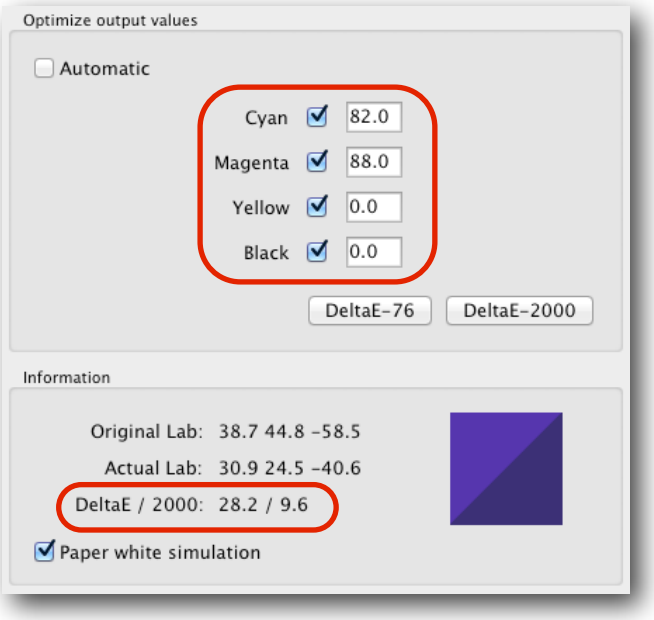
ZePrA 3.5 – Spot Color Processing

Starting with ZePrA 3.5, we have integrated a new module for the high-quality conversion of spot colors to the target color space. Our spot color solution is aimed at printers whose customers impose stringent demands on the color-accurate rendering of spot colors. The target group particularly includes packaging printers who have to deal with numerous spot colors and want to optimize their printing process by converting spot colors into CMYK or Multicolor process colors. The ColorLogic solution offers printers the secure knowledge of getting the best possible conversion of spot colors into process colors, both in terms of colorimetry and from the point of view of best printability.

The classical method

To appreciate the special features of the new solution, we first need to take a look back in order to understand how the previous method for converting spot colors used to work in ZePrA and many other solutions. The ***Convert spot colors to target color space*** checkbox resolves spot colors (DeviceN colors without CMYK components) and converts them to the target profile. The substitute color (referred to as the *Alternate Color Space* in the PDF) assigned to each spot color in the PDF file is used in this context, and processed using the color management settings on the ***Images*** and ***Vectors*** tabs in ZePrA. The PDF alternate color value for a spot color is usually indicated in CMYK or Lab, and is specified in the graphic or layout application used to create the PDF (e.g. Adobe Illustrator, InDesign or QuarkXPress). Given appropriate settings, ZePrA performs DeviceLink conversion from the alternate color space to the target color space. Nevertheless, conversion using the alternate color value is only an inaccurate solution, particularly if the alternate color for the spot color is indicated by device-dependent CMYK values. Even if the alternate color were to be indicated by a measured Lab value, ICC color conversion would usually result in converted colors that are not sufficiently accurate and, above all, not easily printable.

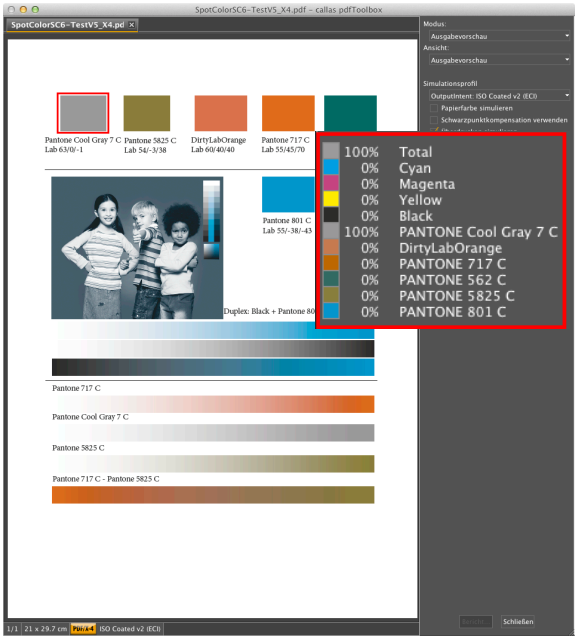
Example: The spot color PANTONE 266 C has an alternate color value of CMYK = 82/88/0/0 in a PDF document. When printed in a high-quality offset process on coated paper in accordance with ISO Coated V2, these CMYK process-color values would produce a dark violet color that is 28.2 Delta E-76 or 9.6 Delta E-2000 off the actual spot color (see screenshot). The color is outside the printable gamut and thus cannot be printed by 4-color offset printing. On a Multicolor printing system with 7 process colors, which would be capable of wonderfully simulating the spot color, the same spot color with the same PDF alternate color value would likewise only be reproduced with a major color error of approx. 9 Delta E-2000. So, in our example, conversion via a stored CMYK alternate color value will result in highly unsatisfactory color reproduction in both printing processes.

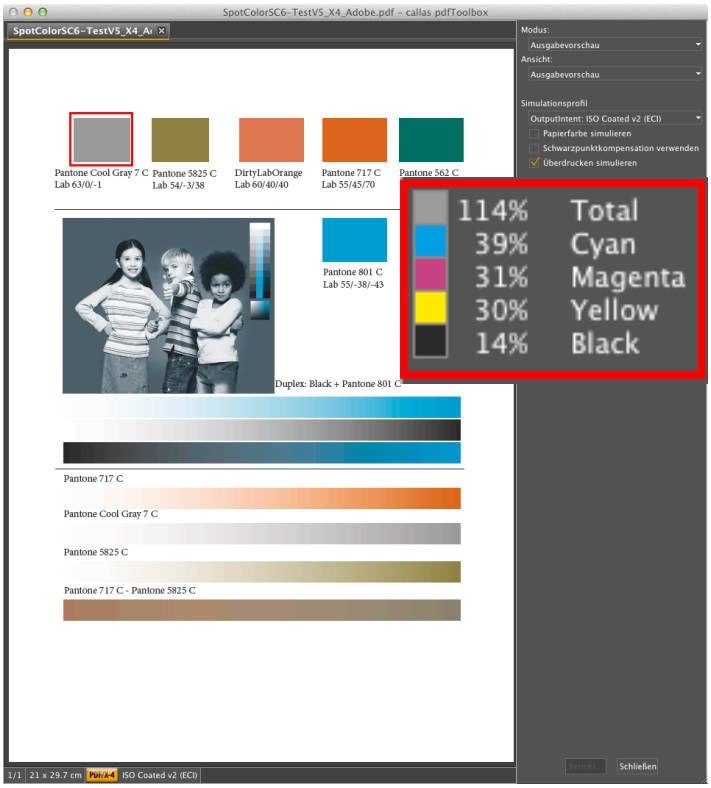


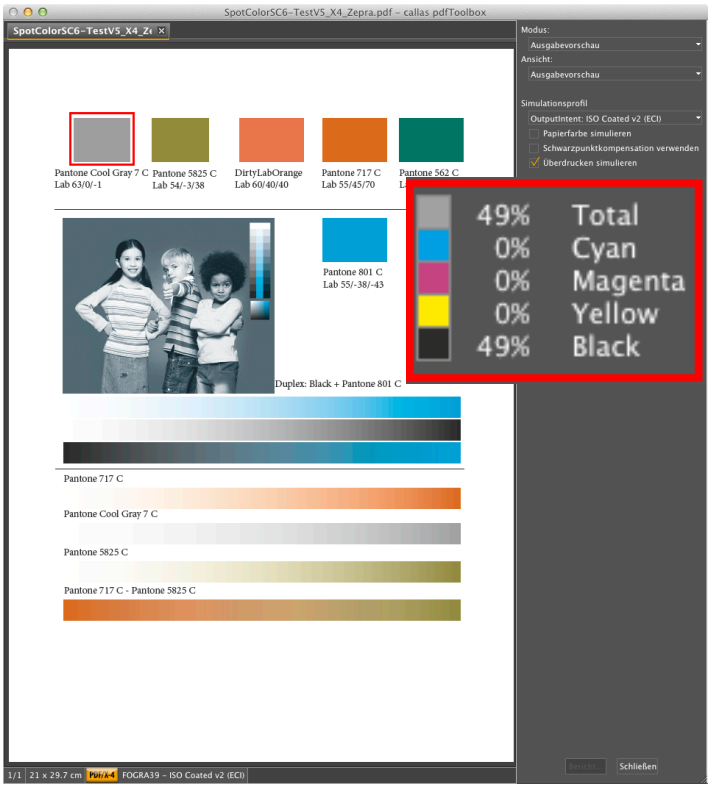
Other problem-solving approaches on the market

Lab alternate color values have been stored for spot colors in the PDF document since the launch of Adobe InDesign CS6. At first glance, this appears to be a better alternative than CMYK alternate color values, but it creates other, sometimes even more serious problems when converting spot colors.

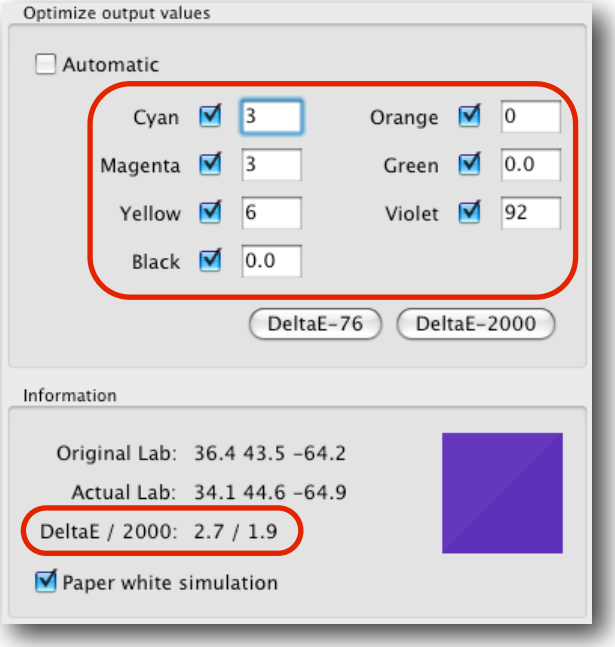
The screenshots show how differently a spot color can be converted to CMYK with a Lab alternate color value. The spot color PANTONE Cool Gray 7C is highlighted in red in the original file in the screenshot on the right. The bottom left screenshot shows that conversion of this spot color by means of a standard tool leads to four process colors, which is highly unsuitable for printing. In contrast, the screenshot on the bottom right shows that conversion using ZePrA not only achieves the most accurate color reproduction, but also manages with the minimum number of channels (only the process color Black is used). Moreover, the screenshots show that the spot color gradients converted with ZePrA have a far purer color appearance than the gradients converted using the standard tool.







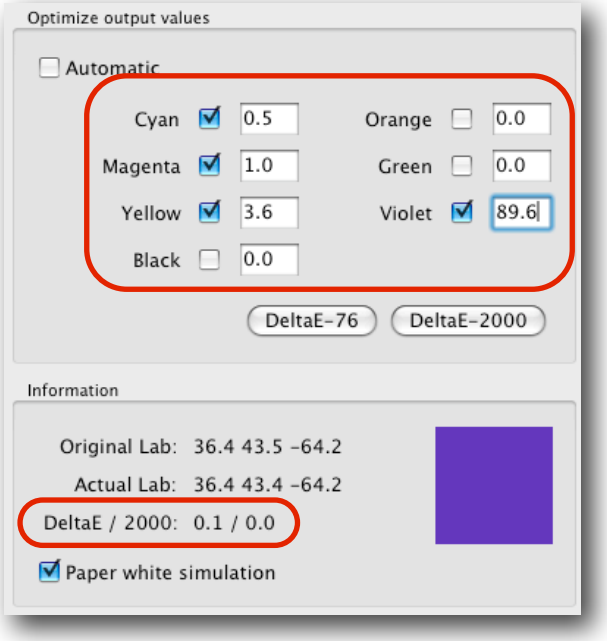
Instead of alternate color values, some other color server solutions on the market use a color library that contains the color values of the solid tones of the spot colors, measured in Lab. Rather than using the PDF alternate color value when converting spot colors to the target profile, these solutions take the Lab value of the solid tone from the color library and convert it to the target color space by the absolute colorimetric method. If the gamut of the target profile is large enough to be able to map the spot color, a good colorimetric match with the solid-tone value is obtained.



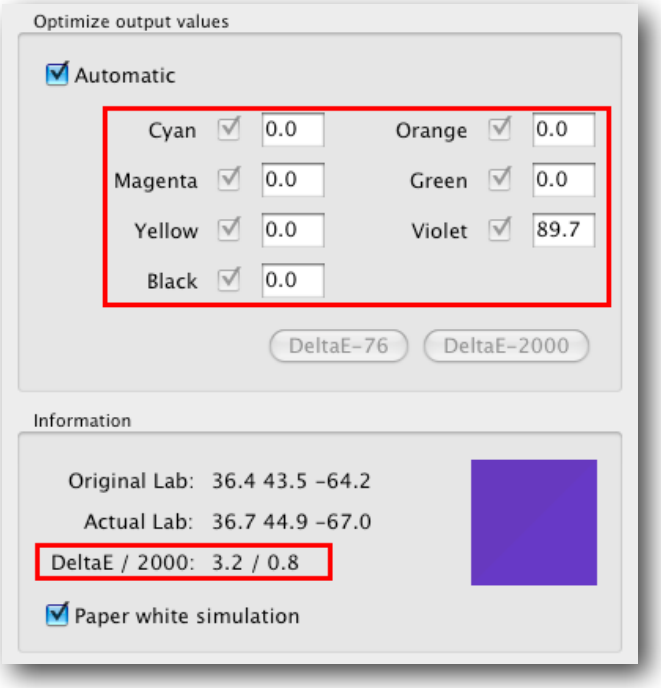
In our example using PANTONE 266 C, this would be the case with our Multicolor printing process, and the spot color could be reproduced quite well with 1.9 Delta E-2000 (the screenshot on the right shows the color conversion that would be obtained with standard tools). However, should the gamut of the target profile not be large enough, the spot color being out-of-gamut, only rarely would the best possible color value with the smallest Delta E be calculated, depending on the target profile used. This is due to the inaccuracy of profiles and the Gamut Mapping used. The biggest drawback of simple colorimetric conversion is, however, that unwanted process color components can emerge (in our Multicolor process, for example, CMYK +Orange+Green+Violet = 3/3/6/0/0/0/92), impairing the quality of the printed image. Just think of a text or a barcode that would thus be composed of several colors and be unsharp as a result of register problems when printed. At the same time, problems can arise when overprinting what were previously spot colors with process colors or other spot colors. Moreover, a library that contains merely the measured solid tones permits only an incomplete prediction regarding the appearance of graduations of the spot colors. So, this approach is bound to fail and may, from the printing point of view, produce poorer results than converting the alternate color value by means of DeviceLink profiles, as previously done in ZePrA.

What would an ideal solution look like?

- Many users would like exact colorimetric conversion of spot colors, which is why there is a need both for color libraries with the correct, measured spectral color values, and also for additional Delta E minimization. Delta E minimization would even make it possible to reproduce our specimen color PANTONE 266 C exactly and without a color error in the 7C Multicolor printing process (see screenshot).
- If and when necessary, users would like to be able to create and use several libraries for the same spot colors, since they need to have separate, optimized color values for different substrates and printing processes.

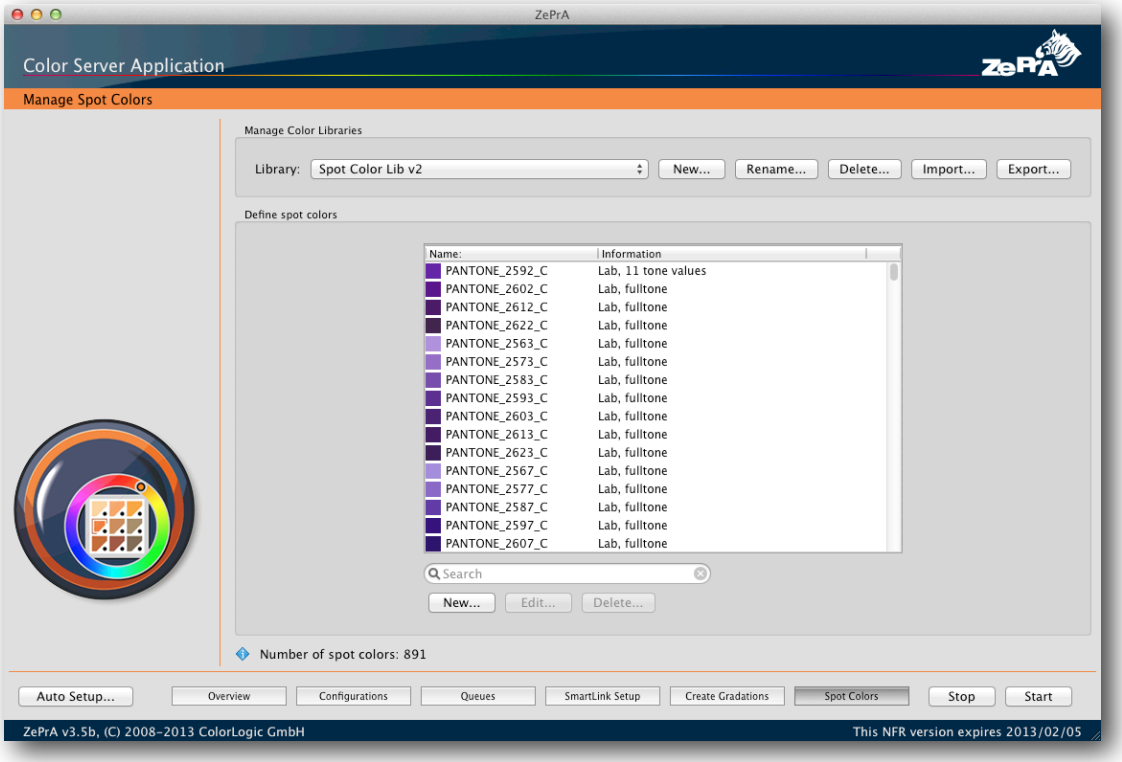


- Similarly, the color libraries must work with measured graduations of the spot colors, so that the 50% value of a spot color can also be reproduced optimally, for example.
- To be able to better calculate overprinting simulations, the measured values should additionally be stored in spectral form, and an intelligent, spectral color mixing model should be used. It is also desirable if the color server is able to preserve overprinting properties to the greatest possible extent.
- When dealing with elements consisting of a mixture of spot colors and other process colors, the color appearance should be simulated as accurately as possible following resolution of the spot color.
- When converting to the target color space, the fewest possible process colors should be used, but the result should nevertheless yield the smallest possible visual color difference. In our example, the optimum solution is to use only the Violet process color (see screenshot) and nevertheless achieve a color error of just 0.8 Delta E-2000.
- Some spot colors perhaps need to be converted to a specified target value (e.g. to a process color), regardless of the smallest possible Delta E. This is necessary for texts or barcodes, for example.
- Similarly, some spot colors have to be excluded from conversion, this being indicated for cutting marks created as spot colors, varnishes or braille characters, for example.



The new spot color solution in ZePrA 3.5

All the above ideal features and numerous other sophisticated technical details have been implemented in the new ZePrA 3.5 spot color solution.



Here's a list of the system's capabilities:

1. You can create several color libraries with the same spot-color names but different measured values for different substrates or different printing processes.
2. You can create color libraries containing the names of colors that are not to be converted (e.g. cutting marks, braille, coatings and the like).
3. You can load measurement data (in TXT or CXF3 format), Named Color ICC profiles or Photoshop color tables containing spot-color designations and color values. Color values can be expressed both in Lab and in spectral form.
4. You can measure solid tones, and also wedges with spot colors, directly from within ZePrA.
5. You can enter any desired graduations of a spot color, and either measure them or enter the measured value.
6. Spot colors in your PDF files are recognized on the basis of the color name, and then converted automatically or manually via the color libraries.
7. You can define what is to be done with spot colors that are not included in your color libraries: convert the spot color with the PDF alternate color space, preserve the spot color, or move the file into the error folder.
8. Special spot colors and their processing can be defined in every configuration.
9. Spot colors are converted to the target color space, thereby utilizing the maximum gamut.
10. Spot color conversion works for output in both CMYK and Multicolor color spaces.
11. "Automatic" function: optimization of the spot color, i.e. of the color value from the library, in the device color space of the target profile of the configuration. Optimization can optionally be performed fully automatically, in which case unnecessary channels are not used or are specified manually.
12. You can manually choose between Delta E-76 and Delta E-2000 minimization. You can moreover define the channels to be modified for optimization. In any case, the color difference to be expected is displayed visually, in Delta E and Delta E-2000.
13. You can map spot colors onto individual or multiple channels of the target color space, retaining full control of the color difference to be expected.
14. The different linearities of different source profiles are taken into account on-the-fly.
15. Identical colors – regardless of whether they are defined in Lab or in the target color space – produce identical color mixtures and wedges.
16. Wedges with spot colors converted to the target color space have the same black composition as the solid tone, i.e. solid tones without black also generate wedges without black, etc.
17. You have a choice of different calculation models for different tasks: either map spot colors automatically onto process-color channels, perform calculation for the best possible overprinting, or use the smallest possible number of color channels during conversion.
18. Use of an intelligent, spectral color mixing model that applies the measured values of the spot colors to obtain the best possible calculation of the overprinting properties and the color impression of the spot color in combination with process colors.