent determines how color matching is done. Since losses always occur during a color space transformation, it can be helpful, for example, to retain the photographic perception of an original and to accept a limit on the number of color values. The following parameters are available for rendering intent: "Perceptual", "Saturation", "Relative Colorimetric" and "Absolute Colorimetric":

- Perceptual

  When you use the "Perceptual" parameter, you obtain an output, that essentially contains the perceptible impression of the original. This means that the precise, colorimetric rendering of the colors is modified in favor of the retention of the relative color relationships. In a smaller target color space, the color gamut is compressed accordingly. Vice versa, in a larger target color space and with suitable profiles, the color space may be expanded. With this color matching option, the hue in all the natural colors of the original is reproduced for the most part correctly but with restrictions in the contrast. The type of color matching is manufacturer-specific, with the user being able to set some of the aspects such as contrast and chroma change during profile generation. This option is especially suitable for photographs.

- Saturation

  In the output, the colors are rendered in such a manner that the color saturation is retained or even emphasized. The type of color matching is manufacturer-specific, with the user being able to define some settings during profile generation. This option is suitable for business graphics where the color saturation is the most important attribute in color rendering.

- Relative colorimetric

  Colors are rendered taking solely the light source into account. The rendering intent of the print medium (e.g. the color of the unprinted paper) is not taken into account. For example, the illuminant of a monitor would be correctly rendered on the print medium. That is why the term "relative" is used. All colors that lie within the output color space are rendered identically. All colors that lie outside of the output color space are displayed on the margin of the output color space. That is why the term "colorimetric" is used.

The advantage of this rendering intent is that different illuminants of different output media are taken into account. The disadvantage is that the color adaptations are not exactly retained when switching from one output medium to another. As a result, very dark or very colorful details in the originals can be lost when they are reproduced. The substrate is not simulated during an output process simulation. If production run paper is used during the simulation, the result is the same as if you used the "absolute colorimetric" rendering intent. This rendering intent is suitable mainly for vector graphics.

- Absolute colorimetric

  Colors are rendered taking the light source and the medium illuminant (e.g. the color of the unprinted paper). For example, the illuminant of a newsprint paper which is shifted from illustration printing paper towards yellow compared to the illuminant of paper is rendered with a yellowish cast. That is why the term "absolute" is used. That is why "Absolute colorimetric" is the default setting for a proof output. All colors that lie outside of the output color space are displayed on the margin of the output color space.

  The advantage of this rendering intent is that the exact color values are retained when switching from one output medium to another. The disadvantage is that any colors that lie outside of the output color space cannot be distinguished. This rendering intent is especially suitable for logos or monochrome objects which must be reproduced exactly the same way on different output media. You can set a separate rendering intent for spot colors that is independent of the color space of the alternative display color. "Absolute colorimetric" is recommended. This makes sure that the spot colors are simulated as best as possible.

- From Document

  The Color Rendering Intents that were defined for images and graphics in the PDF documents are used.

Note: You should select "From Document" only if you are absolutely sure that the edited documents have a rendering intent setting that can correctly control the color space conversion desired. However, you should not use this setting if at all possible because this is very seldom the case.

"BPC" (black point compensation) option

Black point compensation (BPC) becomes active if you enable the "BPC" option. You can enable black point compensation (BPC) for "Relative Colorimetric" "Perceptual" and "Saturation" rendering intents. However, the effect of this option can only be seen for the rendering intent "Relative Colorimetric".

In gamut mapping, all L shadows (in the L*a*b* color space) that are darker than black toner/ink are matched to black toner/ink and, as a result, shadow definition is lost.

Black point compensation enhances the reproduction area when the "Relative colorimetric" rendering intent is used for color space conversion to the L*a*b* color space or from the L*a*b* color space to the device color space. The L*a*b* color space has more lightness levels for dark image parts than the CMYK color space because the L*a*b* color space is larger than the CMYK device color space. In a color space conversion from the L*a*b* to the CMYK color space with "Relative Colorimetric" rendering intent, the color space is cut off or reproduced without definition in the shadows because they are located outside the displayable range. As a result, details in dark parts of the image are often lost, especially if ICC profiles for uncoated papers are used for color space conversion.

Black point compensation matches the black point during color space conversion, causing the definition in such dark image parts to be kept. This "elongates" the shadows causing color shifts to occur also in the lighter color values. For that reason, this method is not always suited to true-color proofing.

We recommend that you use "Perceptual" rendering intent with black point compensation and not "Relative Colorimetric" rendering intent. This rendering intent makes it possible for the various details in dark image parts to be reproduced, while keeping color shifts to a minimum. In principle, differences cannot be fully avoided because of the different sizes of the color spaces.

"Keep CMYK Colors" parameter

When this option is enabled, CMY in solid tint single-color or two-color image parts is kept.

Normally, if color management is used, C=100, M=0, Y=0, K=0 becomes, for example, C=96, M=12, Y=8, K=2. In other words, "dirtying elements" creep in. These elements are fully correct if you have a true-color display. However, this behavior may not be wanted in technical diagrams because color margins occur at the mainly clearly defined edges, for example, due to register errors or if the maximum color of the original printing process is to be retained for this color area.

"Primaries (solid)" selected

Cyan, magenta, yellow and black (K) are the primary colors in the CMYK color model. When this is selected, the primaries are kept in their original color percentages, meaning that they are not changed by color management.

"+ Secondaries (solid)" selected

Secondary colors are colors that result from mixing two primary colors (100% in each case). Secondary colors are "red" (C=0, M=100, Y=100), "green" (C=100, M=0, Y=100) and "blue" (C=100, M=100, Y=0) in the CMYK color model.

When secondary colors are preserved, blue (C=100, M=100, Y=0, K=0), for example, doesn't change. Color management impacts C=100, M=100, Y=0, K=0 to become C=97, M=94, Y=3, for example. The selection of **"+ Secondaries (solid)"** makes sure that this blue stays C=100, M=100, Y=0, K=0. The preservation of secondary colors is always in addition to the preservation of primary colors. This is highlighted by the prefixed plus sign.

By clicking the plus sign in front of the list box, you can set up that CMYK colors will be kept separately for images and graphics.

Caution: You should enable the preservation of primary / secondary colors only if, for technical reasons, the colors really have to be kept and not be influenced by color management. You should never enable these options by default as otherwise you can have results that you may not want in your printing.

Note: Objects or documents in the "Gray" color space are not handled by color management if "Preserve colors" is enabled.

Color management settings for RGB colors.

"Use Embedded Profiles" option

This option lets you define which RGB input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the PDF documents, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the RGB ICC profile selected will be used for color management.
- If this option is not enabled, the RGB ICC profile selected will always be used for color management.

Apart from that, the explanatory notes made for CMYK colors are applicable. See "Use Embedded Profiles" option, page 40.

"Keep Black" group

Note: If PDF documents with grayscale content are output, normally black in the CMYK input profile is used for grayscale color management. Exception: If you enable "Always Keep Black on B/W Pages" and/or "Keep Black in Images" or "Keep Black for Text / Graphics", the settings of the input profile are not used for color management.

"Always Keep Black on B/W Pages" option

If this option is enabled and you are working on black-and-white pages or grayscale pages, black is converted to the K separation of the CMYK output while CMY is set to zero.

"Keep Black in Images" option

If this option is enabled, only C, M and Y are converted to the target CMY color space in images, K is not converted. Black remains identical.

Note: This setting can cause issues during an output if the black inks have different densities in the original and target color spaces.

"Match Lightness" option

This is a special setting that works as follows:

- C, M, Y are converted to the target CMY color space for mid-range and light hues. K is converted by means of a gradation curve.
- A special four-dimensional model keeping K is used for dark hues.

Extensive test series have shown this process to be the best. This setting eliminates most of the problems in complex documents. This function is available only in Heidelberg's color management. This setting is suitable for documents with text, color and gray images.

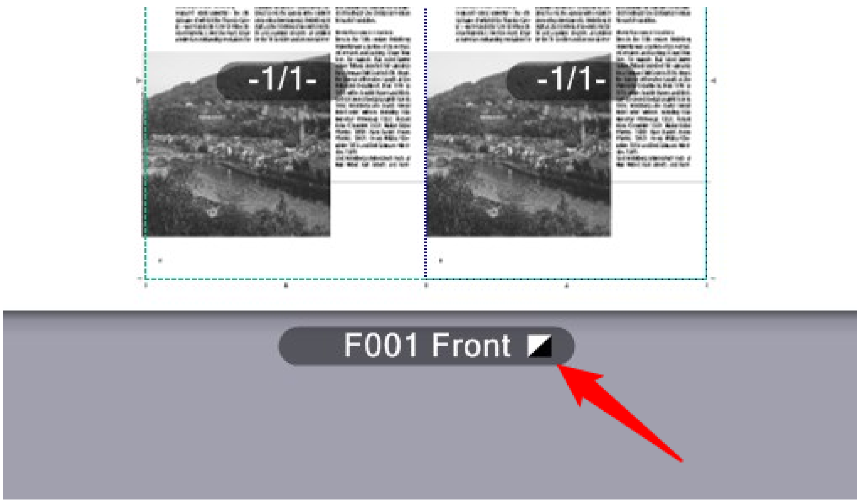
"Keep Black for Text / Graphics" option

If this option is enabled, color management does not affect black in the text or graphic objects. The following options are available for this:

- All

  Black defined for output is kept in its original form for all text and/or graphic objects that only contain black. In other words, color management does not affect black definition.

Note: If "Keep Black for Text / Graphics > All" is enabled and a page has no other separations except for black, this is highlighted in the preview by a black separation icon.



This lets you see right away whether a sheet with apparently black content really only contains the black separation. Otherwise it might be printed unintentionally in several colors.

- Keep 100% Black

  When enabled, this option has the following impact: If black is defined as C=M=Y=0 and K=100% or as R=G=B=0 and/or gray=0 in text or graphic objects, black is kept as 100% black or the colors are set to C=M=Y=0 and K=100%.

"Black Overprint" option for text / graphics

The "Overprint" function is mostly used to avoid register problems and flashes in black fonts and other black graphic objects that lie on top of a colored background. For design purposes, overprint is also used with hard shadows or colored CMYK objects. You can control overprint best if it is set directly in the application that creates the job.

The overprint settings of the Prinect Color Management on the one hand compensates for application shortcomings and on the other processes faulty documents so that you get the overprint effect you want. It's not possible to detect on a page which object is to overprint and which not. For that reason, these settings are not sufficient in some individual cases.

All black elements defined as knockout are set to "overprint" if this option is enabled.

This option affects the following color spaces: "DeviceCMYK" with C=M=Y=0%, "DeviceGray" or "/ Separation/Black". You can use this option specifically on text and/or graphic objects.

Behavior when processing jobs that were defined in version 2017 and contain PagePrint and/ or ImposedPrint sequences

The color settings in the "Digital Printing" step have changed in version 2018 compared to the predecessor version. If such jobs are to be processed with version 2018, the parameters that no longer exist in the current version are processed as follows:

Version 2017	Version 2018
Images:	
"Preserve colors > Keep Black" disabled	"Keep Black in Images" disabled
"Preserve colors > Keep Black > K=K" enabled	"Keep Black in Images" enabled
"Preserve colors > Keep Black > Special" or "Basic" enabled	"Keep Black in Images > Match Lightness" enabled
Text / Graphics:	
"Policy for 100% black in text / graphics > No special policy" enabled	"Keep Black for Text / Graphics" disabled
"Preserve colors > Keep Black > Special" or "Basic" or "K=K" enabled	"Keep Black for Text / Graphics" enabled > "All" enabled
"Policy for 100% black in text / graphics > Keep 100% Black" enabled and "Preserve colors > Keep Black" disabled	"Keep Black for Text / Graphics" enabled > "Keep 100% Black" enabled

"Spot Colors" group

The setting options display when you click the triangle.

In this group you specify whether varnish, white and/or spot colors defined as "DieLines" will be printed.

The settings for varnish or for white display depending on the features of your press.

"Remove Transparent Spot Colors" option

Prerequisite: This option is available only for Versafire CP and Digital Platesetter machines but not for Versafire CV, Primefire 106 and Labelfire 340 presses because these can be fitted with coating units.

Spot colors can be defined as "transparent". This is set in "Colors" in the job settings. Generally, transparent spot colors are used as varnishes.

When this option is enabled, all spot colors defined as "transparent" are removed from the printing data. You should enable this option if the press has no coating unit.

You must disable this option if a coating unit is available and if it is to be used to output transparent spot colors.

"Print Varnish" option

Prerequisite: This option is available only if output to a digital press with a coating unit is set up (using a PagePrint or ImposedPrint sequence), e.g. Heidelberg Versafire CV.

The coating unit is enabled for printing when you enable this option. Varnish is handled as an additional spot color. This requires that the spot color is defined as "transparent". In addition, "Usage" should be set to "Special, printing unit". These data are set in "Colors" in the job settings.

"Print White" option

Prerequisite: This option is available only if output (using a PagePrint or ImposedPrint sequence) to a digital press with an inking unit for "White" spot color is set up, e.g. Heidelberg Versafire CV, Primefire 106 or Labelfire 340 press.

The white inking unit is enabled for printing when you enable this option. White is handled as an additional spot color. This requires that the spot color is defined as "opaque". In addition, "Usage" must be set to "Special, printing unit". These data are set in "Colors" in the job settings.

"Low Inking" / " High Inking" options

Prerequisite: This option is available only for Heidelberg Versafire CV presses.

You define the quality of varnish and/or white with this toggle button.

Note: "Print Varnish" and "Print White" can be enabled at the same time. This parameter affects output depending on which option is set in the print job and which varnish color is available on the press.

"Apply varnish all-over" parameter

Prerequisite: This option is available only if output to a digital press with a coating unit is set up (using a PagePrint or ImposedPrint sequence), e.g. Heidelberg Versafire CV.

This option lets you apply varnish to the whole surface, on the front and/or back of the set paper grade.

For [paper grade]

If different paper grades are used for the cover and the body, you can set each of these paper grades separately with this option. The paper grade displays accordingly.

"Remove 'DieLine'" option

"DieLine" spot colors will not be printed when this option is enabled..

"Output Quality ΔE_{00}"option

This function gives you the option of checking the accuracy with which spot colors can be simulated in digital printing without having to output test prints.

The ΔE 2000 values display for each spot color for the set paper grade. If different paper grades are used for the cover and the body, these values display separately for each of these paper grades. The ΔE 2000 value displayed is red if it exceeds a critical amount.

"Spot Color Matching" function

You can use "Spot Color Matching" if you need special settings for spot color replacement. This function lets you customize the settings for replacing spot colors in your current print job.

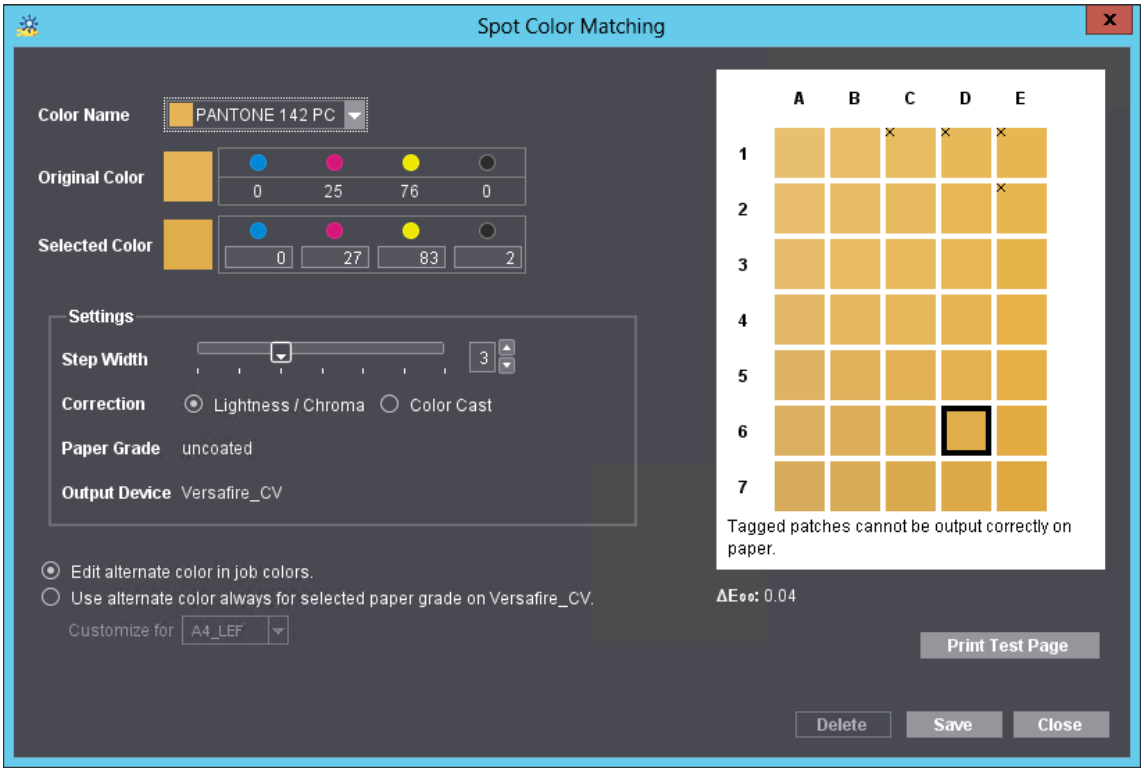
Note: If a color profile is set in the job and it deviates from the output profile defined in the digital print settings of the Prinect Manager, then a warning is issued whenever you click "Spot Color Matching" to open the dialog. This warning draws your attention to the fact that spot color matching is not possible because of the different color profiles. You can choose to apply the output profile of the Prinect Manager for spot color matching or to cancel spot color matching.

We recommend that you have a probe of the correct spot color in the original on hand before you start color matching to be able to compare the printouts of the test charts with this probe.

Note: The settings always relate to a specific paper grade on a specific press.

1. Click **"Spot Color Matching"**.

   The "Spot Color Matching" dialog opens.



2. In the **"Color Name"** list box, first select the spot color for which you want to define a substitute color. All the spot colors that are in the current print job are listed.

   The original color displays in "C4", the middle color patch. Modified colors display around the original color. Colors that cannot be output correctly to the paper set in the print job are marked by an "x".

   The ΔE 2000 value of the currently selected color patch displays below the color patches. When you move over a different color patch with the mouse cursor, the current ΔE 2000 value of this patch displays. This is a fast way to view the differences to the original color and find an optimal substitute color.

   The aim of these settings is to determine a color that optimally replaces the original spot color, allowing it to be output correctly (in other words, a color that is not marked by an "x").

3. Click **"Print Test Page"**. A test chart is printed.

Note: Each test chart printout creates a new separate print job in the Prinect Manager. These test chart print jobs are set up with the color settings that are required for a true-color output.

4. Now compare the printout of the test chart with the original copy and determine the color patch that best matches the original spot color.

5. If the deviation is still too big, enable either **"Lightness/Chroma"** or **"Color Cast"** in **"Correction"** to set the type of color change. Now move the **"Step width"** slider until suitable patches display in the preview window. The bigger the step width, the greater the differences between each of the color patches.
6. Repeat steps 3 and 4 until you are satisfied that the target color is determined accurately enough. On the test chart, the patch with the correct color has an "address", e.g. "D6".
7. Click the "D6" patch in the "Spot Color Matching" dialog.

   The CMYK values or the L*a*b* values (whichever one is defined) of the original color display in **"Original Color"**. The values of the selected color display accordingly in **"Selected Color"** (in our example, those of "D6").

Note: The values of the target color are always specified as CMYK values even if the original color is set in the L*a*b* color space (exception: inkjet presses, see below).

8. Enable **"Edit alternate color in job colors"** if you wish to set the alternate color only for the current print job.

   If the alternate color is always to be set for the paper grade used, enable **"Use alternate color always for paper grade "..." on (...)"** and select the paper grade that will be used for printing the test page in the **"Customize for"** list box. Then these settings affect all print jobs that are printed with this paper grade on this press. This setup is applicable until you edit it again.

9. If you are satisfied with the colors selected, confirm the dialog with **"Save"**.

(10).Use the **"Delete" button** to reset all the settings so that special spot color settings are no longer defined for the particular paper grade/press combination.

The **"Paper Grade"** and **"Output Device"** boxes are for your information only.

Add white background to test page for spot color matching

Prerequisite: The **"Add White Background"** option is available only for presses that have an inking unit for "White" (e.g. Versafire CV, Labelfire 340).

The test page can be given a white background to enhance the color impression when assessing a spot color, for example, when printing to foil.

Enable **"Add White Background"** to use this function.

"Output Profile" area

This is where you can define the output profile of color management, in other words the target color space of printing. This output profile affects all outputs on the set paper grade. The paper grade is shown.

"Simulation Profile" option

When you enable this option, you can select a color profile that controls the reproduction of colors in the screen preview. This gives you an impression of how certain output profiles affect the print result. For example, a page shown in the preview displays as a grayscale if you select a grayscale profile for it

For [paper grade]

Because the output profile controls the correct color settings for the press/printing material combination, this shows the paper grade selected for output. At this point, we would like to point out again that the output profile with the selected paper grade must be created on the intended digital press to make sure that colors will be reproduced accurately. Profile generation should be repeated at certain intervals to correct any changes to the parameters involved (paper property, changes to toner or ink properties).

"Automatic Selection by Paper Type" option

When you enable this option, color is matched automatically to the color profile of the selected paper grade. This requires that the paper grades used are characterized. In other words, there is a suitable color profile that is matched as best as possible to the color reproduction properties of the paper. Normally, this is the best setting for color management.

"Convert to Gray" option

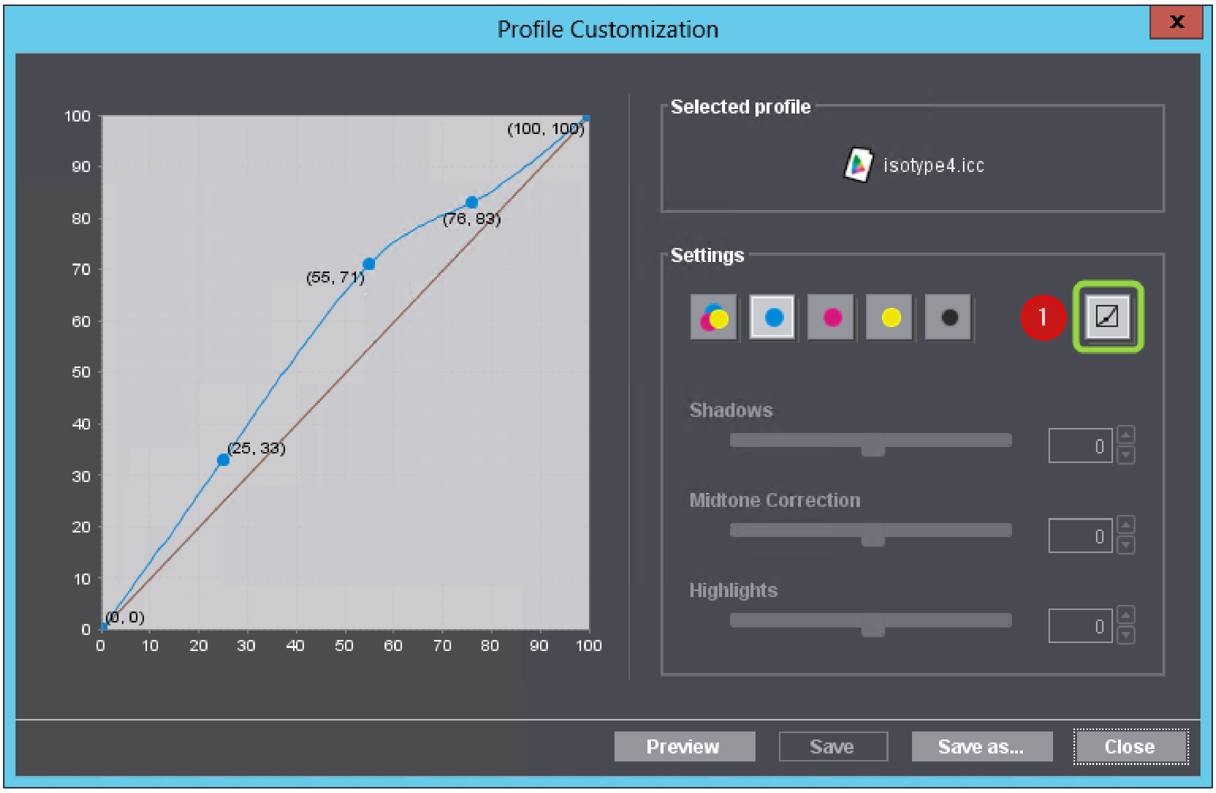
When you enable this option, the job or component job (cover or content) is output as a grayscale even if it contains color pages. This setting displays in the preview.

"Other Profile" option

You can use this option, for example, if you want the cover of a product to have a different paper and/or color setting to the content. In this case, you can select an alternative output profile for the cover.

"Profile Customization" function

The "Profile Customization" function lets you fine-tune the currently set output profile under visual control on the screen when needed. The following dialog opens when you click the "Profile Customization" button:



The name of the active profile displays at the top right.

In "Settings" you will find the toggle (1) for switching between freehand and slider operation of profile customization.

Freehand mode:

1. The sliders are disabled in the freehand mode and you can modify the curve by dragging it while holding down the left mouse button. This creates an "anchor point" and the related coordinates display (in percent). You can create several anchor points by clicking and dragging a number of times.
2. You can remove each anchor point with "Remove" in the context-sensitive menu over the anchor point.
3. When you place the mouse cursor on an anchor point, the coordinates of all other anchor points are hidden.
4. The page displayed in the preview is matched to the new color profile settings when you click "Preview". This lets you check the effect of the edited color profile.

Slider mode:

1. You can use the sliders for "Shadows", "Midtone Correction" and "Highlights" jointly for CMY or separately for C, M, Y and K when you click the toggle button (1). This lets you set the parameters using sliders. The sliders have the following impacts:
   - Shadows: This slider changes the value of the curve at 75%. The values can be changed between -20% and +20%.

- Midtone Correction: This slider changes the curve at 50%. By doing this, the whole curve can be moved up or down, meaning that other values of the curve are matched. The values can be changed between -30% and +30%.
- Highlights: This slider changes the value of the curve at 25%. The values can be changed between -20% and +20%.

The impacts of the changes made with the sliders display immediately in the preview.

2. A slider is reset to its middle position when you double-click its name or the slider itself.

You can save the modified color profile if you are happy with the settings. The mode (freehand or slider) that is currently set is the one that has an impact. The color profile will be overwritten when you click "Save". You cannot overwrite a standard profile installed by default with "Save". Click "Save as" to save the modified color profile under a different name on the Prinect server. The profile can then be used again for subsequent jobs.

Click "Close" to close the dialog. A message appears if changes were made but not saved.

"Color settings" tab for Primefire 106 presses

The options available in this tab are matched to the Primefire 106 press. This means that options that do not suit this press model are not offered for selection. Other options are matched accordingly.

"Color spaces in PDF file"... "must still be customized" or "are already prepared"

Frequently, the input PDF files are prepared for an output process that is not designed for a seven-color inkjet digital press. Instead, they can be prepared for an offset print process or a flexographic output process. These documents can contain CMYK colors, spot colors, DeviceN (CMYK) or DeviceN (CMYK + spot colors). Such documents are referred to as "PDF files with prepared color spaces" in the Prinect digital printing workflow.

For the Primefire 106 and Labelfire 340 inkjet presses, the input documents must be matched to the color space of the inkjet press (C + M + Y + K + Orange + Green + Violet). Because the inkjet presses cannot print spot colors in the original (except for Orange, Green, Violet), it is necessary to convert spot colors to the color space of the digital presses, matching the original colors as accurately as possible to the press color space in this process. The colors are matched to the 7C target color space of the digital presses in a special process called "spectral color management".

This process is enabled or disabled with these options:

"must still be customized" option

Select this option if the PDF files were not yet matched to a special target color space. These documents are printed on the digital press using the setup output condition. Additional matching is not necessary.

The "Source Profiles" group can be seen and used with this option. The settings are equivalent to the settings for toner-based digital presses.

"Source Profiles" group

Color management settings for CMYK colors.

"Enable CMYK Color Management" option

Use this option to specify that a CMYK input profile will be used for color conversion.

Note: Except for the selection of the input profile, the parameters for CMYK color management are also applicable for grayscales.

If this option is not selected, the documents are not processed with color management. This option is necessary, for example, if the digital prints are to be used for color calibration (e.g. with the Prinect Color Toolbox). In this case, the output documents may not be processed with color management. Neither a CMYK input profile nor an output profile will be used.

Note: Color management for documents with RGB and grayscale colors remains enabled even if "Enable CMYK Color Management" is disabled.

"Use Embedded Profiles" option

If documents containing colored objects or images are to be output, these objects are automatically converted so that they can be output in the CMYK or grayscale color space. The input profiles required for the input color space -> profile connection space transformation are usually included in the PDF documents and are used by color management. If the PDF documents do not have an input profile, you can use the standard input profile set by default or select a different one using the Browse button.

You use the "Use Embedded Profiles" option to define which CMYK input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the edited PDF document, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the CMYK ICC profile selected in **"If no profile is known"** will be used for color management.
- If this option is not enabled, the CMYK ICC profile selected in **"If no profile is known"** will always be used for color management.

You can create input ICC profiles – unless appropriate device profiles are already available – for example with the "Prinect Color Toolbox" and place them on the Prinect Server. The ICC profiles are saved in their subfolders in a folder below the path "PTConfig\SysConfig\Resources\ICC Profiles" (PTConfig is the shared configuration folder of the Prinect Server). This is where you can add custom ICC profiles and create appropriate folders if required.

Note: In "Administration" > "Resources" > "ICC Profiles" you can see an overview of all ICC profiles available in the Prinect workflow. See also "ICC profiles", page 21. You can also import new profiles, create a new profile folder, delete profiles, etc.

Separate input profile settings for image and text elements or graphic elements

By default, the "Input Profiles", "Rendering Intent" and "BPC" (black point compensation) parameters are available for CMYK and RGB colors for image, text and graphic objects. This means that the set parameters (input profile, rendering intent, black point compensation) are valid for image, text and graphic objects.

Click the plus sign beside the "Images" icon to display the same parameters for image elements and for text/graphic objects separately. In this way, you can set up the input performance of color management separately for image/text objects and for graphic objects.

The settings that currently can be seen always affect color management.

- Collapsed (plus sign displays): joint settings for image, text and graphic objects.
- Expanded (minus sign displays): separate settings for image objects and text/graphic objects.

Rendering Intent (RI)

In addition to selecting ICC profiles, you can set the rendering intent for the colored objects. Rendering intent determines how color matching is done. Since losses always occur during a color space transformation, it can be helpful, for example, to retain the photographic perception of an original and to accept a limit on the number of color values. The following parameters are available for rendering intent: "Perceptual", "Saturation", "Relative Colorimetric" and "Absolute Colorimetric":

- Perceptual

  When you use the "Perceptual" parameter, you obtain an output, that essentially contains the perceptible impression of the original. This means that the precise, colorimetric rendering of the colors is modified in favor of the retention of the relative color relationships. In a smaller target color space, the color gamut is compressed accordingly. Vice versa, in a larger target color space and with suitable profiles, the color space may be expanded. With this color matching option, the hue in all the natural colors of the original is reproduced for the most part correctly but with restrictions in the contrast. The type of color matching is manufacturer-specific, with the user being able to set some of the aspects such as contrast and chroma change during profile generation. This option is especially suitable for photographs.

- Saturation

  In the output, the colors are rendered in such a manner that the color saturation is retained or even emphasized. The type of color matching is manufacturer-specific, with the user being able to define some settings during profile generation. This option is suitable for business graphics where the color saturation is the most important attribute in color rendering.

- Relative colorimetric

  Colors are rendered taking solely the light source into account. The rendering intent of the print medium (e.g. the color of the unprinted paper) is not taken into account. For example, the illuminant of a monitor would be correctly rendered on the print medium. That is why the term "relative" is used. All colors that lie within the output color space are rendered identically. All colors that lie outside of the output color space are displayed on the margin of the output color space. That is why the term "colorimetric" is used.

The advantage of this rendering intent is that different illuminants of different output media are taken into account. The disadvantage is that the color adaptations are not exactly retained when switching from one output medium to another. As a result, very dark or very colorful details in the originals can be lost when they are reproduced. The substrate is not simulated during an output process simulation. If production run paper is used during the simulation, the result is the same as if you used the "absolute colorimetric" rendering intent. This rendering intent is suitable mainly for vector graphics.

- Absolute colorimetric

  Colors are rendered taking the light source and the medium illuminant (e.g. the color of the unprinted paper). For example, the illuminant of a newsprint paper which is shifted from illustration printing paper towards yellow compared to the illuminant of paper is rendered with a yellowish cast. That is why the term "absolute" is used. That is why "Absolute colorimetric" is the default setting for a proof output. All colors that lie outside of the output color space are displayed on the margin of the output color space.

  The advantage of this rendering intent is that the exact color values are retained when switching from one output medium to another. The disadvantage is that any colors that lie outside of the output color space cannot be distinguished. This rendering intent is especially suitable for logos or monochrome objects which must be reproduced exactly the same way on different output media. You can set a separate rendering intent for spot colors that is independent of the color space of the alternative display color. "Absolute colorimetric" is recommended. This makes sure that the spot colors are simulated as best as possible.

- From Document

  The Color Rendering Intents that were defined for images and graphics in the PDF documents are used.

Note: You should select "From Document" only if you are absolutely sure that the edited documents have a rendering intent setting that can correctly control the color space conversion desired. However, you should not use this setting if at all possible because this is very seldom the case.

"BPC" (black point compensation) option

Black point compensation (BPC) becomes active if you enable the "BPC" option. You can enable black point compensation (BPC) for "Relative Colorimetric" "Perceptual" and "Saturation" rendering intents. However, the effect of this option can only be seen for the rendering intent "Relative Colorimetric".

In gamut mapping, all L shadows (in the L*a*b* color space) that are darker than black toner/ink are matched to black toner/ink and, as a result, shadow definition is lost.

Black point compensation enhances the reproduction area when the "Relative colorimetric" rendering intent is used for color space conversion to the L*a*b* color space or from the L*a*b* color space to the device color space. The L*a*b* color space has more lightness levels for dark image parts than the CMYK color space because the L*a*b* color space is larger than the CMYK device color space. In a color space conversion from the L*a*b* to the CMYK color space with "Relative Colorimetric" rendering intent, the color space is cut off or reproduced without definition in the shadows because they are located outside the displayable range. As a result, details in dark parts of the image are often lost, especially if ICC profiles for uncoated papers are used for color space conversion.

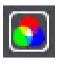
Black point compensation matches the black point during color space conversion, causing the definition in such dark image parts to be kept. This "elongates" the shadows causing color shifts to occur also in the lighter color values. For that reason, this method is not always suited to true-color proofing.

We recommend that you use "Perceptual" rendering intent with black point compensation and not "Relative Colorimetric" rendering intent. This rendering intent makes it possible for the various details in dark image parts to be reproduced, while keeping color shifts to a minimum. In principle, differences cannot be fully avoided because of the different sizes of the color spaces.

"Keep CMYK Colors" parameter

When this option is enabled, CMY in solid tint single-color or two-color image parts is kept.

Normally, if color management is used, C=100, M=0, Y=0, K=0 becomes, for example, C=96, M=12, Y=8, K=2. In other words, "dirtying elements" creep in. These elements are fully correct if you have a true-color display. However, this behavior may not be wanted in technical diagrams because color margins occur at the mainly clearly defined edges, for example, due to register errors or if the maximum color of the original printing process is to be retained for this color area.



Color management settings for RGB colors.

"Use Embedded Profiles" option

This option lets you define which RGB input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the PDF documents, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the RGB ICC profile selected will be used for color management.
- If this option is not enabled, the RGB ICC profile selected will always be used for color management.

Apart from that, the explanatory notes made for CMYK colors are applicable. See "Use Embedded Profiles" option, page 44.

Separate input profile settings for image and text elements or graphic elements

By default, the "Input Profiles", "Rendering Intent" and "BPC" (black point compensation) parameters are available for CMYK and RGB colors for image, text and graphic objects. This means that the set parameters (input profile, rendering intent, black point compensation) are valid for image, text and graphic objects.

Click the plus sign beside the "Images" icon to display the same parameters for image elements and for text/graphic objects separately. In this way, you can set up the input performance of color management separately for image/text objects and for graphic objects.

The settings that currently can be seen always affect color management.

- Collapsed (plus sign displays): joint settings for image, text and graphic objects.
- Expanded (minus sign displays): separate settings for image objects and text/graphic objects.

Rendering Intent (RI)

See "Rendering Intent (RI)", page 55.

"BPC" (black point compensation) option

See "BPC" (black point compensation) option, page 56

Settings for Keep Black

The Keep Black setting must be set up only for text and graphic objects because of the special color management process that is used with Primefire inkjet presses. The settings are equivalent to the settings for toner-based digital presses:

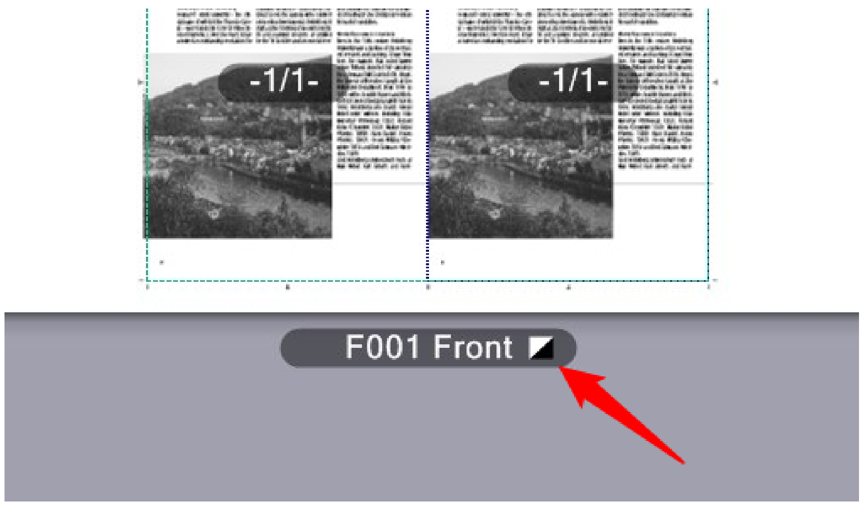
"Keep Black for Text / Graphics" option

If this option is enabled, color management does not affect black in the text or graphic objects. The following options are available for this:

- All

  Black defined for output is kept in its original form for all text and/or graphic objects that only contain black. In other words, color management does not affect black definition.

Note: If "Keep Black for Text / Graphics > All" is enabled and a page has no other separations except for black, this is highlighted in the preview by a black separation icon.



This lets you see right away whether a sheet with apparently black content really only contains the black separation. Otherwise it might be printed unintentionally in several colors.

- Keep 100% Black

  When enabled, this option has the following impact: If black is defined as C=M=Y=0 and K=100% or as R=G=B=0 and/or gray=0 in text or graphic objects, black is kept as 100% black or the colors are set to C=M=Y=0 and K=100%.

"Black Overprint" option for text / graphics

The "Overprint" function is mostly used to avoid register problems and flashes in black fonts and other black graphic objects that lie on top of a colored background. For design purposes, overprint is also used with hard shadows or colored CMYK objects. You can control overprint best if it is set directly in the application that creates the job.

The overprint settings of the Prinect Color Management on the one hand compensates for application shortcomings and on the other processes faulty documents so that you get the overprint effect you want. It's not possible to detect on a page which object is to overprint and which not. For that reason, these settings are not sufficient in some individual cases.

All black elements defined as knockout are set to "overprint" if this option is enabled.

This option affects the following color spaces: "DeviceCMYK" with C=M=Y=0%, "DeviceGray" or "/Separation/Black". You can use this option specifically on text and/or graphic objects.

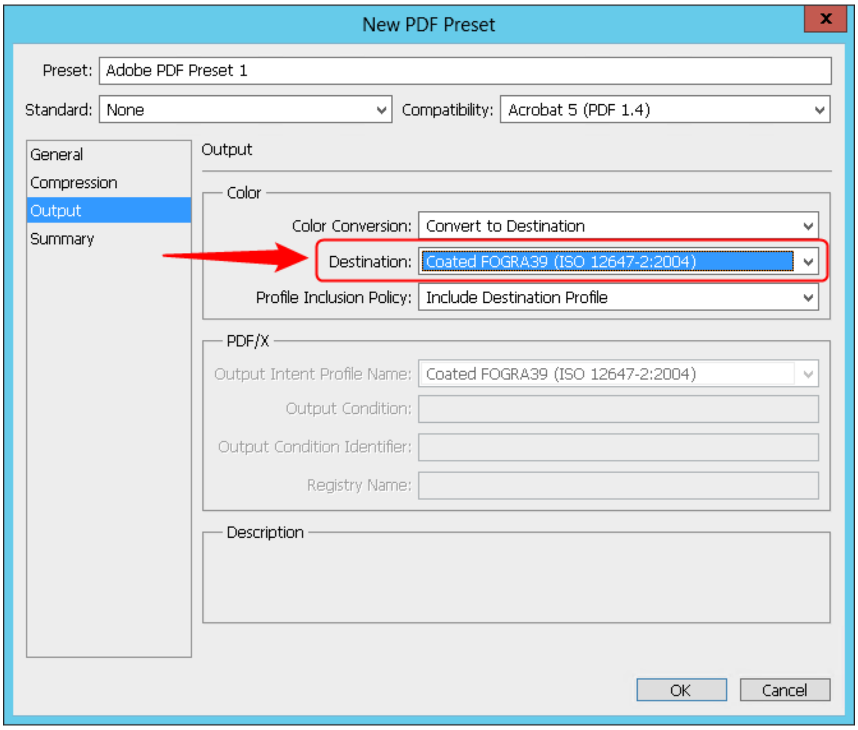
"are already prepared" option

Select this option if the PDF files are already prepared for an output process (as described above) that deviates from the designated output process with a Heidelberg inkjet digital press. Spectral color management for matching the colors to the color space of the digital press is enabled with this option. InRIP Color Management is disabled.

Note: Comparison of the N-Color color profiles with the colors available on the press: If a print job with an N-Color profile is output, the process colors in the profile must also be available on the press. For that reason, the colors of the profile are compared with the colors available on the press. The profile is rejected with an error message if the colors required are not available.

Color management settings for CMYK colors.

You must select "CMYK Work Color Space" in this setting. This setting affects only CMYK colors in the edited PDF files. **"CMYK Work Color Space"** is an ICC profile that is defined in design applications (InDesign, Photoshop, ArtPro, etc.) or in InRIP Color Management as a "press profile" or a "target profile", e.g. "Coated FOGRA39".



Example: CMYK work color space in Adobe Photoshop

After the RIP process, the profile that you select in "CMYK Work Color Space" is applied to the CMYK colors of the edited PDF files and not to any existing spot colors. It should be the same profile that was set as the target profile in the creator application or as the press profile in a Prepare sequence that may have been run beforehand. See "Press Profile" box, page 31.

Note: You can determine the target profile used away from the Prinect workflow by opening the PDF file concerned in Acrobat and creating a preflight report with the Prinect PDF Toolbox. The preflight report contains details about the target profile used ("Color space").

Settings for Keep Black

"Keep Black" option

InRIP Color Management has no influence on the output of black for prepared PDF files.

- Black objects or pure K percentages in CMYK objects:

  Black will be output as a mixture of orange, green and violet (calculated by spectral color management) and C = M = Y = K = 0.

- Black objects and spot color percentages or K separations and spot color percentages:

  Black will be output as a mixture of orange, green and violet (calculated by spectral color management) and percentages of CMYK.

"All" option

Keep Black impacts all objects that have black parts.

"Keep 100% Black" option

Keep Black impacts only objects where area coverage in the black separation is 100%.

"Spot Colors" group

The settings possible in "Spot Colors do not depend on what you selected for "Color spaces in PDF file..." "must be customized" or "are already prepared".

"Print Varnish" option

The coating unit of the Primefire 106 press is enabled for printing when you enable this option. Varnish is handled as an additional spot color.

Apply varnish all-over for Primefire substrates

You enable varnishing for all of the front surface with the **"Front" option**.

"Remove 'DieLine'" option

"DieLine" spot colors will not be printed when this option is enabled..

"Output Quality ΔE_{00}"option

This function gives you the option of checking the accuracy with which spot colors can be simulated in digital printing without having to output test prints.

The ΔE 2000 values display for each spot color for the set substrate. The ΔE 2000 value displayed is red if it exceeds a critical amount.

"Spot Color Matching" function

In principle, the process for spot color matching is similar to that for Versafire presses but the ink recipes used for replacing spot colors are not determined from CMYK colors but use a special process based on the spectral composition (wavelengths of light) of the spot colors. See "Spot Color Matching" function, page 48. As a result, there are some differences in the "Spot Color Matching" dialog:

1. In the **"Color Name"** list box, first select the spot color for which you want to define a substitute color. All the spot colors that are in the current print job are listed.

   The original color displays in the middle color patch "C4" in the preview window. Modified colors display around the original color.

   The aim of these settings is to determine a color that optimally replaces the original spot color, allowing it to be output correctly (in other words, a color that is not marked by an "x").

2. Click **"Print Test Page"**. A test chart is printed.
3. Now compare the printout of the test chart with the original copy and determine the color patch that best matches the original spot color.
4. If the deviation is still too big, enable either **"Lightness/Chroma"** or **"Color Cast"** in **"Correction"** to set the type of color change. Now move the **"Step width"** slider until suitable patches display in the preview window. The bigger the step width, the greater the differences between each of the color patches.

5. Now repeat steps 2, 3 and 4 until you are satisfied that the target color is determined accurately enough. On the test chart, the patch with the correct color has an "address", e.g. "D6".
6. Click the "D6" patch in the "Spot Color Matching" dialog.

   The CMYK values or the L*a*b* values (whichever one is defined) of the original color display in **"Original Color"**. The L*a*b* values of the selected color display accordingly in **"Selected Color"** (in our example, those of "D 6").

   Note: The values of the target color are always specified as L*a*b* values for Primefire or Labelfire digital presses.

   The values for spot color replacement are entered into the color data of the current print job and can be modified there if required. They only affect the current job.

   The ΔE 2000 value of the currently selected color patch displays below the color patches. When you move over a different color patch with the mouse cursor, the current ΔE 2000 value of this patch displays. This is a fast way to view the differences to the original color and find an optimal substitute color.

7. If you are satisfied with the colors selected, confirm the dialog with **"Save"**.

   The **"Paper Grade"** and **"Output Device"** boxes are for your information only.

"Color settings" tab for Labelfire 340 presses

The options available in this tab are matched to the Labelfire 340 press. This means that options that do not suit this press model are not offered for selection. Other options are matched accordingly.

"Color spaces in PDF file"... "must still be customized" or "are already prepared"

Frequently, the input PDF files are prepared for an output process that is not designed for a seven-color inkjet digital press. Instead, they can be prepared for an offset print process or a flexographic output process. These documents can contain CMYK colors, spot colors, DeviceN (CMYK) or DeviceN (CMYK + spot colors). Such documents are referred to as "PDF files with prepared color spaces" in the Prinect digital printing workflow.

For the Primefire 106 and Labelfire 340 inkjet presses, the input documents must be matched to the color space of the inkjet press (C + M + Y + K + Orange + Green + Violet). Because the inkjet presses cannot print spot colors in the original (except for Orange, Green, Violet), it is necessary to convert spot colors to the color space of the digital presses, matching the original colors as accurately as possible to the press color space in this process. The colors are matched to the 7C target color space of the digital presses in a special process called "spectral color management".

This process is enabled or disabled with these options:

"must still be customized" option

Select this option if the PDF files were not yet matched to a special target color space. These documents are printed on the digital press using the setup output condition. Additional matching is not necessary.

The "Source Profiles" group can be seen and used with this option. The settings are equivalent to the settings for toner-based digital presses.

"Source Profiles" group

Color management settings for CMYK colors.

"Enable CMYK Color Management" option

Use this option to specify that a CMYK input profile will be used for color conversion.

Note: Except for the selection of the input profile, the parameters for CMYK color management are also applicable for grayscales.

If this option is not selected, the documents are not processed with color management. This option is necessary, for example, if the digital prints are to be used for color calibration (e.g. with the Prinect Color Toolbox). In this case, the output documents may not be processed with color management. Neither a CMYK input profile nor an output profile will be used.

Note: Color management for documents with RGB and grayscale colors remains enabled even if "Enable CMYK Color Management" is disabled.

"Use Embedded Profiles" option

If documents containing colored objects or images are to be output, these objects are automatically converted so that they can be output in the CMYK or grayscale color space. The input profiles required for the input color space -> profile connection space transformation are usually included in the PDF documents and are used by color management. If the PDF documents do not have an input profile, you can use the standard input profile set by default or select a different one using the Browse button.

You use the "Use Embedded Profiles" option to define which CMYK input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the edited PDF document, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the CMYK ICC profile selected in **"If no profile is known"** will be used for color management.
- If this option is not enabled, the CMYK ICC profile selected in **"If no profile is known"** will always be used for color management.

You can create input ICC profiles – unless appropriate device profiles are already available – for example with the "Prinect Color Toolbox" and place them on the Prinect Server. The ICC profiles are saved in their subfolders in a folder below the path "PTConfig\SysConfig\Resources\ICC Profiles" (PTConfig is the shared configuration folder of the Prinect Server). This is where you can add custom ICC profiles and create appropriate folders if required.

Note: In "Administration" > "Resources" > "ICC Profiles" you can see an overview of all ICC profiles available in the Prinect workflow. See also "ICC profiles", page 21. You can also import new profiles, create a new profile folder, delete profiles, etc.

Separate input profile settings for image and text elements or graphic elements

By default, the "Input Profiles", "Rendering Intent" and "BPC" (black point compensation) parameters are available for CMYK and RGB colors for image, text and graphic objects. This means that the set parameters (input profile, rendering intent, black point compensation) are valid for image, text and graphic objects.

Click the plus sign beside the "Images" icon to display the same parameters for image elements and for text/graphic objects separately. In this way, you can set up the input performance of color management separately for image/text objects and for graphic objects.

The settings that currently can be seen always affect color management.

- Collapsed (plus sign displays): joint settings for image, text and graphic objects.
- Expanded (minus sign displays): separate settings for image objects and text/graphic objects.

Rendering Intent (RI)

In addition to selecting ICC profiles, you can set the rendering intent for the colored objects. Rendering intent determines how color matching is done. Since losses always occur during a color space transformation, it can be helpful, for example, to retain the photographic perception of an original and to accept a limit on the number of color values. The following parameters are available for rendering intent: "Perceptual", "Saturation", "Relative Colorimetric" and "Absolute Colorimetric":

- Perceptual

  When you use the "Perceptual" parameter, you obtain an output, that essentially contains the perceptible impression of the original. This means that the precise, colorimetric rendering of the colors is modified in favor of the retention of the relative color relationships. In a smaller target color space, the color gamut is compressed accordingly. Vice versa, in a larger target color space and with suitable profiles, the color space may be expanded. With this color matching option, the hue in all the natural colors of the original is reproduced for the most part correctly but with restrictions in the contrast. The type of color matching is manufacturer-specific, with the user being able to set some of the aspects such as contrast and chroma change during profile generation. This option is especially suitable for photographs.

- Saturation

  In the output, the colors are rendered in such a manner that the color saturation is retained or even emphasized. The type of color matching is manufacturer-specific, with the user being able to define some settings during profile generation. This option is suitable for business graphics where the color saturation is the most important attribute in color rendering.

- Relative colorimetric

  Colors are rendered taking solely the light source into account. The rendering intent of the print medium (e.g. the color of the unprinted paper) is not taken into account. For example, the illuminant of a monitor would be correctly rendered on the print medium. That is why the term "relative" is used. All colors that lie within the output color space are rendered identically. All colors that lie outside of the output color space are displayed on the margin of the output color space. That is why the term "colorimetric" is used.

  The advantage of this rendering intent is that different illuminants of different output media are taken into account. The disadvantage is that the color adaptations are not exactly retained when switching from one output medium to another. As a result, very dark or very colorful details in the originals can be lost when they are reproduced. The substrate is not simulated during an output process simulation. If production run paper is used during the simulation, the result is the same as if you used the "absolute colorimetric" rendering intent. This rendering intent is suitable mainly for vector graphics.

- Absolute colorimetric

  Colors are rendered taking the light source and the medium illuminant (e.g. the color of the unprinted paper). For example, the illuminant of a newsprint paper which is shifted from illustration printing paper towards yellow compared to the illuminant of paper is rendered with a yellowish cast. That is why the term "absolute" is used. That is why "Absolute colorimetric" is the default setting for a proof output. All colors that lie outside of the output color space are displayed on the margin of the output color space.

  The advantage of this rendering intent is that the exact color values are retained when switching from one output medium to another. The disadvantage is that any colors that lie outside of the output color space cannot be distinguished. This rendering intent is especially suitable for logos or monochrome objects which must be reproduced exactly the same way on different output media. You can set a separate rendering intent for spot colors that is independent of the color space of the alternative display color. "Absolute colorimetric" is recommended. This makes sure that the spot colors are simulated as best as possible.

- From Document

  The Color Rendering Intents that were defined for images and graphics in the PDF documents are used.

Note: You should select "From Document" only if you are absolutely sure that the edited documents have a rendering intent setting that can correctly control the color space conversion desired. However, you should not use this setting if at all possible because this is very seldom the case.

"BPC" (black point compensation) option

Black point compensation (BPC) becomes active if you enable the "BPC" option. You can enable black point compensation (BPC) for "Relative Colorimetric" "Perceptual" and "Saturation" rendering intents. However, the effect of this option can only be seen for the rendering intent "Relative Colorimetric".

In gamut mapping, all L shadows (in the L*a*b* color space) that are darker than black toner/ink are matched to black toner/ink and, as a result, shadow definition is lost.

Black point compensation enhances the reproduction area when the "Relative colorimetric" rendering intent is used for color space conversion to the L*a*b* color space or from the L*a*b* color space to the device color space. The L*a*b* color space has more lightness levels for dark image parts than the CMYK color space because the L*a*b* color space is larger than the CMYK device color space. In a color space conversion from the L*a*b* to the CMYK color space with "Relative Colorimetric" rendering intent, the color space is cut off or reproduced without definition in the shadows because they are located outside the displayable range. As a result, details in dark parts of the image are often lost, especially if ICC profiles for uncoated papers are used for color space conversion.

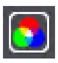
Black point compensation matches the black point during color space conversion, causing the definition in such dark image parts to be kept. This "elongates" the shadows causing color shifts to occur also in the lighter color values. For that reason, this method is not always suited to true-color proofing.

We recommend that you use "Perceptual" rendering intent with black point compensation and not "Relative Colorimetric" rendering intent. This rendering intent makes it possible for the various details in dark image parts to be reproduced, while keeping color shifts to a minimum. In principle, differences cannot be fully avoided because of the different sizes of the color spaces.

"Keep CMYK Colors" parameter

When this option is enabled, CMY in solid tint single-color or two-color image parts is kept.

Normally, if color management is used, C=100, M=0, Y=0, K=0 becomes, for example, C=96, M=12, Y=8, K=2. In other words, "dirtying elements" creep in. These elements are fully correct if you have a true-color display. However, this behavior may not be wanted in technical diagrams because color margins occur at the mainly clearly defined edges, for example, due to register errors or if the maximum color of the original printing process is to be retained for this color area.



Color management settings for RGB colors.

"Use Embedded Profiles" option

See "Use Embedded Profiles" option, page 64.

Separate input profile settings for image and text elements or graphic elements

See "Separate input profile settings for image and text elements or graphic elements", page 65.

Rendering Intent (RI)

See "Rendering Intent (RI)", page 65.

"BPC" (black point compensation) option

See "BPC" (black point compensation) option, page 67.

Settings for Keep Black

The Keep Black setting must be set up only for text and graphic objects because of the special color management process that is used with Primefire inkjet presses. The settings are equivalent to the settings for toner-based digital presses:

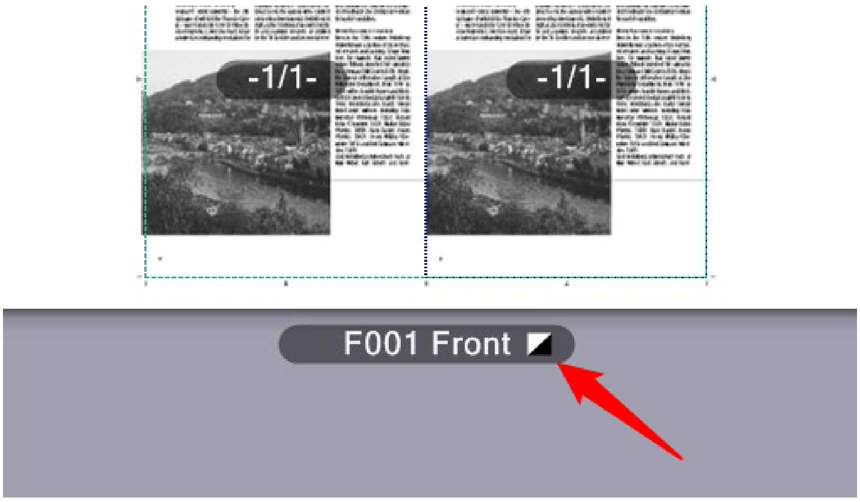
"Keep Black for Text / Graphics" option

If this option is enabled, color management does not affect black in the text or graphic objects. The following options are available for this:

- All

  Black defined for output is kept in its original form for all text and/or graphic objects that only contain black. In other words, color management does not affect black definition.

Note: If "Keep Black for Text / Graphics > All" is enabled and a page has no other separations except for black, this is highlighted in the preview by a black separation icon.



This lets you see right away whether a sheet with apparently black content really only contains the black separation. Otherwise it might be printed unintentionally in several colors.

- Keep 100% Black

  When enabled, this option has the following impact: If black is defined as C=M=Y=0 and K=100% or as R=G=B=0 and/or gray=0 in text or graphic objects, black is kept as 100% black or the colors are set to C=M=Y=0 and K=100%.

"Black Overprint" option for text / graphics

The "Overprint" function is mostly used to avoid register problems and flashes in black fonts and other black graphic objects that lie on top of a colored background. For design purposes, overprint is also used with hard shadows or colored CMYK objects. You can control overprint best if it is set directly in the application that creates the job.

The overprint settings of the Prinect Color Management on the one hand compensates for application shortcomings and on the other processes faulty documents so that you get the overprint effect you want. It's not possible to detect on a page which object is to overprint and which not. For that reason, these settings are not sufficient in some individual cases.

All black elements defined as knockout are set to "overprint" if this option is enabled.

This option affects the following color spaces: "DeviceCMYK" with C=M=Y=0%, "DeviceGray" or "/Separation/Black". You can use this option specifically on text and/or graphic objects.

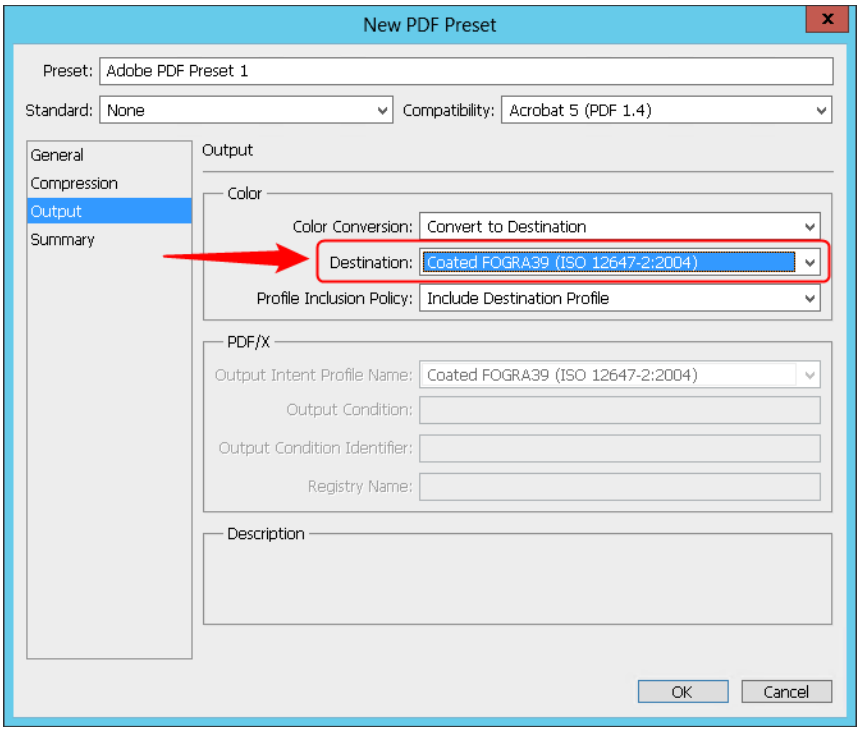
"are already prepared" option

Select this option if the PDF files are already prepared for an output process (as described above) that deviates from the designated output process with a Heidelberg inkjet digital press. Spectral color management for matching the colors to the color space of the digital press is enabled with this option. InRIP Color Management is disabled.

Note: Comparison of the N-Color color profiles with the colors available on the press: If a print job with an N-Color profile is output, the process colors in the profile must also be available on the press. For that reason, the colors of the profile are compared with the colors available on the press. The profile is rejected with an error message if the colors required are not available.

Color management settings for CMYK colors.

You must select "CMYK Work Color Space" in this setting. This setting affects only CMYK colors in the edited PDF files. **"CMYK Work Color Space"** is an ICC profile that is defined in design applications (InDesign, Photoshop, ArtPro, etc.) or in InRIP Color Management as a "press profile" or a "target profile", e.g. "Coated FOGRA39".



Example: CMYK work color space in Adobe Photoshop

After the RIP process, the profile that you select in "CMYK Work Color Space" is applied to the CMYK colors of the edited PDF files and not to any existing spot colors. It should be the same profile that was set as the target profile in the creator application or as the press profile in a Prepare sequence that may have been run beforehand. See "Press Profile" box, page 31.

Note: You can determine the target profile used away from the Prinect workflow by opening the PDF file concerned in Acrobat and creating a preflight report with the Prinect PDF Toolbox. The preflight report contains details about the target profile used ("Color space").

Settings for Keep Black

"Keep Black" option

InRIP Color Management has no influence on the output of black for prepared PDF files.

- Black objects or pure K percentages in CMYK objects:

  Black will be output as a mixture of orange, green and violet (calculated by spectral color management) and C = M = Y = K = 0.

- Black objects and spot color percentages or K separations and spot color percentages:

  Black will be output as a mixture of orange, green and violet (calculated by spectral color management) and percentages of CMYK.

"All" option

Keep Black impacts all objects that have black parts.

"Keep 100% Black" option

Keep Black impacts only objects where area coverage in the black separation is 100%.

"Spot Colors" group

The settings possible in "Spot Colors do not depend on what you selected for "Color spaces in PDF file..." "must be customized" or "are already prepared".

"Remove 'DieLine'" option

"DieLine" spot colors will not be printed when this option is enabled..

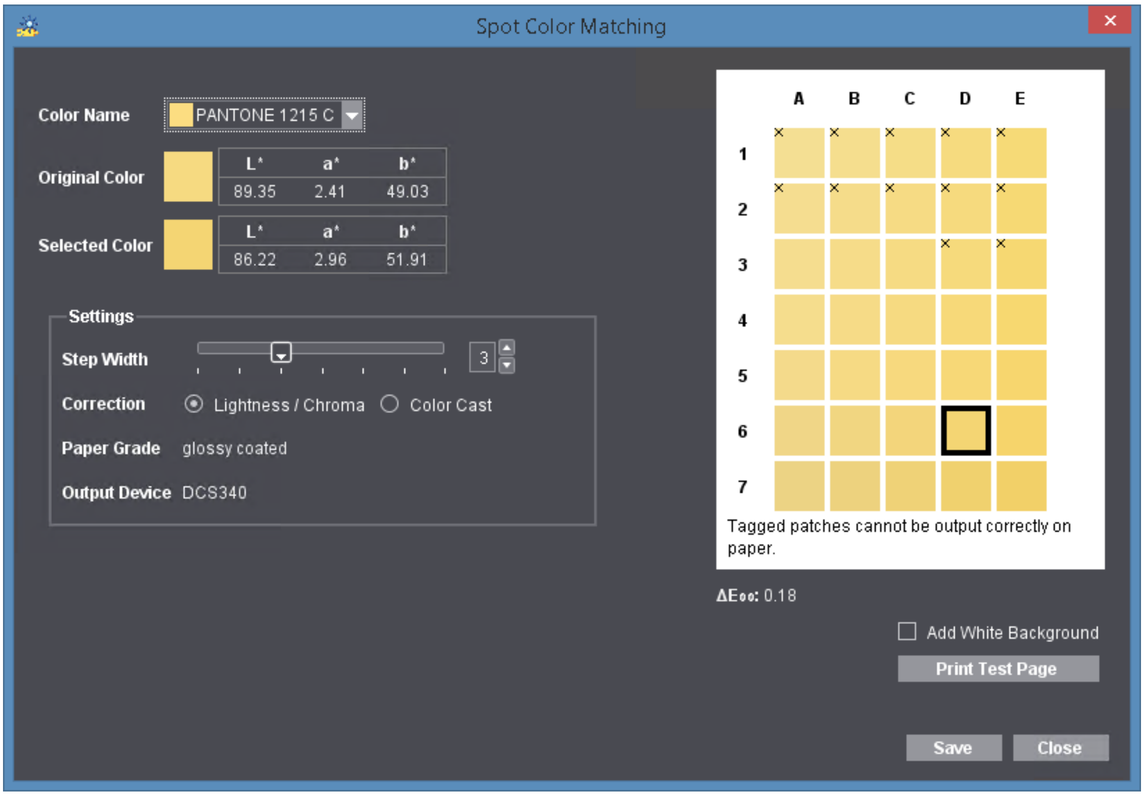
"Output Quality ΔE_{00}"option

This function gives you the option of checking the accuracy with which spot colors can be simulated in digital printing without having to output test prints.

The ΔE 2000 values display for each spot color for the set substrate. The ΔE 2000 value displayed is red if it exceeds a critical amount.

"Spot Color Matching" function

In principle, the process for spot color matching is similar to that for Versafire presses but the ink recipes used for replacing spot colors are not determined from CMYK colors but use a special process based on the spectral composition (wavelengths of light) of the spot colors. See "Spot Color Matching" function, page 48. As a result, there are some differences in the "Spot Color Matching" dialog:



1. In the **"Color Name"** list box, first select the spot color for which you want to define a substitute color. All the spot colors that are in the current print job are listed.

   The original color displays in the middle color patch "C4" in the preview window. Modified colors display around the original color.

   The aim of these settings is to determine a color that optimally replaces the original spot color, allowing it to be output correctly (in other words, a color that is not marked by an "x").

2. Click **"Print Test Page"**. A test chart is printed.
3. Now compare the printout of the test chart with the original copy and determine the color patch that best matches the original spot color.
4. If the deviation is still too big, enable either **"Lightness/Chroma"** or **"Color Cast"** in **"Correction"** to set the type of color change. Now move the **"Step width"** slider until suitable patches display in the preview window. The bigger the step width, the greater the differences between each of the color patches.
5. Now repeat steps 2, 3 and 4 until you are satisfied that the target color is determined accurately enough. On the test chart, the patch with the correct color has an "address", e.g. "D6".
6. Click the "D6" patch in the "Spot Color Matching" dialog.

   The CMYK values or the L*a*b* values (whichever one is defined) of the original color display in **"Original Color"**. The L*a*b* values of the selected color display accordingly in **"Selected Color"** (in our example, those of "D 6").

Note: The values of the target color are always specified as L*a*b* values for Primefire or Labelfire digital presses.

The values for spot color replacement are entered into the color data of the current print job and can be modified there if required. They only affect the current job.

The ΔE 2000 value of the currently selected color patch displays below the color patches. When you move over a different color patch with the mouse cursor, the current ΔE 2000 value of this patch displays. This is a fast way to view the differences to the original color and find an optimal substitute color.

7. If you are satisfied with the colors selected, confirm the dialog with **"Save"**.

   The **"Paper Grade"** and **"Output Device"** boxes are for your information only.

"Add White Background" option

Prerequisite: The **"Add White Background"** option is available only for presses that have an inking unit for "White" (Labelfire 340).

The test page can be given a white background to enhance the color impression when assessing a spot color, for example, when printing to foil.

"Color settings" tab for CTP devices driven as a "Digital Platesetter"

The following options are available for CTP devices:

"Source Profiles" group

Color management settings for CMYK colors.

"Enable CMYK Color Management" option

Use this option to specify that a CMYK input profile will be used for color conversion.

Note: Except for the selection of the input profile, the parameters for CMYK color management are also applicable for grayscales.

If this option is not selected, the documents are not processed with color management. This option is necessary, for example, if the digital prints are to be used for color calibration (e.g. with the Prinect Color Toolbox). In this case, the output documents may not be processed with color management. Neither a CMYK input profile nor an output profile will be used.

Note: Color management for documents with RGB and grayscale colors remains enabled even if "Enable CMYK Color Management" is disabled.

"Use Embedded Profiles" option

If documents containing colored objects or images are to be output, these objects are automatically converted so that they can be output in the CMYK or grayscale color space. The input profiles required for the input color space -> profile connection space transformation are usually included in the PDF documents and are used by color management. If the PDF documents do not have an input profile, you can use the standard input profile set by default or select a different one using the Browse button.

You use the "Use Embedded Profiles" option to define which CMYK input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the edited PDF document, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the CMYK ICC profile selected in **"If no profile is known"** will be used for color management.
- If this option is not enabled, the CMYK ICC profile selected in **"If no profile is known"** will always be used for color management.

You can create input ICC profiles – unless appropriate device profiles are already available – for example with the "Prinect Color Toolbox" and place them on the Prinect Server. The ICC profiles are saved in their subfolders in a folder below the path "PTConfig\SysConfig\Resources\ICC Profiles" (PTConfig is the shared configuration folder of the Prinect Server). This is where you can add custom ICC profiles and create appropriate folders if required.

Note: In "Administration" > "Resources" > "ICC Profiles" you can see an overview of all ICC profiles available in the Prinect workflow. See also "ICC profiles", page 21. You can also import new profiles, create a new profile folder, delete profiles, etc.

"Separate input profile settings for image and text elements or graphic elements" option

By default, the "Input Profiles", "Rendering Intent" and "BPC" (black point compensation) parameters are available for CMYK and RGB colors for image, text and graphic objects. This means that the set parameters (input profile, rendering intent, black point compensation) are valid for image, text and graphic objects.

Click the plus sign beside the "Images" icon to display the same parameters for image elements and for text/graphic objects separately. In this way, you can set up the input performance of color management separately for image/text objects and for graphic objects.

The settings that currently can be seen always affect color management.

- Collapsed (plus sign displays): joint settings for image, text and graphic objects.
- Expanded (minus sign displays): separate settings for image objects and text/graphic objects.

Rendering Intent (RI)

In addition to selecting ICC profiles, you can set the rendering intent for the colored objects. Rendering intent determines how color matching is done. Since losses always occur during a color space transformation, it can be helpful, for example, to retain the photographic perception of an original and to accept a limit on the number of color values. The following parameters are available for rendering intent: "Perceptual", "Saturation", "Relative Colorimetric" and "Absolute Colorimetric":

- Perceptual

  When you use the "Perceptual" parameter, you obtain an output, that essentially contains the perceptible impression of the original. This means that the precise, colorimetric rendering of the colors is modified in favor of the retention of the relative color relationships. In a smaller target color space, the color gamut is compressed accordingly. Vice versa, in a larger target color space and with suitable profiles, the color space may be expanded. With this color matching option, the hue in all the natural colors of the original is reproduced for the most part correctly but with restrictions in the contrast. The type of color matching is manufacturer-specific, with the user being able to set some of the aspects such as contrast and chroma change during profile generation. This option is especially suitable for photographs.

- Saturation

  In the output, the colors are rendered in such a manner that the color saturation is retained or even emphasized. The type of color matching is manufacturer-specific, with the user being able to define some settings during profile generation. This option is suitable for business graphics where the color saturation is the most important attribute in color rendering.

- Relative colorimetric

  Colors are rendered taking solely the light source into account. The rendering intent of the print medium (e.g. the color of the unprinted paper) is not taken into account. For example, the illuminant of a monitor would be correctly rendered on the print medium. That is why the term "relative" is used. All colors that lie within the output color space are rendered identically. All colors that lie outside of the output color space are displayed on the margin of the output color space. That is why the term "colorimetric" is used.

  The advantage of this rendering intent is that different illuminants of different output media are taken into account. The disadvantage is that the color adaptations are not exactly retained when switching from one output medium to another. As a result, very dark or very colorful details in the originals can be lost when they are reproduced. The substrate is not simulated during an output process simulation. If production run paper is used during the simulation, the result is the same as if you used the "absolute colorimetric" rendering intent. This rendering intent is suitable mainly for vector graphics.

- Absolute colorimetric

  Colors are rendered taking the light source and the medium illuminant (e.g. the color of the unprinted paper). For example, the illuminant of a newsprint paper which is shifted from illustration printing paper towards yellow compared to the illuminant of paper is rendered with a yellowish cast. That is why the term "absolute" is used. That is why "Absolute colorimetric" is the default setting for a proof output. All colors that lie outside of the output color space are displayed on the margin of the output color space.

The advantage of this rendering intent is that the exact color values are retained when switching from one output medium to another. The disadvantage is that any colors that lie outside of the output color space cannot be distinguished. This rendering intent is especially suitable for logos or monochrome objects which must be reproduced exactly the same way on different output media. You can set a separate rendering intent for spot colors that is independent of the color space of the alternative display color. "Absolute colorimetric" is recommended. This makes sure that the spot colors are simulated as best as possible.

- From Document

  The Color Rendering Intents that were defined for images and graphics in the PDF documents are used.

Note: You should select "From Document" only if you are absolutely sure that the edited documents have a rendering intent setting that can correctly control the color space conversion desired. However, you should not use this setting if at all possible because this is very seldom the case.

"BPC" (black point compensation) option

Black point compensation (BPC) becomes active if you enable the "BPC" option. You can enable black point compensation (BPC) for "Relative Colorimetric" "Perceptual" and "Saturation" rendering intents. However, the effect of this option can only be seen for the rendering intent "Relative Colorimetric".

In gamut mapping, all L shadows (in the L*a*b* color space) that are darker than black toner/ink are matched to black toner/ink and, as a result, shadow definition is lost.

Black point compensation enhances the reproduction area when the "Relative colorimetric" rendering intent is used for color space conversion to the L*a*b* color space or from the L*a*b* color space to the device color space. The L*a*b* color space has more lightness levels for dark image parts than the CMYK color space because the L*a*b* color space is larger than the CMYK device color space. In a color space conversion from the L*a*b* to the CMYK color space with "Relative Colorimetric" rendering intent, the color space is cut off or reproduced without definition in the shadows because they are located outside the displayable range. As a result, details in dark parts of the image are often lost, especially if ICC profiles for uncoated papers are used for color space conversion.

Black point compensation matches the black point during color space conversion, causing the definition in such dark image parts to be kept. This "elongates" the shadows causing color shifts to occur also in the lighter color values. For that reason, this method is not always suited to true-color proofing.

We recommend that you use "Perceptual" rendering intent with black point compensation and not "Relative Colorimetric" rendering intent. This rendering intent makes it possible for the various details in dark image parts to be reproduced, while keeping color shifts to a minimum. In principle, differences cannot be fully avoided because of the different sizes of the color spaces.

"Keep CMYK Colors" parameter

When this option is enabled, CMY in solid tint single-color or two-color image parts is kept.

Normally, if color management is used, C=100, M=0, Y=0, K=0 becomes, for example, C=96, M=12, Y=8, K=2. In other words, "dirtying elements" creep in. These elements are fully correct if you have a true-color display. However, this behavior may not be wanted in technical diagrams because color margins occur at the mainly clearly defined edges, for example, due to register errors or if the maximum color of the original printing process is to be retained for this color area.

Color management settings for RGB colors.

"Use Embedded Profiles" option

This option lets you define which RGB input profile will be used:

- If this option is enabled and a device-dependent input profile is embedded in the PDF documents, then this profile will be used as the input profile.
- If this option is enabled and no input profile is embedded in the PDF files, the RGB ICC profile selected will be used for color management.
- If this option is not enabled, the RGB ICC profile selected will always be used for color management.

Apart from that, the explanatory notes made for CMYK colors are applicable. See "Use Embedded Profiles" option, page 74.

Separate input profile settings for image and text elements or graphic elements

See "Separate input profile settings for image and text elements or graphic elements" option, page 74.

Rendering Intent (RI)

See "Rendering Intent (RI)", page 75.

"BPC" (black point compensation) option

See "BPC" (black point compensation) option, page 76.

Settings for Keep Black

The settings are equivalent to the settings for toner-based digital presses:

"Keep Black in Images" option

If this option is enabled, only C, M and Y are converted to the target CMY color space in images, K is not converted. Black remains identical.

Note: This setting can cause issues during an output if the black inks have different densities in the original and target color spaces.

"Match Lightness" option

This is a special setting that works as follows:

- C, M, Y are converted to the target CMY color space for mid-range and light hues. K is converted by means of a gradation curve.
- A special four-dimensional model keeping K is used for dark hues.

Extensive test series have shown this process to be the best. This setting eliminates most of the problems in complex documents. This function is available only in Heidelberg's color management. This setting is suitable for documents with text, color and gray images.

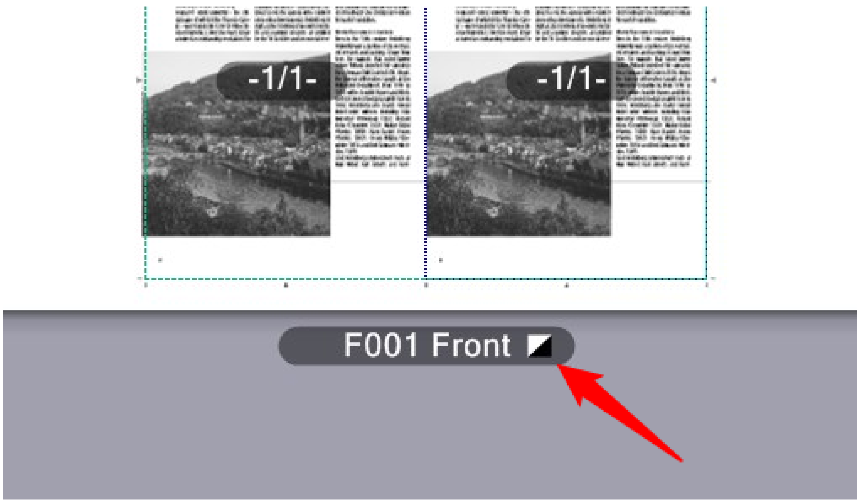
"Keep Black for Text / Graphics" option

If this option is enabled, color management does not affect black in the text or graphic objects. The following options are available for this:

- All

  Black defined for output is kept in its original form for all text and/or graphic objects that only contain black. In other words, color management does not affect black definition.

Note: If "Keep Black for Text / Graphics > All" is enabled and a page has no other separations except for black, this is highlighted in the preview by a black separation icon.



This lets you see right away whether a sheet with apparently black content really only contains the black separation. Otherwise it might be printed unintentionally in several colors.

- Keep 100% Black

  When enabled, this option has the following impact: If black is defined as C=M=Y=0 and K=100% or as R=G=B=0 and/or gray=0 in text or graphic objects, black is kept as 100% black or the colors are set to C=M=Y=0 and K=100%.

"Black Overprint" option for text / graphics

The "Overprint" function is mostly used to avoid register problems and flashes in black fonts and other black graphic objects that lie on top of a colored background. For design purposes, overprint is also used with hard shadows or colored CMYK objects. You can control overprint best if it is set directly in the application that creates the job.

The overprint settings of the Prinect Color Management on the one hand compensates for application shortcomings and on the other processes faulty documents so that you get the overprint effect you want. It's not possible to detect on a page which object is to overprint and which not. For that reason, these settings are not sufficient in some individual cases.

All black elements defined as knockout are set to "overprint" if this option is enabled.

This option affects the following color spaces: "DeviceCMYK" with C=M=Y=0%, "DeviceGray" or "/Separation/Black". You can use this option specifically on text and/or graphic objects.

"Spot Colors" group

Some of these settings are equivalent to the settings for toner-based digital presses:

"Remove Transparent Spot Colors" option

Prerequisite: This option is available only for Versafire CP and Digital Platesetter machines but not for Versafire CV, Primefire 106 and Labelfire 340 presses because these can be fitted with coating units.

Spot colors can be defined as "transparent". This is set in "Colors" in the job settings. Generally, transparent spot colors are used as varnishes.

When this option is enabled, all spot colors defined as "transparent" are removed from the printing data. You should enable this option if the press has no coating unit.

You must disable this option if a coating unit is available and if it is to be used to output transparent spot colors.

"Remove 'DieLine'" option

"DieLine" spot colors will not be printed when this option is enabled..

"Map Spot Colors to Process Colors" option

When this option is enabled, spot colors are not output as separate color separations but are converted to CMYK colors.

The impact of this option is visualized in the sheet preview.

Note: The spot colors that are set in "Colors" in the print job are always used in the "Digital Printing" step.

- PDF documents generally have "recipes" for replacing the spot colors in the document by process colors (CMK replacement). In other words, each spot color in the document has set CMYK values that replace this spot color. In "Colors" you can set which replacement policies will be used, those in the job settings or those in the PDF documents.
- The "Administration" section of the Prinect Cockpit also has recipes for spot color replacement in "Color Tables". In "Colors" you can set which replacement policies will be used, those in the job settings or those in "Administration > Color Tables".

"Output Quality ΔE_{00}"option

This function gives you the option of checking the accuracy with which spot colors can be simulated in digital printing without having to output test prints.

The ΔE 2000 values display for each spot color for the set paper grade. If different paper grades are used for the cover and the body, these values display separately for each of these paper grades. The ΔE 2000 value displayed is red if it exceeds a critical amount.

"Spot Color Matching" function

You can use "Spot Color Matching" if you need special settings for spot color replacement. This function lets you customize the settings for replacing spot colors in your current print job.

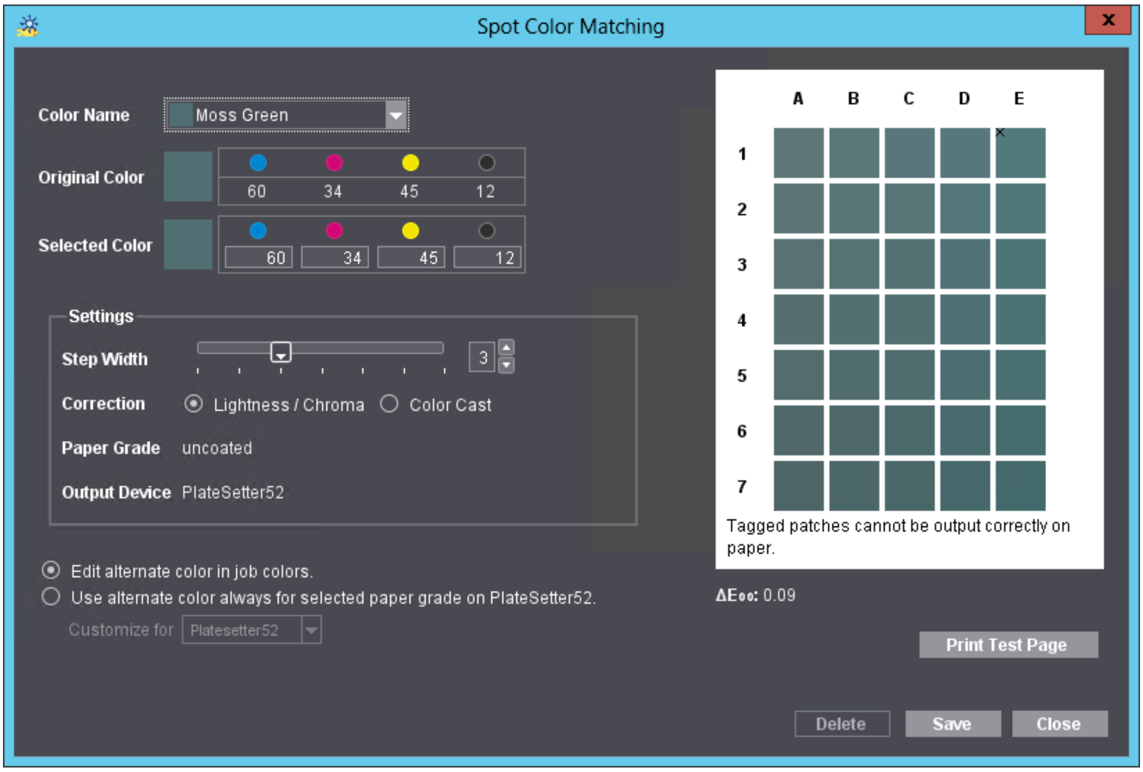
Note: If a color profile is set in the job and it deviates from the output profile defined in the digital print settings of the Prinect Manager, then a warning is issued whenever you click "Spot Color Matching" to open the dialog. This warning draws your attention to the fact that spot color matching is not possible because of the different color profiles. You can choose to apply the output profile of the Prinect Manager for spot color matching or to cancel spot color matching.

We recommend that you have a probe of the correct spot color in the original on hand before you start color matching to be able to compare the printouts of the test charts with this probe.

Note: The settings always relate to a specific paper grade on a specific press.

1. Click **"Spot Color Matching"**.

   The "Spot Color Matching" dialog opens.



2. In the **"Color Name"** list box, first select the spot color for which you want to define a substitute color. All the spot colors that are in the current print job are listed.

   The original color displays in "C4", the middle color patch. Modified colors display around the original color. Colors that cannot be output correctly to the paper set in the print job are marked by an "x".

   The ΔE 2000 value of the currently selected color patch displays below the color patches. When you move over a different color patch with the mouse cursor, the current ΔE 2000 value of this patch displays. This is a fast way to view the differences to the original color and find an optimal substitute color.

   The aim of these settings is to determine a color that optimally replaces the original spot color, allowing it to be output correctly (in other words, a color that is not marked by an "x").

3. Click **"Print Test Page"**. A test chart is printed.

Note: Each test chart printout creates a new separate print job in the Prinect Manager. These test chart print jobs are set up with the color settings that are required for a true-color output.

4. Now compare the printout of the test chart with the original copy and determine the color patch that best matches the original spot color.

5. If the deviation is still too big, enable either **"Lightness/Chroma"** or **"Color Cast"** in **"Correction"** to set the type of color change. Now move the **"Step width"** slider until suitable patches display in the preview window. The bigger the step width, the greater the differences between each of the color patches.
6. Repeat steps 3 and 4 until you are satisfied that the target color is determined accurately enough. On the test chart, the patch with the correct color has an "address", e.g. "D6".
7. Click the "D6" patch in the "Spot Color Matching" dialog.

   The CMYK values or the L*a*b* values (whichever one is defined) of the original color display in **"Original Color"**. The values of the selected color display accordingly in **"Selected Color"** (in our example, those of "D6").

Note: The values of the target color are always specified as CMYK values even if the original color is set in the L*a*b* color space (exception: inkjet presses, see below).

8. Enable **"Edit alternate color in job colors"** if you wish to set the alternate color only for the current print job.

   If the alternate color is always to be set for the paper grade used, enable **"Use alternate color always for paper grade "..." on (...)"** and select the paper grade that will be used for printing the test page in the **"Customize for"** list box. Then these settings affect all print jobs that are printed with this paper grade on this press. This setup is applicable until you edit it again.

9. If you are satisfied with the colors selected, confirm the dialog with **"Save"**.

(10).Use the **"Delete" button** to reset all the settings so that special spot color settings are no longer defined for the particular paper grade/press combination.

The **"Paper Grade"** and **"Output Device"** boxes are for your information only.

"Output Profile" group

This is where you define which output profile will be used for CTP output.

"Automatic Selection by Paper Type" option

When you enable this option, color is matched automatically to the color profile of the selected paper grade. This requires that the paper grades used are characterized. In other words, there is a suitable color profile that is matched as best as possible to the color reproduction properties of the paper. Normally, this is the best setting for color management.

"Convert to Gray" option

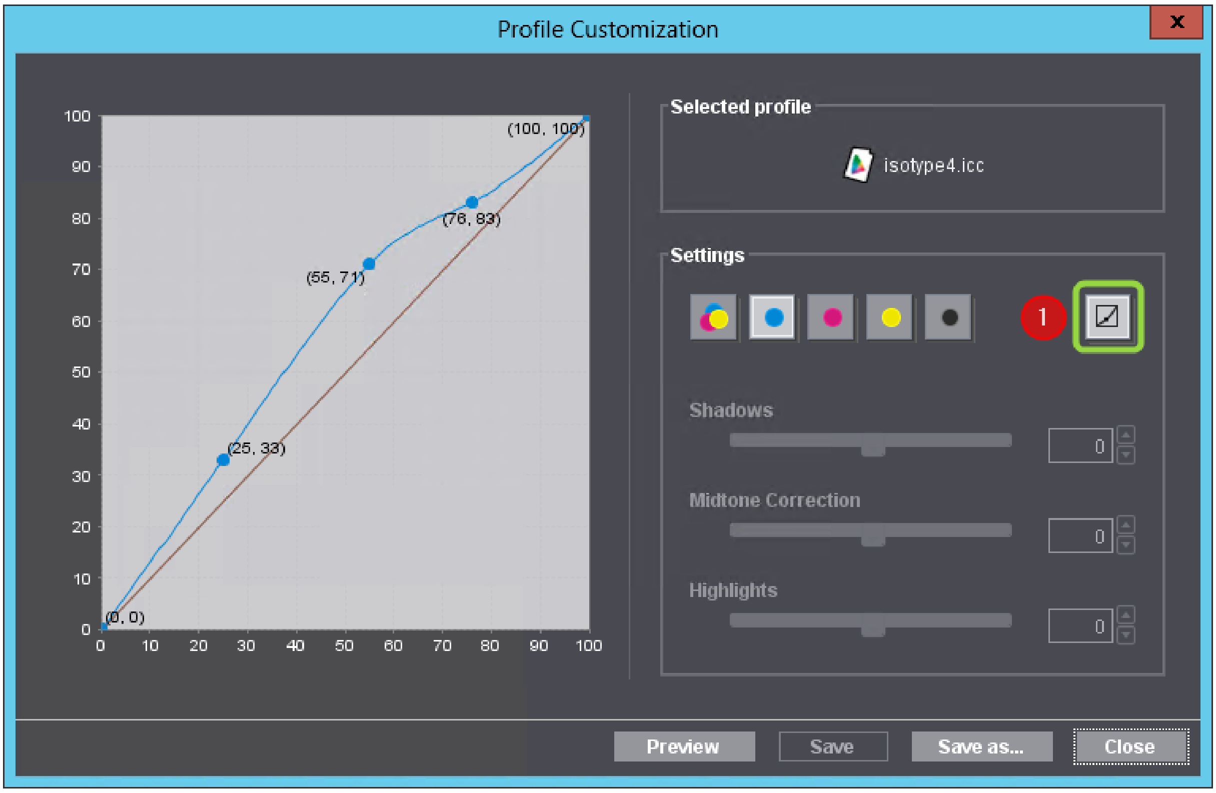
When you enable this option, the job or component job (cover or content) is output as a grayscale even if it contains color pages. This setting displays in the preview.

"Other Profile" option

You can use this option if you want to use a different output profile to the one selected by default for the set paper for CTP output. Use the Browse button to select an ICC profile file in the system environment.

"Profile Customization" function

The "Profile Customization" function lets you fine-tune the currently set output profile under visual control on the screen when needed. The following dialog opens when you click the "Profile Customization" button:



The name of the active profile displays at the top right.

1. You can set "Shadows", "Midtone Correction" and "Highlights" jointly for CMY or separately for C, M, Y and K by clicking the toggle for switching between freehand and slider operation (1). The sliders for this are then enabled.
2. The page displayed in the preview is matched to the new color profile settings when you click "Preview". This lets you check the effect of the edited color profile.
3. You can save the modified color profile if you are happy with the settings. The color profile in the current job will be overwritten when you click "Save". Click "Save as" to save the modified color profile under a different name on the Prinect server. The profile can then be used again for subsequent jobs.
4. Click "Close" to close the dialog. A message appears if changes were made but not saved.

Quality of Color Reproduction in Printing

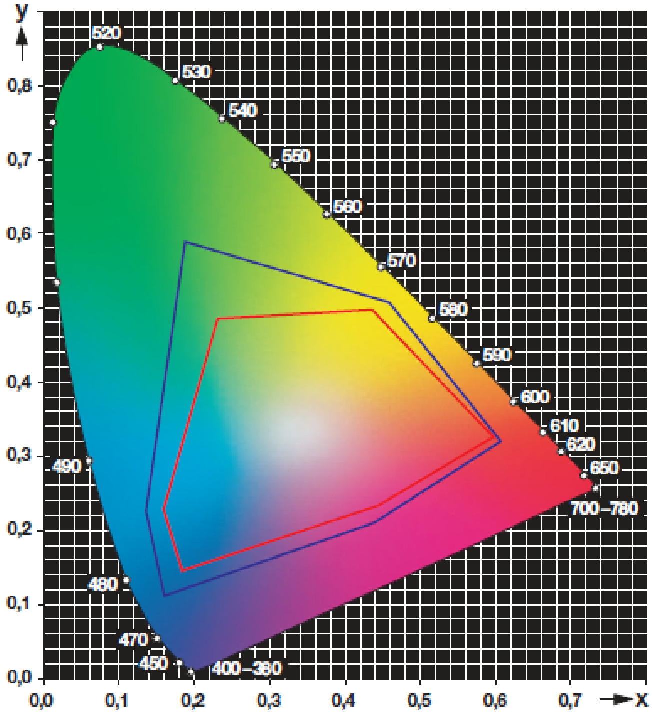
The aim of quality assurance in printing is to reproduce colors correctly and consistently throughout the whole print run. Beside the ink and the chromaticity of the printing material, the key influencing variables are ink film thickness, screen value, ink balance as well as ink trapping and color order.

This chapter will show you which factors can influence the quality of color reproduction in the print. Backed up by this knowledge, you can match the quality of printing optimally to the output process used (print process, printing material, inks used).

Ink film thickness

In offset printing, the maximum coating thickness that can be applied is around 3.5 micrometers for process reasons.

On art paper with process colors as per ISO 2846-1, the correct chromaticity loci should be achieved on coating thicknesses between 0.7 and 1.1 micrometers. The standardized corner points of the CIE chromaticity diagram may not be achieved if unsuitable lithographies, badly matched printing materials or unsuitable process colors are used.



The reproducible color gamut is also smaller if saturation is not optimal. In the diagram, the red-rimmed area shows a color gamut that is smaller because of underinking of all three process colors. The blue-rimmed area would be achieved if saturation were optimal.

From a physical viewpoint, the influence of ink film thickness on the optical appearance can be explained as follows:

Process colors are not opaque but transparent (translucent). Light penetrates the process color. When passing through the color, it hits pigments that absorb a more or less large part of certain wavelengths of light.

Depending on the pigment concentration and ink film thickness, light hits a greater or smaller number of pigments, with different amounts of light absorbed accordingly. The rays of light finally reach the surface of the printing material and are reflected (remitted) by it. In this process, light must penetrate through the coating again before reaching the eye.

A thick coating of ink absorbs more fractions of light and reflects less than a thin coating. That is why the observer sees a darker and more saturated hue. The fraction of light reaching the eye forms the basis for assessing the color concerned.

Screen value

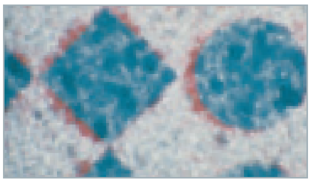
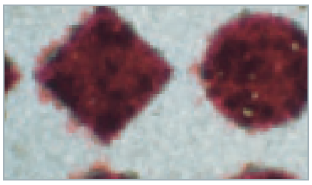
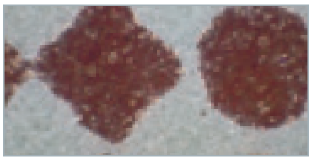
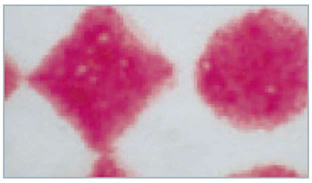
Besides ink, screen value is the most important influencing variable for the optical appearance of a color shade. In terms of a film, screen value corresponds to the covered part of a certain area. The lighter the hue to be reproduced, the smaller the covered part. In classical screening with a constant screen ruling (also called screen frequency), screen dots of a size varying according to the tonal value desired are used for the reproduction of different color shades. In frequency-modulated screening, on the other hand, work is based on the different spacing of screen dots of the same size. Screen values are usually specified in percent.

Changes in screen value

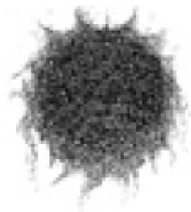
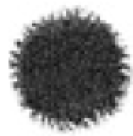
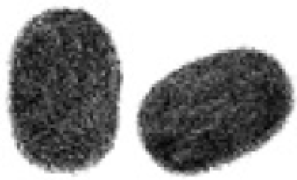
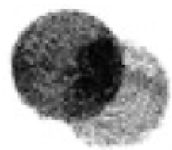
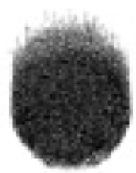
When a screen dot passes from plate onto rubber blanket and onto the printing stock, its geometric size and, accordingly, its tonal value can change because of various influences.

Changes in the screen value due to the process can be compensated in prepress. For this purpose, print samples are measured and compared with the originals. This gives you transfer characteristic curves. If work in the process chain from the digital camera to the finished print product is standardized, i.e. always to the same defaults, a print product that is true to the master copy can be expected.

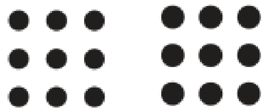
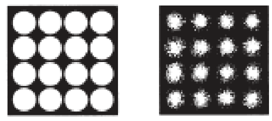
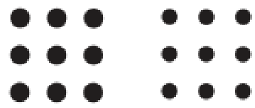
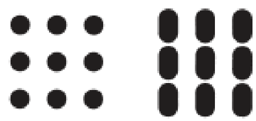
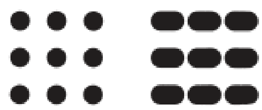
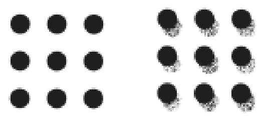
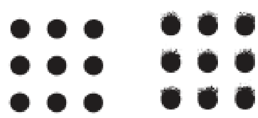
What cannot be predicted in advance are changes to the screen value that are caused by printing difficulties. Special attention must be paid to them during printing. Here are the major ones:

Path of screen dot	Influences on screen dot	What screen dots look like	
Printing plate	Material, wear during printing		Screen dots on the plate
Dampening	Dampening solution quantity, PH value, surface tension, water hardness, temperature		
Inking up	Ink film thickness, consistency, temperature		Screen dots on the plate after inking up
Rubber blanket Pressure rubber blanket / printing material	Material, state, surface Cylinder unrolling		Screen dots on the rubber blanket
Printing material Sheet conveyance Delivery	Surface, paper quality Transfer register Smearing		High magnification clearly shows the first-class result on the printing material.

Screen dot deformation

Dot gain refers to the enlargement of dots in printing compared to the original data, although the gain cannot be influenced by the press operator because it is caused by the process, by the materials or by the machine properties.	
Fill-in is the decrease in size of non-printing areas in the shadows until they disappear completely. Slurring or doubling can also cause fill-in.	
Sharpening refers to a decrease in the screen value in printing compared to the original data. In practice, sharpening is often used to also describe a reduction in dot gain, even when the dots are still fuller in printing than in the digital data.	
In slurring, the shape of a dot changes during printing as a result of relative movements between plate and rubber blanket and/or between rubber blanket and press sheet, for example, a round dot changes into an oval one. Slurring in print direction is called circumferential slurring and slurring at a right angle to this is known as lateral slurring. If both types of slurring occur at the same time, the direction of slurring is diagonal.	
In offset printing, doubling is when a shadow-like, mainly smaller, unintentional dot is printed next to the intended dot. Doubling is caused by ink being out of register when transferred between rubber blanket and plate.	
On a press, smearing refers to those screen dot deformations that are caused by mechanical influences after printing. Smearing is also used as a synonym for ink set-off.	

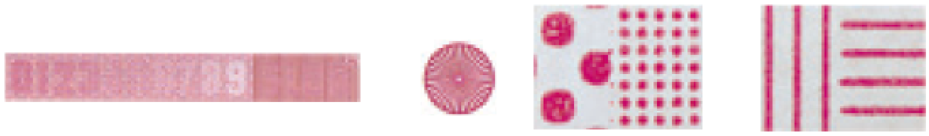
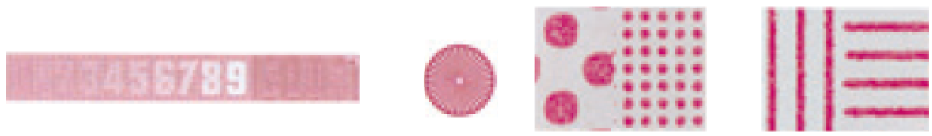
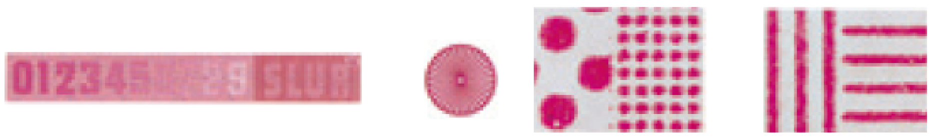
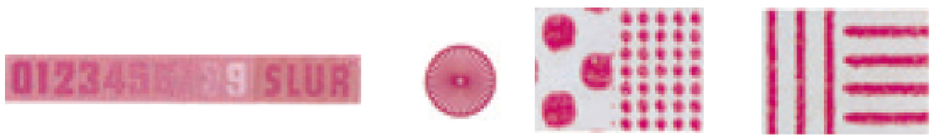
What the press operator needs to keep in mind

Dot gain can be monitored technically and visually using control strips and the increase in size captured. Print control strips are particularly suited to visual assessment. Fill-in can be monitored especially using halftone control elements with high tonal values.	Correct Incorrect 
Dot gain and fill-in are mainly the result of excessive ink feeding, insufficient dampening solution feed, too much pressure between plate and rubber blanket or the blanket being too slack. It can also be due to incorrect setting of the inking and dampening form rollers.	Correct Incorrect 
Normally, in printing there is always a certain amount of dot gain. Sharpening can occur as a result of process errors like plate blinding or ink setup on the rubber blanket. Countermeasures: Wash rubber blankets and inking units more frequently, maybe change the ink and print order, check inking form rollers, pressure setting and unrolling.	Correct Incorrect 
Slurring is most conspicuous in line screens. In many cases, the parallel lines provide information about the direction of slurring. Circumferential slurring usually indicates that the plate and rubber blanket cylinders are not turning smoothly in relation to one another or that the cylinders exert too much pressure on each other. For that reason, these factors should be monitored very accurately. Frequently, slurring is also caused by the rubber blanket being too slack or by too much inking. Lateral slurring rarely occurs by itself. If it does, particular attention should be paid to the printing material and rubber blanket.	Correct Incorrect  Correct Incorrect 
The same elements are used for monitoring doubling and slurring. In addition, the screen dots must be examined with a magnifier because the line screen elements alone cannot tell you whether it is a case of slurring or doubling. There are many reasons for doubling. Generally, they are related to the printing material and its immediate environment.	Correct Incorrect 
Smearing occurs very rarely on modern sheetfed presses. The areas of a sheetfed press where the sheet is supported mechanically on the freshly printed side are the most likely sources of smearing. A stiff printing material increases the likelihood of smearing. Smearing can also occur on the delivery pile or on perfecting presses.	Correct Incorrect 

The type of change that the screen value undergoes can be determined fast and visually by means of printed control elements like a SLUR strip. These elements visually magnify the malfunction in printing.

Errors like dot gain or sharpening, slurring or doubling have a greater impact in fine screens than in coarse ones. Fine dots namely decrease or increase by the same width as coarse dots. However, many small dots together have a circumferential length several times that of coarse dots with the same tonal value. Consequently, in printing more ink is applied around fine dots compared to coarse ones. That is why areas with a fine screen frequency appear darker. This fact is exploited by control elements.

By way of example, we will now take a brief look at the structure of the SLUR strip and how it works. This strip combines coarse screen elements (background) and fine screen elements (numerals).

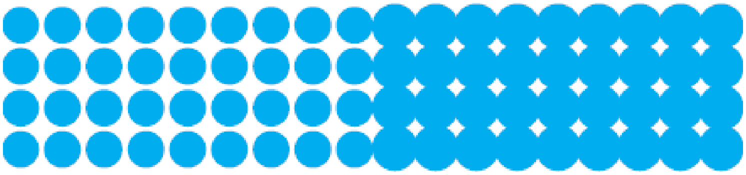
Good	
Fuller	
Leaner	
Lateral slurring	
Circumferential slurring	

In contrast to the consistent tonal value of the coarse screen, the numerals 0 thru 9 have a fine screen frequency with increasing tonal values. If the numeral 3 and the coarse screen patch have the same tonal value on a well printed sheet in a production run, the numeral 3 can no longer be detected. However, as dot gain increases in printing, the number blends in more and more with the tonal value of the background with each higher number. The fuller the printed dots become, the higher the value of the invisible number.

This works in reverse when sharpening occurs. In this case, the numeral 2, 1 or even 0 becomes illegible compared to normal printing. However, the numeral only indicates whether printing is becoming fuller or leaner. The causes must be identified by examining the plate or even during printing with a magnifier.

The SLUR part to the right of the numerals indicates primarily whether there is slurring or doubling. The word SLUR is equally legible in lean, full and normal printing, with the whole patch appearing somewhat lighter or darker.

It is easy to detect the directional spread typical for slurring and doubling in the word SLUR. In circumferential slurring, for example, the horizontal lines forming the word SLUR that run parallel to the lead edge of print become thicker. In lateral slurring, the vertical lines forming the background of the word SLUR become darker.



Correct Incorrect

The illustration shows how changes in screen dot impact the printed result in the case of dot gain. A different hue is the result if the dots of even one color are bigger than desired. Naturally, this also impacts the composite print. In offset printing, the dots mainly become bigger as they are transferred from one step to the next. This is known as dot gain.

Control strips indicate whether the result of printing is good or bad, but they do not provide any information about absolute figures or the types of errors. Therefore, an objective measuring process is needed to assess the quality of the screen values with verifiable data.

Dot gain

Dot gain is the difference between the screen values of the (digital) original data and those in printing. Differences occur on the one hand through geometric changes in the halftone dots and through light absorption on the other.

Exactly like the screen value, dot gain is also usually specified in percent. Because dot gain can vary according to the different tonal value range, the appropriate reference value should also be specified when giving details about dot gain.

Example: Dot gain = 13CIEL*a*b* with screen value original data = 40CIEL*a*b*. Modern measuring devices show the dot gain directly.

Attention: Dot gain specifies the difference between the screen value in printing and that of the original data in absolute figures. Consequently, in the example above you have a tonal value of 53CIEL*a*b* in printing while the tonal value of the original data is 40CIEL*a*b*.

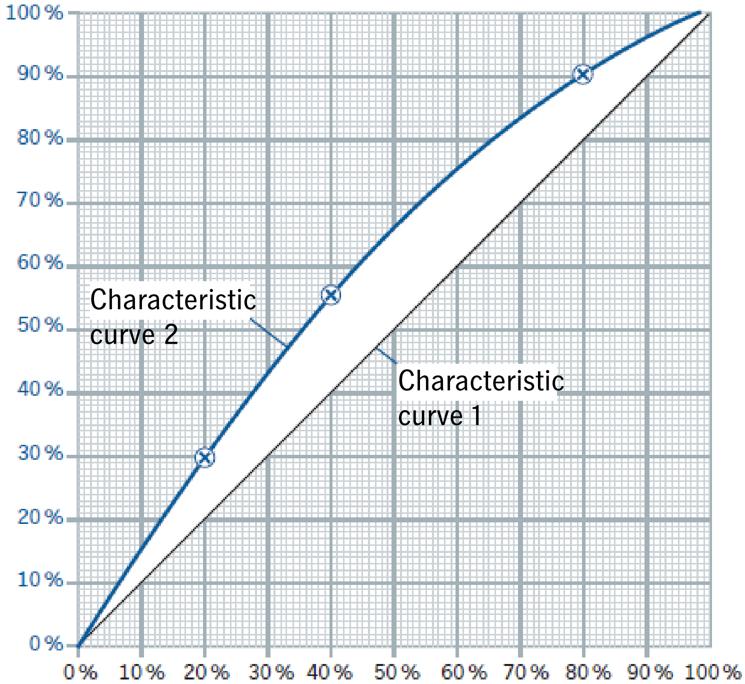
Printing Characteristic

The deviation of the screen values in printing from those of the original data can be depicted clearly in what is known as a printing characteristic (curve).

To determine the characteristic curve, graduated halftone patches and a solid tint patch with all colors are printed under reproducible conditions. After that, the halftone patches and the solid tint patches are measured with a densitometer or spectrophotometer. The values determined in this way are entered in a diagram against the tonal values of the original data, and the result is a characteristic curve.

It is only valid for the specific combination of ink, paper, pressure setting, rubber blanket and plate. A different characteristic curve results if the same procedure is run on another press with different ink or paper.

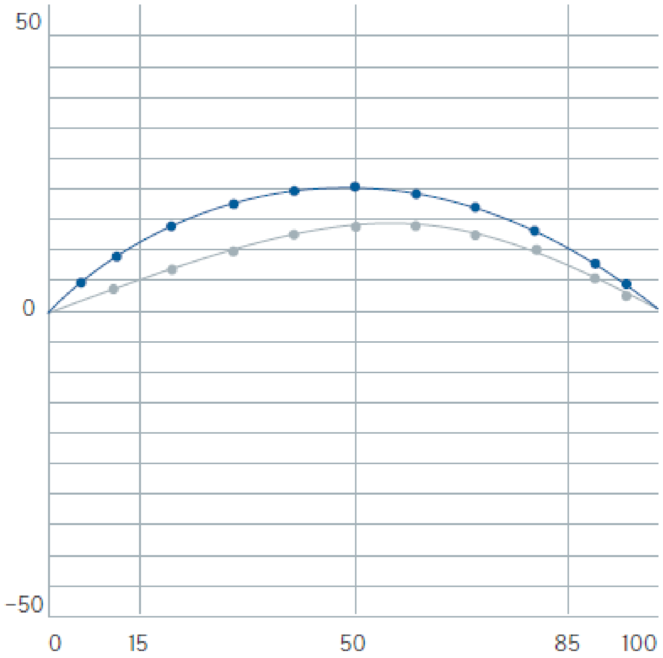
Printing Characteristic



Characteristic curve 1 is a straight line at an angle of 45°. It indicates that the tonal values of the original data and of the print are identical. In practice, this cannot be achieved. Characteristic curve 2 portrays the tonal values measured in the print. The area between both characteristic curves is the dot gain, mathematically the difference between tonal value in print and tonal value in the original data.

The midtones give you the best information for determining dot gain in printing. The characteristic curve shows that tonal value deviations are the most pronounced in this range. Using characteristic curve 2, the CTP device can be set so that the desired tonal values are achieved in print (with the usual dot gain).

To achieve this, it is important that the CTP device was set in advance so that the dot size on the plate corresponds exactly to the dot size of the original data. In other words a tonal value of 50CIEL*a*b* in the file must also be 50CIEL*a*b* on the plate. This step is known as linearization. The second step then consists of adapting the dot size in print so as to offset dot gain. This step is known as process calibration.



The diagram shows the deviation of the tonal values between the desired curve (in this case ISO 12647-2, gray) and the actual print result (blue).

In practice, there are always minor deviations because of fluctuations in the process. For this reason, tolerances are specified for dot gain. To keep the print quality as consistent as possible, it is imperative to check the tonal values at regular intervals using a print control strip.

Relative print contrast

As an alternative to dot gain, the relative print contrast K_{rel} (CIEL*a*b*) is determined now and again. This is particularly useful for monitoring screening in three-quarter tones.

A printed product should have as much contrast as possible. To this end, the solids must have a high color density whereas the screens must be printed with as much definition as possible (optimum difference of dot gain). When the inking and consequently the screen dot density increase, the contrast rises. But this can be done up to a certain level only. Beyond this point, the screen dots tend to become fuller and consequently, in particular in shadow areas, to fill in. This in turn reduces the portion of paper white, and the contrast decreases again.

If there is no measuring device that can show the contrast value directly, relative print contrast can be determined through calculation or using the FOGRA grid table. If the contrast value becomes worse in production despite consistent solid tint density, this can indicate that the rubber blankets need washing. If solid tint density is correct, the contrast value can be used to assess different factors that influence the print result, for example:

- Unrolling and cylinder pressure
- Rubber blankets and underpacking
- Dampening
- Inks and additives

The relative print contrast is no longer specified in ISO 12647-2. Instead, values are given for solid tints and dot gain of the individual colors. Consequently, relative print contrast also results from this. Relative print contrast remains an important variable if this standard is not applied because, for example, an FM screen is used

Color balance / Image structure

As already mentioned, hues in four-color printing are reproduced by specific percentages of cyan, magenta, yellow and black. A color deviation results whenever these percentages change. To prevent this from happening, the color percentages must be kept in the balance required to reproduce the hue desired.

The hue becomes lighter or darker if only black changes. This does not disturb perception of the color to any great degree. The same can be said if the chromatic colors change by the same amount in the same direction. However, the observer is much more alert to changes in hue. This happens when the chromatic colors change by different amounts or, in the worst case, in the opposite direction. Such changes in the color balance can be seen most clearly in the gray patches. For that reason, the term gray balance is often used in this context.

The extent to which unavoidable fluctuations of each ink in the print process have an impact depends decisively on the image structure selected in prepress. In this respect, the questions relevant for printing are:

- Which inks make up the gray areas?
- What is used to darken colored image areas?
- How is shadow definition generated?

Briefly: What do gray and achromatic components consist of and what is the resulting total area coverage?

Remember: Gray and achromatic components can be generated either from cyan, magenta and yellow or by using black. A combination is also possible.

Color composition

Hues in four-color printing are reproduced by specific percentages of cyan, magenta, yellow and black. A color deviation results whenever these percentages change in printing in relation to the originally set defaults. To prevent this from happening, the color percentages must be kept in the balance required to reproduce the hue desired.

The hue becomes lighter or darker if only black changes, something the observer does not find particularly disturbing. The same can be said if the chromatic colors change by the same amount in the same direction. However, the observer reacts much more to changes in hue. This happens when the chromatic colors change by different amounts or, in the worst case, in the opposite direction. Such changes in the color balance can be seen most clearly in the gray patches. For that reason, the term gray balance is often used in this context.

The extent to which unavoidable fluctuations of each ink in the print process have an impact depends decisively on the image structure selected in prepress. In this respect, the questions relevant for printing are:

- Which inks make up the gray areas?
- What is used to darken colored image areas?
- How is shadow definition generated?

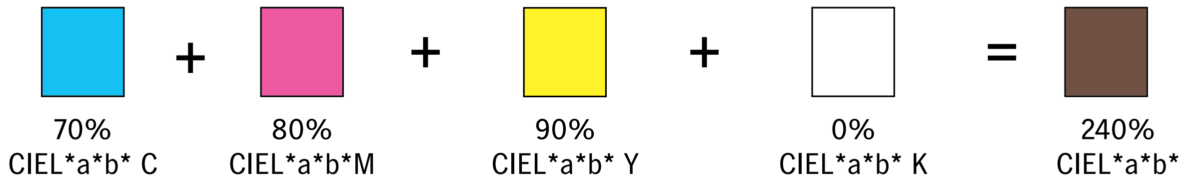
In brief: What do gray and achromatic components consist of and what is the resulting total area coverage? Remember: Gray and achromatic components can be generated either from cyan, magenta and yellow or by using black. A combination is also possible.

- Chromatic reproduction, page 96
- Achromatic reproduction, page 98
- Achromatic reproduction with under color addition (UCA), page 99
- Achromatic reproduction with under color removal (UCR), page 100
- Chromatic reproduction with gray stabilization, page 101
- Chromatic reproduction with gray component replacement (GCR), page 101
- Five, six and seven-color printing, page 102

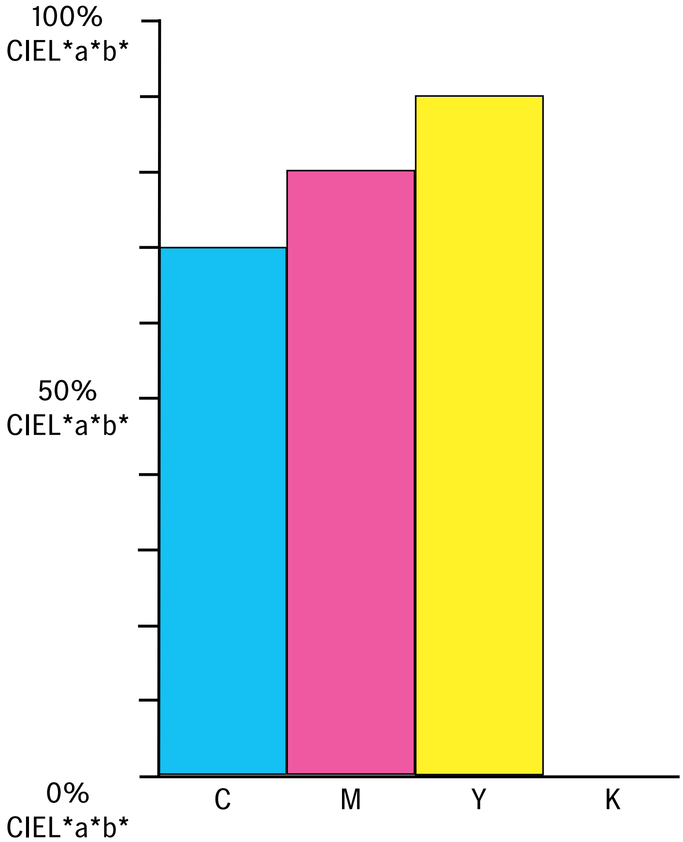
Chromatic reproduction

In chromatic reproduction, all achromatic values are made up in principle of subsets of the chromatic inks cyan (C), magenta (M) and yellow (Y). In other words, all gray areas, all tertiaries and shadows contain the three chromatic inks. Black (K) is used only to support image shadows and enhance shadow definition (skeleton black).

Chromatic reproduction without black:



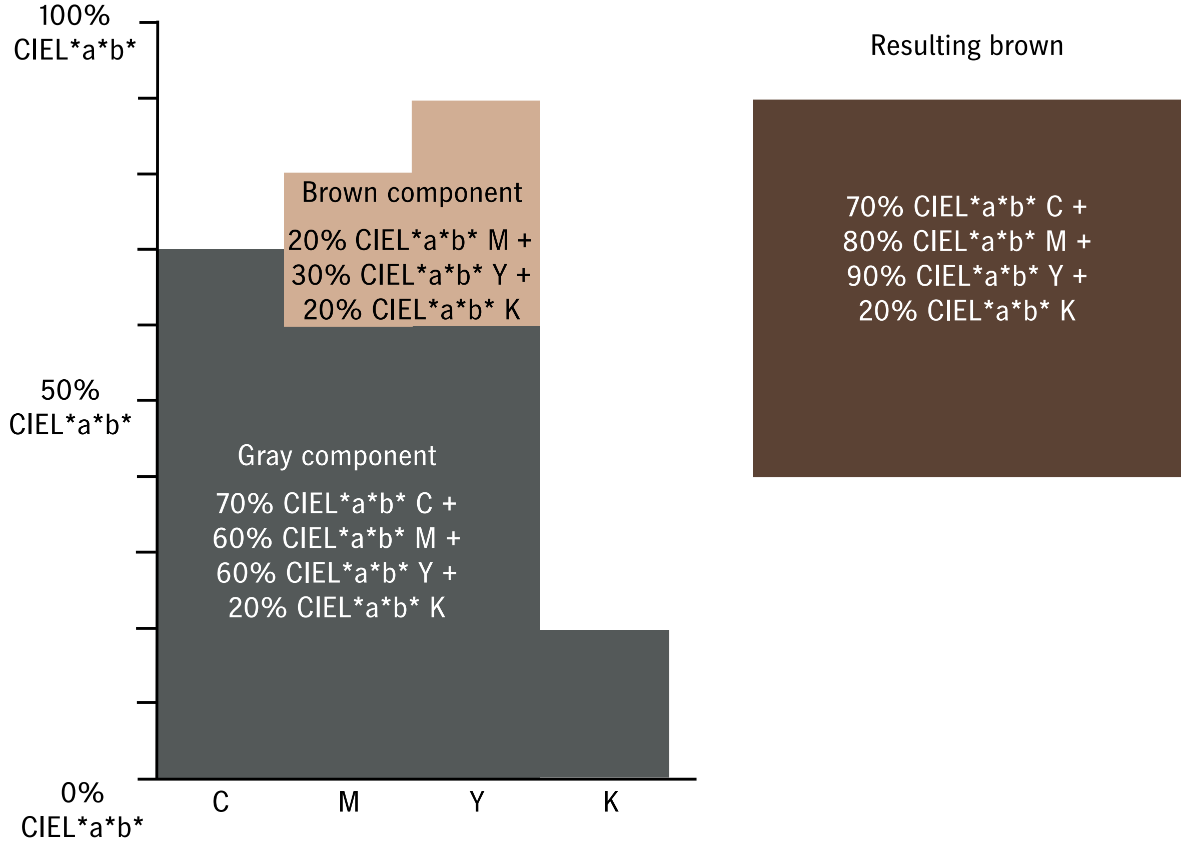
In chromatic reproduction, brown as shown in the illustration was made up of 70% CIEL*a*b* cyan, 80% CIEL*a*b* magenta, 90% CIEL*a*b* yellow and 0% CIEL*a*b* black. Therefore, the total area coverage is 240% CIEL*a*b*.



Chromatic reproduction with 20% CIEL*a*b* black

The effect of the colors with a black percentage of 20% CIEL*a*b* is illustrated below. Brown (like above + 20% CIEL*a*b* K) is made up of an achromatic component, a gray component and a chromatic component. Compliant with ISO 12647-2, 70% CIEL*a*b* cyan, 60% CIEL*a*b* magenta and 60% CIEL*a*b* yellow produce gray in the composite print; 20% CIEL*a*b* K darkens gray. Only the remaining 20% CIEL*a*b* magenta and 30% CIEL*a*b* yellow form the light brown chromatic component. This is made somewhat darker by the black component.

The result is a brown that is darker because of its 20% CIEL*a*b* K than the brown in chromatic reproduction without black.

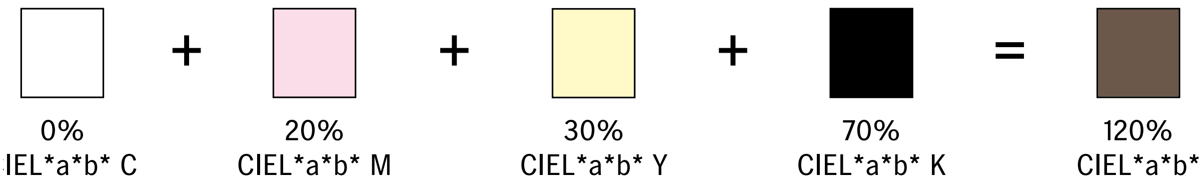


Chromatic reproduction leads to high total area coverages that theoretically can be 400% CIEL*a*b* but in practice are max. 375% CIEL*a*b*. These high total area coverages have a negative influence on ink trapping, drying and powder consumption. Color balance is difficult to maintain in printing.

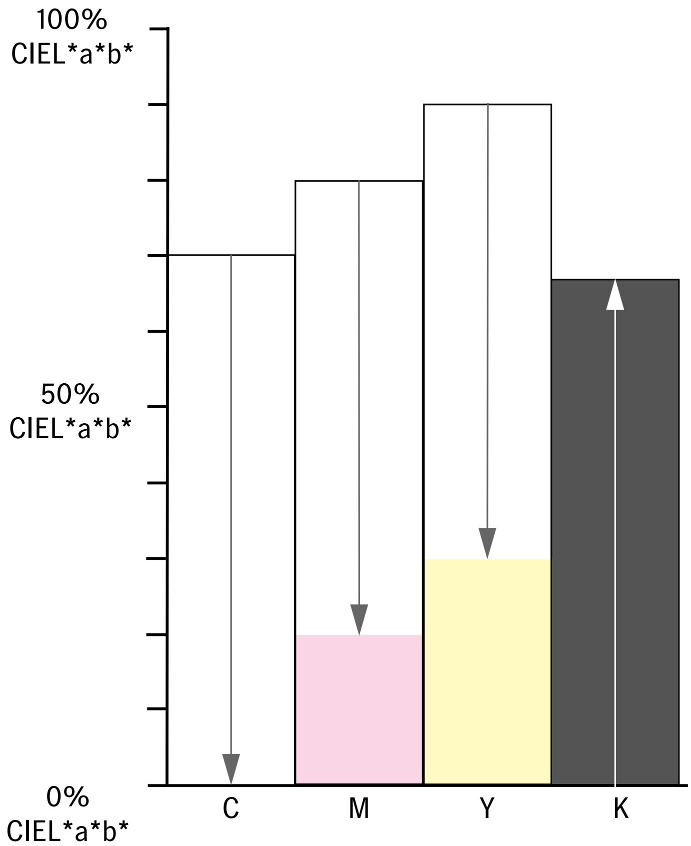
Achromatic reproduction

In contrast to chromatic reproduction, all achromatic components are replaced in principle by black in the achromatic reproduction of multi-color print images. Neutral, "achromatic" hues consist therefore only of black, and black is also used to darken chromatic hues and for shadow definition. All hues consist of a maximum of two chromatic inks plus black. This makes color balance more stable.

In theory, brown from the previous section is made up as follows when using achromatic reproduction: 0% CIEL*a*b* C + 20% CIEL*a*b* M + 30% CIEL*a*b* Y + 70% CIEL*a*b*K.

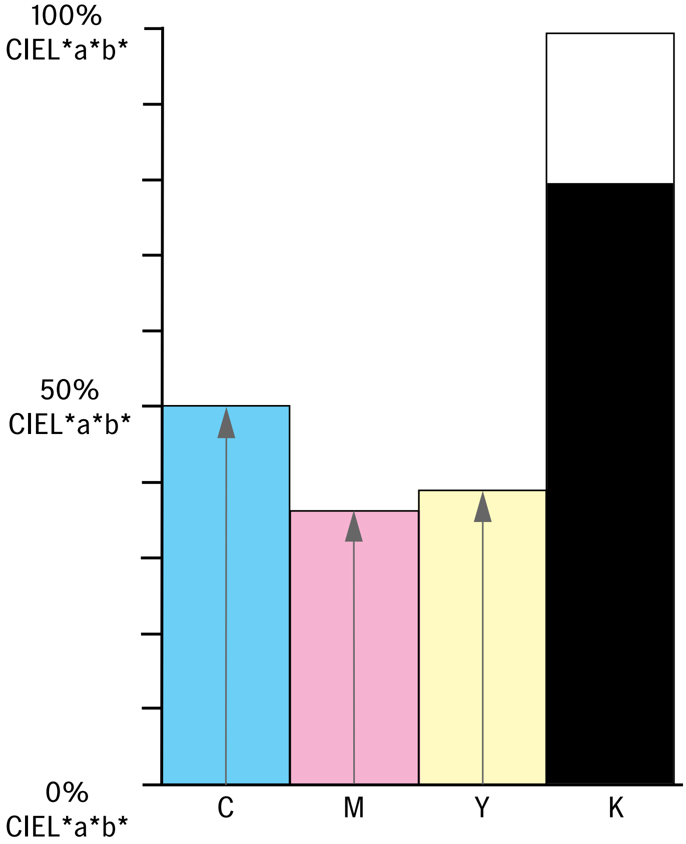


However, this shows that simply replacing the achromatic components produced with CMY by black does not result in the same color in print. The main reason for this is due to the shortcomings of actual inks. Similar colors are produced only by modifying the chromatic components and black, e.g. to 62CIEL*a*b* M, 80CIEL*a*b* Y and 67CIEL*a*b* K. Achromatic reproduction corresponds to 100CIEL*a*b* GCR (gray component replacement).



Achromatic reproduction with under color addition (UCA)

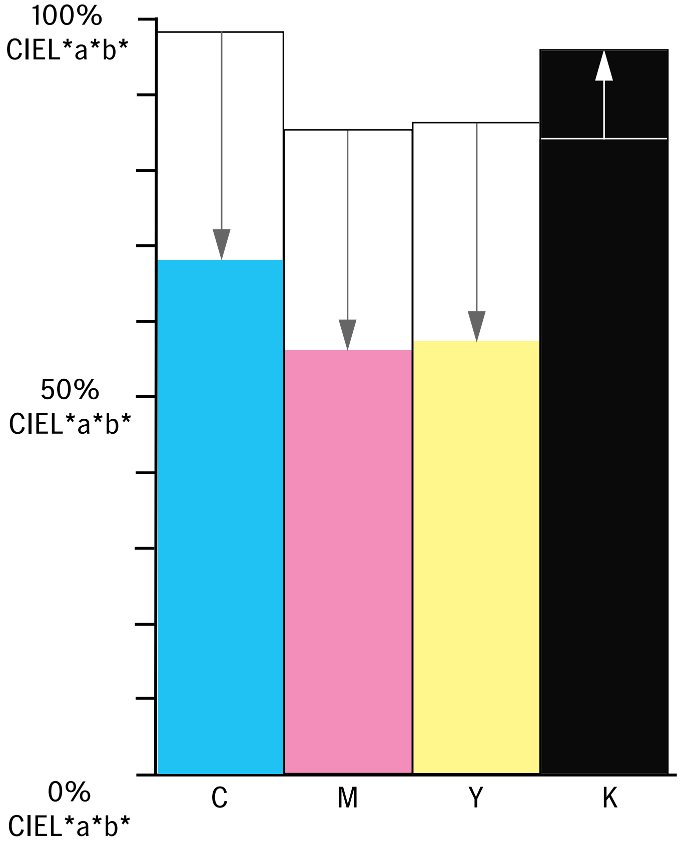
Black occasionally shows insufficient shadow definition in the darker part of the gray axis, meaning that the part is not darkened enough. In such cases, achromatic reproduction with under color addition is applied. In UCA (Under Color Addition), the darker part of the gray axis is softened. This means that black is reduced and the neighboring chromatic areas are enhanced by adding an achromatic component made up of C + M + Y. This process depends in particular on the combination of printing material and ink.



The illustration above shows you an example of under color addition (K reduced, C, M, Y enhanced).

Achromatic reproduction with under color removal (UCR)

In chromatic reproduction, the highest total area coverages are found in the neutral three-quarter tones up to black. Under color removal (UCR) offsets this drawback. The achromatic component made up of C + M + Y is reduced in the neutral shadows and, to a lesser extent, in the neighboring chromatic areas, while black is increased.



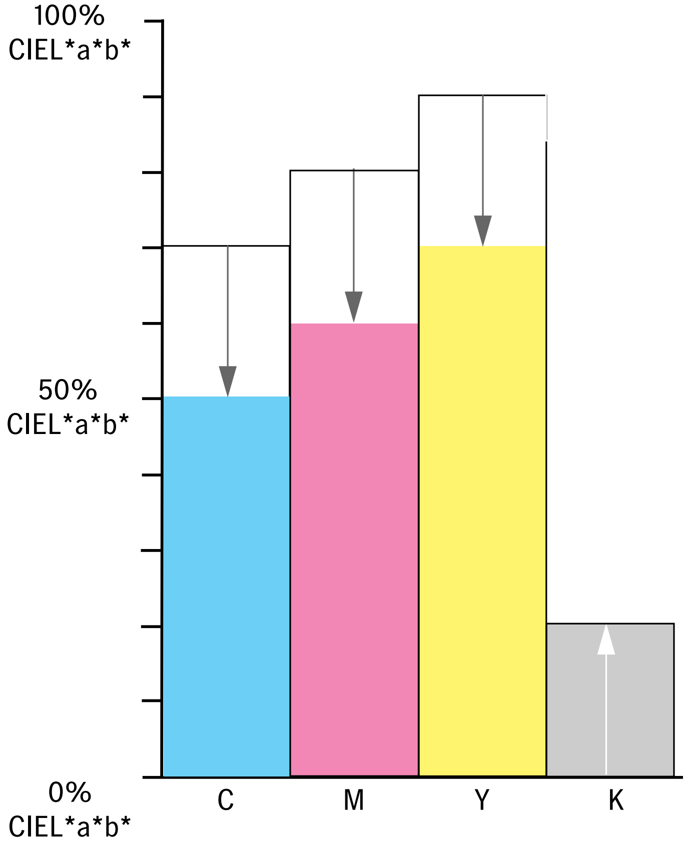
In the example, UCR reduces the initial area coverage of 98% CIEL*a*b* cyan + 86% CIEL*a*b* magenta + 87% CIEL*a*b* yellow + 84% CIEL*a*b* black = 355% CIEL*a*b* by 78CIEL*a*b* to 68% CIEL*a*b* cyan + 56% CIEL*a*b* magenta + 57% CIEL*a*b* yellow + 96% CIEL*a*b* black = 277%. This has a positive effect on ink trapping, drying and balance in the shadows.

Chromatic reproduction with gray stabilization

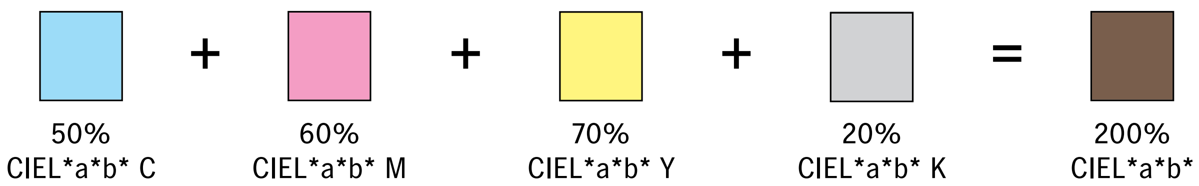
Chromatic grays are difficult to keep balanced in printing. Color casts readily occur. These can be counteracted by gray stabilization. Achromatic components made up of C + M + Y are replaced partly or fully by black along the whole gray axis and, to a lesser extent, in the neighboring chromatic areas, unlike with UCR where only the darker end of the gray axis is affected. In practice, this is also known as a "long black".

Chromatic reproduction with gray component replacement (GCR)

In gray component replacement (GCR), C, M, Y components neutralizing to gray are replaced by achromatic black both in the neutral and in the chromatic image areas. As a result, GCR can be used for all intermediate stages between chromatic and achromatic images in all image areas. In other words, it is not restricted to gray areas like UCR, UCA or gray stabilization. Gray component replacement is occasionally also referred to as complementary color reduction.



In theory, brown from the above examples could also be generated with GCR as follows:



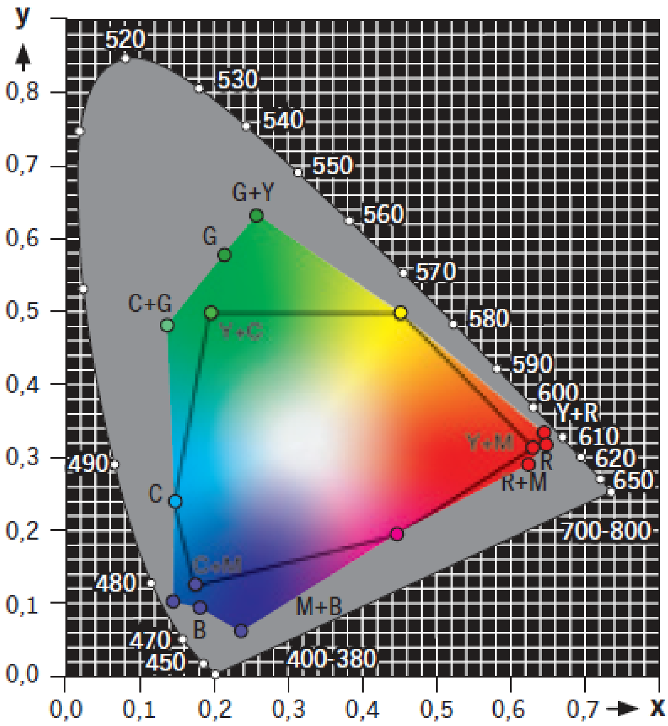
In the same way as in achromatic reproduction, identical colors are also not obtained in practice if only part of the achromatic CMY is replaced by black without modifying the chromatic component as well. See section "Achromatic reproduction", page 98. Similar colors are achieved, for example, as follows:

49% CIEL*a*b* C + 70% CIEL*a*b* M + 80% CIEL*a*b* Y + 30% CIEL*a*b* K.

Five, six and seven-color printing

Modern four-color printing also meets the high quality demands in image reproduction. Despite this, with some originals and when quality demands are extremely high, it can be necessary to use special color sets.

The reproducible color gamut can be extended by the use of further colors (in addition to the four primary colors) or special process colors. In the illustration, the measured values of a seven-color print are plotted to the CIE chromaticity diagram.



The hexagon on the inside shows the color gamut of the process colors cyan, magenta and yellow (measured values). The surrounding dodecagon shows the extended color gamut that was obtained using the additional colors green (G), red (R) and blue (B).

Ink trapping and color order

Ink trapping

Ink trapping is another variable influencing color reproduction. It reveals how well ink transfers to a previously printed ink compared to printing to an unprinted material. In this process, a difference must be made between "wet-on-dry" printing and "wet-in-wet" printing.

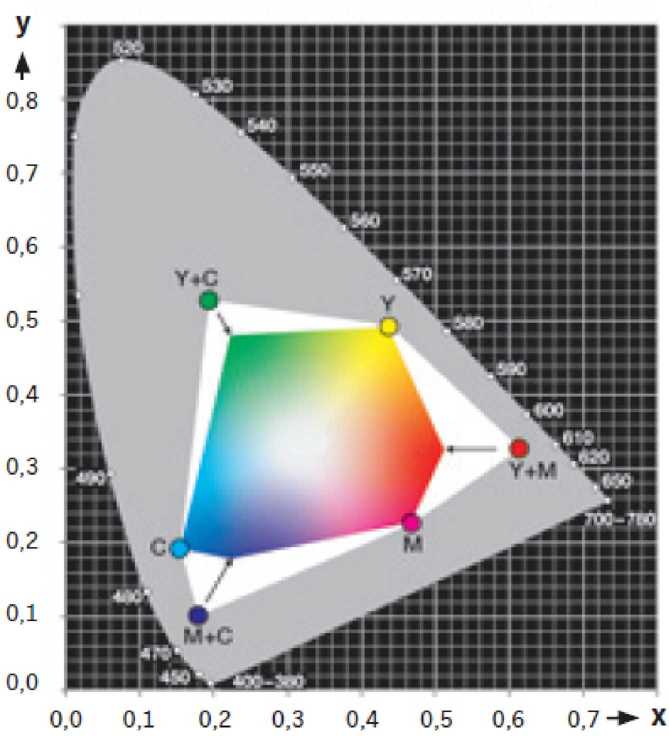
"Wet-on-dry" printing is when an ink is printed directly on the printing material or on an ink that is already dry (e.g. toner digital printing). By contrast, "wet-in-wet" printing is when the next ink is applied to an ink that is still wet. It has become a habit to use the term "wet-in-wet" printing when printing to multicolor offset presses.

Ink trapping is good if inking is uniform and the hue located at the correct chromaticity locus.

By contrast, ink trapping is not adequate if the desired hue cannot be achieved. This can apply to all mixed colors. The result of this is: The color gamut becomes smaller, and certain color nuances can no longer be reproduced.

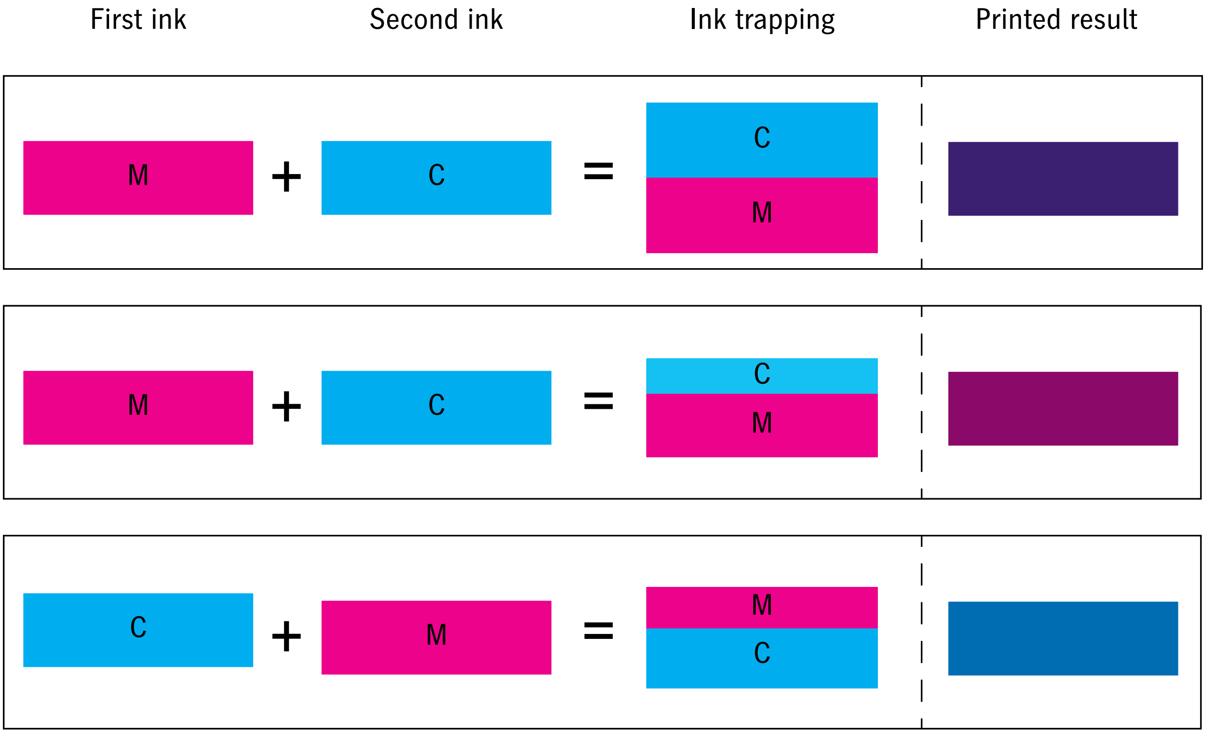
Even if the right ink film thicknesses are printed with a given color set and the chromaticity loci of the primary colors cyan, magenta and yellow are at the specified chromaticity locus, it can still happen that the chromaticity loci of the mixed colors red, green and blue cannot be achieved because of overprinting faults.

The CIE chromaticity diagram below shows the impacts that faulty ink trapping or an unfavorable color order have on the printed result. The white area illustrates the extent of dot loss as a result of trapping issues.



Color order

The schematic diagram illustrates three different sequences for overprinting cyan and magenta.



Examples for different overprinting of two inks

In the first example, magenta was printed on a single-color press. After it dried, cyan was printed on top of it ("wet-on-dry"). Both colors have the same coating thickness. Ink trapping is good and the desired chromaticity locus was achieved.

The second example was produced on a multicolor press. Firstly, magenta was printed on the dry paper ("wet-on-dry"), then cyan on magenta that was still moist ("wet-in-wet"). While trapping for magenta on the paper was good, ink trapping for cyan was not as satisfactory (caused by ink splitting during overprinting). On the whole, a red with a blue cast was the result.

In the third example, printing was also wet-in-wet, but with the reverse color order (magenta on cyan). The result is a blue with a red cast.

The color order black - cyan - magenta - yellow has asserted itself as the standard in four-color printing. To reduce the effects of ink trapping difficulties in special cases, the original and plates should be examined closely before the plate is mounted. For example, it may be advantageous when printing solids to print the lighter form before the heavier one.

This applies especially when overprinting halftones and solids. The halftone should be printed first on the white paper and the solid on top of that.

Print control strips

Print control strips can be printed along with the document contents to assess the print quality by measurement. Print control strips are usually placed as marks on the press sheet: on the leading edge of the sheet, on the trailing edge of the sheet or the center of the sheet. Central placement is preferred for perfecting presses and imposed sheets.

Print control strips are supplied in digital form by Fogra and various manufacturers. Heidelberg has been supplying its DIPCO (Digital Print Control Elements) package for several years. In addition to conventional print control strips, the DIPCO package also includes "mini spots" for color and process monitoring. In addition to use in manual assembly, all DIPCO strips are also designed as a "color mark" for automatic assembly in Prinect Signa Station

Which print control strip is used depends primarily on the colors of the job. Standard strips begin as of four colors. If less colors are printed, the remaining patches stay empty. Another criterion is the colorimeter used. The size of the measuring patches depends on the diameter of the measuring aperture. There are limits as to how small this aperture may be since it also has to record the tonal values of the halftone patches reliably. In compliance with ISO 12647, the measuring aperture should correspond to 15 times the screen frequency, and at least 10 times this value. Example: 80 lines/cm = 0.125 mm line definition. Based on this, the minimum size of the measuring aperture is
0.125 x 15 = 1.875 mm.

All print control strips consist of several different measuring patches that will be described below.

Solid tint patches

The consistency of inking is monitored with solid tint patches. It is advisable to use one solid tint patch per ink, spaced to match the width of the ink zones (32.5 millimeters in the case of Heidelberg). This means that solid tint patches can be used for automated control of the solid tints.

Solid tint overprint patches

These patches are used for the visual and metrological assessment of ink trapping.

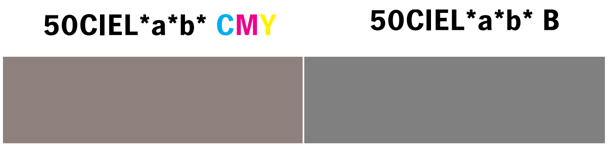
Color balance patches

A difference is made between solid tint and halftone color balance patches.

With solid tint patches, the overprinting of cyan, magenta and yellow should produce a fairly neutral black. For comparison, a black solid tint patch is printed beside the overprint patch.

The halftone patches for cyan, magenta and yellow produce a fairly neutral gray when overprinted if the ink film thickness is correct, the color order is standard and dot gain is normal.

Color balance patches are used for visual monitoring and also for automatic gray balance control of cyan, magenta and yellow.

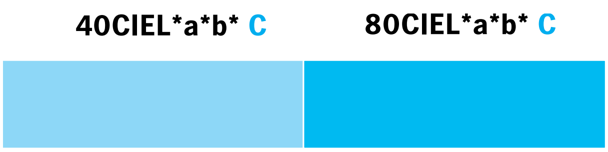


In a standardized print process compliant with ISO 12647-2, gray balance must be achieved primarily by applying an ICC color profile when generating the separations.

Halftone patches

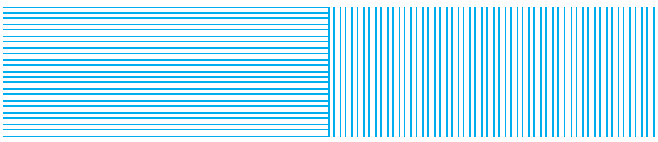
Halftone patches have different screen values depending on the manufacturer.

Dot gain and relative print contrast are calculated from the values measured in the halftone and solid tint patches.

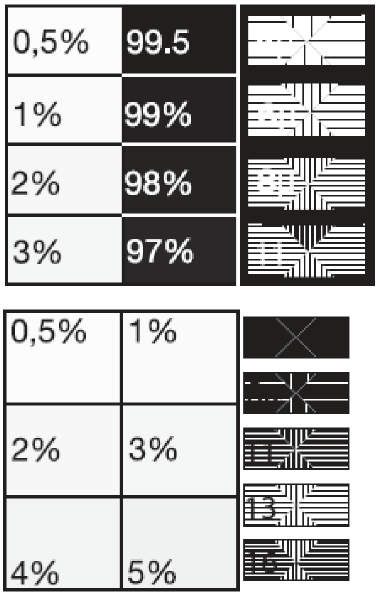


Today, print control strips with 40CIEL*a*b* and 80CIEL*a*b* patches are most widely used for monitoring the print process.

Slurring and doubling patches



Line screens at different angles are used to check slurring and doubling patches visually and through measurement.


0,5%
99.5
1%
99%
2%
98%
3%
97%
0,5%
1%
2%
3%
4%
5%

A **Achromatic value**

Each tertiary color or color shade can be divided into two parts - into a chromatic and an achromatic value. The gray component contained in the mixed color is defined as the achromatic value. In chromatic reproduction with ideal process colors, it consists of equal parts of cyan, magenta and yellow. These parts neutralize each other, lose their chromatic nature and as a result appear achromatic. With ideal process colors, the achromatic value can be replaced partly or entirely by black. Achromatic reproduction takes place when the achromatic value is removed completely.

B **Black generation**

In under color removal (UCR), cyan, magenta and yellow are reduced in favor of a corresponding amount of black at dark and neutral points in the image. This causes black generation (amount of black in CMYK) to change compared to printing without UCR. As a result, less color is needed to create a specific hue, i.e. the area coverage is reduced. This means that the gray axis is more stable. Also, there are fewer trapping problems during the printing process. Since fewer chromatic colors are used, costs can be reduced.

Black point compensation

In gamut mapping, all L shadows that are darker than black ink are matched to black ink and, as a result, shadow definition is lost. Black point compensation enhances the reproduction area when the "Relative colorimetric" rendering intent is used for color space conversion to the L*a*b* color space or from the L*a*b* color space to the device color space.

C **Calibration**

In the Prinect Manager environment, "calibration" or "process calibration" refers to the standardization of the screen dot sizes in the whole print process. Screen dots become larger during imaging of the plates (because of scattered light) and printing of the paper in the press. Inaccuracies in the screen dot size result in errors in color reproduction. During process calibration, the dot sizes on each output medium (plate, printing material) are measured using a dotmeter or densitometer and compared with the digital nominal defaults. Calibration curves result from the difference and can be used to correct the digital originals, producing the correct dot sizes on the output media as a result. The calibration data sets for process calibration are created with the "Prinect Calibration Manager" software.

Chroma

Chroma (C*) describes the intensity of a color we perceive. It describes what makes this color different from one which is perceived as achromatic and has the same degree of brightness. Terms such as gray, pastel-colored, very chromatic, etc. are used to describe this property. Chroma depends greatly on lightness. Colors perceived as being very light or very dark have only a slight amount of chroma.

Chromatic value

Each tertiary color or color shade can be divided into two parts - into a chromatic and an achromatic value. The gray component contained in the mixed color is defined as the achromatic value. In chromatic reproduction with ideal process colors, it consists of equal parts of cyan, magenta and yellow. These parts neutralize each other, lose their chromatic nature and as a result appear achromatic. With ideal process colors, the achromatic value can be replaced partly or entirely by black. Achromatic reproduction takes place when the achromatic value is removed completely.

Chromatic/achromatic reproduction

Each tertiary color or color shade can be divided into two parts - into a chromatic and an achromatic value. The gray component contained in the mixed color is defined as the achromatic value. In chromatic reproduction with ideal process colors, it consists of equal parts of cyan, magenta and yellow. These parts neutralize each other, lose their chromatic nature and as a result appear achromatic. With ideal process colors, the achromatic value can be replaced partly or entirely by black. Achromatic reproduction takes place when the achromatic value is removed completely.

CIE
International uniform standards for evaluating color stimuli were established in 1931 by the Commission Internationale de l'Eclairage (CIE), the International Commission on Illumination. Color-matching functions with three imaginary light sources (X, Y and Z) were defined to describe a standard observer whose visual perception corresponds to what the average person sees. The spectral curve for "Y" (l) was chosen to be equivalent to the human perception of lightness. So-called tristimulus values are calculated both from the spectral curve of the color and from the color-matching functions.

CIE XYZ system
International uniform standards for evaluating color stimuli were established in 1931 by the Commission Internationale de l'Eclairage (CIE), the International Commission on Illumination. Color-matching functions with three imaginary light sources (X, Y and Z) were defined to describe a standard observer whose visual perception corresponds to what the average person sees. The spectral curve for "Y" (l) was chosen to be equivalent to the human perception of lightness. So-called tristimulus values are calculated both from the spectral curve of the color and from the color-matching functions.

CIELAB color space
CIE established the fundamentals for the L*a*b* color space in 1976, and which is usually referred to as the CIELAB color space. LAB denotes a color coordinates system which is closely related to visual perception. The CIELAB color space consists of the lightness axis L*, the red-green axis a* and the yellow-blue axis b*. The distances in this color space are the same and reflect approximately what we perceive. This color space can be calculated from or to the CIE XYZ color space on the basis of clear mathematical correlations. The L* value describes the lightness of the color and can lie between 0 (for absolute black) and 100 (for reference white). Color coordinates a* and b*, which can have positive and negative values, define its chroma.

Color Carver
The Color Carver is the engine that is responsible for color management in the Prinect workflow.

Color management
An ICC profile (synonym = color profile) is a standardized set of data that describes the color space of a color input device or color reproduction device (e.g. monitor, printer, scanner, etc.). The aim of a systematically applied color management is for source material that was captured with an input device to be reproduced as similarly as possible on any output device. Color management systems can synchronize devices like scanners, digital cameras, monitors, printers as well as filmsetters and platesetters. The color displays according to the print conditions, for example. ICC is the abbreviation for the International Color Consortium, an association of a large number of manufacturers of graphic, image processing and layout applications, founded in 1993 with the aim of achieving standardization in color management systems.

Color space conversion
Color space conversion basically matches the image or graphic data from the creator color space (e.g. color space of a digital camera) to the color space of the output device or process (e.g. color space of a press or color printer).

Color space pattern
A repeat pattern (color space pattern) is used to portray single graphic elements several times in a set order. Trapping is not possible on such an object. The position viewed in Acrobat may

also deviate from the position output.

D **DeviceLink profiles**
DeviceLink profiles are special color profiles that are used in color management. DeviceLink profiles describe color transformation that bypasses the L*a*b* color space and overwrite the output profile normally used for the transition from the L*a*b* color space to the output device. Doing without the L*a*b* interim color space gives you controlled transformation especially of the K separation.

DFE
The DFE (Digital Front End) is the variant of the Prinect Manager designed for digital printing. The DFE fully supports the digital printing workflow for Heidelberg and Gallus digital presses and with restrictions for digital presses of other manufacturers.

DieLine
The "DieLine" spot color is used on Prinect Signa Station in the marks layer. Lines in this color describe the pages and the sheet format.

Digital Front End
The Digital Front End is the variant of the Prinect Manager designed for digital printing. The Digital Front End fully supports the digital printing workflow for Heidelberg and Gallus digital presses and with restrictions for digital presses of other manufacturers.

Digital Print Connector
The Prinect Digital Print Connector lets you connect digital presses of other manufacturers to the Prinect workflow. Ricoh, Hewlett Packard, Xerox, Canon and Kodak digital presses are supported. Connection of these digital presses is through virtual printers. These are machine configurations that are set up at the user interface on the terminal PC of the respective press.

Dot gain
Dot gain refers to the increase in the size of screen dots caused by printing or by imaging to plates. This can make an image appear darker (fuller) and/or color shifts can occur. Dot gain depends on the printing process, the type of paper or printing medium used and the ink. It also depends on the settings of your printer/press as well as on the screen settings. Consequently, different dot gains result for prints and proofs. Dot gain is the deviation from the ideal characteristic printing curve.

E **Engine**
In the Prinect Manager, the various tasks are done by engines. This means that there are engines for preflighting (initial check) the print jobs, for color management, for rendering, etc. The engines can be installed on one central Prinect server or on several dedicated engine computers.

EPS
EPS (Encapsulated PostScript) is a device-independent PostScript code. In other words, it does not have any format-dependent information.

G **Gamut**
Gamut is the set of all colors that a device (e.g. monitor, printer, scanner, film) can display, reproduce or record. Formally, gamut is the range in the color space that can be altered to the output device by internal color blending.

Gradation
A gradation (reproduction of the tonal value) defines the relation between the original density and the reproduction density. With transparent originals, density is defined as the logarithmic ratio of transmitted light to incident light, with reflective originals, it is the logarithmic ratio of reflected light to incident light.

Gray balance
Gray balance defines the ratio of the three chromatic inks cyan, magenta and yellow to each other so that gray tones in the original are also gray, i.e. neutral, in the reproduced image. Gray balance depends on the paper used, in particular on its hue, on the process colors and their intensity in print. It also depends on the printing process and the printing form. Visually, magenta and yellow penetrate more than cyan. For that reason, the value for cyan is generally greater than the value for magenta and yellow to produce a neutral tone in the overprint. Same amounts of cyan, magenta and yellow produce a brownish hue in the overprint.

H **Hexachrome**
PANTONE® Hexachrome is a color space that is made up of the six primaries (cyan, magenta, yellow, black, orange and green) instead of the four primaries (CMYK).

Hifi Color
Hifi Color is a color space that is made up of the seven primaries (cyan, magenta, yellow, black, red, green and blue) instead of the four primaries (CMYK).

I **ICC**
An ICC profile (synonym = color profile) is a standardized set of data that describes the color space of a color input device or color reproduction device (e.g. monitor, printer, scanner, etc.). The aim of a systematically applied color management is for source material that was captured with an input device to be reproduced as similarly as possible on any output device. Color management systems can synchronize devices like scanners, digital cameras, monitors, printers as well as filmsetters and platesetters. The color displays according to the print conditions, for example. ICC is the abbreviation for the International Color Consortium, an association of a large number of manufacturers of graphic, image processing and layout applications, founded in 1993 with the aim of achieving standardization in color management systems.

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Inspection Level
Inspection Level is a level in PDF documents that contain Inspection Control marks. These documents can be used by the press module, Heidelberg Inspection Control.

J **JPEG 2000**
"JPEG 2000" is a further development of the JPEG (Joint Photographic Expert Group) ISO standard. A higher compression rate and a better quality than with the other compression methods is achieved through a different transformation method ("Wavelet") . Compression of images using JPEG 2000 takes quite a lot of time.

L **Lightness**
In a color, lightness defines the amount of light reflected from the surface. It is influenced by the way a surface reflects impinging light. Reflectance refers to the way light is reflected off the surfaces of non-luminous bodies. The minutely fine unevenness of the surface ensures that a mirrored image does not result but that the image is remitted diffusely (scattered). Lightness describes the intensity of light in a color. Terms such as dark, light, very light, etc. are used to

describe this property. Colors with the same spectral distribution but different lightness are different colors.

Linearization
In the Prinect Manager environment, linearization refers to the standardization of the screen dot sizes during imaging of the plates. Screen dots become larger during this process because of scattered light. Inaccuracies in the screen dot size result in errors in color reproduction. Linearization makes sure that the size of the physical dot on the plate is the size needed to correctly produce the tonal value set in the master copy.

O **Output Intent**
Output Intents are color conversion instructions in the PDF. An Output Intent describes color reproduction for the final target device (e.g. an offset press) on which the PDF document is to be output. Output Intents overwrite working color spaces when displaying and printing data. However, the colors in the PDF document are not converted.

P **Paper (printing materials)**
Paper (printing material) is the press sheet that is printed by the plate. The folding scheme or folding sheet must fit on the paper.

PDF/VT
PDF/VT documents are PDF documents with multiple pages that are designed for printing variable data. Such documents mainly consist of a great number of pages that are divided into "records".

PDF/X
PDF/X is a data exchange format that contains all the elements required for printing data. PDF/X is an ISO standard for the reliable exchange of digital data in prepress. The standardization of the PDF, based on defined criteria, allows PDF files to be created that meet all of the prepress requirements exactly. In other words, PDF/X is a PDF format that is used specifically in prepress.

PostScript XObjects
Special objects that cannot be described by PDF can be embedded in the PDF as PostScript XObjects.

Primary color
Primary colors are the colors used to produce secondary colors. A primary color cannot be produced by mixing two secondary colors. Red, green and blue in additive color mixing, cyan, magenta and yellow in subtractive color mixing.

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Print black
Black is used quite often to increase the density range. Another reason to print black is the impression of increased sharpness of the reproduction if the contours are defined with only one (strong) color, if possible, with a screen. An image whose gray tones are composed mainly of black is less sensitive to ink fluctuations in the printing press. In addition, chromatic inks are more expensive than black ink. The obvious thing to do would thus be to substitute the chromatic color with black which would result in gray anyway. A disadvantage, however, is that screen rosettes may be more noticeable in the so-called tertiary tones, i.e., mixed colors of the third order which are composed of equal or unequal percentages of the three chromatic inks.

Printing material
Paper (printing material) is the press sheet that is printed by the plate. The folding scheme or folding sheet must fit on the paper.

Process calibration
In the Prinect Manager environment, "calibration" or "process calibration" refers to the standardization of the screen dot sizes in the whole print process. Screen dots become larger during imaging of the plates (because of scattered light) and printing of the paper in the press. Inaccuracies in the screen dot size result in errors in color reproduction. During process calibration, the dot sizes on each output medium (plate, printing material) are measured using a dotmeter or densitometer and compared with the digital nominal defaults. Calibration curves result from the difference and can be used to correct the digital originals, producing the correct dot sizes on the output media as a result. The calibration data sets for process calibration are created with the "Prinect Calibration Manager" software.

Process standard
Process standards are specifications of process parameters and their values that are to be applied when creating color separations, separation films or printing plates for four-color printing and for proof printing. Process standards include color data for printing materials, inks, dot gains and tolerances. Reference files are characterization files based on a process standard and used to check printing or proof printing. Profiles are files for color separation based on characterization data with process-specific restrictions for color composition and color gamut.

Proof Color
"ProofColor" is assigned to objects when creating the signature layout at the Prinect Signa Station. These objects are to appear in the imposition proof but not in the imagesetter output.

R Records
PDF/VT documents are PDF documents with multiple pages that are designed for printing variable data. Such documents mainly consist of a great number of pages that are divided into "records".

Reference file
Process standards are specifications of process parameters and their values that are to be applied when creating color separations, separation films or printing plates for four-color printing and for proof printing. Process standards include color data for printing materials, inks, dot gains and tolerances. Reference files are characterization files based on a process standard and used to check printing or proof printing. Profiles are files for color separation based on characterization data with process-specific restrictions for color composition and color gamut.

Repeat pattern
A repeat pattern (color space pattern) is used to portray single graphic elements several times in a set order. Trapping is not possible on such an object. The position viewed in Acrobat may also deviate from the position output.

Reproduction of the tonal value
A gradation (reproduction of the tonal value) defines the relation between the original density and the reproduction density. With transparent originals, density is defined as the logarithmic ratio of transmitted light to incident light, with reflective originals, it is the logarithmic ratio of reflected light to incident light.

S Scatter Proof
Scatter Proof is a mode for proofing with the Prinect Manager in which several objects (pages) are gathered in a pool for output until, optimally arranged, they fill the sheet size of the proofer with at least waste as possible. Then the proof sheets are output.,

Secondary colors
Secondary colors are mixed colors of first order. They are produced from equal or unequal amounts of two primary colors, such as red from magenta and yellow or orange from a large amount of yellow and a little magenta.

Spreading
Trapping is needed to cover up flashes or color margins that may be caused by register errors when overprinting several color separations. For example, flashes occur if the films are mounted inaccurately or if the printing presses are not adjusted precisely. Flashes are also likely to occur if the paper used is affected by the machine or by temperature, air humidity and the moisture content of inks. If the adjacent colors are relatively dark, even a very narrow flash is noticeable and cannot be overlooked. The simplest way of avoiding flashes is by spreading the lighter color into the darker color. During an overprint, the colors will overlap slightly and no flashes will occur even if there are slight shifts in color.

T **Transfer functions**
Transfer functions are elements that can be found in the PDF code. They are used for artistic effects and for correction of the properties of a particular output device. In this way, a document that is planned for output on a particular imagesetter, for example, can have transfer functions that compensate the dot gain generated by this device. Transfer functions can be used to modify the colors of single page elements through additional instructions in the PDF code of the documents.

Trap
Lines that are created during trapping as chokes or spreads are referred to as traps or trap lines.

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U **UCR**
In under color removal (UCR), cyan, magenta and yellow are reduced in favor of a corresponding amount of black at dark and neutral points in the image. This causes black generation (amount of black in CMYK) to change compared to printing without UCR. As a result, less color is needed to create a specific hue, i.e. the area coverage is reduced. This means that the gray axis is more stable. Also, there are fewer trapping problems during the printing process. Since fewer chromatic colors are used, costs can be reduced.

Under color removal
In under color removal (UCR), cyan, magenta and yellow are reduced in favor of a corresponding amount of black at dark and neutral points in the image. This causes black generation (amount of black in CMYK) to change compared to printing without UCR. As a result, less color is needed to create a specific hue, i.e. the area coverage is reduced. This means that the gray axis is more stable. Also, there are fewer trapping problems during the printing process. Since fewer chromatic colors are used, costs can be reduced.

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