Prinect
Color and Quality

HEIDELBERG

Prinect Image Control
User Guide

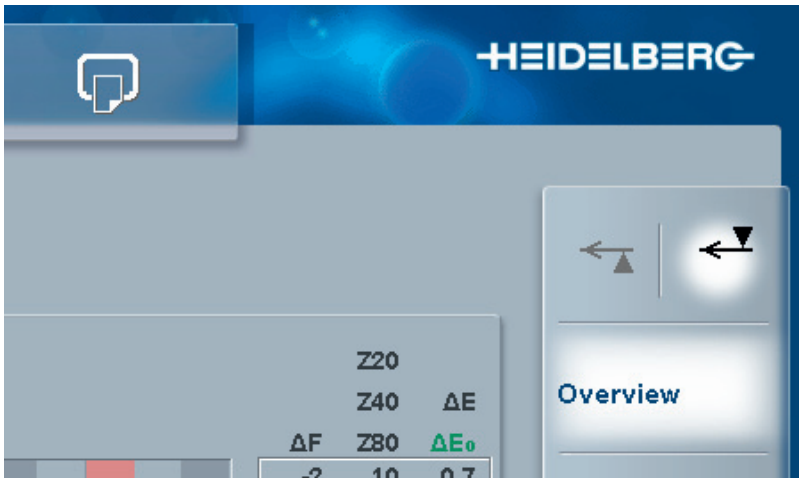
Chapter 1
About this User Guide

This User Guide is designed to give you background information on how to use Prinect Image Control in your everyday work. It tells you about the various functions in Prinect Image Control and how to use them.

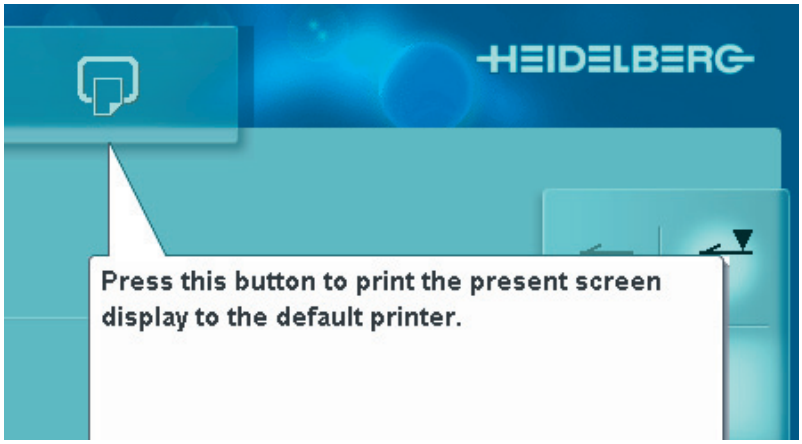
Our practical tips sum up important information and are easily recognizable in their hatched boxes.

This User Guide assumes you are familiar with Prinect Image Control and therefore does not cover all its functions in detail. Information on individual operations can be found in the online help function for Prinect Image Control or in the user instruction manual.

You can call up the online Help function by touching the Heidelberg logo on the touchscreen.



When you touch an area, a help text for this area appears.



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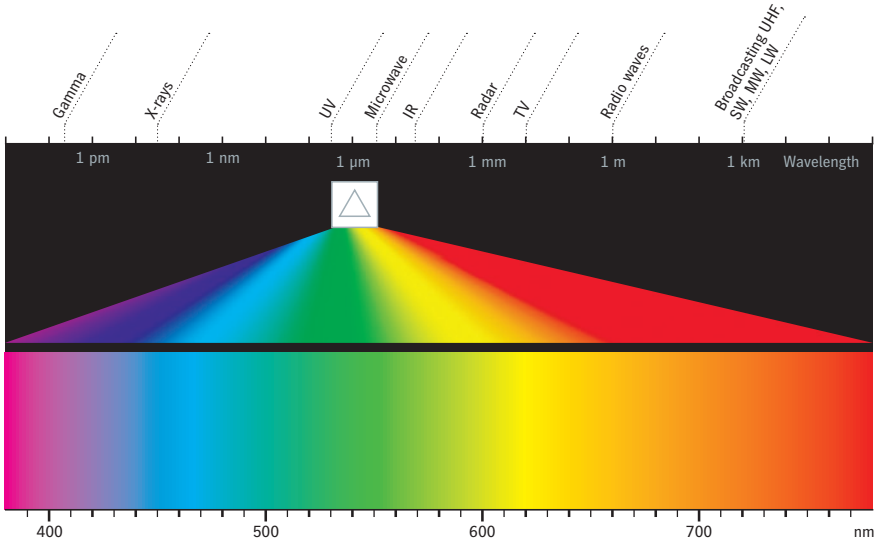
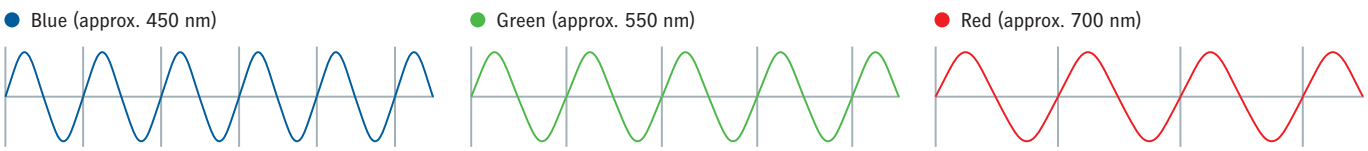
Chapter 2
The fundamentals of light and color and densitometric and spectrophotometric measurement

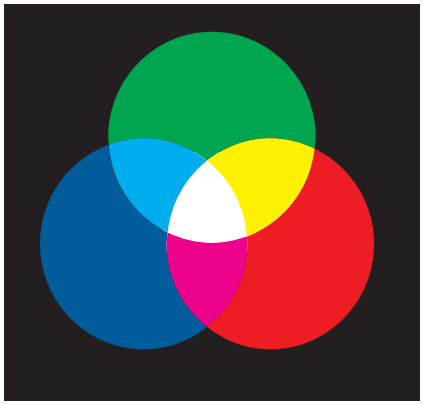
2.1 Light and color

In the 18th century scientists discovered that light is made up of electromagnetic waves. These waves are measured using meters as the metric unit. A nanometer (nm) is the equivalent of a millionth of a millimeter. Each color in the visible spectrum has a different wavelength. The human eye can only perceive wavelengths approximately in the range of 380 nm and 780 nm in the spectrum.

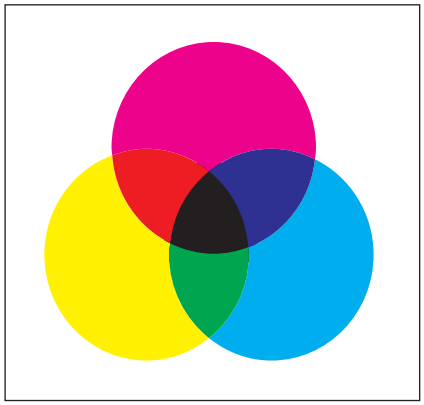


As you can see in the diagram, blue has a shorter or lower wavelength than green, and, in turn, green has a shorter wavelength than red. The colors we see with our eyes and respond to with our brains are mostly a mixture of several different wavelengths.

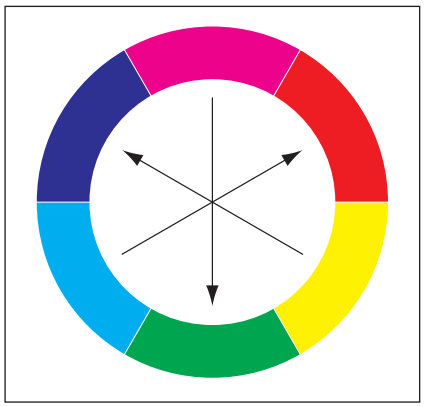




In more precise terms, the light waves perceived by our eyes meet receptors that respond to the colors blue, green and red. Monitors or televisions, for instance, use blue, green and red rays of light. In varying proportions, these rays are capable of remitting almost all the visible colors we know. If you mix together blue, green and red rays of light of the same intensity, you will get white light. If you decrease the intensity, the colors become darker. We call this process the additive color mixture. Mixing the colors red and blue together results in magenta; red and green produces yellow and green and blue produces cyan.



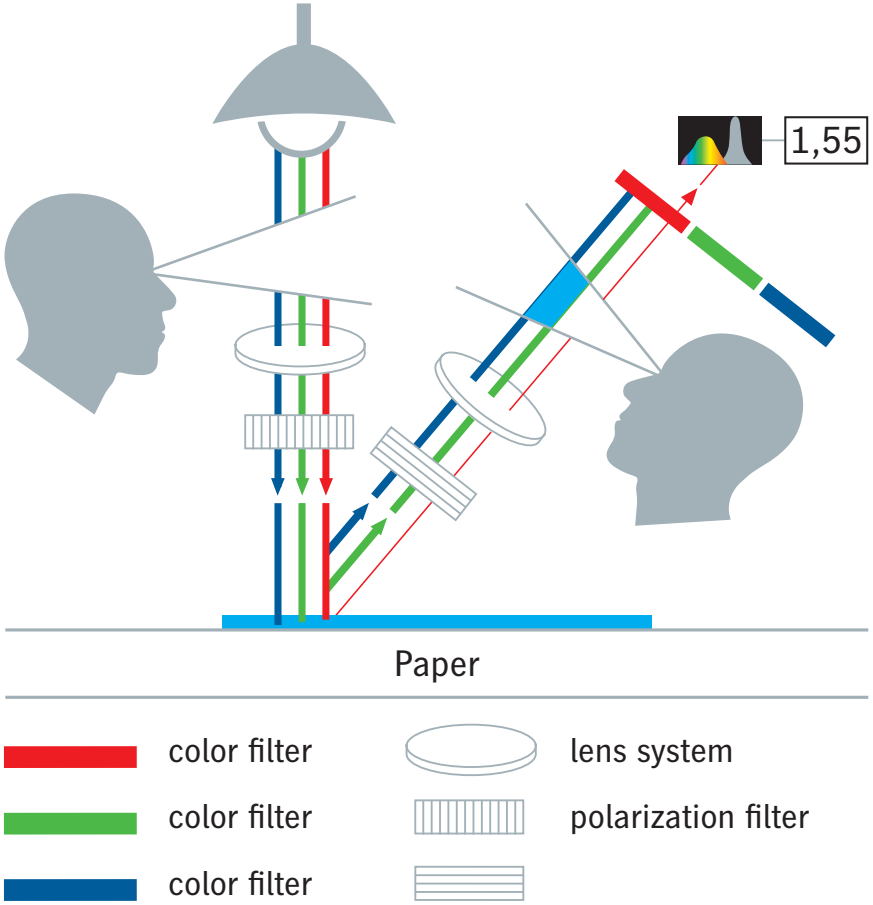
Since you cannot print on paper with light, color pigments are used in printing for the primary colors magenta, cyan and yellow in the so-called subtractive color system (see the figure on the left). The proportion of each of these primary colors is regulated according to the size of the screened dots: the larger the screened dot, the higher proportion of primary color. The color mixtures in printed images are produced by printing different sizes of screen dots in the primary colors cyan, magenta and yellow over each other. Printing an area with all three primary colors over each other usually results in a dark brown color. To print a proper black, a black pigment is printed with the fourth primary color black to give higher contrast. We call the four primary colors cyan, magenta, yellow and black (contrast or key) CMYK process colors.



In the 6-color color wheel, the primary colors cyan, magenta and yellow are opposite the so-called complementary colors red, green and blue.

In earlier times color separations were produced by placing a foil that had been colored with the complementary colors over the image. For instance, the proportion of magenta in an image template was “filtered” with a green foil.

Conventional densitometers still use complementary color filters for measuring the process colors cyan, magenta and yellow.



2.2 Densitometers and spectrophotometers

To measure the ink film thickness or the density of a printed ink using a densitometer, a lamp projects light on to a colored area. Part of this light is absorbed by the colored area, the rest is reflected. A sensor with a complementary filter inserted in front of the densitometer measures the amount of reflected light and compares this with the amount of light that is reflected from paper that has not been printed on (paper white).

Example:

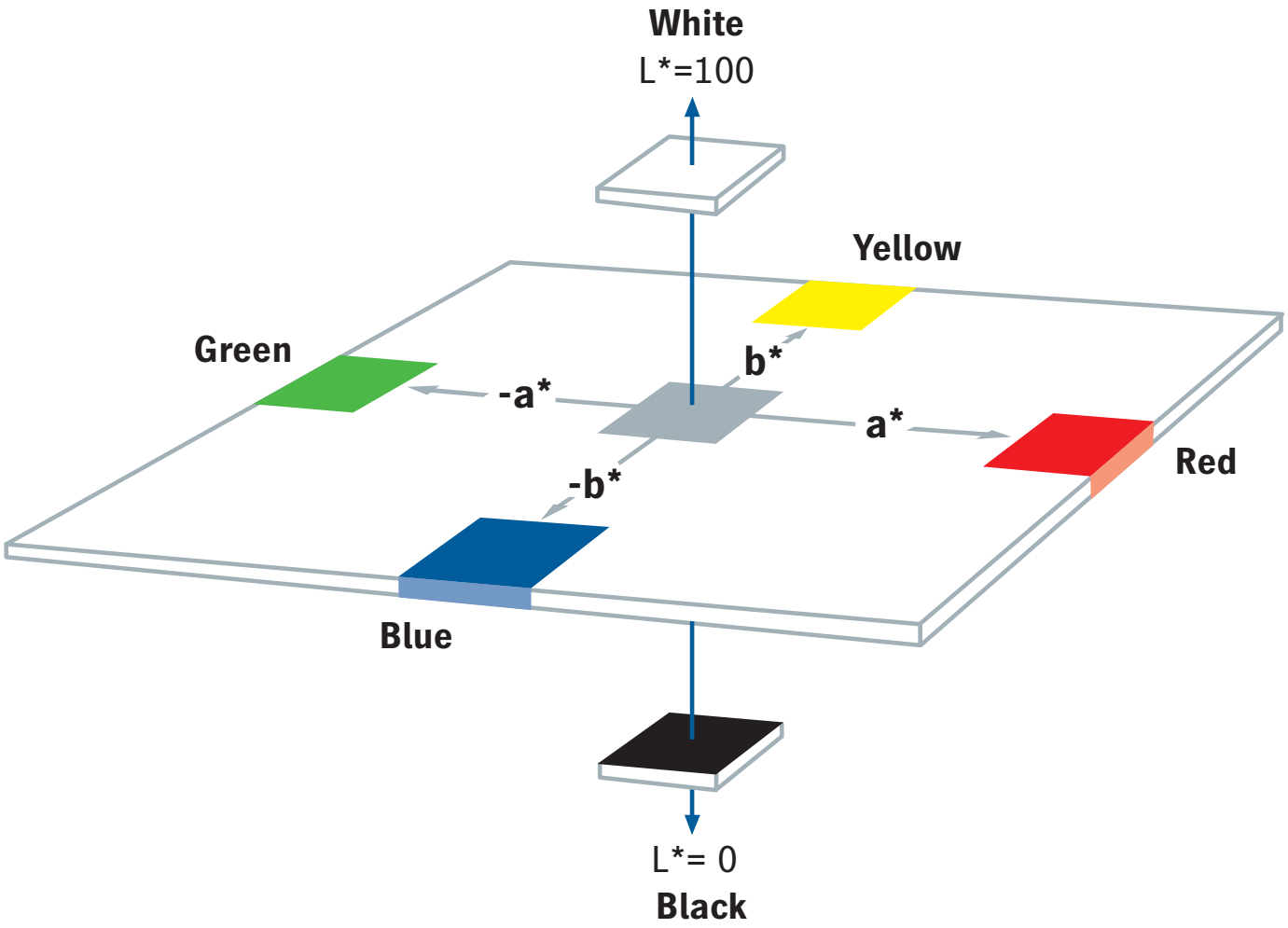
The white light of a lamp strikes a colored area printed with cyan. The green and blue portions of the white light are reflected, the red portion is absorbed. Using a red color filter, the sensor measures the amount of absorbed and reflected light in the cyan-colored area in comparison to paper white. The more light that is absorbed, the higher the measured, so-called density value is.

Since a densitometer only measures the amount of light, it is in actual fact color-blind. This makes it more suitable for measuring the ink densities of the process colors cyan, magenta, yellow and black and then indicating them as density values when printing images using process colors. There are times, for instance, when cyan might even have the same density value as magenta.

However, with the aid of so-called L*a*b* values, the ISO 12647-2 standard defines precisely which color tones the printer needs to achieve for the process colors cyan, magenta, yellow and black when printing. Since a densitometer tells you nothing about the color content of a color, other measurement devices are used more and more these days – so-called spectrophotometers. A spectrophotometer can measure the remission curve across the entire visible spectrum between 380 nm and 780 nm and, since every color tone has its own remission curve, a spectrophotometer can therefore define colors very accurately.

The graphic arts industry uses the L*a*b* color model (1976) for color evaluation. A spectrophotometer can calculate the density as well as the L*a*b* value from the remission curve.

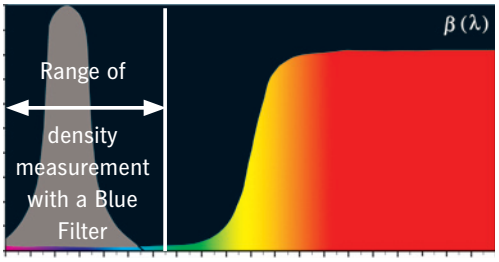
There are three axes in this color space – Lightness (L*), the axis from green to red (a*) and the axis from blue to yellow (b*). In simple terms, the L*a*b* color model is like a sphere in which you can objectively define each individual color with an L*a*b* coordinate in a color space.



Today densitometers are only used to check the ink film thickness of the process colors cyan, magenta, yellow and black (CMYK) at the press. Problems can occur when an exact L*a*b* value is required for printing. For example, when printing according to standards such as ISO 12647-2 or using special colors that need to be immediately recognizable as corporate branding colors.

In the example below, a densitometer uses the same filter (blue) for measuring the colors orange and green. It is unable to recognize any differences between the colors because it only measures reflected light. Today modern print shops use spectrophotometers to measure and evaluate colors.

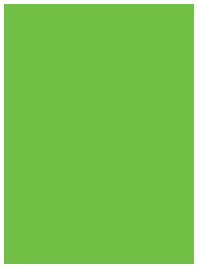
The measurement unit for the difference between 2 colors is called “Delta E” (ΔE*).

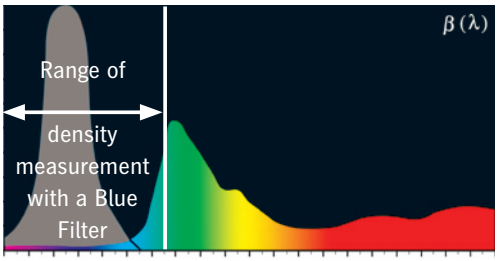


D =	1.60
L =	60.2
a =	56.8
b =	62.9

HKS 8 color sample

Density and L*a*b* values





D =	1.60
L =	59.4
a =	56.7
b =	49.3

HKS 65 color sample

Density and L*a*b* values

$$\Delta E^* = \sqrt{(60.2 - 59.4)^2 + (-56.7 - 56.8)^2 + (62.9 - 49.3)^2} = 114.4$$

A densitometer shows exactly the same density values for HKS 8 and HKS 65. Spectral curves however define each individual color exactly.

Chapter 3
The basic rules for correct measurement and control

3.1 Essential requirements

- The printing press has been serviced and adjusted according to Heidelberg guidelines. In particular, the press inking and dampening units are set up correctly.
- Print and prepress processes, in particular, the press, CtP and proofing, are preset and coordinated with each other according to standards. These standards can be company-internal standards, or an international standard such as the ISO 12647-2 standard. Standards are the cornerstone for faster, more efficient and better reproducible processes. Heidelberg offers the service “Print Color Management” (PCM) for adapting print, CtP and proof processes to ISO 12647-2.
- Target color values for standard-compliant print production have been determined on the basis of the materials used (inks and substrates) and are stored as color sets in Prinect Image Control. The substrate’s paper white value must be used for every color set that is stored in Prinect Image Control.

3.2 Things you need to know for every job

- Use PPF data from prepress or from the repeat job.
- Use Preinking program 1 if the inking unit is empty; use Preinking program 2 if you are changing the job without changing the ink.
- Do not pull the sheet too early on. Pulling sheets too early can lead to undershooting or overshooting of color control. Do not manually intervene between two control steps.
- Since the paper absorbs the printing ink, to ensure consistent measurement you should measure the printed sheet immediately after pulling it if possible (always at the same time).
- It is generally a good idea to halt the printing press during makeready rather than leaving it to idle. This allows the ink profiles in the inking unit to be retained.
- The machine should not be stationary during measurement if at all possible (no stoppers).

3.3 Objective

If the printing press has been set up properly, there should be a color deviation of $\Delta E < 5$ on average when measuring the first pulled sheet. Any greater color deviations indicate that the ink presetting characteristic curves need to be optimized. If the press has been set up properly, it should then be possible to achieve a color deviation of $\Delta E < 2$ within two to three measurement cycles. Correct measurement and fast regulation are only possible when the inking/dampening units as well as the dampening solution supply are properly set up and regularly checked.

Chapter 4
The essentials for successfully using Prinect Image Control

4.1 Technical requirements

- A network connection with at least 100 MBit
- A power connection with at least 27 amp at 110 V or 11.8 amp at 230 V

4.2 The printing press

- The printing press must be equipped with PressCenter software S10A.11/ S11A.03 or CP2000 V47.7 or higher

4.3 Prinect Prepress Workflow

- Prinect Prepress Interface Version 4.5 (or higher), correct configuration for Prinect Image Control, or
- Prinect Pressroom Manager Version 10 (or higher), correct configuration for Prinect Image Control.

In addition, for correct transmission of the type and position of the print control strips and Mini Spots

- Signa Station Version 1.5 (or higher) with the option Presetting.
- Prinect Meta Dimension/Prinect Renderer with hotfixes and the activated option “CIP4, PPF & Plate Remake”.

- PPF data with a resolution of between 49 dpi and 100 dpi must be available at Prinect Image Control. In 3rd party workflows, the halftone areas in the preview images of the PPF file may contain moiré because, for example, they have been reduced from the high resolution image file for plate exposure (2,540 dpi) down to 50 dpi. In such cases Prinect Image Control is unable to regulate the halftone areas due to the moiré.
- In some circumstances there may also be constraints when using a prepress workflow from another manufacturer.

4.4 Standard device configuration

- All presses are connected/configured
- All prepress paths are set up
- All processes for generating .ppf in Pressroom Manager/Prepress Interface are set up
- All paths for exporting measurement data to Analyze Point are set up
- Required print control strips and Mini Spots are activated/not needed are deactivated
- Customer-specific color sets are set up
- The network printer is set up/the path for saving PDF screenshots or protocols is set up

Chapter 5
Prinect Image Control features

5.1 Key features in brief

Prinect Image Control is a color measurement system for regulating the ink zones of the printing press. It is the only system in the world that is capable of spectrophotometrically measuring and regulating not only a print control strip but also the entire sheet.

Device features

- Prinect Image Control is equipped with high-resolution image spectrophotometers for measuring the entire sheet. The measuring system measures the L*a*b* values of a sheet sized 75 × 106 cm at 50 million measurement points. This ensures reliable regulation of the image and detailed analysis of print quality over the entire sheet.
- Prinect Image Control controls up to 4 presses
- A measurement cycle takes around 20 seconds
- Print run quality can be documented by printing out or saving the protocol. Data export to Prinect Workflow enables Analyze Point to display centralized quality reports.
- Repeat jobs can be saved in a database.
- The device measures complete test forms and exports the measurement data to Prinect Color Toolbox for generating an ICC profile and calibrating the process.
- The integrated process analysis software Quality Monitor (Color Interface option) can assess process quality in real time on the basis of the test elements (Mini Spots) positioned on the sheet. Any necessary corrections can be carried out immediately.
- The web-based Remote Service provides the basis for interactive remote diagnosis, troubleshooting and user support on site by Heidelberg Service.

Prinect Image Control constraints

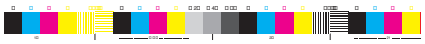
As with all color measurement and control systems in the graphic arts industry, there are constraints with:

- Metalized, opaque and highly pigmented printing inks
- Metallic, transparent and colored print substrates
- Light pastel tones that are close to paper white

To comprehensively regulate CMYK and special colors from the image requires a solid tone area for every color in all ink zones. These control areas must be no smaller than 5 mm × 5 mm, with a minimum patch coverage of 20 %. Patch coverage should not be confused with tone value increase (TVI).

In critical cases we recommend testing the quality of Prinect Image Control's performance with the specific materials you intend to use.

Chapter 6
Color control methods



Prinect CS-4i

Prinect CS-5i

Prinect CS-6i

Prinect Micro 6i

Prinect Micro 8i

6.1 Color control with color control strips/print control strips

Color control with print control strips is easy and is ideal when setting up a job according to standard target values.

The basis for (solid tone) control is a color set containing reference spectral curves with target L*a*b* values for the printing inks and paper white used. The figure on the left shows some of the strips available in the Heidelberg print control strip range.

Depending on the type, the print control strips contain solid tone patches for cyan, magenta, yellow, black and special colors, as well as tone value patches, gray patches and patches for analyzing ink acceptance and slurring and doubling.

Prinect Image Control Next Generation can also measure the micro print control strips used by Prinect Inpress Control. These micro print control strips save space and therefore paper costs, yet contain more patches for regulation and process control.

1 

Measurement block for controlling solid tone patches.

2 

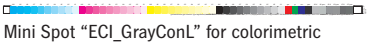
Measurement block for controlling solid tones, 70 % tone value as well as slurring and doubling errors.

3 

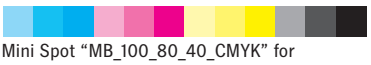
Measurement block for controlling solid tones as well as 25 %, 50 % and 75 % tone value.

4

Measurement block for controlling solid tones as well as 40 % and 80 % tone value. The measurement blocks 2 to 4 are available for all colors in measurement block 1.

5 

Mini Spot “ECI_GrayConL” for colorimetric control of solid tones and overprinted colors as well as tone value in 10 % increments. Gray balance is checked visually.

6 

Mini Spot “MB_100_80_40_CMYK” for colorimetric control of solid tones and 40 % and 80 % tone value.

7 

Mini Spot “PCS_40AB” for colorimetric control of conformance to standards.

6.2 Process evaluation with Mini Spots

First and foremost, Mini Spots are used for process control. They deliver information that print control strips are unable to due to lack of space. On the one hand, Mini Spots are used for analyzing processes, e. g. evaluating solid tones, tone values, trapping or gray balance. On the other hand, they are also the basis for carrying out color management and creating or adapting ICC profiles.

If Mini Spots are positioned on the sheet in such a way there is a solid tone patch in every zone for every printed color, zonal inking can also be regulated using Mini Spots rather than print control strips.

6.3 Control with in-image measurement

Control by measuring the image itself has the following advantages in comparison to control only using print control strips/color control strips:

- Just one measurement run analyzes not only the solid tone patches in the print control strip, but also all available measurement areas in the image and uses them for control. This means inking control is based on a combination of solid tones in the print control strip and the areas and tone values in the print image. This control method corrects process-induced tone value fluctuations in the image, which is not the case if control is performed only in the solid tones using a print control strip.
- There are considerably more measurement values available for each zone when regulating the image – control becomes more reliable.
- Since the measurement values are determined in the circumferential direction for each zone, they are more meaningful for colors in the image than measurement values that have only been measured with print control strips at the front or tail edge of the sheet.
- Color is controlled from the areas of the sheet that are to be sold to the customer.
- In principle, an image can be color controlled without using a print control strip, providing there are sufficiently large enough solid tone areas in each zone for each printed color. For example in packaging printing, if you are printing folding cartons with tuck flaps in staggered positions in the print direction, control can take place via solid tone patches positioned between these tuck flaps.
- If you are using a CIP3/CIP4 PPF file from prepress, non-overprinted solid tones areas are identified and assigned to the appropriate target values fully automatically with no extra makeready time required. In homogeneous (constant) halftone areas, the printer can easily and rapidly find other halftone areas with the same values and assign target values with the aid of the PPF file. As the selection is made via the PPF file, and not the measured sheet, it can be performed very early on in the make-ready stage, regardless of the actual color deviations of the printed sheet.

There are two approaches to image-based control:

- OK sheets
- Homogeneous image areas

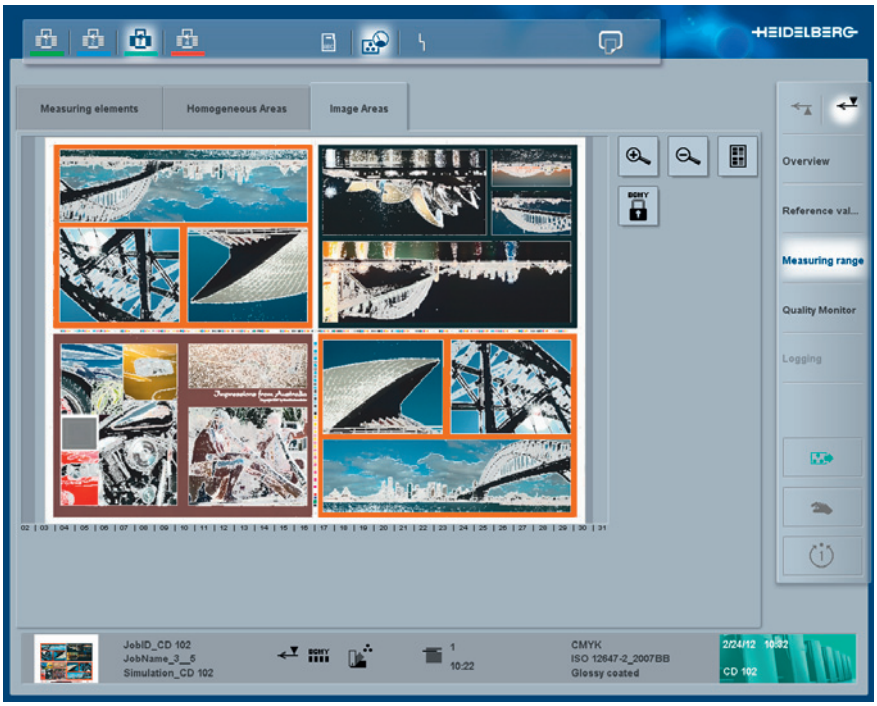
These approaches are described in detail in the following chapters.

Prinect Image Control is unique in that it enables a combination of control methods: regulation using print control strips/color control strips means that only solid tone areas are controlled. This control method is ideal when there are no reference images available for approving the OK sheet, or in short print runs according to standards. If additional images or halftone areas in the sheet have been defined for control, Prinect Image Control regulates not only the solid tone areas, but also directly in the image and halftone areas. This ensures that despite process-related fluctuations these areas can be kept as stable as possible. It should be noted that areas with special colors can only be regulated directly in the image providing they are non overprinted solid tone areas. Overprinted special color areas and images containing special colors cannot be regulated directly in the image and the software automatically excludes these areas from regulation.

6.4 OK sheet

The function OK Sheet is the easiest and fastest way of reliably controlling a print run in the image. After the customer has approved the OK sheet, the image that has just been measured and agreed with the customer as a reference is saved by the printer as the OK reference sheet in Image Control. At a touch of a button all the controllable measurement points in the image are then defined as target values. Prinect Image Control then ensures the color remains as close as possible to the OK sheet during the print run – even if the solid tones change in the print control strip. This way, the sellable image remains as consistent as possible.

Here you can see the image areas Prinect Image Control uses for regulation. Areas that cannot be controlled, e. g. have too little ink coverage, are automatically excluded from regulation.

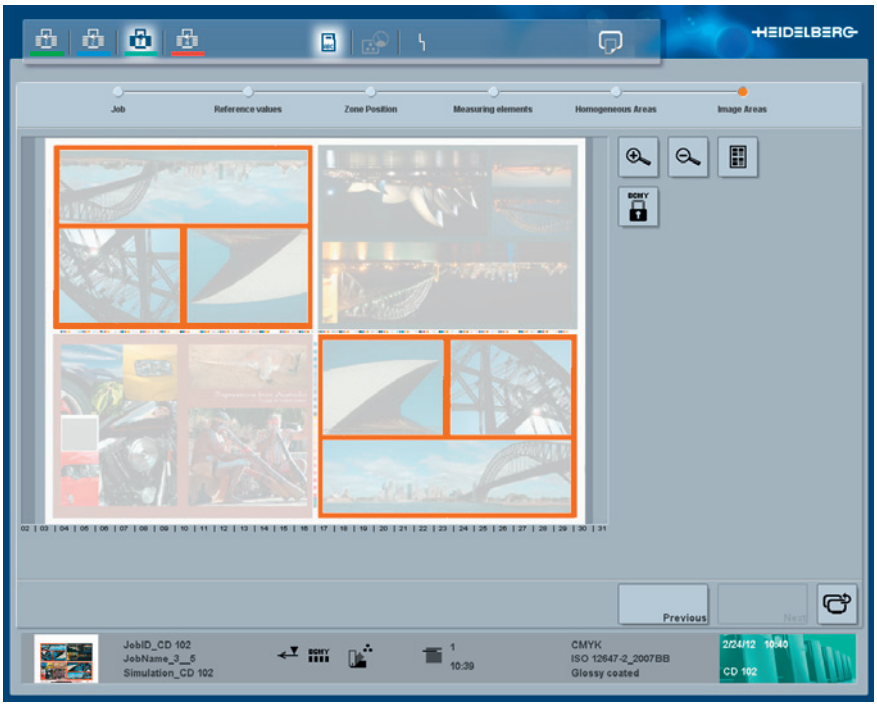


If there is no PPF available for the job, the function OK Sheet can only be used when printing with the process colors CMYK.

6.5 Homogeneous solid tone areas

Special colors are especially important to brand name customers. This makes it essential that such areas are always regulated directly in the image if at all possible. Using the PPF from prepress, Prinect Image Control can fully automatically find all the non-overprinted solid tones and assign the target values for regulating solid tone colors. Zonal color deviations during makeready have no impact on the correct assignment of the target values. With the aid of the real time preview, you can see at a glance that all areas have been correctly identified.

The orange solid tone frame is automatically used for control, even if the color is not included in the print control strip/color control strip.



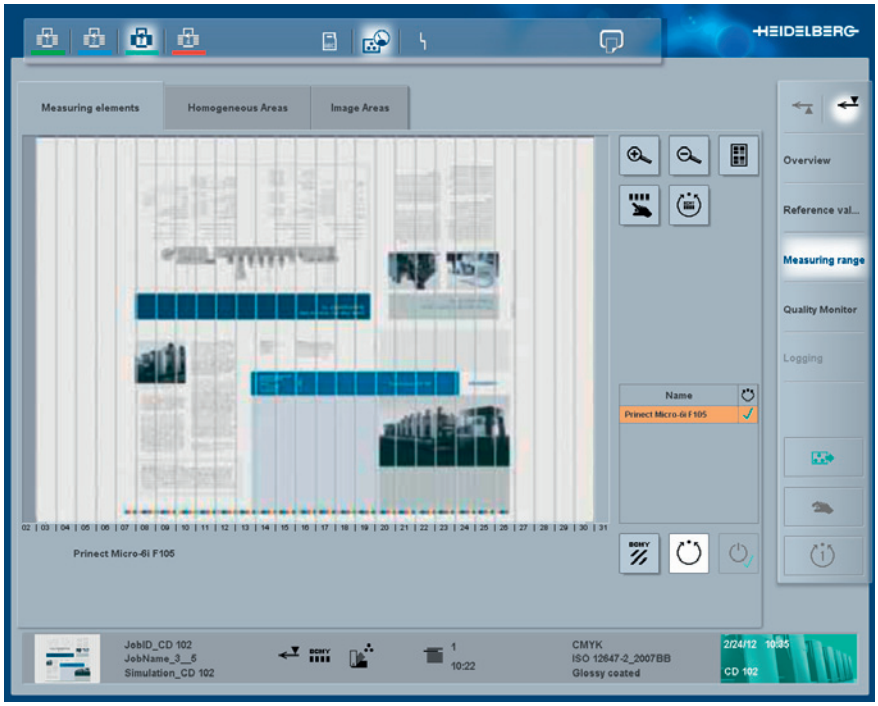
In the example on the right, the image can be controlled without using print control strips/color control strips. Ink take-off bars have been positioned in such a way as to provide solid tone areas for every printed color in every ink zone, thus enabling regulation of the inking from the image. This way the printer can save between 5 to 10 mm valuable cardboard.

6.6 Homogeneous halftone areas

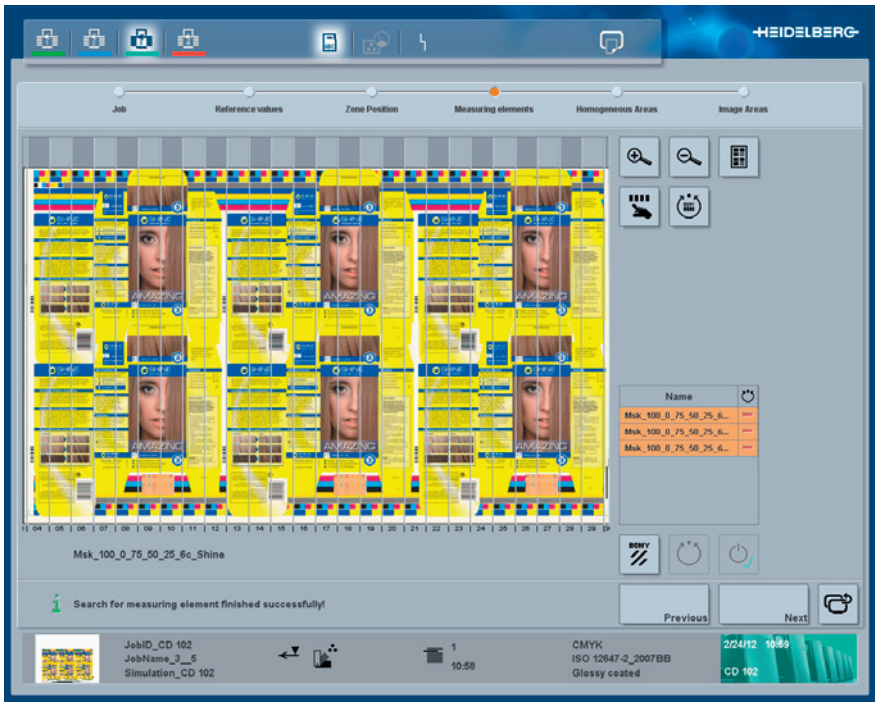
Color control on the basis of homogeneous halftone areas is useful when a color tone is made up from the process colors cyan, magenta, yellow and black (CMYK) and needs to be kept stable throughout the print run. Halftone values are highly susceptible to process fluctuations and therefore the printer has difficulty in keeping them stable when the inking is being regulated from solid tone patches of the print control strip only. With the function for homogenous halftone areas, the printer can simply assign any target value to a homogenous or consistent halftone area and Prinect Image Control will regulate the inking so the target color is achieved as closely as possible and remains stable throughout the print run. With the aid of the PPF file from prepress, the printer can still safely select the same halftone areas despite possible differences in register or zonal inking fluctuations when setting up the job. The printer marks an area and the software searches in the color separations of the PPF file for identical tone values elsewhere on the sheet and automatically selects these values. After approval, the printer can save new target values in the color archive and use them again for repeat jobs or as target values for the same halftone areas in other jobs.

6.7 Which control method is used when?

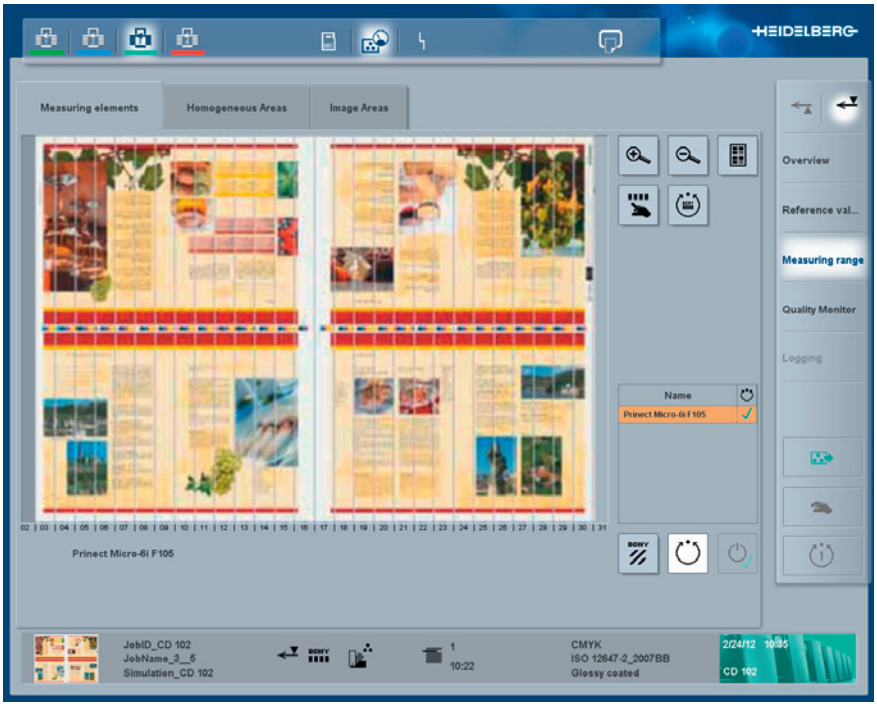
- Color control using print control strips/color control strips is ideal for job makeready. Jobs with low ink coverage or pages with text are always regulated with print control strips. In general, a print control strip should always also be printed if there is sufficient space on the sheet. Information such as slurring, doubling or ink acceptance is only ever available from print control strips or Mini Spots.



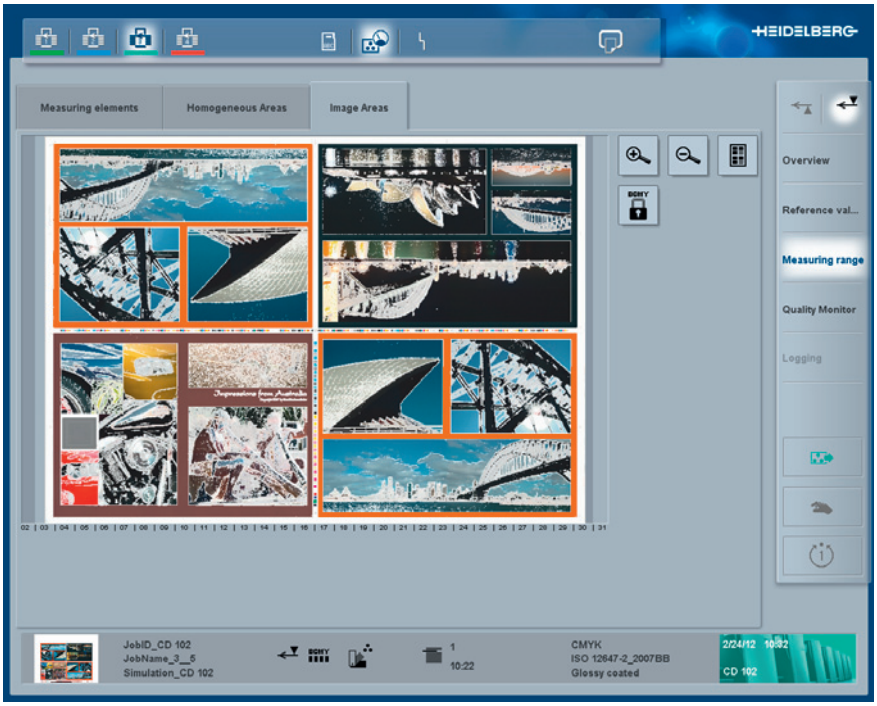
- Color control with solid tones (homogeneous solid tone areas) is useful when there are solid tone areas in the image. A solid tone patch or ink takeoff bar can also be positioned on waste areas – a situation that often occurs in packaging printing.



- Color control using homogeneous halftone areas is useful when you need to keep key colors in halftone areas as stable as possible, such as when printing color swatches or corporate colors. This function is used most frequently when special colors are made up from CMYK. This function is also very helpful for registration colors or transitions to a different page.



- Color control using the OK sheet is the standard method for achieving consistent results throughout long print runs or work and turn. The advantage here is that the OK sheet signed off by the customer can be input as the reference sheet. Ideally, there is sufficient ink coverage in each of the colors you want to regulate to minimize color fluctuations.

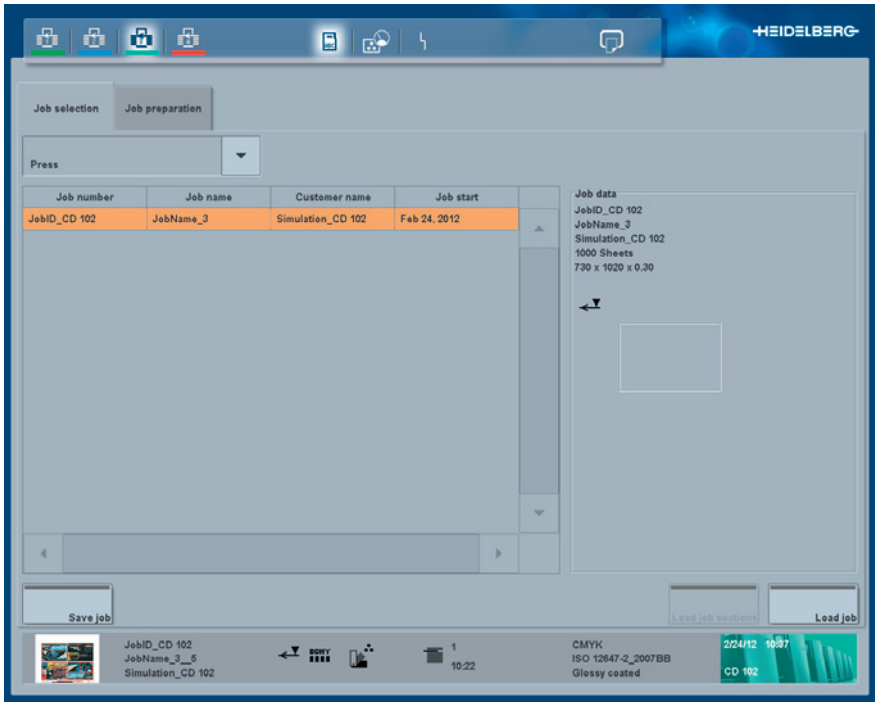


Chapter 7
Setting up a job

1. Loading a job
Up to 4 printing presses can be connected to Prinect Image Control.

The first step is to select the required press channel.

The job can be either loaded from the press or for repeat jobs from the internal database in Prinect Image Control.

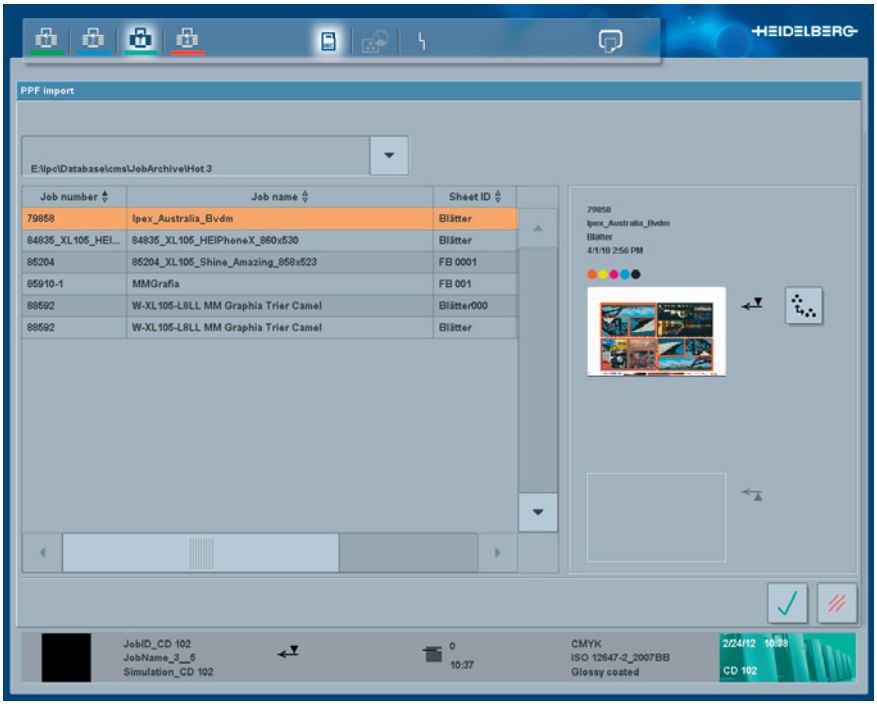


2. Warning
The yellow warning sign is a reminder that the PPF file from prepress needs to be loaded before all image control functions can be used. Depending on the press' software status, the PPF is either assigned fully automatically or needs to be assigned manually.

If no PPF file is loaded, Prinect Image Control only measures and regulates on the basis of the print control strips. Even if there is no PPF file, the printer is able to use Mini Spots for measurement and evaluation.

3. Assigning the PPF from prepress

Preview images make it easy to assign the correct PPF file. If both sides of a perfecting operation are stored in one job, then both sides of the sheet are immediately assigned.

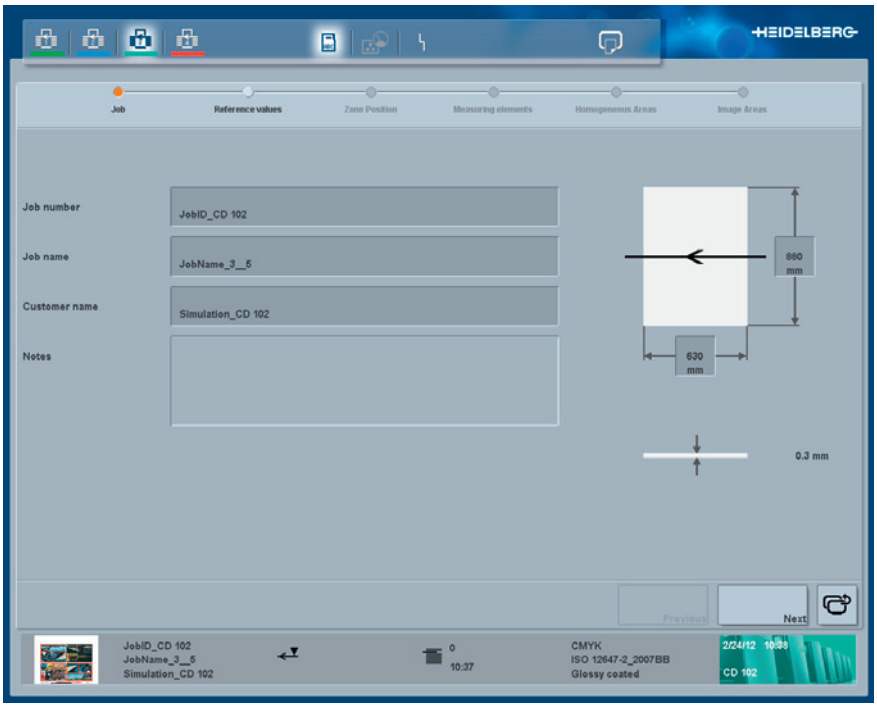


4. Checking the paper format

A setup assistant guides you step by step through the system's setup procedure for the print job.

The software automatically takes over the job data and sheet format from the press control console.

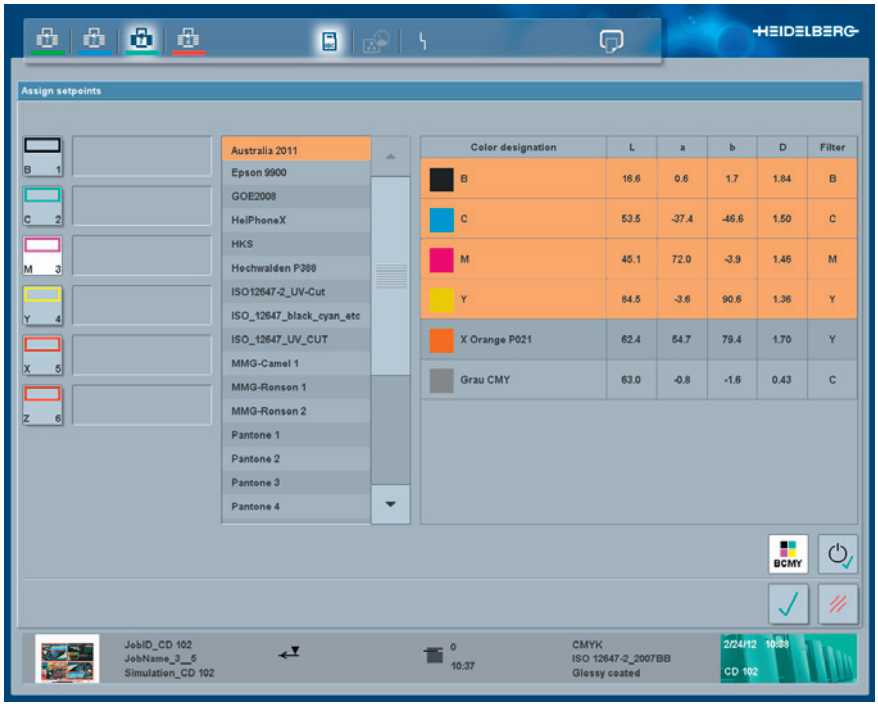
If there is no printing press assigned to the channel you have selected (offline operation), you will need to manually assign the sheet format.



5. Selecting target values
The target value database contains color sets with target spectral curves for inks and papers.

Target values for HKS, Pantone and ISO standards are already stored as factory settings.

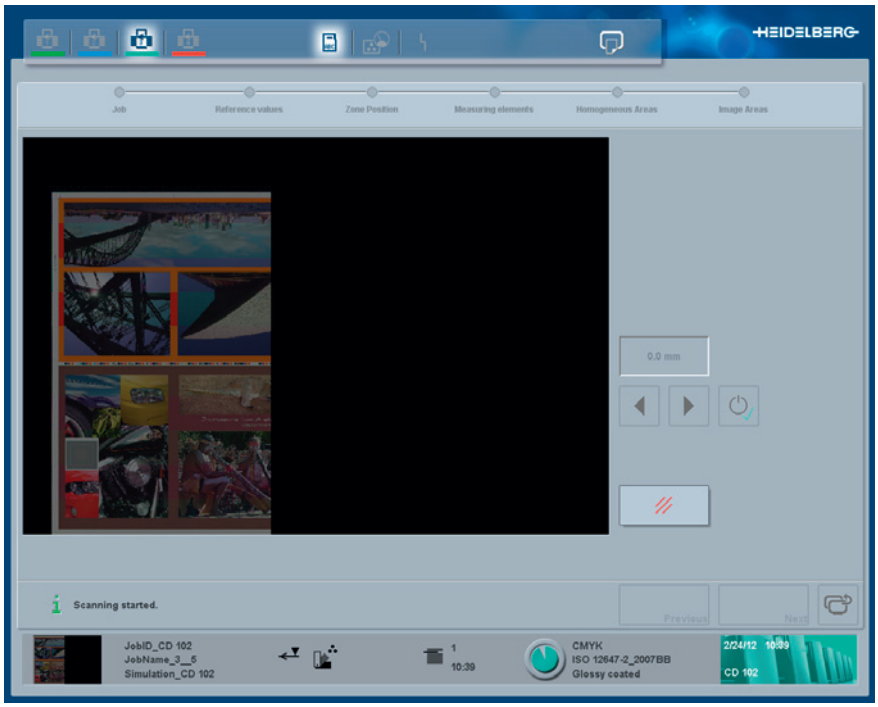
You can also add your own color sets to the database.



6. Measuring
The printer places the sheet within the suction area at the front stop.

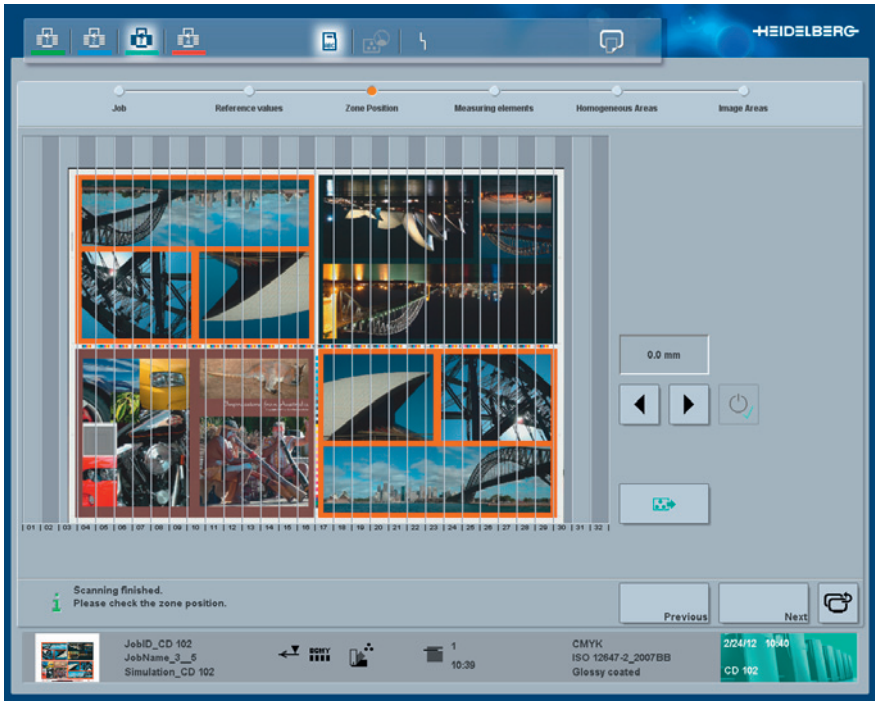
Suction holds the sheet flat on the table during measurement.

The first time a job is measured, Prinect Image Control automatically measures and calibrates paper white and detects the edge of the sheet. The spectrophotometer is also automatically focused according to the thickness of the substrate.



7. Checking the ink zone position

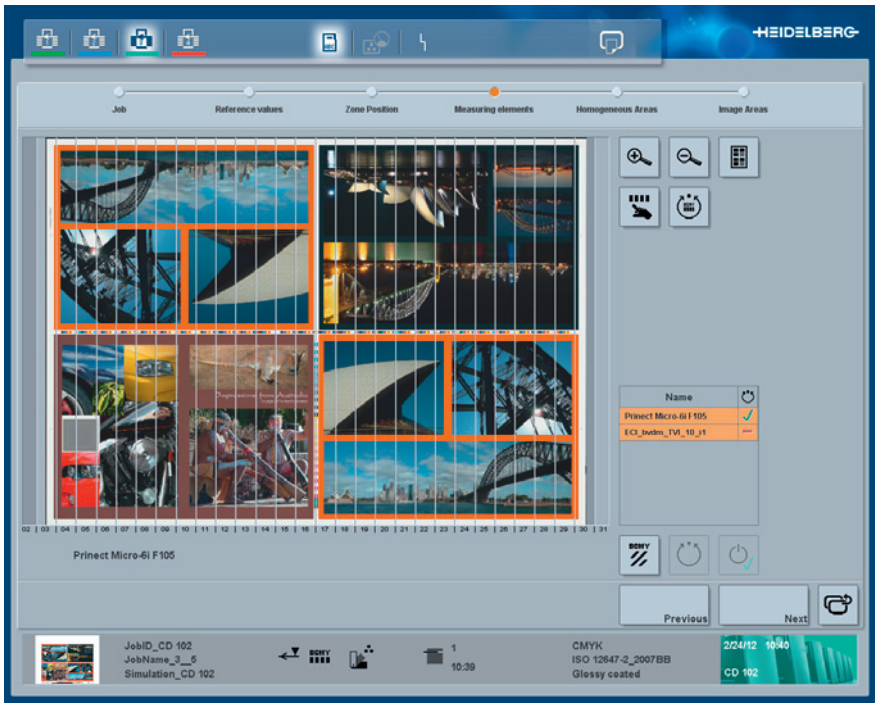
If the job entails printing off-center, Prinect Image Control calls up the displacement data from Prinect Press Center and repositions the image so that the position of the ink zones matches the subject.



8. Controlling measurement elements

The software is able to automatically identify any print control strips/color control strips that have been activated in the service menu “Measuring Elements”.

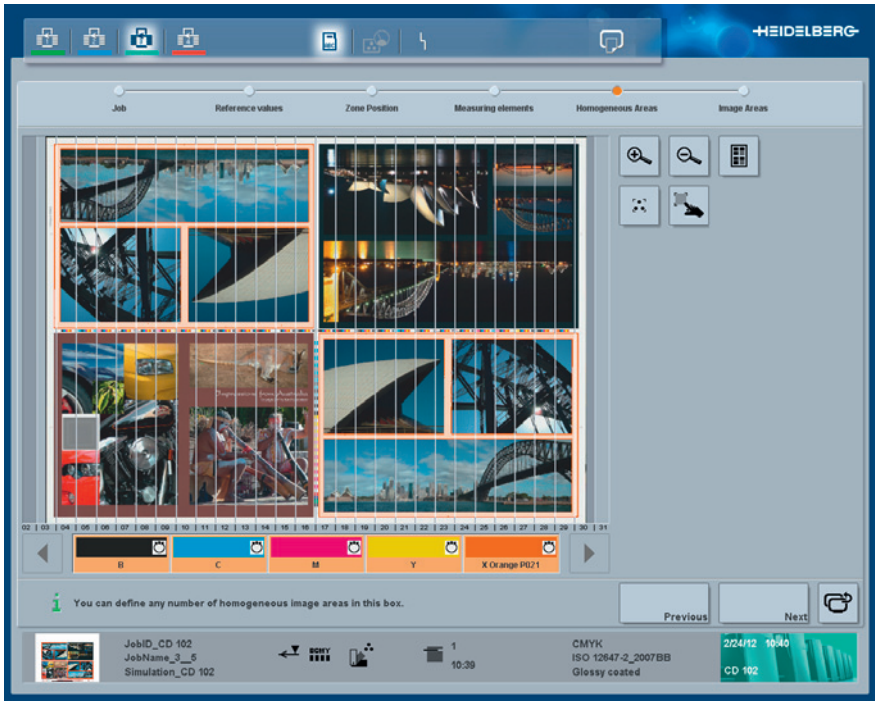
A green check mark shows that the element is being used for color control. Elements marked in red (minus sign) are evaluated for process analysis but are not used for control.



9. Controlling homogeneous areas

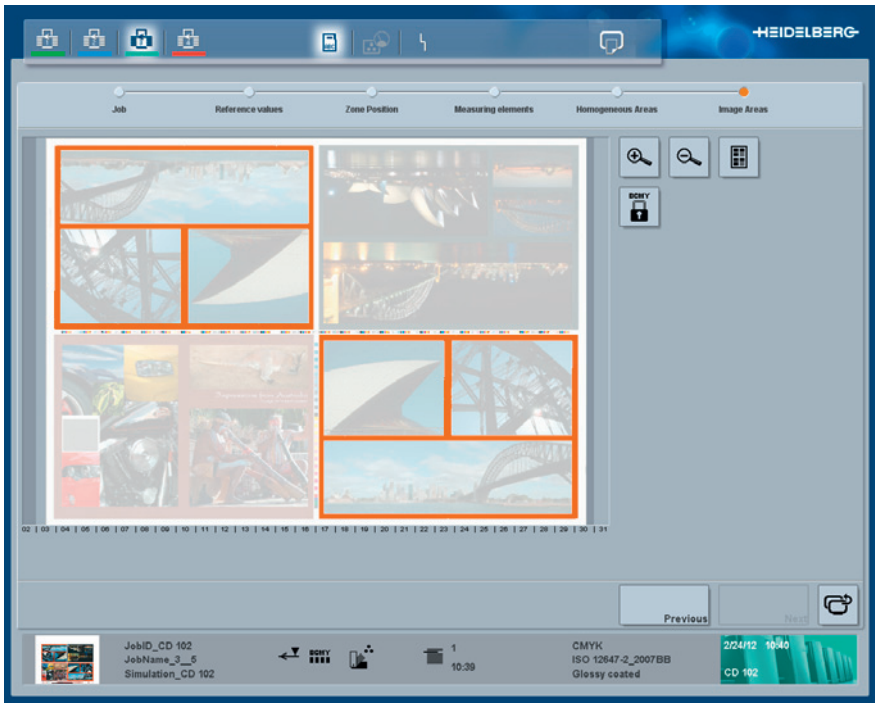
The software automatically recognizes all non-overprinted solid tone areas from the PPF file and uses these for regulation.

The printer can deactivate the image regulation function for a solid tone if he wants to control it manually (e. g. metalized colors).



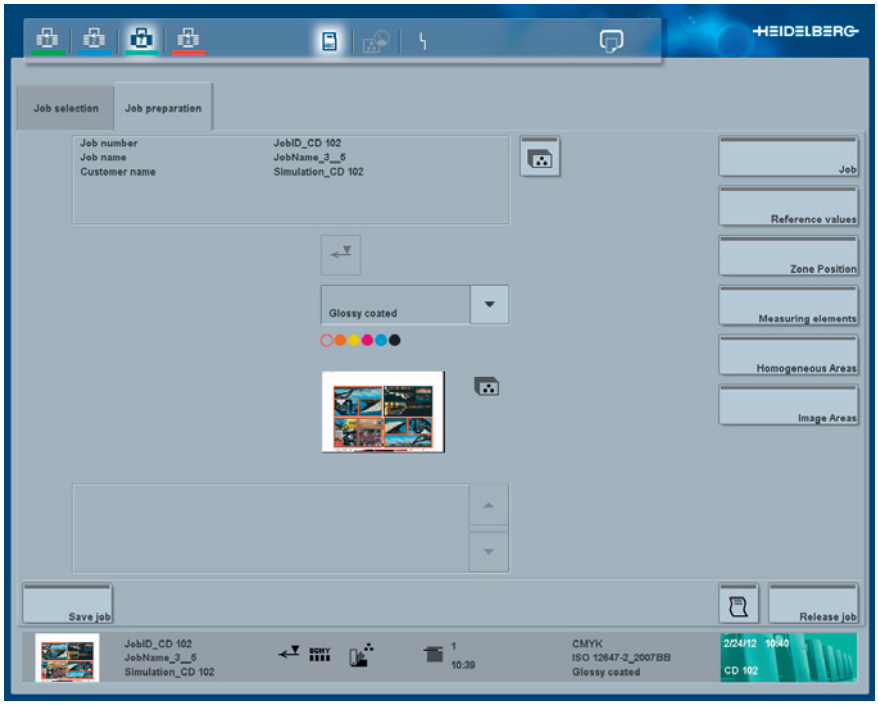
10. Controlling image areas

The printer can control all regulated areas in the image. The non-regulated areas are shown in soft focus mode.



11. Take-over a job

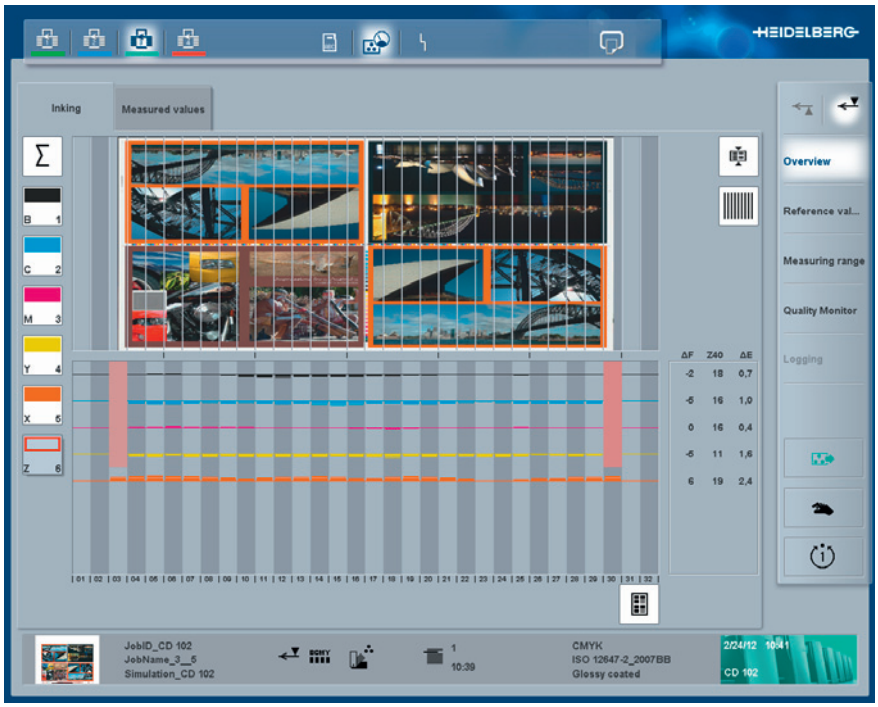
When all the adjustments have been made and checked, the printer can then release the job.



12. Overview

The overview shows the color deviations from the target value for each individual ink zone in each inking unit in the press.

When the printer has confirmed the regulation recommendations, Prinect Image Control automatically sends the adjustments for all ink zones to the press, which in turn automatically corrects the ink zones accordingly.



13. Adjusting target values

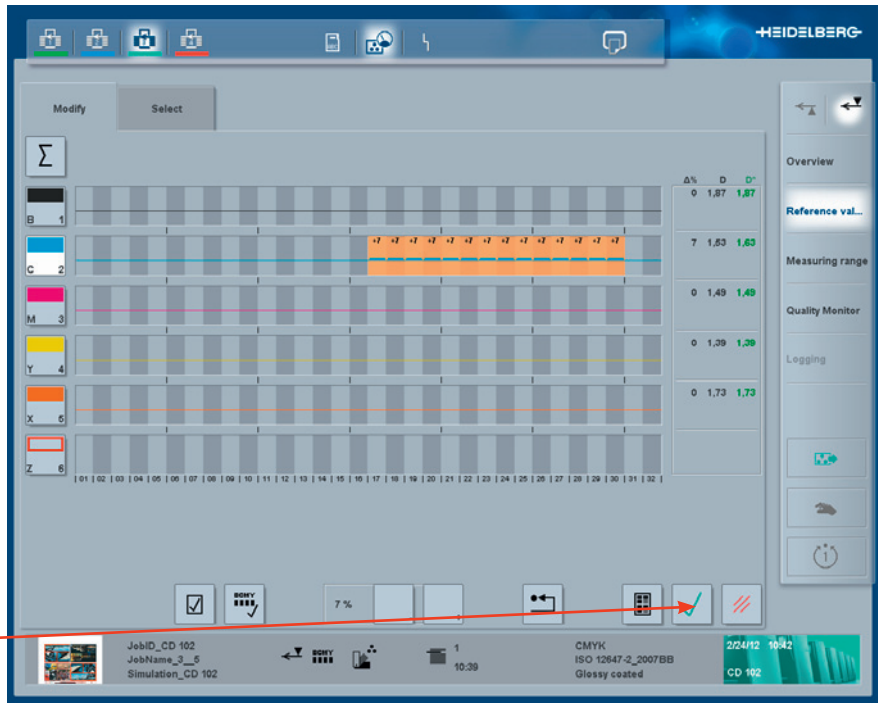
After the printer has selected a printing unit and has marked the zonal areas he wants to change, he can adjust the target value in percent.

A density preview shows what the inking will be like after it has been changed.

The target value is changed by clicking the plus/minus buttons.

14. Confirming the changes

The image preview can be hidden or revealed at any time.



Confirms all changes and exits the menu.

15. Implementing the corrected adjustments

The overview immediately shows any deviations after the target value has been corrected.

The follow-up button sends the corrections to the printing press.

16. Adding homogeneous areas for regulation

The pipette selects a halftone area. The software automatically highlights all identical halftone values throughout the sheet.

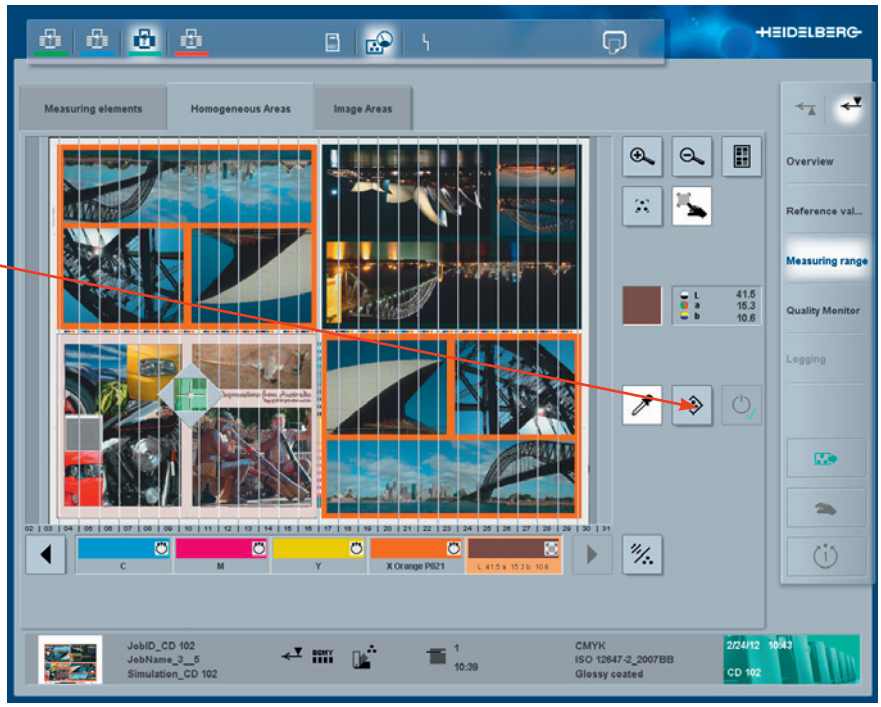
The printer confirms his selection and the software incorporates the area selected by the pipette into the target value list.

17 Adding a halftone area target value to the target value list

Following confirmation, the software assigns the Lab value measured in the area marked by the pipette as the new target value for all the same homogeneous CMYK halftone areas.

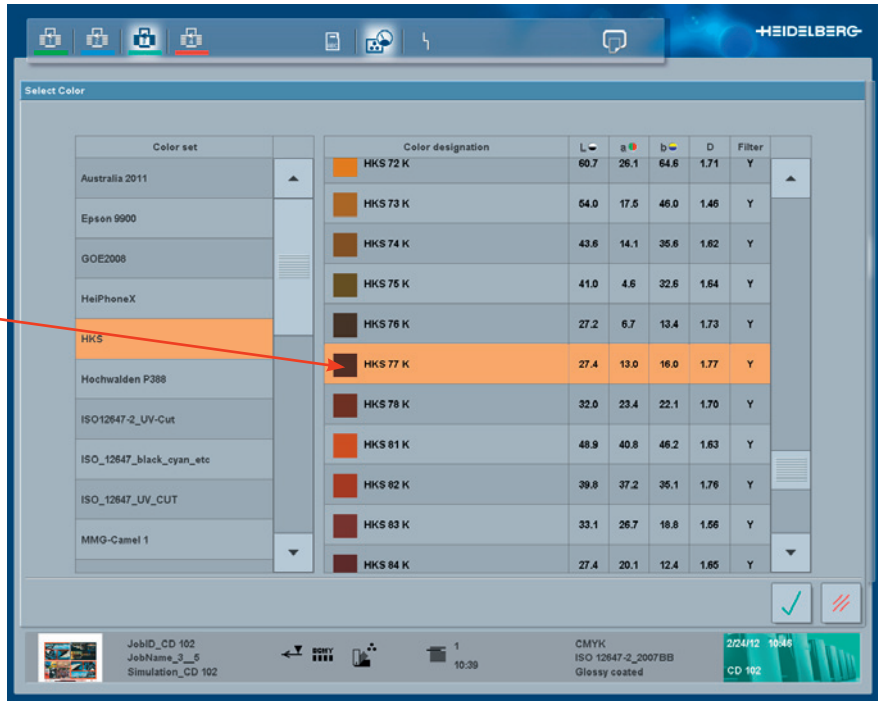
18. Assigning a target value from the archive

If required, the printer can assign a target value to the halftone area from the color database.



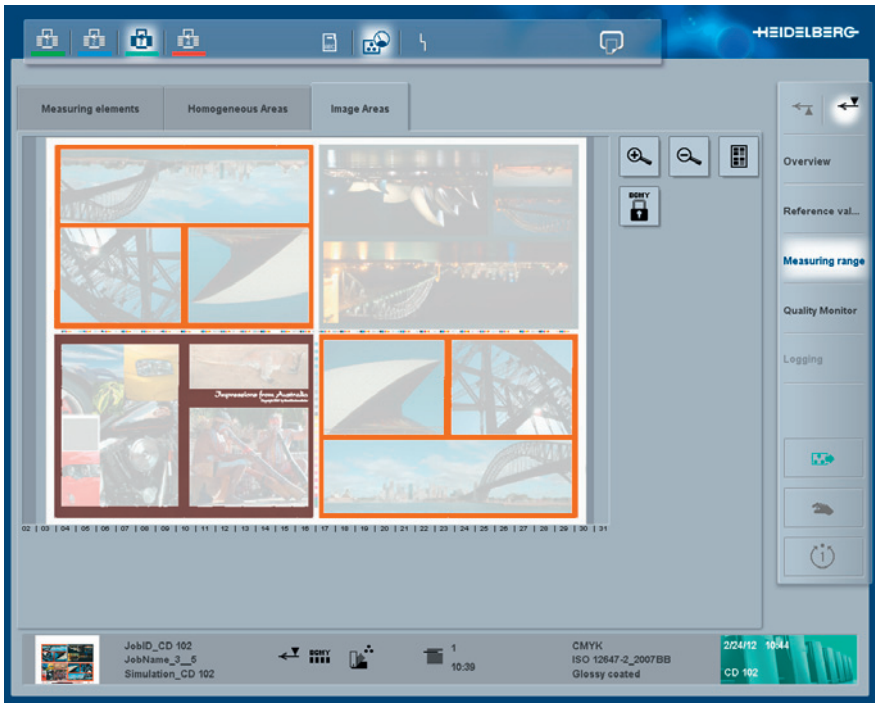
Together with the print shop's own colors, reference values for HKS® and Pantone® color systems are stored in the color archive.

The printer selects the target values he is looking for in the color archive and confirms them.



19. Controlling image areas

The menu "Image Areas" shows all the regulated areas on the sheet.



20. Confirming deviations

The overview shows the updated deviations that are necessary for correcting inking in the halftone area.

The printer now sends the new regulation recommendations to the press at the touch of a button.

Chapter 8
Defining a color set

A printing ink's properties are determined mostly by its pigments and their composition. In day-to-day routine this means that in some circumstances, depending on the paper, every color requires a different ink film thickness to reach a specific target value. Since the ink itself cannot be changed at the press, it can happen that a target value, e. g. ISO standard, cannot be precisely complied with using that particular ink-paper combination.

To ensure that production according to standards is reliable and reproducible, you need to set up an individual color set in the target value database for each ink-paper combination. Spectral curves for each color and paper white are stored in this color set and from them target L*a*b* values, color deviations (Delta F), color space deviations (Delta E, Delta E0) and correction values for ink zone positions are determined. A color set needs only to be set up once.

The following describes how to create a color set:

1. Selecting and copying a color set

To save time, you can copy an existing color set and replace its colors values with new ones. In this case, it is worthwhile copying a color set that only contains the four process colors (CYMK).

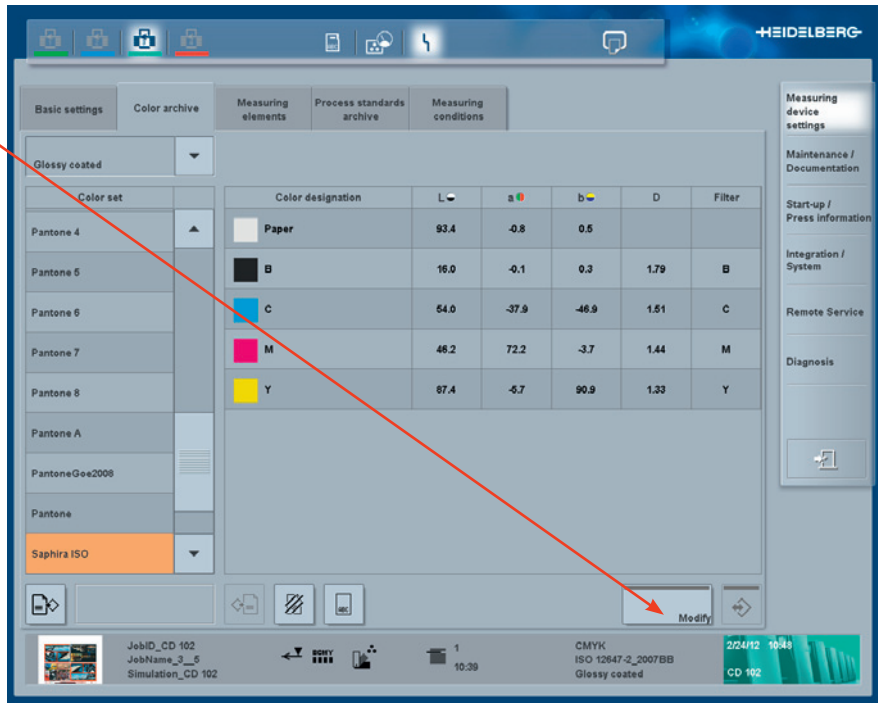
Clicking this icon creates a new color set.

2. Naming the color set

Since a color set always describes an ink-paper combination, we recommend naming the color set according to a standard, the manufacturer's name for the ink and the paper type, and if necessary the customer's name, too.

3. Changing a color set

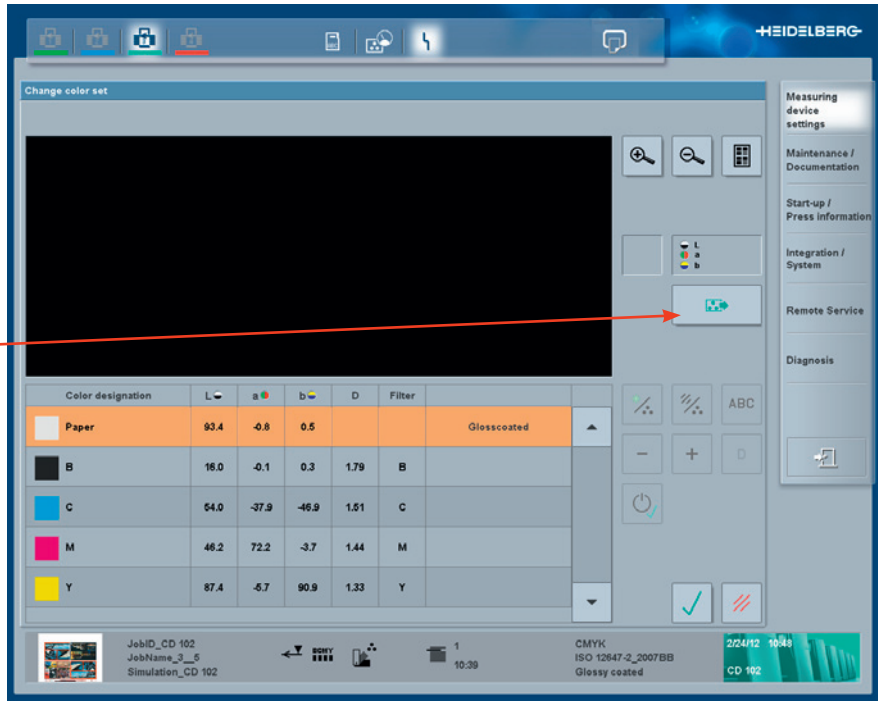
Clicking this button opens the window for changing the color set.



4. Measuring the sample or sheet

First of all, Prinect Image Control needs to measure a printed sheet or sample containing the required color.

Clicking this icon activates suction to engage the sheet or color sample and initiates measurement.

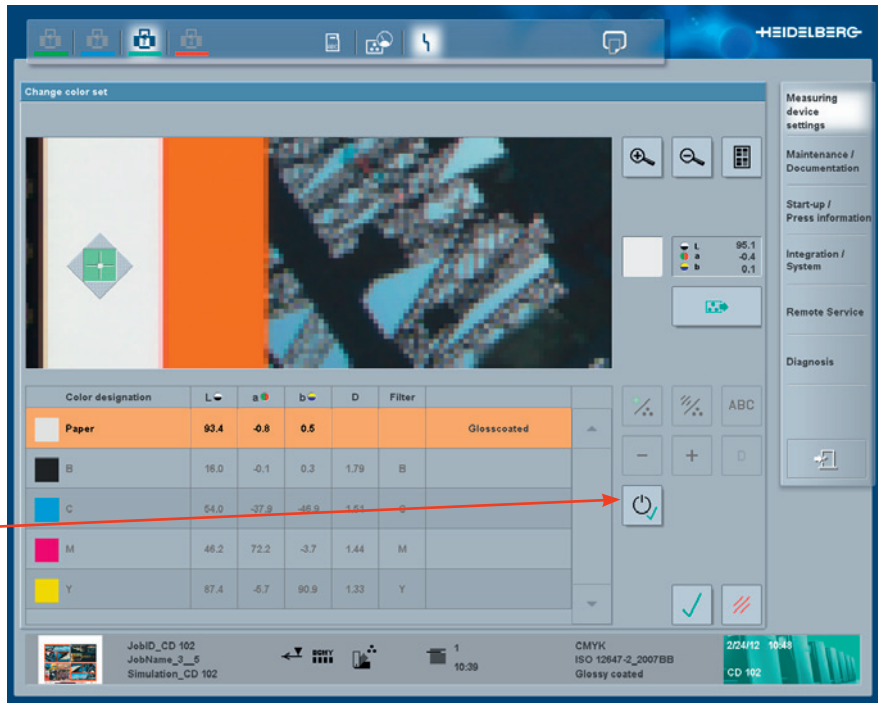


5. Marking and measuring paper white

Since the white of the paper has a large impact on the measured color, you should always first assign an area containing paper white.

Mark the required area using the magnifying glass and pipette icons.

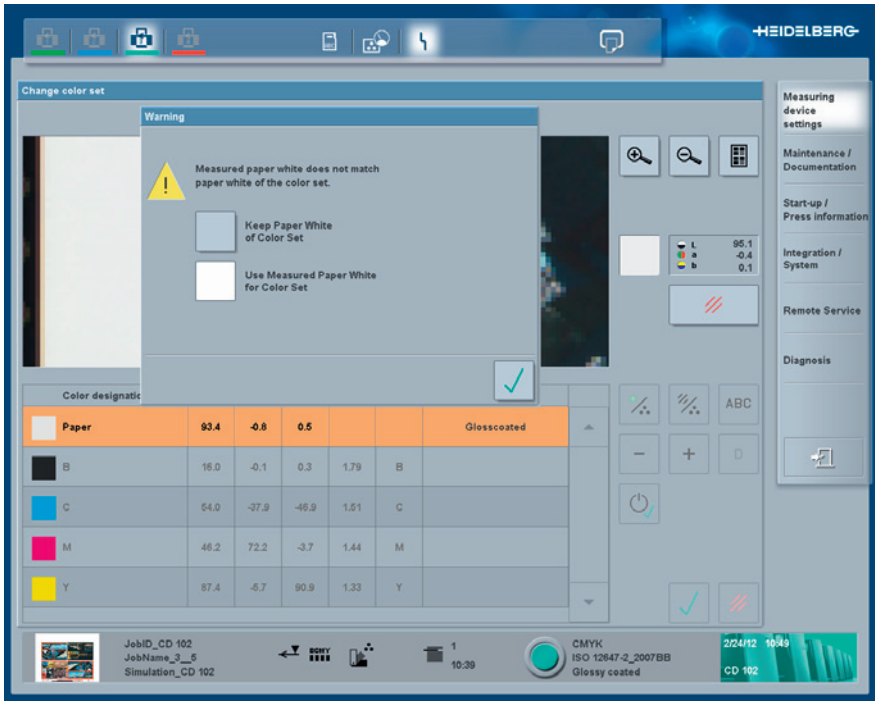
Clicking this icon takes over the position marked with the cursor.



6. Setting paper white

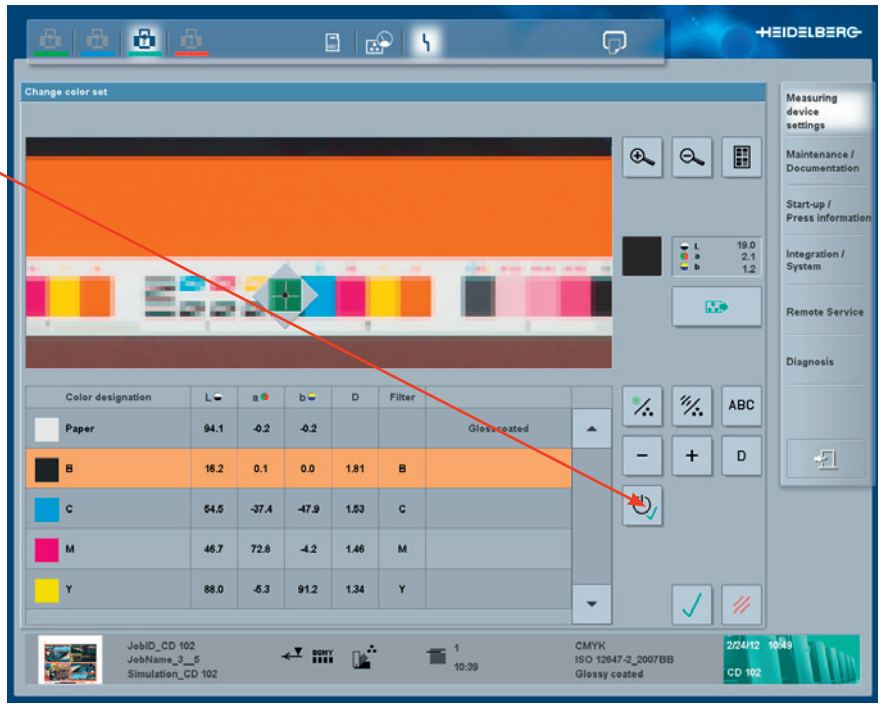
If you input a completely new color set, the paper white values measured should be taken over as the basis for all inks.

The existing value can be retained if you are only adding one new ink to the color set.



7. Marking and measuring colors

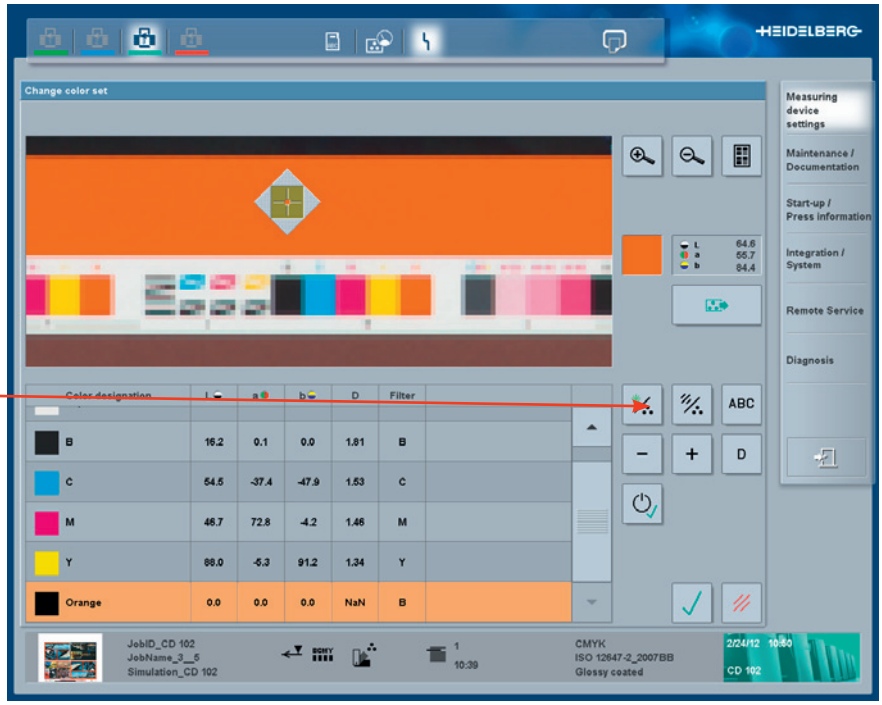
The new values are assigned by positioning the pipette on the color area for each required color and then confirming them.



8. Adding special colors

You can also add a special color to the existing process colors (CMYK). If you are setting up a color set for special colors only, all the colors that are not required can be deleted.

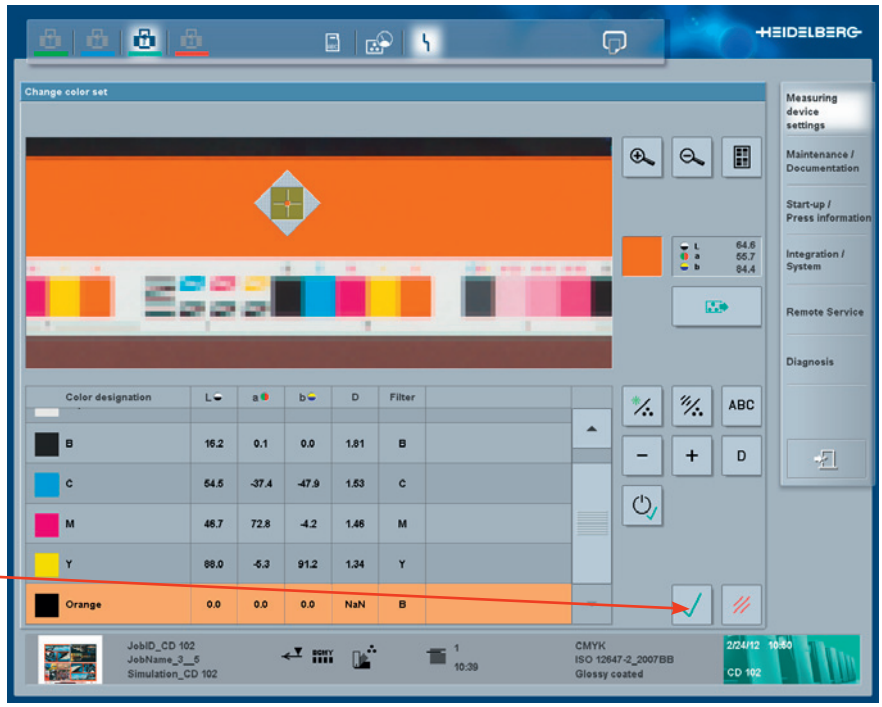
Click this icon to add a new color.



9. Input and measurement of colors

The new value is input by selecting the new color and positioning the pipette on the special color area you want to measure.

Click this icon to exit the menu and save the entire color set.



10. The new color set is now available

Chapter 9
Data management

9.1 Data archives

Prinect Image Control has various data archives. This means there is a color archive available when you set up a job. When defining a print control strip/ color control strip, the system reverts to the measurement element archive. This archive is managed via the service menu.

The following is a brief description of the individual archives:

Colors and target values

- The color archive is for saving color sets. Spectral curves and the resultant target values for inks and papers are saved in the color sets. They act as the reference values for regulation with Prinect Image Control. If you are using a different paper in production printing than the one saved in the color set, Prinect Image Control automatically calculates the target values for the paper you are actually using. This is not a device error, but rather is aimed at achieving the same impression of color on the paper you are using as in the stored template. For this reason, the first measurement brings the stored target values into line with the paper white being used. We recommend that every ink-paper combination is measured with its own color set, since Prinect Image Control not only stores the L*a*b* values, but also the key spectral curves for calculating the deviations Delta E (ΔE) and color (ΔF). Color sets can contain colors other than the process colors cyan, magenta, yellow and black (CMYK). Special colors used for one or more jobs can also be saved in a color set. Printers in packaging printing usually use color sets that contain only special colors. You can also copy individual colors from one color set to another one.

Print control strips and Mini Spots

- Print control strips/color control strips and Mini Spots are stored in the measurement element archive. Print control strips and Mini Spots are managed separately from each other to avoid any confusion. You can deactivate any measurement elements that are not required. The software then only offers you a choice of the activated print control strips and Mini Spots in three clearly understandable lists organized according to their application.

PPF/JDF

- To use the Prinect Image Control in-image regulation functions you need a CIP3-/CIP4 conforming PPF file from prepress. There are no functional constraints when the PPF file is generated with prepress from Heidelberg. Prinect Prepress Interface or Prinect Pressroom Manager add data to the contents of the PPF file from the prepress workflow for Prinect Image Control and then save these data via the network. When setting up the job in Prinect Image Control, the printer loads the PPF file from the network and the software analyzes the color separations in the PPF file. It is worthwhile setting a time limit for storing PPF files, so files that are no longer required are automatically deleted. This gives you a better overview and ensures fast performance.

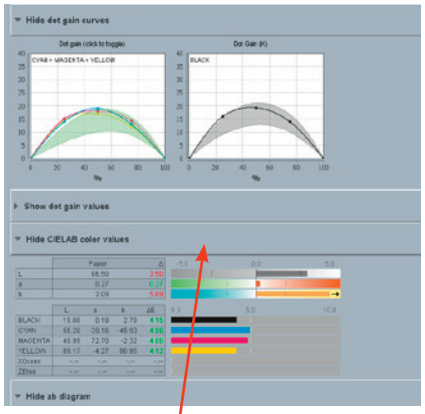
Chapter 10
Process control and color management

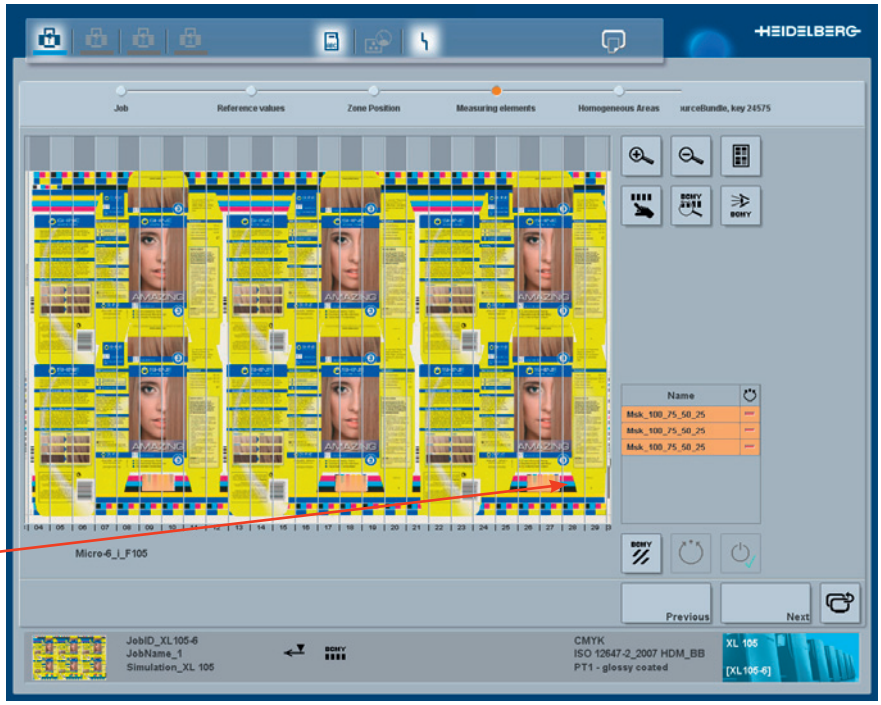
Mini Spots provide you with more process information than the print control strips and are therefore ideal for evaluating process quality. Their integration in Prinect Workflow enables immediate correction of tone value curves in prepress workflow or the generation of ICC profiles for color management with Prinect Color Toolbox. Mini Spots are small quality evaluation elements that can be positioned wherever space allows on the printed sheet (gutters, margins etc.). Using the Color Interface option with its integrated process analysis software Quality Monitor, the printer can check in Prinect Image Control the process quality and whether the measured sheet complies with the print standard (e. g. ISO 12647-2) in real time. International standards are already stored in the system and your own corporate standards can be added in the service menu. If the printer detects a deviation from the standard, e. g. a change in tone value increase after a new ink batch has been delivered, he can store the measurement values from Prinect Image Control directly via the network and they are then processed by Prinect Prepress Workflow. This means, for instance, that the tone value characteristic curve can be easily adjusted in the RIP. When the next plate set has been imaged, the printer can immediately check the results of the corrections at the press using Mini Spots. Mini Spots are ideal for all printing jobs that demand a process control that ensures consistently high quality.

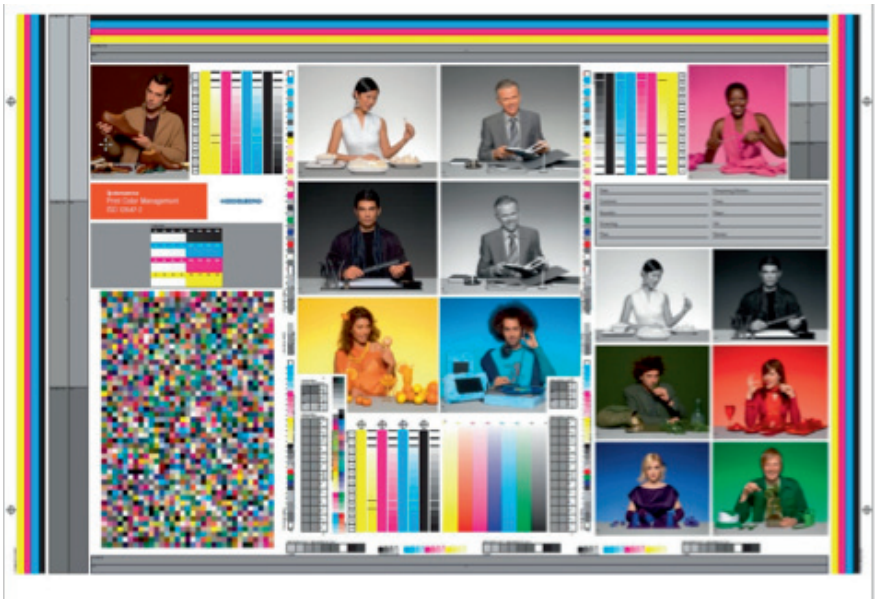
In packaging printing Mini Spots can be positioned on covered flaps or in die-cutting or trimming areas. When positioned near to the image, they provide reliable information on the color and tone value quality in the sheet. Our example on next page shows packaging with tuck flaps staggered in the print direction. Positioned accordingly at the front and tail edge of the sheet between the tuck flaps, there is a solid tone color patch for regulation for every printed color in every zone. This enables you to save money when printing certain packaging forms, since there is no need for a continuous print control strip. The Mini Spots positioned close to the image contain solid tone patches and 3-level tone value patches for process evaluation using the integrated process analysis software Quality Monitor.

Output systems in prepress workflow, such as monitors or proofing systems, are designed to give you a preview of the printed sheet and therefore should simulate the press color space as exactly as possible. The color management system defines this color space with a so-called ICC output profile. This profile defines the entire process, including printing inks, substrates and press settings. Prinect Image Control measures entire test forms and, with the Color Interface option, can export their measurement values together with their test charts. Prinect Color Toolbox generates ICC profile files from these measurement values, which in turn are used by monitors and proofing systems to simulate the color space of the press. The Heidelberg

color calibration test form has been designed specifically for calibrating processes and generating profiles. In just one measurement run Prinect Image Control transmits all the test form measurement values to prepress. Prinect Image Control is the central quality control station for prepress and the print room in one unit.



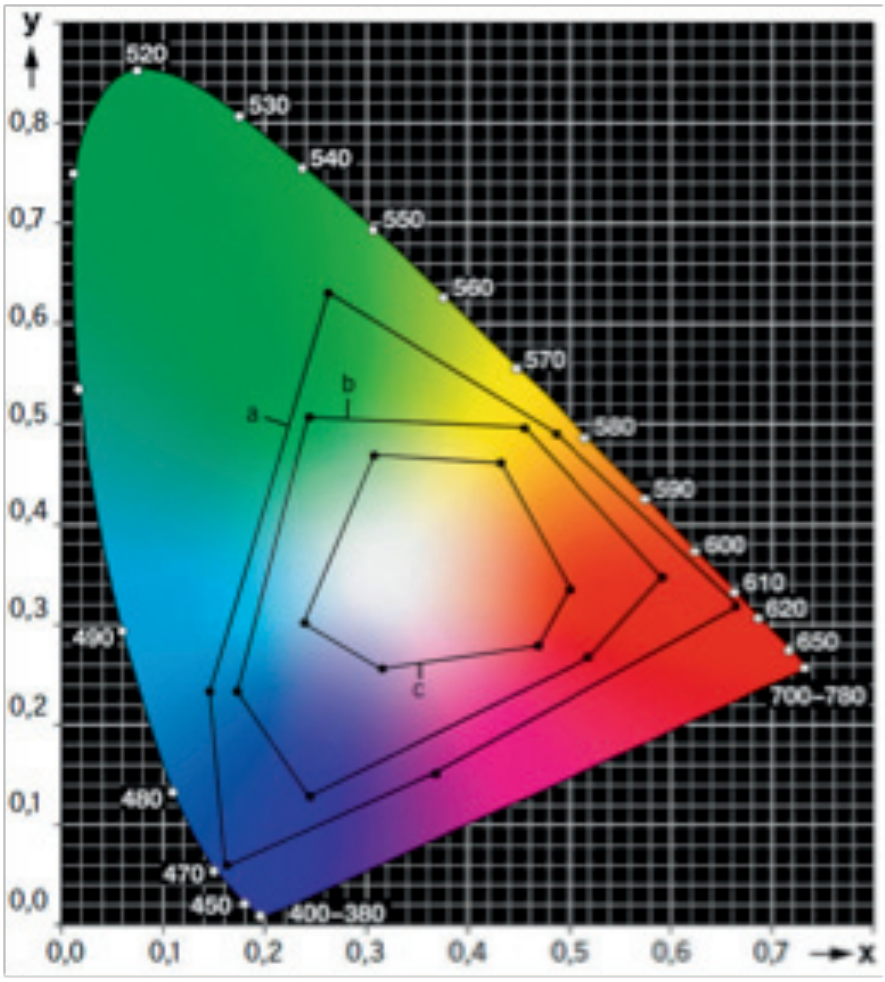




Prinect Image Control is ideal for evaluating test charts as part of the color management process. Measurement of the entire printed sheet takes around 20 seconds, which also enables assessments in wet state.

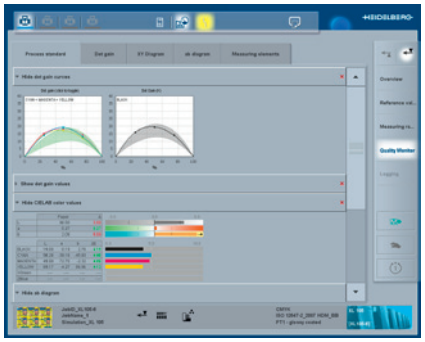
Every output device has its own color space constraints. The diagram on the right shows the color space constraints for:

a) Color photography (outer contour)
b) High-quality offset printing (centre contour)
c) Newspaper printing (inner contour)



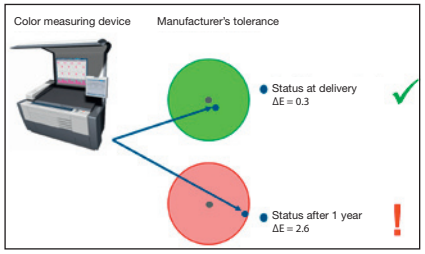
The objective for each profiling process is to map a color space (for example, offset printing) onto another color space (for example, a monitor's color space). Using a profile and monitoring the relevant process parameters will enable you to achieve accurate color results when printing.

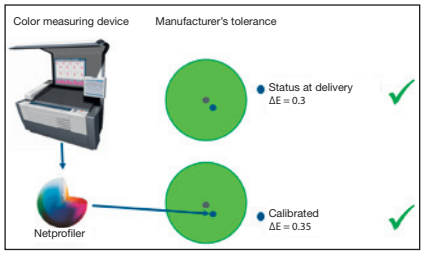
Chapter 11
Add-on modules/options



11.1 Color Interface with integrated Quality Monitor

- Using the Color Interface option with its integrated process analysis software Quality Monitor, the printer can check in Prinect Image Control the process quality and whether the measured sheet complies with the print standard (e. g. ISO 12647-2) in real time. International standards are already stored in the system and your own company standards can be added in the service menu.
- Analysis of the measurement values from the print control strips and Mini Spots enables the printer to keep a constant eye on the process parameters inking and tone value increase. Together with Color Interface, Prinect Image Control can export the measurement data from the print control strips, Mini Spots and test charts via the prepress network. The measurement data are processed in the Heidelberg prepress workflow or with Prinect Color Toolbox: for example, for adjusting tone value characteristic curves for CtP plate imaging, generating or correcting ICC profiles or for long-term quality analyses.
- Prinect Image Control with Color Interface option enables color measurement feedback to Prinect Pressroom Manager job reports in Analyse Point for centralized job reporting and evaluation. Color Interface turns Prinect Image Control into the quality center in prepress and the print room.





11.2 Netprofiler

- The Netprofiler option is designed to enable operators to colorimetrically calibrate Prinect Image Control measurement devices on their own. Netprofiler works in three stages: it checks measurement accuracy, calibrates the measurement device, and finally generates a detailed report and certificate. Netprofiler ensures that the calibration of the spectrophotometer in Prinect Image Control always remains close to the original ex-factory settings and the print shop is able to provide their customers with proof of the quality of their measurement systems if required.
- Prinect Image Control measures the measurement patches on a color calibration card with reference color patches. The printer then compares these Prinect Image Control measurement values with those stored on a USB stick from a manufacturer's color measurement system that has previously measured the same reference card. The software adjusts any measurement differences and recalibrates the system to its original state. The measured data can be sent via Remote Service to Heidelberg, if required, and Heidelberg then sends a calibration protocol with a certificate by email to the customer.
- We recommend ordering the color calibration card with its USB stick well before Prinect Image Control is installed. The calibration card is valid for 12 months.

Chapter 12
Comparing two measurement devices

Since there is no accurate measurement value reference for optical measurement devices, such as the “universal measure unit” for distance, we need other methods to ensure that different devices deliver results that are as comparable as possible. As a rule, different color measurement devices always deliver different measurement values, no matter what technology they are based on. However, to be able to compare different devices, measurement parameters must agree with each other as closely as possible. It is therefore absolutely vital that measurement conditions have been set correctly.

The ISO 12647-2 standard and the ISO 13655 standard specify the following device settings for spectral color measurement:

- Lighting: D50
- Standard observer: 2°
- ΔE calculation: CIE L*a*b* (1976)
- Measurement geometry: 45°/0° or 0°/45°
- Reference white: absolute
- Measurement backing: black for measurement at the press

There are various regional settings used to measure density:

USA: Density filter according to ANSI T without polarization filter
Reference white: absolute

Europe: Density filter according to ISO status E (DIN 16 536)
or ISO I (DIN 16 536 NB) with polarization filter
Reference white: relative (paper white)

Before you can compare the results from several different color measurement devices, you need to first define a “master”, to which all other devices and their settings are adjusted. It is far easier to use a standard, such as the ISO 12647-2 standard for offset printing.

As an example, the following table shows excerpts from Media Standard Print (Edition 2010) for color values. This document is available at www.bvdm-online.de and can be downloaded free of charge.

Color values for black backings – only for measuring production print runs

	Paper type 1 + 2			Paper type 4		
	L*	a*	b*	L+	a*	b*
Black (K)	16	0	0	31	1	1
Cyan (C)	54	–36	–49	58	–25	–43
Magenta (M)	46	72	–5	54	58	–2
Yellow (Y)	87	–6	90	86	–4	75
Red (M + Y)	46	67	47	52	53	25
Green (C + Y)	49	–63	26	53	–42	13
Blue (C + M)	24	21	–45	37	8	–30
C + M + Y	22	0	0	32	0	0
Paper white	93	0	–3	92	0	–3

Paper types (PT)

1 = 115 g/m² glossy coated, white
2 = 115 g/m² matte coated, white
4 = 115 g/m² uncoated, white offset

Tolerances

Paper:	L* = +/– 3	a*, b* = +/– 2
Printing inks:	dE* = 5.0	dH = 2.5

Chapter 13
Frequently asked questions

13.1 Prinect Image Control constraints

Prinect Image Control has been designed for a wide range of applications. Constraints or incorrect measurements (as with all other color measurement systems on the market) may occur in the following applications:

- With metalized, opaque and highly pigmented printing inks
- With metallic, transparent and colored print substrates
- With light pastel tones that are close to paper white
- Image control cannot be used in measurement areas with patch coverage less than 20 % per color and ink zone, in measurement areas smaller than 5 mm × 5 mm with homogeneous colors and overprinted areas containing special colors.

In such cases we recommend testing the quality of measurement and control with Prinect Image Control with the specific materials you intend to use.

13.2 Rules for low area coverage

- Measurement areas in the image must be at least 5 mm × 5 mm for every color printed.
- Print forms with lots of text and lines should be regulated using print control strips/color control strips. The measuring device is unable to accurately identify very fine detail sufficiently.

13.3 Measurement tolerances between devices from different manufacturers

Since different spectrophotometers are constructed differently, it is very difficult to compare measurement values from different measurement devices. This is particularly true when the measurement devices come from different manufacturers.

13.4 Color measurement (L*a*b*)

When comparing measurement results on a daily basis, errors can often occur because the measurement devices are set incorrectly. The rule is: measuring color in accordance with ISO 13655 should always be carried out in unpolarized mode, irrespective of whether the colors are measured in a dry or a wet state. The graphic arts industry specifies using the 2° Standard Observer only. In accordance with ISO 12647-2, D50 lighting with a color temperature of 5,000 Kelvin and the color system CIE L*a*b* 1976 should be selected. White comparison is carried out with absolute white.

13.5 Densities and tone values

A conventional densitometer measures the densities for cyan, magenta, yellow and black using optical filters. The USA standard specifies filters in accordance with ANSI T, whilst the rest of the world usually uses filters in accordance with DIN 16536 or DIN 16536 NB (narrow band). As with L*a*b* values, spectrophotometers calculate densities and tone values directly from the measured spectral curves (not from the L*a*b* values). This conforms to standards and is usual for modern measurement devices. This procedure generally leads to around 1–2 % lighter tone values. White comparison for density values is carried out according to ANSI T on absolute white, and according to ISO E on paper white.

13.6 Polarization filters

When measuring density, polarization filters are used to suppress the glossy effect of wet printing inks. This simulates the density measurements for a dry sheet.
Prinect Image Control has an integrated high-end scanning spectrophotometer with a physical polarization filter that is capable of measuring spectral curves for the reference color sets and print control strips on the sheet both in polarized and unpolarized mode. This means that polarized density values from the print control strip are also available.

13.7 Wet target values for correctly achieving the (dry) standard

Print shop's customer expects standard-compliant print products that they usually check and evaluate in a dry state. The printer, however, prints with wet inks and needs to immediately release the OK sheet to start production. The color appearance may change on the way from wet to dry. To eliminate this gap, the following procedure is recommended:

If you want to print to standard with wet color values, you will need to determine the wet target values using a so-called inking series. The different inking levels of the various ink zones in a wet condition for every printed color is stored or saved in a protocol. After the printing ink has completely dried, the dry L*a*b* values are measured for the zonal inking levels and compared with the target values for the standard. The zone with the smallest dry deviation from the standard target value has to be evaluated. The corresponding wet inking value of this zone will be saved as the new wet target value in the color archive (color set). Prinect Image Control then accurately regulates the wet printed ink according to the inking which results in the desired color value according to the standard when dry.

Chapter 14
Examples

The following examples describe how to set up typical print jobs in Prinect Image Control. In addition to the operations described, there are also other options which we have not described here. These outlines are intended as a guide for setting up your own jobs and do not describe the system's full potential. The title of each sample job gives you information about how the print form is put together, and an illustration shows you it in more detail. Makeready is then described step-by-step.

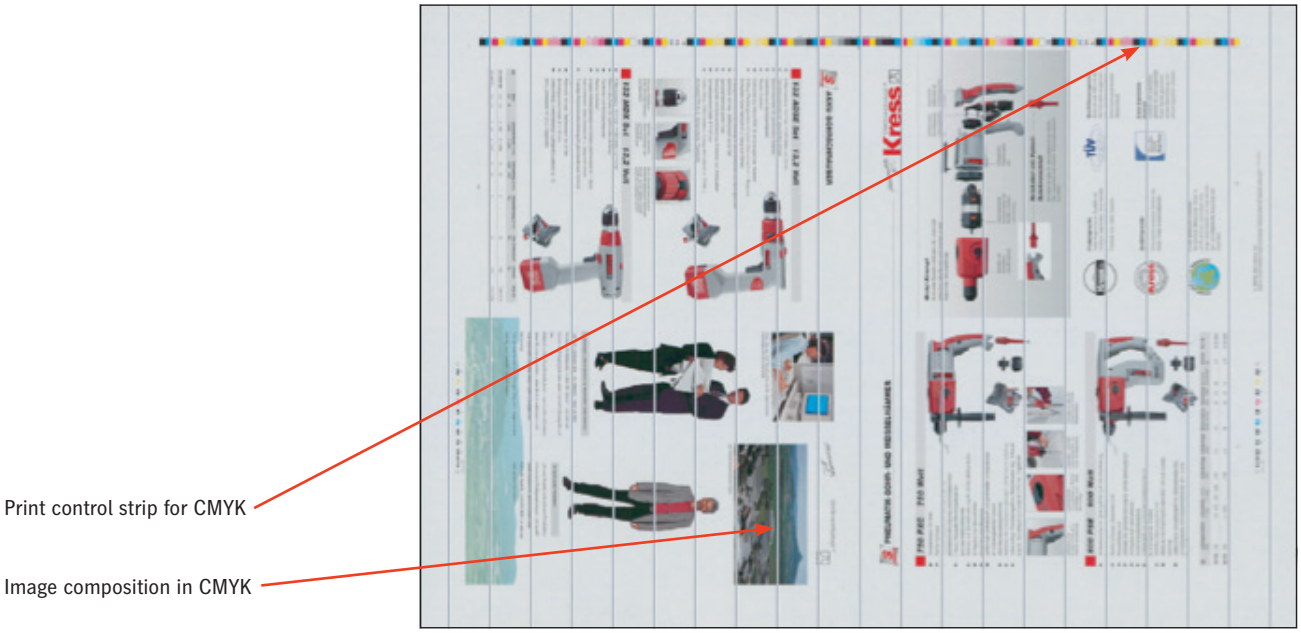
The general rules are:

- If the largest solid tone color in one particular area in a print zone is smaller than 5 mm × 5 mm, you will need to regulate using print control strips/color control strips.
- If the color areas are 5 mm × 5 mm or larger, you can choose between the various control methods.
- Continue to routinely measure and release during printing.
- Make sure the press is printing stably between measurements.
- Do not pull a sheet too early after correcting the color and make sure that the inking/dampening units are stable.

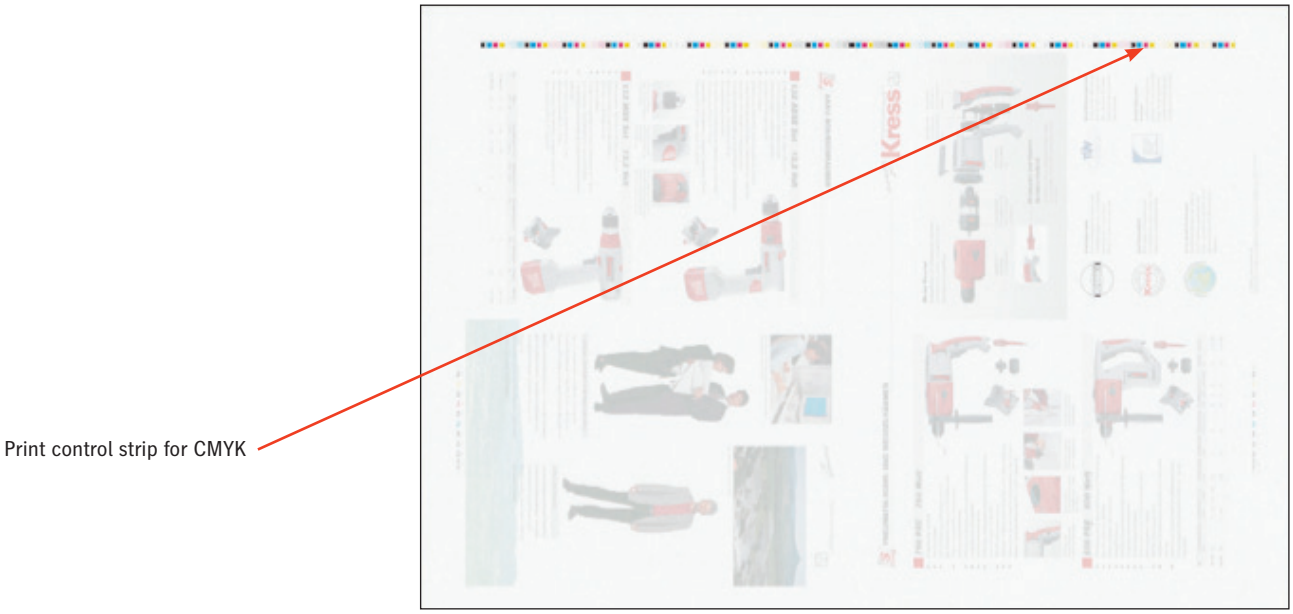
14.1 CMYK job with low area coverage

Control with print control strip

We recommend here regulating with print control strip since the print form's area coverage is so low.



Prinect Image Control always measures the entire sheet. You can check which areas have been used for control in the menu "Image Area".



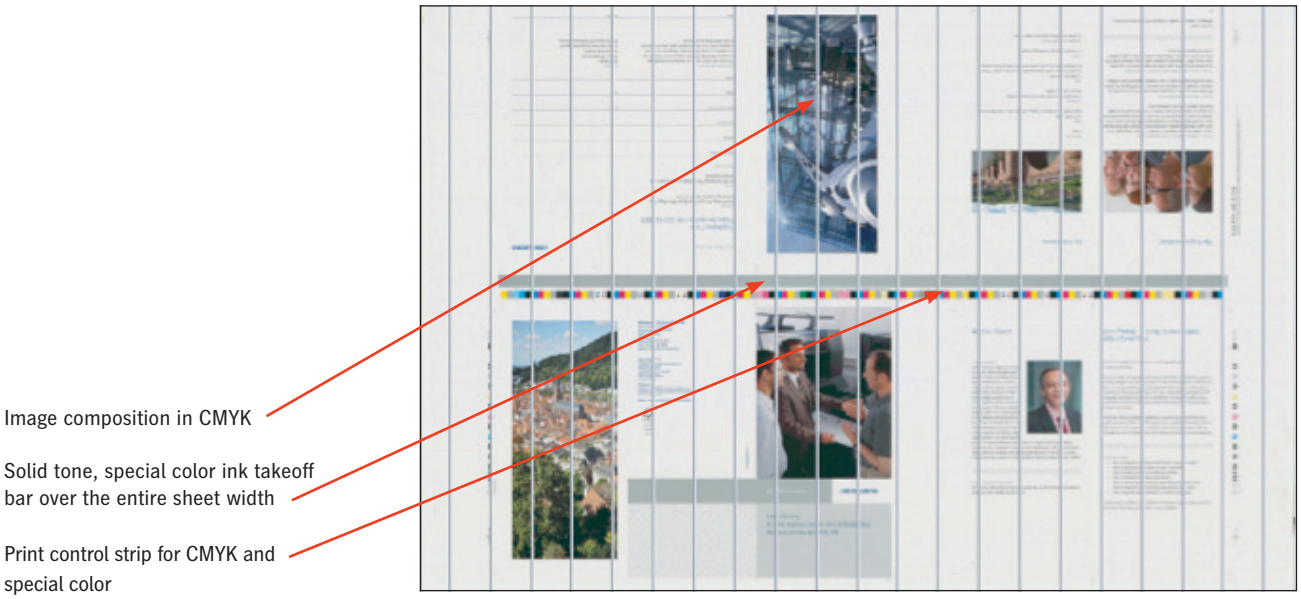
Makeready

1. Load the job from the press, select the color set for the process colors CMYK
2. Carry out the first measurement
3. Check the position of all control elements
4. Release the job
5. The dialog box "Overview" shows the recommendations for regulation

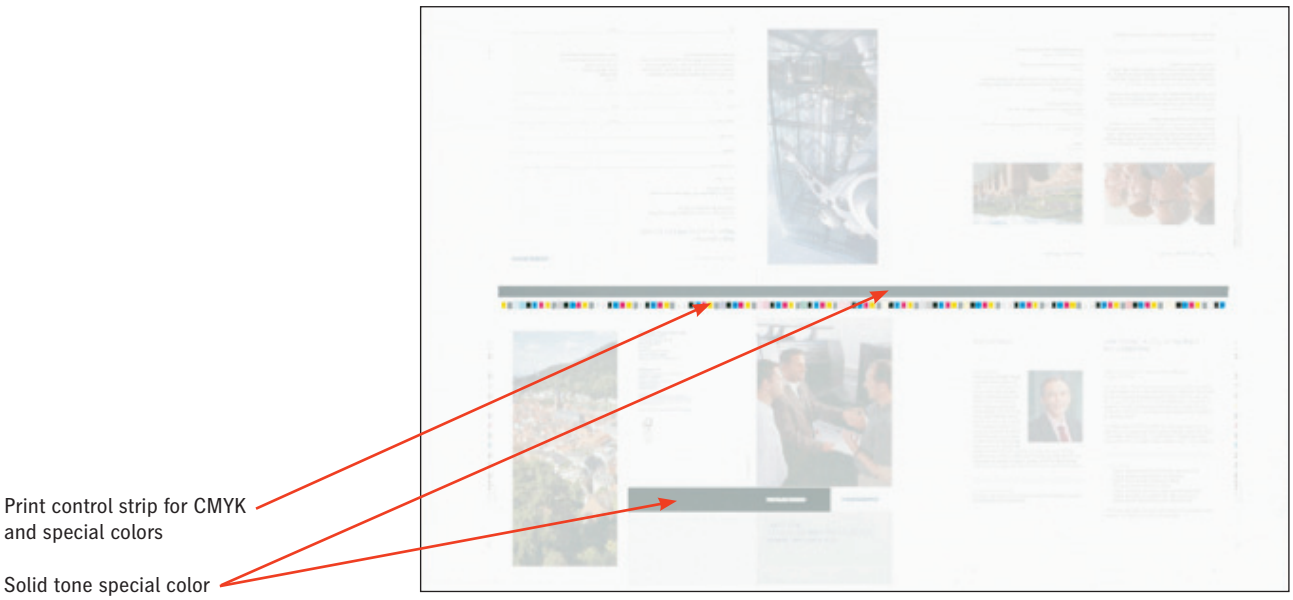
14.2 5c job with low area coverage and solid tone gray special color

Control in the print control strip + homogeneous special color area

We recommend here regulating the process colors CMYK with print control strip since the print form's area coverage is so low. The special color can also be controlled in the solid tone ink takeoff bar and therefore does not need necessarily to be present in the print control strip.



Prinect Image Control always measures the entire sheet. You can check which areas have been used for control in the menu "Image Area". Prinect Image Control automatically finds all the solid tone areas that are suitable for control.



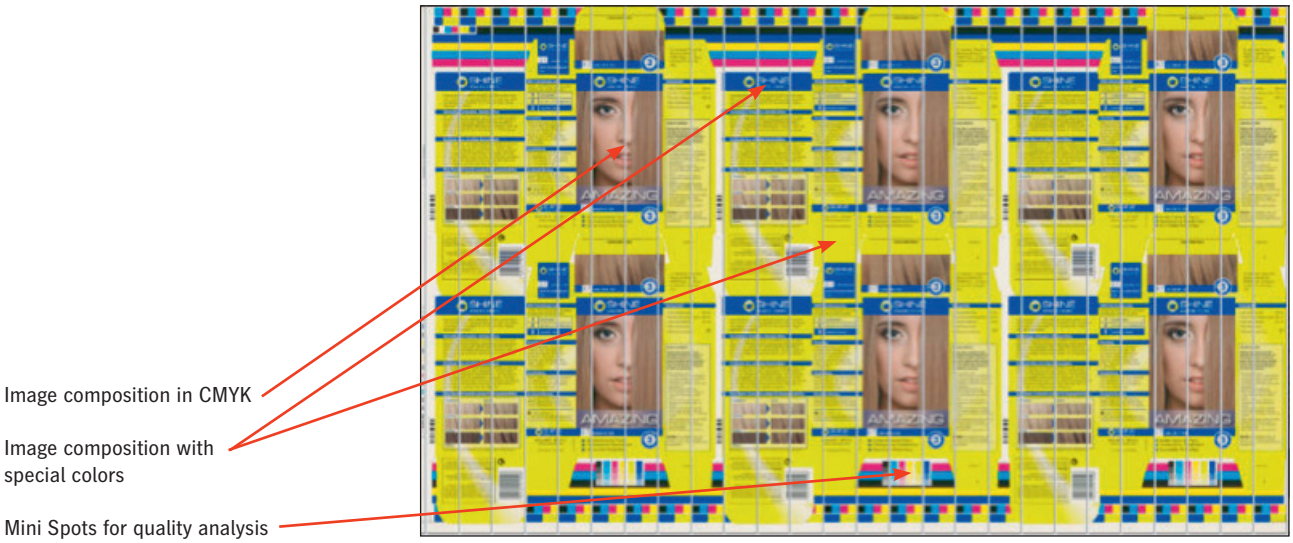
Makeready

1. Load the job from the press, select the color set for the process colors and the target values for the special color from the archive
2. Carry out the first measurement
3. Check the position of all control elements
4. Check the position of all homogeneous solid tone areas
5. Release the job
6. The dialog box "Overview" shows the recommendations for regulation

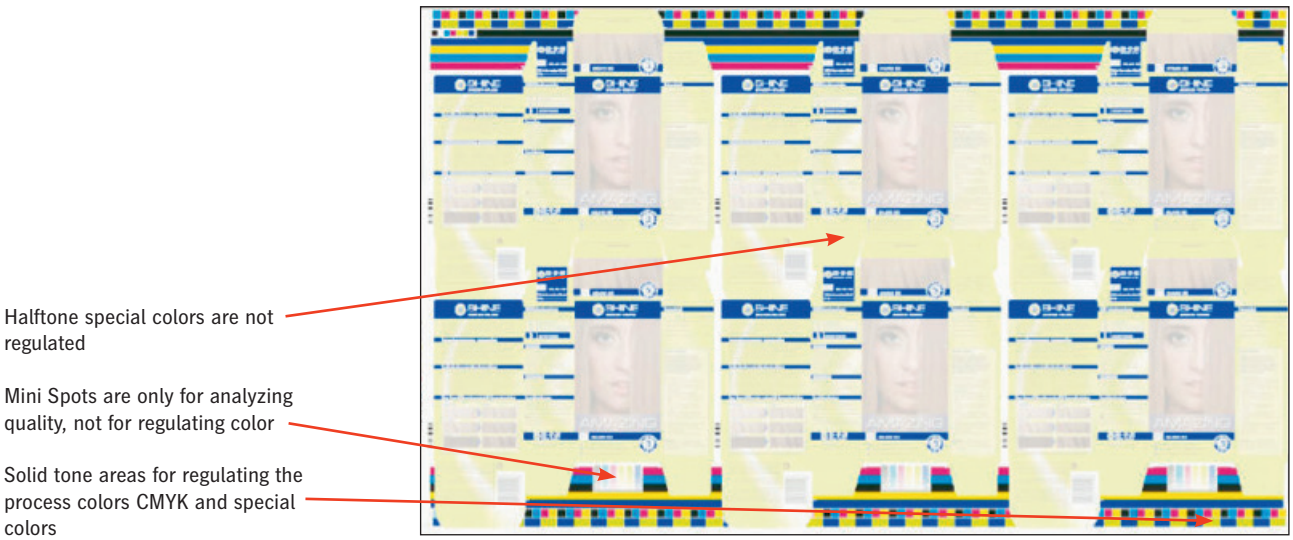
14.3 6c job without print control strip but with solid tone control patches in each ink zone

Color control using homogeneous solid tone areas

We recommend here regulating all colors using homogeneous solid tone areas since there is a solid tone patch for every printed color in each ink zone. Process control is carried out using Mini Spots.



Prinect Image Control always measures the entire sheet. You can check which areas have been used for control in the menu “Image Area”. Prinect Image Control automatically finds all the solid tone areas that are suitable for control.

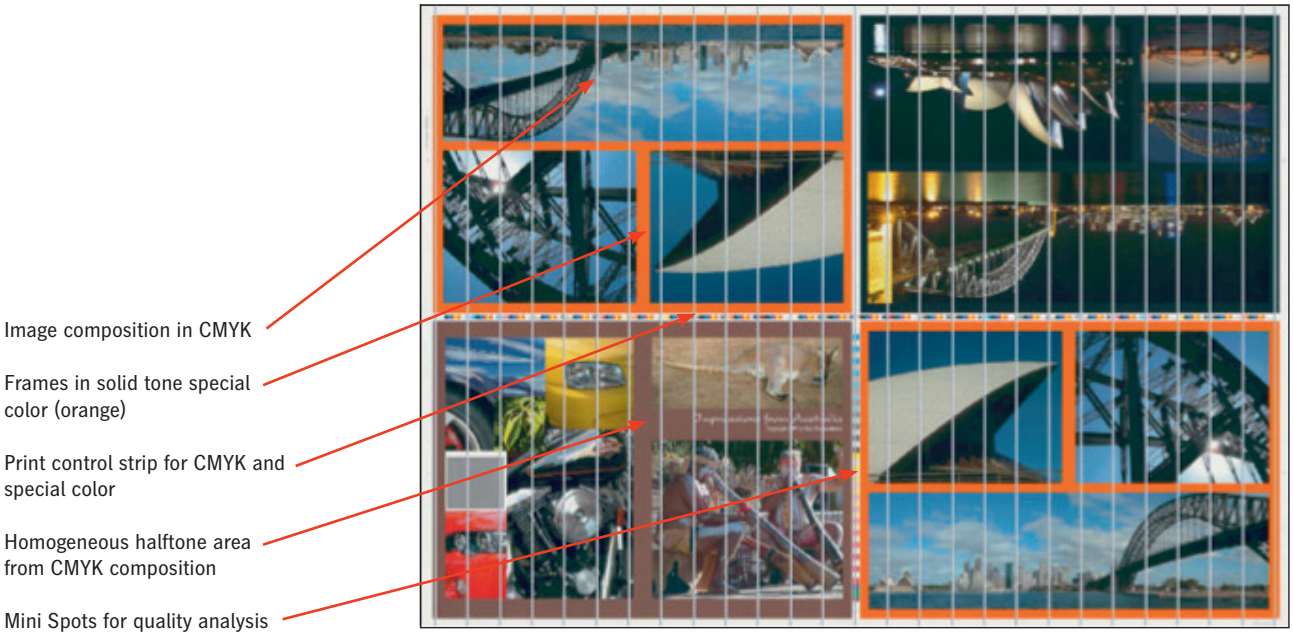


Makeready

1. Load the job from the press, select the color set for the process colors as well as the target values for the special colors from the archive
2. Carry out the first measurement
3. Check the position of all control elements
4. Check the position of all homogeneous solid tone areas
5. Release the job
6. The dialog box “Overview” shows the control recommendations

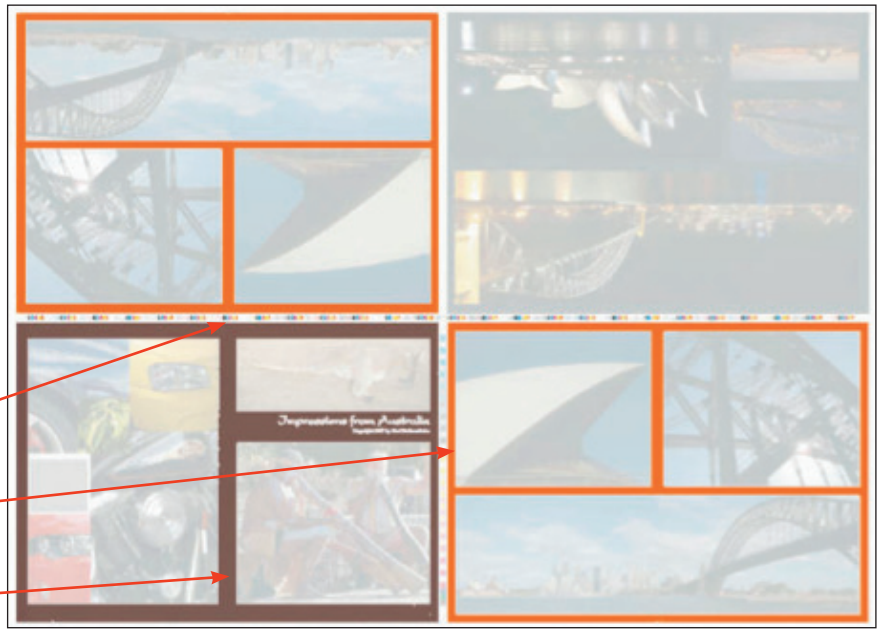
14.4 5c job with print control strip, homogeneous CMYK halftone areas and solid tone special color orange – variation 1

Control using homogeneous areas Solid tone + halftone



In this case we recommend setting up all colors with print control strips. Since the special color orange is present in large enough areas over the entire sheet width in all print zones, it does not need necessarily to be present in the print control strip and can be regulated by only using homogeneous solid tone areas. In this example, the brown made up from the process colors CMYK is especially important for the customer as his corporate color and therefore control needs to focus primarily on this color. This area can be assigned a target value, even from the first measured makeready sheet using “Homogeneous halftone areas”, and kept stable throughout the print run. Prinect Image Control utilizes both the print control strip as well as the image area selected for regulation.

Prinect Image Control always measures the entire sheet. You can check which areas have been used for control in the menu “Image Area”. Prinect Image Control finds fully automatically all the solid tone areas that are suitable for control.

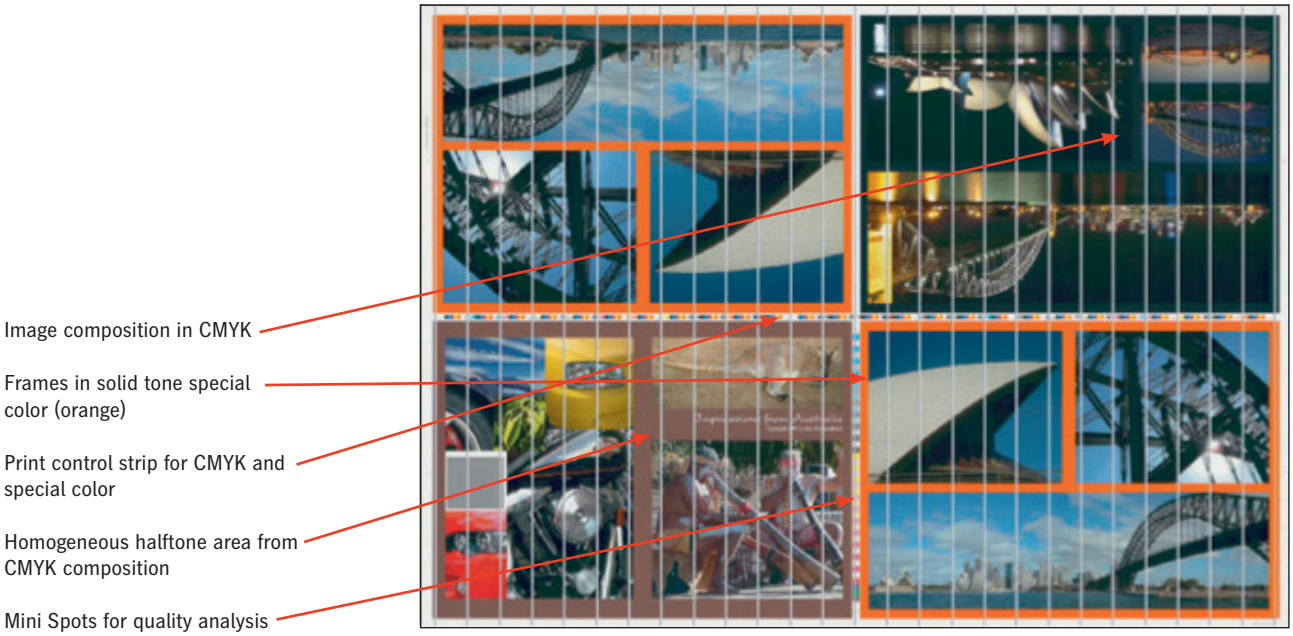


Makeready

1. Load the job from the press, select the color set for the process colors as well as the target values for the special color from the archive.
2. Carry out the first measurement
3. Check the position of all control elements
4. Check the position of all homogeneous solid tone areas
5. Select the brown halftone area with the pipette in the menu “Homogeneous areas” > “Halftone” and assign the target values from the color archive.
6. Release the job
7. The dialog box “Overview” shows the control recommendations

14.5 5c job with print control strip, homogeneous CMYK halftone areas and solid tone special color orange – variation 2

Control using to the homogeneous solid tone areas + OK sheet for the process colors CMYK



The print control strip is used for setting up all the colors. Since the special color orange is present in large enough areas over the entire sheet width in all print zones, it does not need necessarily to be present in the print control strip and can be regulated by only using homogeneous solid tone areas. In this example the entire image should be kept as stable as possible over the first-pass print run and, after the sheets have been turned, the reverse side should match the front side as closely as possible. This is why the printer uses the OK sheet function after he has achieved the OK sheet for the process colors CMYK for the first side and saves the current color values in the sheet as target values for the reverse side. Prinect Image Control then incorporates the print control strips and the entire image in its regulation recommendations.

Prinect Image Control always measures the entire sheet. You can check which areas have been used for control in the menu “Image Area”. Prinect Image Control automatically finds all the solid tone areas that are suitable for control.

Image composition in CMYK

Frames in solid tone special color (orange)

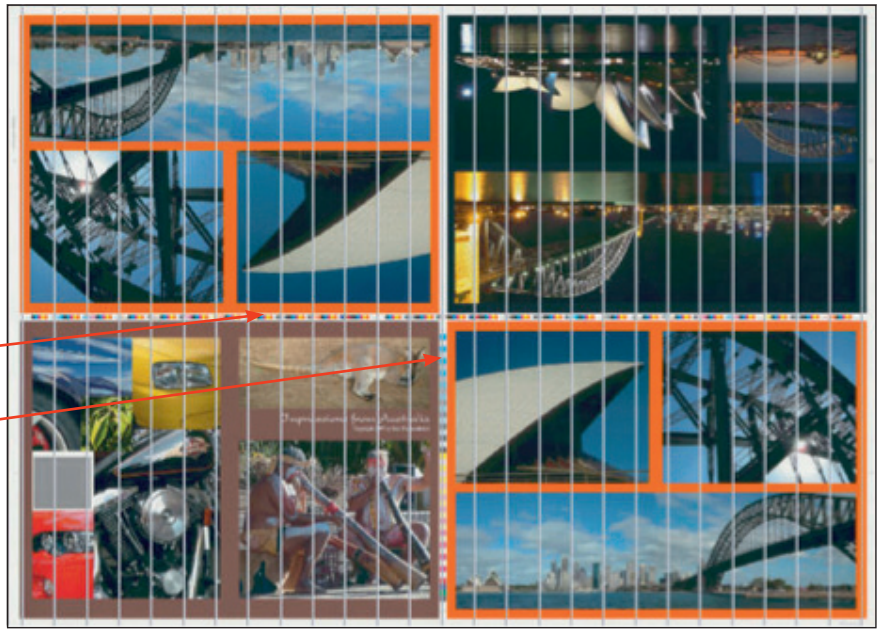
Print control strip for CMYK and special color

Makeready

1. Load the job from the press, select the color set for the process colors as well as the target values for the special color from the archive
2. Carry out the first measurement
3. Check the position of all control elements
4. Check the position of all homogeneous solid tone areas
5. Release the job
6. The dialog box “Overview” shows the control recommendations
7. Measure and send corrections to the press for as long as it takes until you have achieved the OK sheet
8. Select the function “OK sheet” in the menu “Target values” for the process colors CMYK and confirm. The special color orange is still regulated as a homogeneous solid tone

14.6 Process evaluation with the integrated quality analysis software Quality Monitor

When the printer has achieved the OK sheet he immediately checks whether it conforms to the standard.



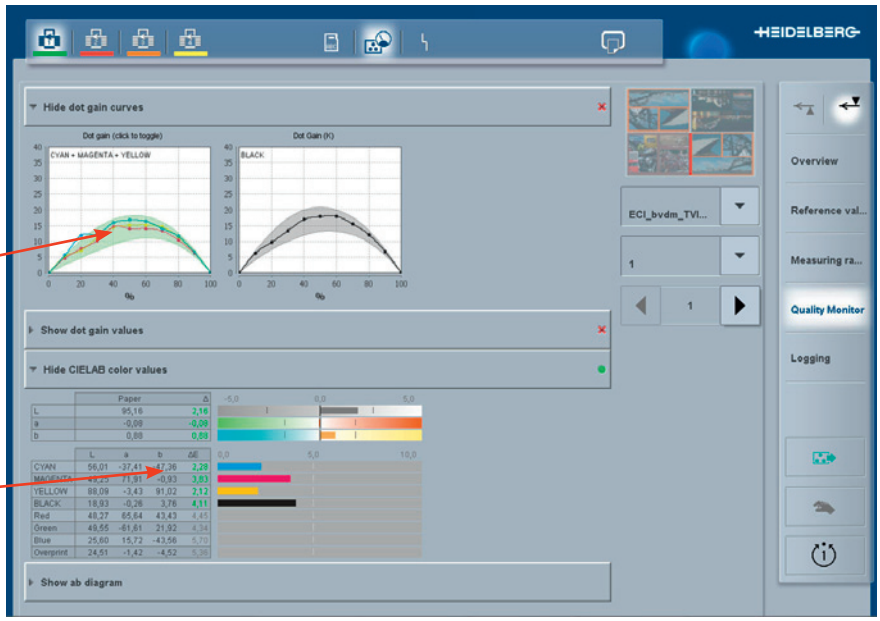
The integrated process analysis software Quality Monitor (Color Interface option) evaluates the measuring elements after every measurement cycle. In this case the measurement data are selected for the process colors CMYK from the print control strip and the Mini Spot with 10 % tone value increments. Since the color orange is printed as a solid tone area, the printer does not need a tone value analysis for this color.

When matching the printed sheet to reference values, the printer ensures first that inking is consistent over the entire sheet. This is carried out on the basis of the solid tone control patches in the print control strip, which contains a control patch for every printed ink in each ink zone. If register has been correctly set and inking is consistent with the target color over the entire sheet width, the printer then checks the image for errors such as slurring or doubling, smearing, etc.

Before he starts the production print run, he can also check in Quality Monitor whether the solid tone color and tone value increase comply with the print standard. On the basis of this key process information he can then decide which actions he still might need to carry out.

Tone value analysis

Color analysis



Glossary

Actual Value

The value actually measured for a sample. → Reference value

Area Coverage

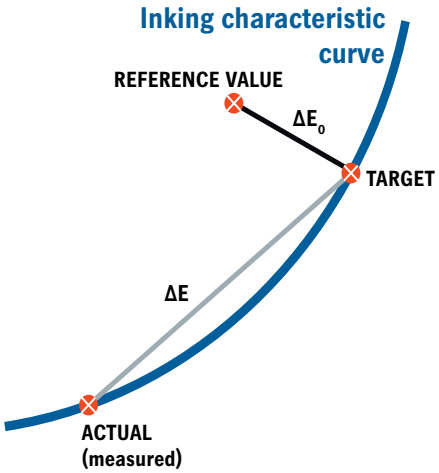
The portion of the total surface area that is covered (with image elements). Area coverage is usually given as a percentage. A distinction is made in print between the effective area coverage calculated from optical measurements and the geometric area coverage calculated from area measurements.

Color Distance ΔE

ΔE (Delta E): describes the distance between two colors in the L*a*b* color space, calculated as the different between their L*a*b* values. Under optimal conditions, ΔE values under 2 can be achieved in offset printing.

$$\Delta E^* = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2}$$

Color distance ΔE	Assessing the color distance
Less than 0.2	Imperceptible
0.2 to 1.0	Very small
1.0 to 3.0	Small
3.0 to 6.0	Medium
Greater than 6.0	Large



ΔE0

(Delta E possible or Delta E zero): describes the distance between the predefined target value and the maximum achievable value with the present combination of ink and paper.

ΔF

(Delta F): control factor in %.
ΔF values (Delta color/Delta inking deviation) are defined from the comparison of the L*a*b* target values with the actual L*a*b* values. They describe the color deviation from the target value in percent.

Color Management

A method/system for coordinating the various units and equipment involved in the workflow for processing color images all the way to the finished print product. Color management is used to ensure correct color reproduction from input to output, e. g. on printing presses.

Densitometer

A density measurement device. Reflective densitometers are used for the printing process. To determine the density, the result of a white measurement is compared with a measurement of a color area. → Density

Density

Density (D) is the measure of the light absorption of an ink film. Mathematically this is the relationship between a measurement of unprinted paper and a measurement of printed paper.

$$\beta = \frac{L_{eP}}{L_{ew}}$$

$$) = -\lg \beta$$

β = 0.9 D = 0.05

β = 0.5 D = 0.30

β = 0.1 D = 1.00

β = 0.01 D = 2.00

β = 0.001 D = 3.00

Dot Gain/Tone Value Increase (TVI)

In comparison to their originally defined digital size halftone dots grow in area when printed on paper due to process-related optical and mechanical factors. Tone value increase is the percentage difference between the dot size of the original digital data and the dot size printed on paper. Essentially, tone value increase is influenced by the screen ruling, the paper surface, color rheology, the blanket and its pressure and the water supply.

Ink Fading

This describes a diminishing ink layer thickness in circumferential direction (from leading to trailing edge of the sheet) in offset printing.

Ink Film Thickness/Ink Level

The physical thickness of an ink film of applied ink. It is what essentially determines a color's density value.

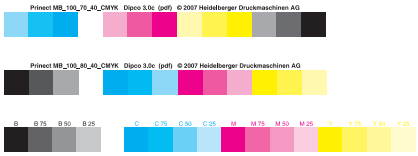
Inking characteristic curve

An inking characteristic curve is the line in the 3-dimensional color space that is produced when printing with different ink film thicknesses on a specific paper with a specific ink. The course of the inking characteristic curve in the color space depends mainly on the substrate and the inks used.

Metameric Colors

Colors with different spectra that look the same under one source of illumination but different under others. This phenomenon is known as metamerism.

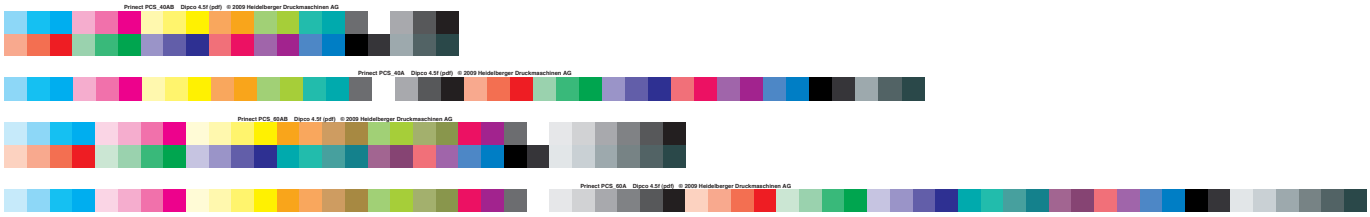
Process control, adjusting the print characteristic curves

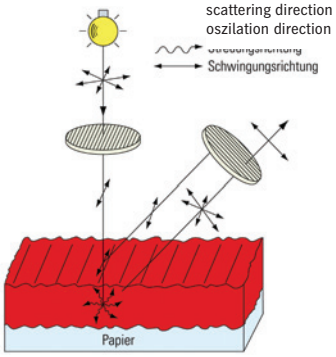


Mini Spots

Mini Spots are small quality evaluation elements that can be positioned wherever space allows on the printed sheet (gutters, margins etc.). The measurement values from the Mini Spots are evaluated with the process analysis software “Quality Monitor”. Using Prinect Color Toolbox you can then adjust CtP calibration curves and generate ICC profiles. Mini Spots are ideal for teaming up with print control strips which can only deliver limited process data due to the lack of space.

Process control, adjusting the print characteristic curves and converting color measurement data





Nanometer (nm)

Unit of length, 1 nm = 0.000001 mm. A fine hair has a diameter of 0.020 mm; one thousandth of this is 0.000020 mm or 20 nm.

Polarization Filter

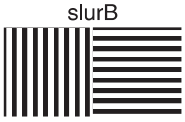
A polarization filter can be inserted in front of a densitometer to filter out glare. This makes the measurement practically independent of whether the ink is dry or not. One drawback, however, is that it increases the measured density value.

Print Characteristic Curve

A graphical representation of the relationship between the tone values of prepress data (typically halftone or tone values) and the corresponding tone values (screen percentages) on the printed sheet. → Dot gain

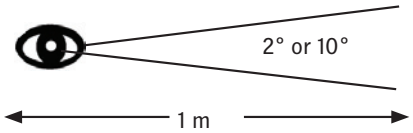
Reference Value

The target value for a measuring sample. The aim of control is always to ensure the smallest possible deviation between the reference value and the actual value. → Actual value



Slurring/doubling (S/D)

Slurring/doubling values in %. S/D values are calculated from the difference in area coverage between the geometric diagnostic patches.

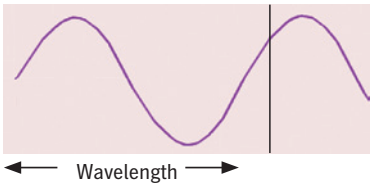


Standard Observer

A test series is performed to determine which color perception an average standard observer associates with a particular color. The 2° test setup reflects a typical situation for reading books and magazines. The 10° test setup simulates viewing of a poster wall.

Tone Value Increase (TVI)

→ Dot gain



Wavelength

The physical length of a wave period.

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