



Prinect
Color and Quality

HEIDELBERG

Standardization in Offset Printing

Prinect Color Solutions

Prinect Color Solutions – User Guide

In the publication series *Prinect Color Solutions – User Guide* we aim to take a closer look at individual aspects of the color workflow. The focus here is on practical applications.

The aim of Prinect Color Solutions is to optimize printing press presettings and monitor the printing process before, during and after print. This is achieved essentially by improved integration of the printing press into prepress workflows. The following data is exchanged between prepress and press to this end:

- Printing material parameters,
- Parameters of printing inks and consumables,
- Target values of the printing process for making presettings on the Prinect CP2000 Center,
- Zonal dot area values on the printing plate.

This allows printing presses to be set up fast following a job change. For print control using Prinect Image Control and Prinect Axis Control, information about the printing process and the contents of the print sheet is made available via the Prinect Prepress Interface.

Prepress supplies the parameters for presetting and monitoring the print. The parameters are generated by the Prinect Signa Station, Prinect Printready System and Prinect MetaDimension applications. The Calibration Manager is responsible for creating the correct calibrations of the plate setter and the printing process, PrintOpen for profiling printing and proofing processes and Quality Monitor for monitoring all the components involved.

There is a complex interaction between the individual components. *Prinect Color Solutions – User Guide* is designed to make this interaction more transparent for the user.

Standardization in Offset Printing

The aim of this Standardization in Offset Printing document is to describe the opportunities of a standardized working method with the components of the Prinect Color Solutions for prepress and printing.

Standards are publicly accessible documents for the manufacture of products and systems that are made binding through national or international agreements. Standards create a common language between those involved, between manufacturers and users, between customers and suppliers. Yet standards also create production stability within a company due to clearly structured workflows. Successful standardization brings cost reductions in daily production and improves quality with fewer customer complaints.

In future the demand for standardization in offset printing will increase – with corresponding effects on how modern print shops work. The reasons for this are clear. Binding standards offer predictable results and consistent, comparable quality regardless of location and output device. Yet there is also a desire on the part of print buyers to remain independent in their selection of print shops. This will make standardized interfaces a decisive factor in winning orders in future.

There are many factors involved in the path from digital drafts to printed sheets which influence the inking result. Dot gain is one important example of this, as it can change with new paper or different ink sets. Printing plates can also have different ink trapping characteristics, and printers are often faced with color specifications and proofs from customers that are almost impossible to reproduce on their presses. In this respect, standardization helps all parties detect potential problems early on.

Advantages of standardization from the print shop's perspective include

- Improved productivity throughout the entire added value chain
- Detailed coordination throughout the entire process – from prepress to printing
- Increased process reliability and repeatability due to systematic quality control.

This publication shows at which workplaces and in what form standardization is supported in terms of color. This knowledge then also allows further reaching functions to be exploited more easily.

Software Versions

The present publication refers to the following software versions of Prinect products:

Software Versions	
Prinect CP2000 Center	Version 39
Option ColorAssistant	Version 43
Prinect Image Control	Version 4.0
Calibration Manager	Version 2.3
Quality Monitor	Version 1.1
PrintOpen	Version 5.1

More recent versions of the software generally also support the functions described, although the look of the actual user interface may vary slightly. Information about this is given in the respective product and user documentation. The products and options described here are not always supplied as standard, so some of them may have to be purchased separately.

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Standardization – An Overview

Standardization first of all requires defined standards. Standards are guidelines, processes and procedural instructions for production of multi-color printed products with repeatable quality that are recognized in the graphic arts industry and particularly in printing.

Yet standards are not all created equal. They can vary greatly.

For example, there are international standards, which are drawn up by the ISO (International Organization for Standardization with HQ in Geneva). These include standards for process colors which ensure comparable printing ink quality across manufacturers or different ink batches. They are also standards for process monitoring in printing and proof printing, including film and plate exposure, as well as standards for measurement technology and data communication.

Alongside international standards there are also so-called industry standards, which are developed by individual manufacturers or joint ventures and assume the status of a standard through mutual agreement. An example of a manufacturer agreement is the International Color Consortium (ICC), which drew up the profile format specifications. Adobe's PDF (Portable Document Format) is an example of a manufacturer standard that has achieved the status of a generally accepted standard through market forces.

Alongside this, there are also national standards, such as DIN standards (Deutsches Institut für Normung with HQ in Berlin). However, these have lost some ground in the last few years. National standards tend to be adopted as international standards very quickly, as international standards automatically apply in national legislation.

From International Standard to Accepted Practice

Standards are not always easy for companies to apply in practical operations. There is a great number of interdependencies between the standards. It is easy to lose track of what applies where. And even the interpretation of what is written in a standard is not always easy. This is why in Germany the "German Printing and Media Industries Federation" (bvdM) issues a national guideline. The Offset Printing Process Standard is a detailed description of the individual steps involved in print production. The Process Standard describes resources, some of which are free of charge (such as ICC profiles) and some of which must be purchased (such as the Altona Test Suite).

Manuals and resources are also created and published by motivated users that get together to form groups, such as the ECI (European Color Initiative). Examples of work include the White Papers on color management and digital photography, monitoring tools such as the ECI 2002 test chart or the recent Gray Control Strip development for various printing conditions.



bvdM.



The Altona Test Suite has been developed from the specifications of the Offset Printing Process Standard. The data format and the color description of the objects in these documents are based on the PDF/X standard ISO 15930-3. The documents in this suite are used to check proof printing systems, although they can also be applied to printing. They are based on the standard characterization data and ICC profiles of FOGRA and ECI. The characterization data, on the other hand, is the basis for the “Ugra/FOGRA Media Wedge” control element. These control elements are then in turn evaluated according to the ISO 13655 standard.



International standards, national guidelines and national resources form a consistent system that works well in practice, at least in Germany. However, there is still room for improvement.

From Accepted Practice to International Standard

Standards, guidelines and resources describe the current state-of-the-art. They are not a minimum consensus, but describe the results that can be achieved under standard conditions. Standards are fluid and are subject to continuous further development. They are checked and adapted to current practices in a 4 to 5 year cycle, sometimes even sooner. At the moment, the inking values of the secondary colors in the process standard ISO 12647-2 are being revised and adjusted to real print results.

Measuring and Monitoring – Basis of Standardization

Objective measurement of the properties that have an influence on quality is absolutely vital. The most important properties include the inking values of solids in printing and the tone values of continuous tones. The Process Standard specifies the reference values. They are measured using suitable control elements, such as quality control strips, or special elements, such as a media wedges. The measured values are then compared with the reference values and evaluated.

Alongside the measurements, a visual check is also necessary. If the customer supplies a proof, the production run must be compared to this and any necessary corrections made. In terms of gray reproduction, the human eye is far more sensitive than a measuring device. And in certain circumstances individual corrections are also necessary here. The measuring devices and the visual proofing conditions need to be standardized. There are applicable standards and resources for this.

The measurement backing (material underneath the product) plays an important role in color measurement and visual color matching, and is often a cause of irritation. While spectral color measurement itself is predominantly standardized and works well, there is still a long way to go before the standards concerning the measurement backing are in line with modern practice. First and foremost, the guidelines need to offer better descriptions of how to handle this.

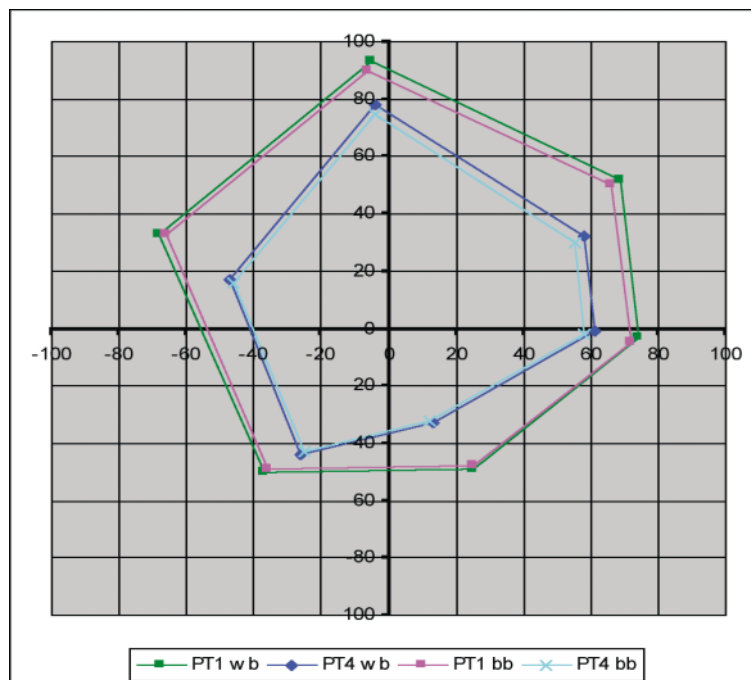
During color measurement, white and black backings give different numerical values depending on the transparency of the paper. And if both sides of a sheet are printed, the reverse side can also influence the measured values of the front. Not only the measured values, but also the visual perception of the sheet is then altered.



Laboratory tests on color samples are performed against a white backing. For process monitoring in printing a black backing is stipulated, to minimize the influence of the printed reverse side. Yet for process monitoring in proof printing, a white backing is generally used today, in contradiction to the standard. When performing visual checks there is no real standard. Common practice and standards have each gone their own way here, and standardization is required to once again establish consistent conditions.

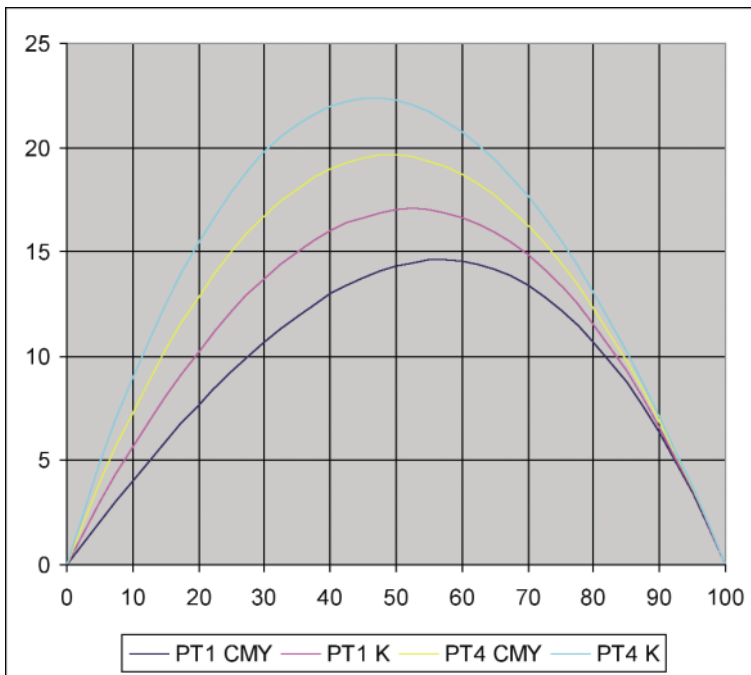
Reference Values and Tolerances

Inking values and dot gain are the central elements in process standardization according to ISO Standard 12647-2. Alongside the approximate definition of paper types for offset printing, it is the color coordinates of paper and process colors as well as the combined printing of the process colors that are of particular interest for process monitoring. As you can see in the following graph, there are significant differences between the “coated” (PT1) and “uncoated” (PT4) paper types. However, there are also differences in reference values for white (wb) and black (bb) backings which should not be underestimated.



Alongside stipulation of the reference values there are also tolerances for the paper white and the inking of the process colors. These tolerances apply for the make-ready phase when setting up the machine ready for printing. Since actual production in offset printing is not absolutely stable, slightly different tolerances apply here. In certain circumstances, the sum of permitted deviations can lead to a situation where a print is quite different from the actual standard. The goal of inking control when setting up a printing press and then for subsequent production should be to stick as close to the specifications as possible.

The next graph shows the dot gain curves for coated and uncoated paper at a screen frequency of 60 lines/cm. Although today’s standards state that corrections must be made to the curves for other screen frequencies, in practice many operations use a single curve for a broad range of frequencies. This is possible in computer-to-plate workflows due to process calibration.

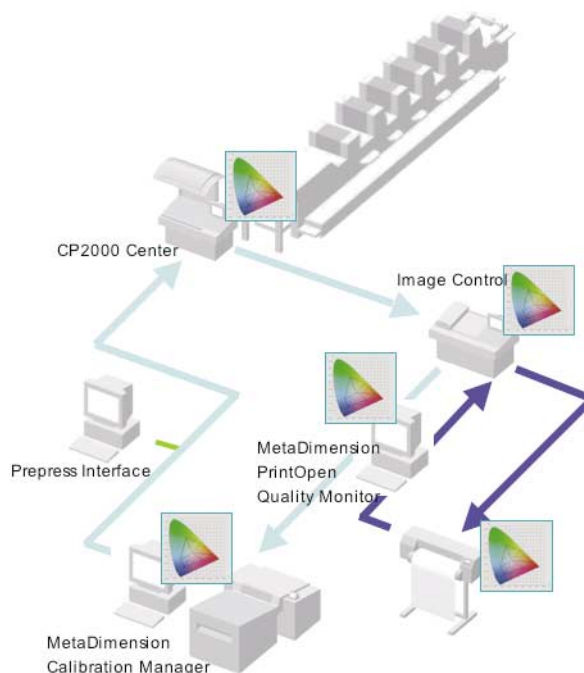


Slightly different tolerances apply for analog proof printing and OK sheets as well as for production. In the worst case scenario, the tolerances can be added to one another here as well. In principle this is permitted, although it leads to poor printed results and disputes between customers and print shops. As is the case with inking, the aim must be to remain as close as possible to the standard during production using ink control.

Printing and Print Monitoring

Heidelberg supports the standardization of the production flows with regard to color in various products at various workplaces. It is important that these workplaces are networked using open interfaces and formats here. JDF (Job Definition Format) and PPF (Print Production Format) are used to transport information here. Measured color values are transferred using formats standardized by the ISO.

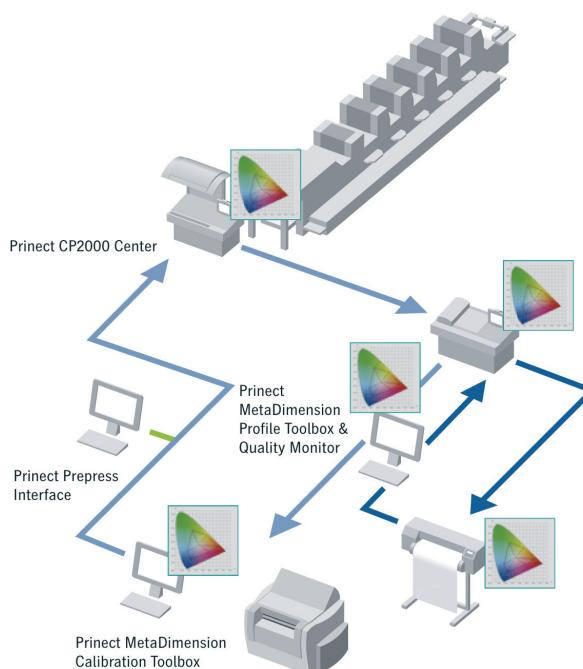
Inking-relevant information of a job is sent from Prinect MetaDimension via Prinect Prepress Interface to Prinect CP2000 Center/Print Center, where the default settings are made. Prinect CP2000 Center and Prinect Image Control control the inking throughout the entire print job. Measured values of step wedges are recorded using Prinect Image Control. The Calibration Manager then calculates tonal corrections from this for plate setting with MetaDimension. The evaluations created using Quality Monitor document the level of standardization achieved for the ink. Prinect MetaDimension can produce reference prints when connected to a proof printer for visual comparison of the print job. The profiling of the proof printer is done using PrintOpen, while the quality control is performed by Quality Monitor. Using a Heidelberg complete prepress and printing system is a good way to gain a consistent color workflow.



Ink control takes place on Prinect CP2000 Center together with a suitable spectral color measuring technology, preferably with Prinect Image Control/Axis Control. Other measuring devices can also be used, although this involves manual control.

Default characteristic curves for controlling the ink volumes of the ink zones are defined on the Prinect CP2000 Center. With a full Heidelberg Workflow, the selection can be made automatically using the process parameters of paper type (coated, uncoated), ink set (manufacturer) and color (cyan, magenta, etc.). Using these parameters, in combination with the zonal area coverage values on the printing plates of the individual colors, it is possible to quickly find optimum inking across the entire sheet and thereby reduce waste to an absolute minimum.

With Prinect Image Control or Prinect Axis Control, for example, the quality control strips can be measured and the measured values compared with the reference values of the Process Standard defined in the devices. The printing press is then adjusted using the correction values calculated from the differences. The corrected default characteristic curves can be saved as new default settings during a print job and then used in the next job.



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Standardization and Prinect CP2000 Center

Standardization on the Prinect CP2000 Center means defining default characteristic curves for controlling the ink volumes of the ink zones for defined standardized printing conditions. The standardized printing conditions are specified by the Offset Printing Process Standard or an internal company standard. With a full Heidelberg Workflow, the characteristic curves can be selected automatically using the process parameters of paper type (coated, uncoated), ink set (manufacturer) and color name (cyan, magenta, etc.). For the density value the measurement conditions have to be given.

The standardization on the Prinect CP2000 Center must always be seen in context with the printing plate calibration in prepress and the control offered by Prinect Image Control. Standardization here always means standardization of the entire workflow.

It is important to note at this point that successful standardization requires a well maintained and set-up printing press.

Creating a new Standard (Characteristic Curves)

The default characteristic curves for defined printing conditions are saved in a database. New characteristic curves can be created and existing characteristic curves adjusted. The ColorAssistant option offers help in achieving automatic optimization of the ink presetting characteristic curve.

Several characteristic curves for ink presetting are set in the factory. For each of the 3 paper types “glossy coated“, “matt coated” and “uncoated”, there are 7 colors (black, cyan, magenta, yellow, special color 1, special color 2, special color 3). These characteristic curves have the name HEIDELBERG. They can be copied but not changed or deleted. They are the basis for customized characteristic curves.

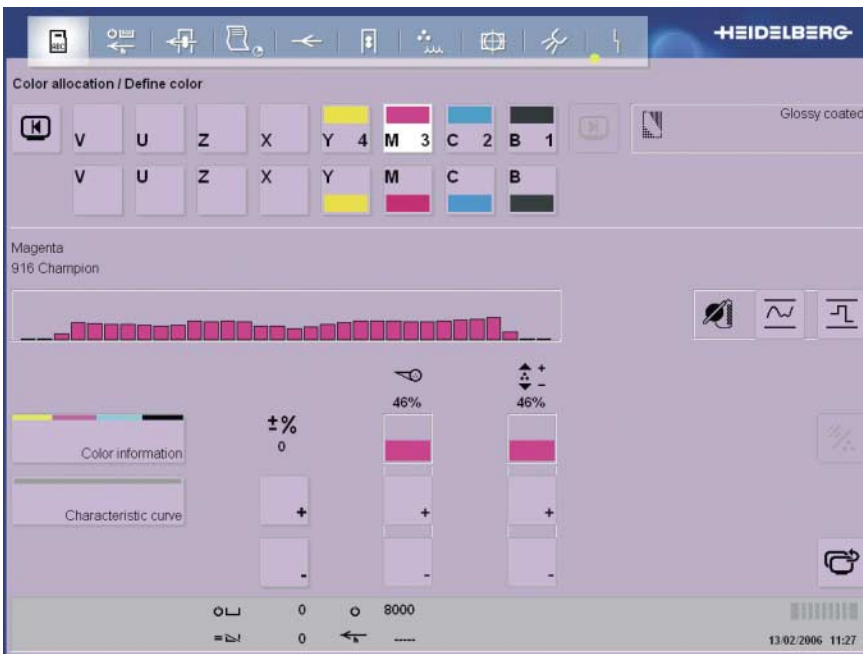
How to create new characteristic curves for the three paper types to meet new printing conditions (new color sets, new density values) is described in the manuals.

Working with Standards (Characteristic Curves)

A new job is loaded via the “Job/Job preparation” menu. The entry Prepress Interface (PPF) should be selected as data source here. An automatic selection of the characteristic curves is only possible via the Prepress Interface. Otherwise the correct characteristic curves have to be selected manually.

If the job contains thumbnail images for perfecting, these are displayed. If the PPF file has been transferred correctly, Prinect CP2000 Center automatically takes over the correct paper type and paper description. This can be checked in the “Job preparation/Printing material” menu. If necessary, corrections can also be made here.

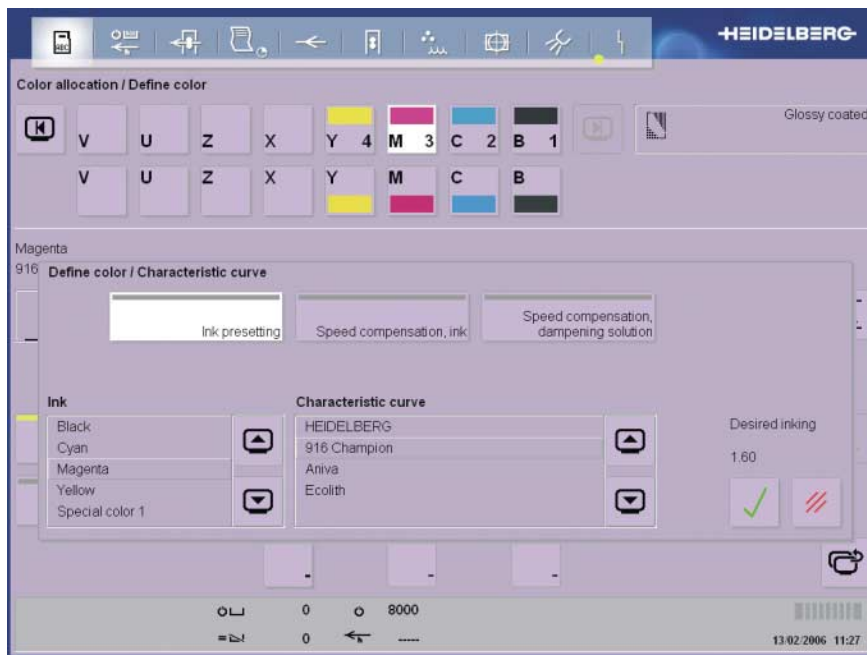
Users can check whether the color allocation has been made correctly in the “Job preparation/Color allocation” menu. If necessary, corrections can also be made here.



The “Job preparation/Color allocation” screen

In the top right of the screen you can see the “Glossy coated” paper type. The ink set “916Champion” is displayed for the selected color “Magenta”.

Prinect CP2000 Center automatically selects the corresponding characteristic curves for ink presetting based on the parameters of color, printing material, ink set and desired inking.



The “Color allocation/Define color/ Characteristic curves” screen

The characteristic curve selection can be checked in the “Color allocation/ Define color/Characteristic curves” menu. If necessary, corrections can also be made here.

If no characteristic curve in the database has the right parameters, Prinect CP2000 Center selects the best suited standard curve for the ink/printing material combination.

How to work with characteristic curves for the three paper types and different color sets is described in the manuals.

Standardization and Prinect Image Control

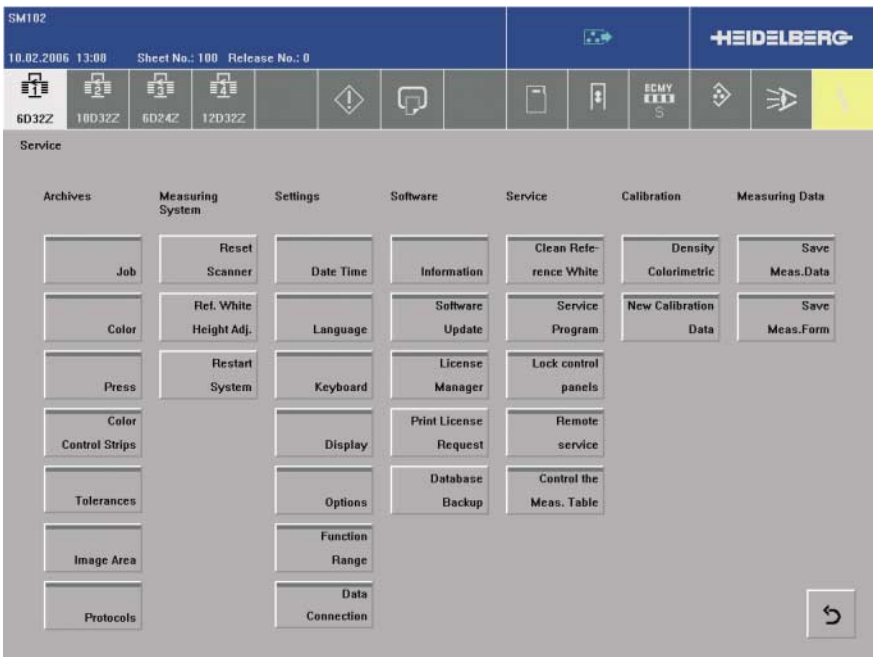
Standardization in Prinect Image Control is based on the definition and application of color sets and paper types for defined printing conditions. The spectra and numerical values of the inks and paper are used for controlling.

A detailed description of procedures when creating and applying standards goes beyond the scope of this brief introduction. It is extremely important that users read the manual of the current Prinect Image Control software version for details on this.

Creating a new Standard

Standards can be created and edited in the “Service” section under “Archives Color”. The color database is called up via the “Color” button.

The color values in the archive are always saved with reference to their paper white. If this is altered or if the job is printed using a different paper white than the one saved in the color set, the color values are automatically converted to match the altered paper white.



The Service dialog window – Calling up the color archive

The local color database is located in the bottom left-hand part of the color archive screen. There is a folder for each standard here, and a subfolder for each paper type. This structural hierarchy helps the user manage a large number of color sets.

The screenshot shows the Heidelberg Color Database interface. At the top, it displays 'SM102', the date and time '10.02.2006 13:08', 'Sheet No.: 100', and 'Release No.: 0'. The main area features a grid of color patches. To the right, the 'Color Database' panel shows the selected color 'C' with a date of '26.01.2006'. Below this, the color values are listed: L: 55.80, a: -37.09, b: -50.71, D[C]: 1.54, dE: 0.00, dL: 0.00, da: 0.00, db: 0.00, and Z70: 14.0. A table below the main panel lists process colors (B, C, G, M, P, Y) with their corresponding L, a, b, and D values. The bottom right section contains several control buttons: 'Manage Color Set', 'Enter', 'from Color Control Strip', 'New Reference Value', 'New Color Set', 'Reset to Standard', 'Delete Reference Value', and 'Delete Color Set'.

The Color Database screen –
Selecting a data record and a color

In our example the standard “ISO 12647-2 PSO” has been selected for glossy coated paper “Glossy”. The color values and density values of the process colors (B, C, M, Y) are displayed in the window to the right of this. The paper white (P) and a gray value (G) are also displayed.

A color can now be selected for editing using the arrows on the right next to the window. The values are displayed again in the top right section.

A new color set can also be defined by pressing the “New color set” button in the lower section of the screen. The system then generates a new subfolder with a color set name chosen by the user and the subfolders for the various paper types (glossy, matt and mature, corresponding to glossy coated, matt coated and uncoated). Copies are also created for all process colors, gray patches and paper from the standard color set.



The Color Database screen – Entering new density values

When printing, the layer thicknesses or densities of process colors are altered. This change is converted by the Prinect Image Control software into changes of the inking values. The $L^*a^*b^*$ values cannot be changed directly here.

Pressing the “D” button calls up a dialog for entering a new density value. The value can be entered using the numeric keypad and then confirmed.



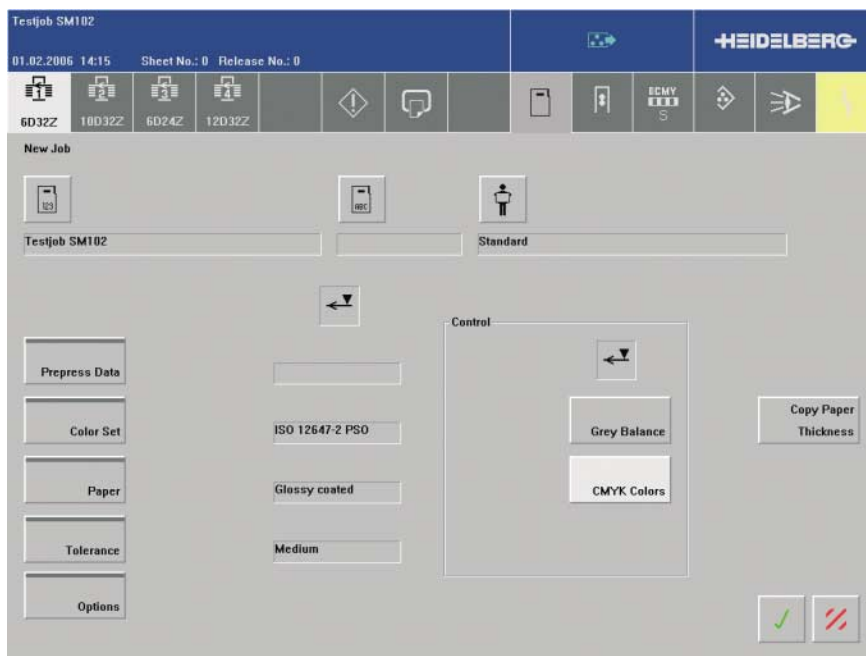
The Color Database screen – New density and color values

Entering a new density value alters the $L^*a^*b^*$ values. The new values are displayed in the lower section of the screen.

Working with Standards

New jobs are set up in the “New Job” menu. In the “New Job” screen you can select a color set and a paper.

The “Color set” button must be highlighted to select a new color set. The “Paper” button must be highlighted to select the right paper type. By selecting a color set and the correct paper type you ensure that the right reference values are automatically copied from the database for the process inks.



The New Job screen – Selecting color set and paper

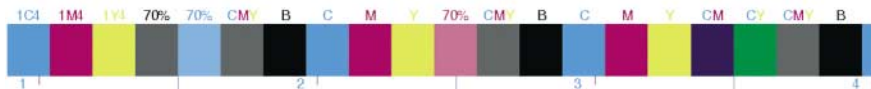
How to work with color sets and paper types is described in detail in the manuals.

Standardization and Quality Monitor

The Quality Monitor is part of the Prinect Profile Toolbox and the Prinect Calibration Tool-box. The software is used to monitor, assess and document device and process calibrations. Film and plate exposure devices as well as printing and proof printing processes can be monitored. Various aids are provided for this and various measuring devices are supported.

With the measuring functions of the Quality Monitor you can perform a manual or automatic measurement of test elements or quality control strips with spectrophotometers, densitometers or plate measurement devices that are directly connected. Measured values can be imported or exported in the ISO format in line with the ISO standard 12642. Prinect Image Control and non-supported measuring devices can also be integrated into the assessments using the import function.

The Quality Monitor supports various predefined CMYK, CMY and RGB test elements, CMYK monitoring elements and linearization wedges, which can be selected to match the desired check. The size of the test elements ranges from 135 up to 1,485 color fields, while the other elements have between 7 and 210 color fields. Every test chart and every monitoring element has its own special layout, which is partially adjusted to an automatic measurement by strip readers. The elements can be scaled to allow a measurement with Prinect Image Control.



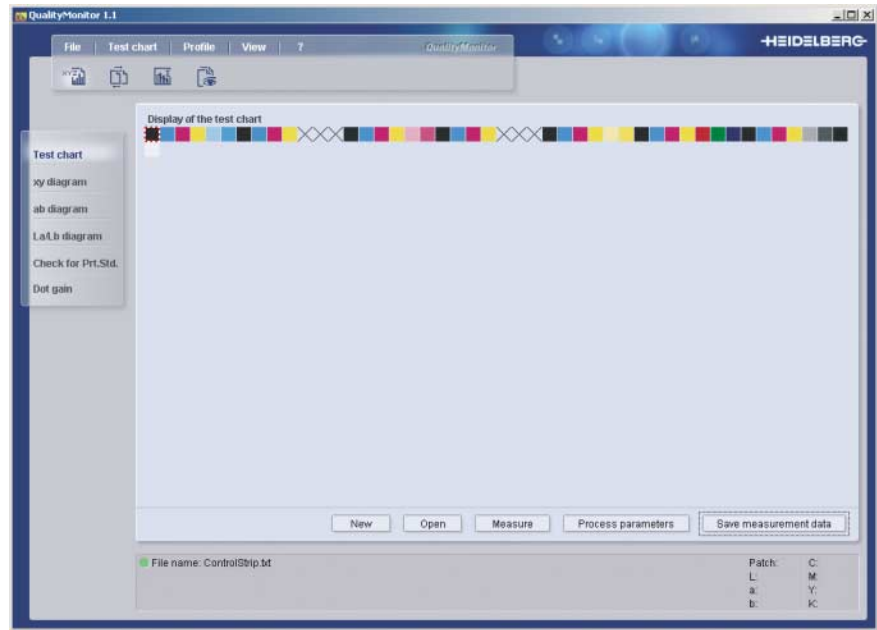
Comparison with the reference values gives a good assessment of quality. Reference values can be both measured values (comparison with a good sheet) and predefined standards (ISO 12647-2 process control). Standards can be set up by the user and tolerances can also be specified for the process values here.

Creating a new Standard

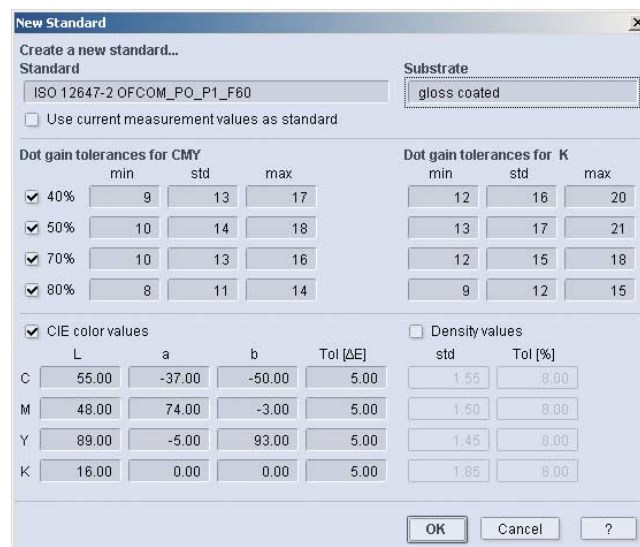
In the “Measurement” main program function you can perform a comparison of the measured values with the values of a standard while the measured data is open (in the example further down a quality control strip has been imported) by selecting the “Process standard” function.

In this window you can select a predefined standard and also define and manage your own standards. After calling up the “New standard” window you can set the parameters.

The “Measurement” program function with imported or measured test chart (quality control strip)



The screen is preassigned with the values of the standard last selected. You can modify these values and save them as a new standard, enter all new values and then save these as a standard or simply accept the current measured values as a standard. In the example shown below an international standard in line with ISO 12647-2:2004 has been defined for sheet-fed offset printing for paper type 1 and a dot gain defined for a screen frequency of 60/cm.



Creating a new process standard

The name of the standard and the description of the printing material can be entered as free text which is later used to select the standard. The dot gains and tolerances are specified for the process colors C, M and Y together, while for the process color K a different specification may be made. In the lower section of the screen the specifications for inking and the density values of the process colors are entered. The check boxes allow you to specify which values should be used for the evaluation. By hitting “OK” the values are saved and the window closed.

Comparison of Measured Values and Standards

In the “Process standard” screen the current measured values are compared with the standard selected in the right-hand section of the screen. However, dot gain and density comparisons are only performed if the measured values offer this information. This is the case when the spectra are also saved. This option should always be switched on when measuring. Measured values that are extracted from profiles do not have this information. This generally also applies to measured values from characterization data.



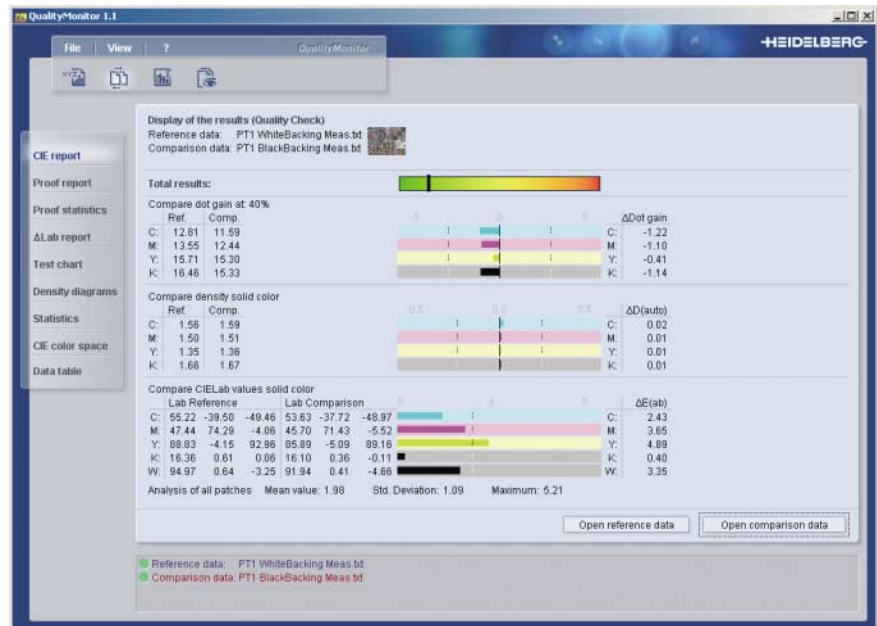
Checking measured data to ensure it meets the process standard

The dot gain is checked in the top part of the window. The area highlighted green in the graphs is the tolerance range of the standard. The curves should ideally lie in the center of the tolerance range. In the small table on the right you can see the numeric values and the deviation from the set points for the 40% and 70% fields. An evaluation is also performed of the spread, the maximum difference in dot gain of the chromatic process colors.

The inking values and the densities are displayed in the lower part of the window. The color bars indicate the magnitude of the deviation. The tolerance values are shown in the graph as small vertical lines. The deviations from the set points are shown again on the right in numeric form.

Using Measured Values as Standards

In the “Comparison” main program function you can compare two sets of measured data with one another. Similarly to the comparison with the process standard described above, the dot gain, densities and color values of the process colors are compared with one another in the “CIE report” section. This function is particularly useful if you wish to specify a print as a reference for subsequent prints. Reference data and comparison data must come from the same test charts and should also contain spectral measured values if you wish to perform an evaluation of the dot gain and density.



Comparing two data records

In the top part of the window there is an overall assessment using a mark on a colored bar. The left-hand green section represents a comparison where all comparison values are essentially within tolerances. The central yellow section displays a critical print and the right-hand red section a print that is well outside tolerances.

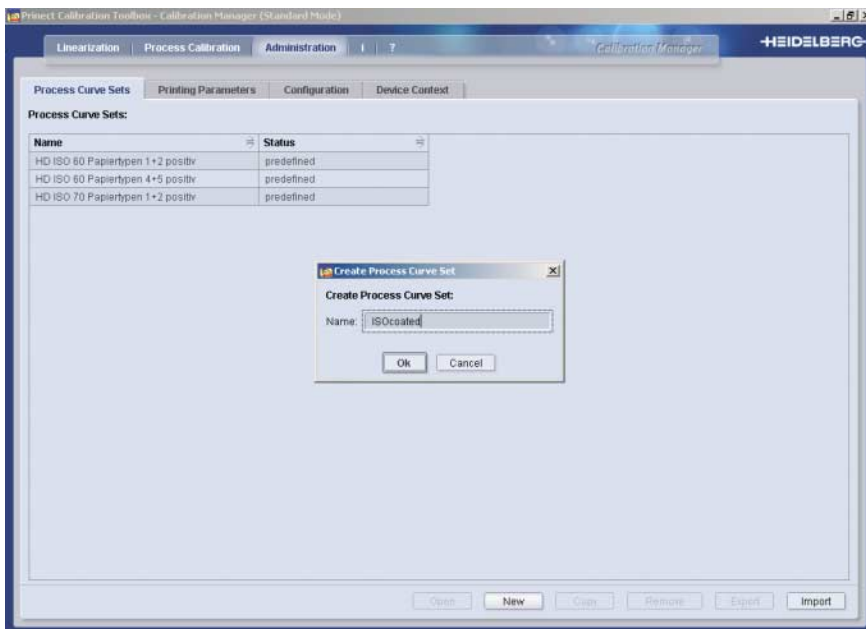
The other displays represent the evaluation of the process standard. The paper white, average value, spread and maximum value over all fields of the test chart are also evaluated and displayed in the color values section.

Standardization and Calibration Manager

The Calibration Manager is a piece of software used to generate calibration curves. Calibration curves control the tone value reproduction on film or printing plate and are used when a job is imaged (exposure). They adjust the digital data to the individual steps of a printing process to get the desired output. Calibration curves can consist of combinations of linearization and process calibration curves. Process calibrations are created for paper and printing inks to achieve a defined dot gain.

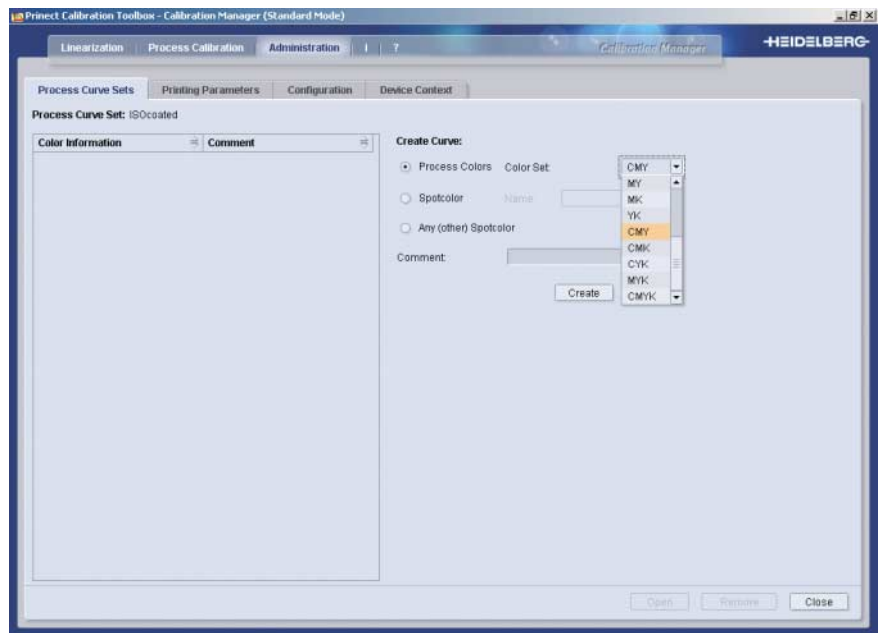
Creating a new Standard

The dot gain curves or sets of process curves are created and managed in the “Administration” program function. There are three predefined sets of curves to match the current ISO Standard 12647-2:2004. The user can also easily create new sets of curves.



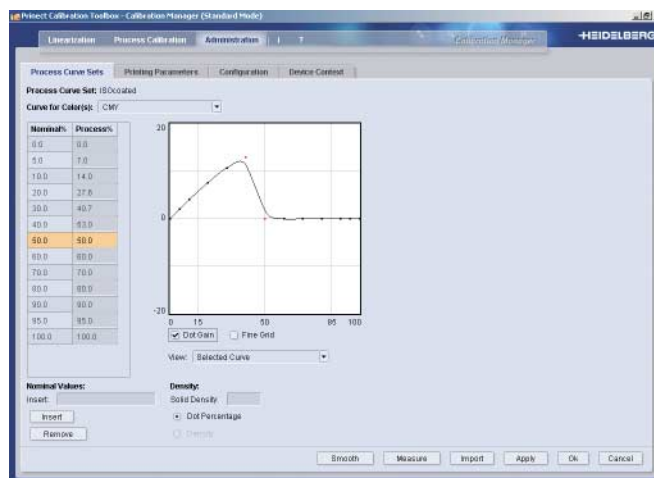
Creating a new set of process curves

Clicking on the “New” button calls up a window where the name of a new set of curves can be entered. After hitting “OK” a user-defined data record is recorded which can be opened by hitting “Open” to define the further parameters.



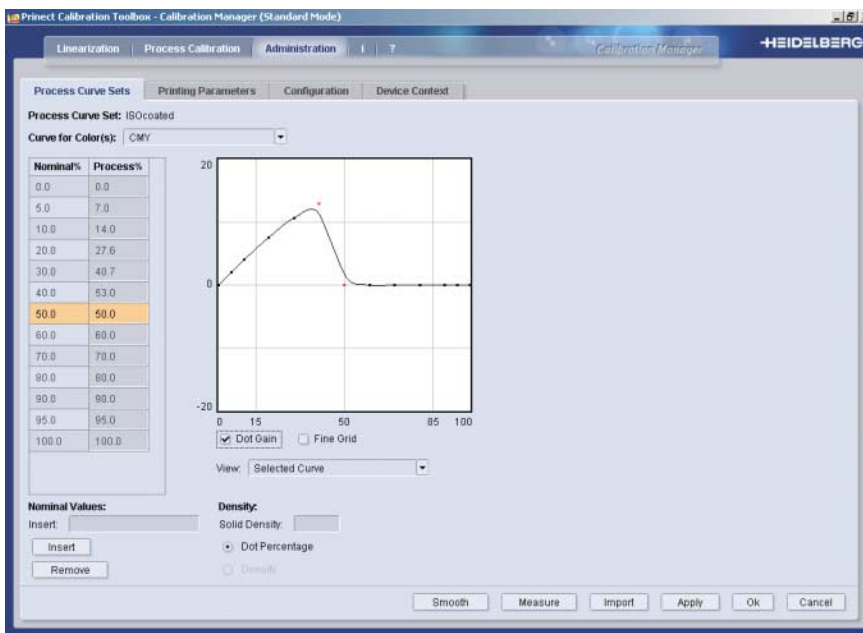
Selecting the curves to be generated

First of all you specify which process curves should be created as target curves for a calibration. With an ISO Standard the curves of the chromatic process colors are the same, and black has a 3 % higher dot gain. So two curves are created, one for CMY and one for K. However, you can also create four individual curves. This makes sense in certain cases, especially when users wish to employ different curves as a way of adjusting the gray balance.



Set of process curves ready for entry of parameters

The process curve for which parameters are to be entered is selected by hitting the “Open” button.

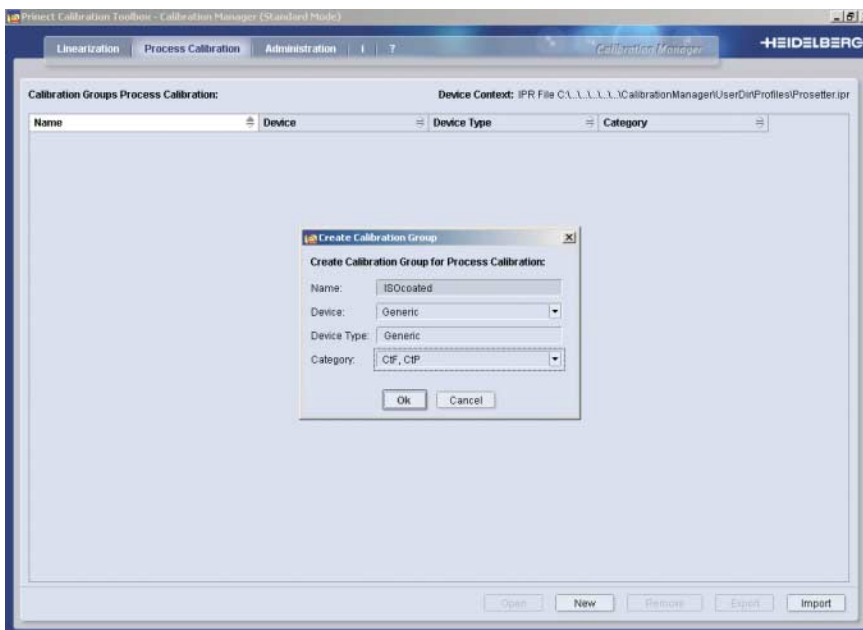


Entering parameters for a set of process curves

In the “Process %” column the reference values are entered for the nominal values. Individual pairs of values can be deleted. Additional pairs of values can also be inserted. In the graph the tone values and optionally also the dot gain values are displayed. Hitting “OK” saves the values, which can then be used as a standard for the calibration.

Creating a new Process Calibration

New calibration groups are created and managed in the “Process calibration” section. The process is started by hitting the “New” button. The name, device, device type and category are specified in the window that then appears.



Creating a new calibration group for a process calibration

After clicking on “OK”, parameters can be entered for this calibration group by hitting the “Open” button.

Entering parameters for the calibration group

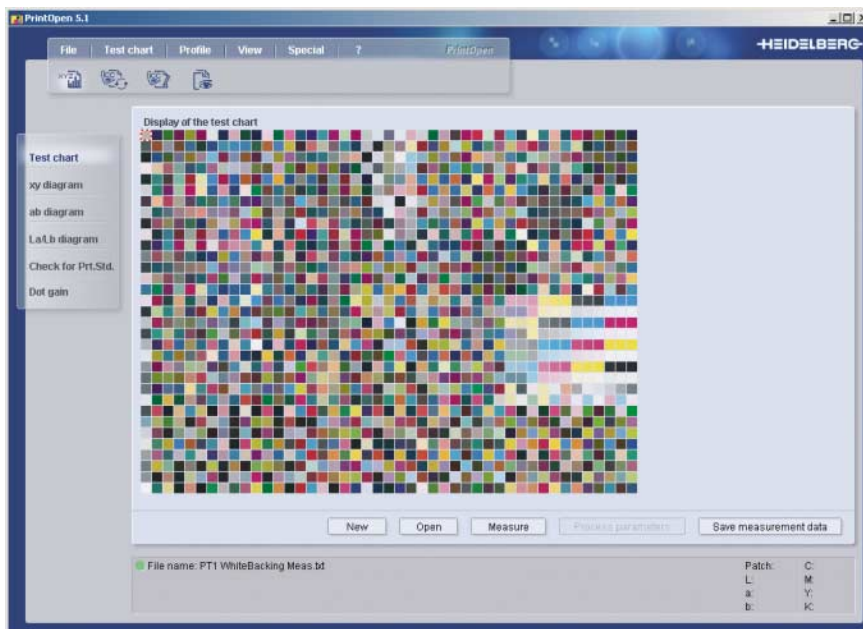
A set of process curves is selected. After entering all the other parameters and clicking on “OK”, this calibration group can be called up again and measured values entered. The process calibration is calculated from the comparison of the measured values with the process curves. This is then used to image the printing plates.

Standardization and PrintOpen

With PrintOpen, ICC profiles of calibrated and monitored print and proof printing processes are created. Parameters of the processes themselves are also optional components of the profiles. These are saved in defined tags and can be used during the subsequent processes as a means of monitoring. And many of the parameters can also be copied back from the data in the profile. For example, the paper white and the process colors are given in the tables with the relative/absolute rendering intent. The dot gain values are also included, but in a form unlike their typical depiction. However, users can draw on these for comparison purposes.

Creating a New Standard

In the “Measurement” main program function you can perform a comparison of the measured values with the values of a standard while the measured data is open (in our example a characterization data record based on the test element ECI2002 has been imported) by selecting the “Process standard” function.



The “Measurement” program function with imported or measured test chart

In this window you can select a predefined standard and also define and manage your own standards. After calling up the “New standard” screen you can set the parameters.

The window is preassigned with the values of the standard last selected. You can modify these values and save them as a new standard, enter all new values and then save these as a standard or simply accept the current measured values as a standard. In the example shown below an international standard in line with ISO 12647-2:2004 has been defined for sheet-fed offset printing for paper type 1 and a dot gain defined for a screen frequency of 60/cm.

Standard: ISO 12647-2 OFCOM_PO_P1_F60

Substrate: gloss coated

Use current measurement values as standard

	Dot gain tolerances for CMY			Dot gain tolerances for K		
	min	std	max	min	std	max
<input checked="" type="checkbox"/> 40%	9	13	17	12	16	20
<input checked="" type="checkbox"/> 50%	10	14	18	13	17	21
<input checked="" type="checkbox"/> 70%	10	13	16	12	15	18
<input checked="" type="checkbox"/> 80%	8	11	14	9	12	15

	CIE color values				Density values	
	L	a	b	Tol [ΔE]	std	Tol [%]
C	55.00	-37.00	-50.00	5.00	1.55	8.00
M	48.00	74.00	-3.00	5.00	1.50	8.00
Y	89.00	-5.00	93.00	5.00	1.45	8.00
K	16.00	0.00	0.00	5.00	1.85	8.00

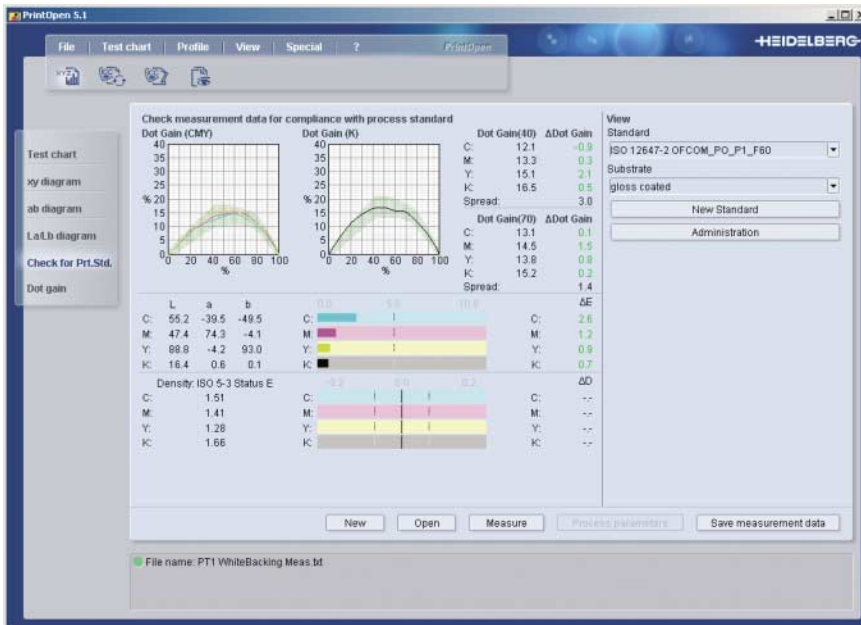
Buttons: OK, Cancel, ?

Creating a new process standard

The name of the standard and the description of the printing material can be entered as free text which is later used to select the standard. The dot gains and tolerances are specified for the process colors C, M und Y together, while for the process color K a different specification may be made. In the lower section of the window the specifications for inking and the density values of the process colors are entered. The check boxes allow you to specify which values should be used for the evaluation. By hitting “OK” the values are saved and the window closed.

Comparison of Measured Values and Standards

In the “Process standard” screen the current measured values are compared with the standard selected in the right-hand section of the screen. However, dot gain and density comparisons are only performed if the measured values offer this information. This is the case when the spectra are also saved. This option should always be switched on when measuring. Measured values that are extracted from profiles do not have this information. This generally also applies to measured values from characterization data.



Checking measured data to ensure it meets the process standard

The dot gain is checked in the top part of the window. The area highlighted green in the graphs is the tolerance range of the standard. The curves should ideally lie in the center of the tolerance range. In the small table on the right you can see the numeric values and the deviation from the set points for the 40% and 70% fields. An evaluation is also performed of the spread, the maximum difference in dot gain of the chromatic process colors.

The inking values and the densities are displayed in the lower part of the window. The color bars indicate the magnitude of the deviation. The tolerance values are shown in the graph as small vertical lines. The deviations from the set points are shown again on the right in numeric form.

Adjusting Measured Values to Standards

PrintOpen provides a range of functions for converting measured characterization data. The simplest method is a conversion based on values of the primary colors C, M, Y and K and the new paper white. These values can be taken from a process standard. More complex methods, which will not be discussed here, can also be used to adjust the secondary colors to reference values. There is also the possibility to adjust the dot gain to standards.

In the main “Measurement” program function you can use the “Special” menu item to call up the “Conversion of color data – color values” function when measured data is open.

Conversion of color data - color values									
Convert color data for changed print process									
Change media white									
	Current value				New value				
	L	a	b	→	L	a	b		
White	94.93	0.68	-3.30	→	95.00	0.00	-2.00		
Change CIE values of primary colors									
	Current values				New values				
	L	a	b	→	L	a	b		
C	55.03	-39.30	-49.69	→	55.00	-37.00	-50.00		
M	47.42	74.33	-3.99	→	48.00	74.00	-3.00		
Y	88.80	-4.12	93.44	→	89.00	-5.00	93.00		
K	16.36	0.61	0.00	→	16.00	0.00	0.00		
Change dot gain at: 40%									
	Current values					New values			
	C [%]	M [%]	Y [%]	K [%]	→	C [%]	M [%]	Y [%]	K [%]
	10.4	13.1	14.8	16.3	→	10.4	13.1	14.8	16.3

Converting measured color data for adjustment to standards

On the left-hand side of the screen we can see the current color values and dot gains for the paper white and process colors. On the right-hand side users can now enter new values, for example those of the process standard. It is important to note that the values for dot gain were not determined from the density values but rather from the colorimetric values. They differ significantly from the typical values for cyan, but less for magenta. The values for yellow and black are comparable. So if we now know from the comparison in the previous section that the dot gain in cyan is only 12% instead of the required 13%, we can increase the value for cyan in the screen shown above from 10.4% to around 11.3% in this case ($10.4\% / 12.0\% * 13.0\%$).

After clicking “OK”, the measured color data is then converted to a new standard.

Appendix: Overview of Important Standards

ISO 2846-1:1997

Graphic technology – Colour and transparency of ink sets for four-colour-printing – Part 1: Sheet-fed and heat-set web offset lithographic printing

As its title suggests, this international standard specifies the inking and transparency of printing ink sets for 4-color offset printing. It does this by laying down standardized conditions for testing printing inks under laboratory conditions with special devices as well as specifying a suitable paper (coated, wood-free, without optical brighteners, Scheufelen Phoenix Imperial APCO II/II). The measurement of inking is performed in line with ISO 13655 with a white backing. The color values must stay within tolerances laid down by the reference values of the standard within a defined layer thickness range. A defined transparency of the color must also be maintained to ensure that accurate color values can be achieved in subsequent combined printing. The only way to check colors against this standard is in the laboratory.

The standard is currently being revised.

ISO 12642:1996

Graphic technology – Prepress digital data exchange – Input data for characterization of 4-colour process printing

As its title suggests, this international standard specifies a data record and a data exchange format for measured values to characterize 4-color printing processes. The standard is also known under the name IT8.7/3. The data record consists of common combinations of chromatic printing ink tone values, some of which are also defined with tone values for black printing ink. The measured color values that accompany these tone value combinations describe the achievable printing color space and the behavior when printing the colors together.

The standard is currently being revised and a second part is being added. This “Part 2” describes a further data record for improved measurement of the combined printing behavior. The standard is also known under the names ECI2002 and IT8.7/4. It is complemented by the DIN standard 16614, which described the data record of the ECI2002.

ISO 12647-2:2004

Graphic technology – Process control for the manufacture of half-tone colour separations, proof and production prints – Part 2: Offset lithographic processes (2004)

This part of the international standard ISO 12647 describes process monitoring for continuous tone color separations, proof prints and print production in offset printing.

- Stipulation of the parameters for film and plate exposure: screen frequency, screen angle, dot shape, tone value sum
- Stipulation of paper types and their properties: color coordinates, gloss, grammage and tolerances
- Stipulation of inking in sets of printing inks and their overprinting on the various paper types

- Stipulation of dot gain in printing for chromatic colors and black, whereby black typically has 3% more dot gain
- Stipulation of tolerances for solids, dot gain and spread of chromatic colors
- Stipulation of measurement conditions for color measurement: illuminant D50, 2° viewing angle, 0/45 or 45/0 geometry, no polarization filter, black measurement backing. Measured values for white measurement backings are given as extra information

The standard is currently being revised and is to include informative color values for overprinting the process colors.

ISO 13655:1996

Graphic technology – Spectral measurement and colorimetric computation for graphic arts images

As its title suggests, this international standard describes the spectral measurement and colorimetric calculation of graphic arts images. It describes the requirements of spectral data measurement, such as calibration, spectral energy distribution and wavelength range of the illumination, measuring geometry and sample backing. In addition, the requirements of colorimetric calculation, such as illuminant D50, 2° standard viewing angle, weighting coefficients for spectral values, algorithms for calculating the color values CIEXYZ and the calculation of derived factors (CIELAB, CIELCH, Delta E) are all given.

There are currently plans to revise the standard.

ISO 15076-1: 2005

Image Technology – ICC Colour Management – Architecture, profile format, and data structure

This international standard describes a color management architecture with colorimetrically defined reference color spaces and a profile format specification for the exchange of color data between various input and output devices. The reference color spaces CIEXYZ and CIELAB are based on the illuminant D50. The profile format specification is tag-oriented and describes the color properties of the devices together with preferred reproduction of digital image data.

ISO 15930-3:2002

Graphic technology – Prepress digital data exchange – Use of PDF – Part 3: Complete exchange suitable for colour-managed workflows (PDF/X-3)

This part of the international standard ISO 15930 describes the application of Adobe's Portable Document Format (PDF) for the exchange of digital data in a document. The document contains all specifications that are necessary for output in a printing process. In particular, the document contains ICC profiles for accurate color reproduction.

Offset Printing Process Standard (ProzessStandard Offsetdruck) 2001/2003

Ways to achieve constant quality from prepress right up to the printed product –

Published by The German Printing and Media Industries Federation (bvdm)

The Process Standard was published by the German Printing and Media Industries Federation (bvdm) in 2001. With supplements in 2003 it now represents an extended national implementation of the ISO Standard 12647-2.

It contains

- a description of the inspection methods and work tools,
- a description of the processes,
- a description of the requirements of data and films,
- a description of the requirements of proof printing and on-press proofing,
- a description of the requirements of printing plate manufacture and production printing.

Since 2003 it has incorporated the contents of the current ISO Standard from 2004.

The standard is currently being revised and will then be re-released with the changes of the ISO Standard 12647-2.

Print Media Standard (MedienStandard Druck) 2004

Technical guidelines for data and proof printing – published by the German Printing and Media Industries Federation (bvdm)

The Print Media Standard is made up of various modules, and it is the user's own responsibility to ensure that these are organized and implemented correctly. The guidelines of the Print Media Standard contain information on all significant components required for correct application in the individual printing processes. This includes characterization data, ICC profiles and requirements of color management. It reflects the current level of standardization and is regularly adjusted to the latest developments. It is consistent with ISO 12647-2, -3 and -4 as well as the Offset Printing Process Standard.

The standard is currently being revised.

Altona Test Suite 2004/2005

Application Package – Reference prints, inking standards, Test Suite files, characterization data, ICC profiles, documentation – Published by the German Printing and Media Industries Federation (bvdm)

Altona Test Suite is a joint venture of the German Printing and Media Industries Federation (bvdm) in Wiesbaden, the European Color Initiative (ECI), EMPA/Ugra St. Gallen and the print research company FOGRA in Munich. The application suite consists of reference prints and inking standards that have been produced carefully to tight tolerances. The package also includes a CD-ROM with Test Suite files, characterization data and ICC profiles in line with standard printing conditions according to ISO 12647. Comprehensive documentation describes in detail the elements of the Altona Test Suite and how to use them. It also supplies all information needed for standardized process monitoring. The Altona Test Suite consists of a set of PDF files that have been developed specifically for inspecting digital output devices – and in particular proof printing solutions, conventional and digital printing systems.

Ugra/FOGRA Media Wedge 2.0

Published by Ugra and Fogra

Media Wedges are used to check proof prints. The UGRA/FOGRA Media Wedge consists of solid ink patches and continuous tone patches, overprinting, step wedges in gray and step-by-step to neutral composite gray. The specifications come from the current FOGRA characterization data and correspond to those of the Altona Test Suite. Comparing measured values and specifications gives a good assessment of quality.

Characterization data 2004

Published by Fogra, IFRA and ECI

Characterization data in line with ISO 12642 or DIN 16614 is provided for standard printing methods (offset printing, gravure printing, newspaper printing) and paper. It currently represents the best possible approximation to the standards and is based on real printing conditions, paper and printing inks. The characterization data is the basis of the Altona Test Suite and the Ugra/FOGRA Media Wedge. It has been created in line with the guidelines of the Offset Printing Process Standard and the corresponding guidelines for newspaper printing and gravure printing.

Standard profiles 2004

Published by IFRA and ECI

ICC profiles in line with ISO 15076 are required for color separation and print monitoring. They are based on the current characterization data and should reflect a realistically achievable print result.

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