Digital PANTONE® Libraries in X-Rite Products

Many X-Rite solutions for the design, photo, prepress, printing, and packaging markets include digital PANTONE® libraries. This whitepaper explains the procedures used by X-Rite and Pantone to create the digital color data, how a customer can verify whether their product includes the most current version of the digital PANTONE library for the PANTONE PLUS SERIES or PANTONE® Goe™ (as appropriate), and how their version of the digital library can be upgraded, if needed.

A brief history:

In 2003, a major change was made in the production process of the PANTONE MATCHING SYSTEM books. The paper type was changed to one that contained optical brightening agents (OBAs), and as such the first edition of the PANTONE MATCHING SYSTEM Version 3 print run was carefully measured using various X-Rite instruments to create the data characterization. Please refer to 'Appendix A' for a complete description of this change. The digital data from this characterization data became the de-facto reference data for the PANTONE MATCHING SYSTEM. As a matter of practice, each print edition of the PANTONE MATCHING SYSTEM is not measured to produce new reference data.

The 2003 data set _was the de-facto reference_, not the printed books. The press conditions for each subsequent press run were adjusted to match the digital reference data produced in 2003. The books will have a small, but measureable deviation from the center of the production standards, as is common with any printing process.

The rationale for this process is based upon the need to maintain a single reference data set that can be used by all subscribers. If the standard data are changed on the basis of each subsequent printing of the books, the interoperability between applications would be impacted because of differences found in the data. This philosophy was carried forward when the PANTONE® Goe™ system was introduced in 2005. **It is important to reiterate that the books act as guides, not as reference standards.** The dates on various data files may differ, but the reference digital data has not changed since 2003.

In certain cases, reference data may reflect a different *measurement* condition, but is still based on the 2003 production reference. Most, if not all application vendors utilize data based upon UV-Excluded measurements. This data is generally the most consistent data for reference, because it eliminates the variability introduced by light source and optical brightening agent interaction. The first edition of the PANTONE MATCHING SYSTEM Version 3 print run was measured under many measurement conditions, which included, among others, sphere measurements and UV-Included measurements. It is important to note that the numbers returned by instruments with different geometries will be, by definition, different. The differences found between file dates and included values have led to great confusion about whether the data for any given application or instrument is 'current', or 'correct', but the fact remains that only one reference set was measured, and the values of this set make up the digital data of the libraries available for use today.

The data sets found today in instruments that were manufactured by X-Rite prior to its acquisition of GretagMacbeth are based on the original X-Rite standard, which was common to all of its instruments (500 Series, 939). For former GretagMacbeth products, data sets were measured with SpectroEye using each filter setting (No, Pol, D65 and UVcut).

As part of the continuing evolution process of the Pantone system, the PANTONE PLUS SERIES system was launched in 2010. The PANTONE PLUS SERIES increased the number of physical colors in the system and reordered the colors in the book. Concurrent with this change there was a move to Forestry Stewardship Council (FSC) papers that are based upon renewable and managed forests. These papers also contain optical brighteners, but they are slightly different from the 2003 papers.

These changes dictated that the entire data set be re-evaluated and in 2010, the entire data set was re-measured concurrently with the production of the new series of PANTONE PLUS SERIES books. This data set was measured in four modes: Tungsten/No filter, UV cut, Polarization Filter and D65 filter. This data is based upon the new X-Rite Graphic Arts Standard (XRGA).

The 2010 digital characterization data set *is the new de-facto reference*, not the printed books. The press conditions for each subsequent press run will be adjusted to match the digital reference data produced in 2010. The books will have a small, but measureable deviation from the center of the production standards - just as any printing process will produce. All digital PANTONE libraries will be based upon this measurement set.

Digital PANTONE Libraries and the X-Rite Graphic Arts Standard (XRGA)

In 2010 X-Rite introduced the X-Rite Graphic Arts standard, or XRGA. The XRGA metrology standard is optimized for advances in color science so that

all of our customers – regardless of their legacy affiliation to X-Rite or to GretagMacbeth - can enjoy high-quality data exchange between sites that use different instrumentation. XRGA is applicable to all graphic arts 0/45 and 45/0 instruments

Historically, both X-Rite and GretagMacbeth each maintained their own traceable calibration standards and processes. We were aware that these differences represented an issue for our customers, especially for those that use multiple measurement instruments concurrently in their workflows. The new XRGA metrology was designed to quantify the differences between measurements obtained using instruments from both X-Rite and GretagMacbeth prior to the two companies' merger, in order to arrive at the definition of a new corporate X-Rite factory calibration standard for our graphic arts instrumentation. This has also allowed us an opportunity to implement new advances in color technology to our calibration standards for ISO-13655, and ensure that they are traceable to NIST.

For most of X-Rite products, the switch to XRGA results in very small differences in measurement values, so many customers will not need or want to make any changes. For customers who wish to update to XRGA, X-Rite provides seamless means to move existing databases to the new XRGA standard.

Most X-Rite prepress and pressroom instruments and software now ship as XRGA compatible from the factory, including i1 Solutions, 500 Series, SpectroEye, 939, EasyTrax and IntelliTrax. The digital PANTONE PLUS SERIES library is also XRGA-native.

For more information on XRGA, please visit www.xrite.com/xrga.

What process was used to create the digital PANTONE libraries?

The digital PANTONE libraries were compiled based on measurements taken with a Spectroeye on the printed master fan deck library for the 2010 edition of the PANTONE PLUS SERIES print run at Pantone headquarters in Carlstadt, NJ (USA). Implementation of the XRGA standard in the process now allows the data set to be independent of instrument type. Earlier data sets required distinct differentiation between GretagMacbeth and X-Rite instrument sets. Before distribution, all data sets are verified and approved by X-Rite and Pantone.

How can I be sure I am using the correct standard?

In this instance, it is actually incorrect to refer to the printed version (fan deck, guide, or book) as a 'standard'. The printed sample is actually a representation of the standard.

Why is there a difference in measurement values between the digital data and the printed book?

If wide variances exist between your digital PANTONE library and your printed book, please verify the following:

- First verify whether your printed book or fan deck is in good condition. Depending on the amount of use it gets and the environment in which it is stored, it can become faded, soiled, etc. Pantone, Inc. recommends all printed books be replaced annually.

- Is there a defect on the printed color sample? As most instruments have a small measurement aperture, small defects on the color sample might impact the measurement. To avoid such defects, please ensure your environment is clean. You may also try measuring another area on the same color sample, or use an average of measurements from different areas on the same sample.

- What type of filter is in use on your instrument? Different filters can result in differences between the measured sample and the digital data. In some applications, the digital data is included for all filter settings. Please verify in your product's manual or by looking at the support section for your product online at www.xrite.com.

Do I have the most recent digital PANTONE library?

Most new instruments and software are shipped from X-Rite with the latest, and most up-to-date digital data for the various PANTONE libraries, which are included with that product as indicated at time of sale. Not all X-Rite products automatically come with both the PANTONE PLUS SERIES and PANTONE Goe digital libraries. Please check your product's documentation and/or current brochures online at www.xrite.com to confirm which digital PANTONE libraries are included with your product.

If your instrument is a number of years old, you might have outdated data for the digital PANTONE libraries stored in your instrument. You can verify which version of digital data you have according to the instructions below.

How can I check if my instrument is equipped with the latest digital PANTONE PLUS SERIES library?

SPECTROEYE

Which digital PANTONE libraries are available for SpectroEye?
- PANTONE PLUS SERIES Coated and Uncoated
- PANTONE® FORMULA GUIDE Coated, Uncoated and Matte
  (For No-, Pol-, D65 and UVCut filter)
- PANTONE® Goe™ Coated and Uncoated
  (For No-, Pol-, D65 and UVCut filter)

How are the latest versions of the PANTONE digital libraries referenced in SpectroEye?
- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE: Version 3, 2004

- PANTONE® Goe™:   Version 1, 2008

Where can I find the PANTONE digital library version information in SpectroEye?
- Main Menu > Database > Color Guides > "library name"

If the library in your instrument is outdated, please visit the Support section of the SpectroEye product page on xrite.com

528/530

Which digital PANTONE libraries are available for 528/530?
- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE Coated, Uncoated and Matte
  (For Unpolarized filter only)

How are the latest versions of the PANTONE digital libraries referenced in 528/530?
- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE: 2005

Where can I find the PANTONE library version information in 528/530?
- Main Menu > Match

If the library in your instrument is outdated, please visit the Support section of the 528 or 530 product page on xrite.com

INTELLITRAX

Which digital PANTONE libraries are available for IntelliTrax?
- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE Coated, Uncoated and Matte
- PANTONE® Goe™ Coated and Uncoated

How are the latest versions of the PANTONE digital libraries referenced in IntelliTrax?
- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE: Pantone 2005
- PANTONE® Goe™:   Pantone Goe

Where can I find the PANTONE library version information in IntelliTrax?
- Editor > Targets > Target Library

If the library in your instrument is outdated, please visit the Support section of the IntelliTrax product page on xrite.com

INKFORMULATION/COLORQUALITY SOFTWARE

Which digital PANTONE libraries are available for InkFormulation and ColorQuality software?
- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE Coated, Uncoated and Matte
  (for No-, Pol-, D65 and UVCut filter)
- PANTONE® Goe™ Coated and Uncoated

(for No-, Pol-, D65 and UVCut filter)
How are the latest versions of the PANTONE digital libraries referenced in InkFormulation and ColorQuality software??

- PANTONE PLUS SERIES
- PANTONE® FORMULA GUIDE: PANTONE solid 2004
- PANTONE® Goe™: PANTONE Goe 2008

Where can I find the PANTONE library version information in InkFormulation or ColorQuality software?

- "Color libraries" selection list

If the library in your software is outdated, please visit the Support section of the relevant product page on xrite.com

Note: the data for InkFormulation and ColorQuality software was measured with a SpectroEye. Data sets measured with a 939 or 530 instrument are not currently available for InkFormulation or ColorQuality software.

X-RITECOLOR MASTER SOFTWARE

Which digital PANTONE libraries are available for ColorMaster software?

- PANTONE® FORMULA GUIDE Coated, Uncoated and Matte (For NoFilter)

Please note that the PANTONE PLUS SERIES digital library, which is the most current, is NOT available for X-RiteColor Master software.
Note: The data for X-RiteColor Master software was measured with a 939. Data sets measured with a SpectroEye instrument are not currently available for X-RiteColor Master software.

i1PUBLISH SOFTWARE SUITE

i1Profiler Software & PANTONE Color Manager Software
Which digital PANTONE libraries are available in the i1Publish software suite?

- PANTONE PLUS SERIES
- PANTONE® Goe™ Coated and Uncoated

To access digital PANTONE library information for profile generation and QA in the i1Publish software suite, you must first launch the PANTONE Color Manager application, and then drag and drop or import your selected colors into i1Profiler software.

How are the latest versions of the PANTONE digital libraries referenced in PANTONE Color Manager and i1Profiler?

- PANTONE PLUS SERIES   PANTONE+
- PANTONE® Goe™:   Pantone Goe

Where can I find the PANTONE library version information in PANTONE Color Manager?

- The user can click the fan deck button at the bottom right of the application, or you can select a fan deck from the View menu > Fan Deck

COLORMUNKI™ DESIGN & COLORMUNKI CREATE

Which digital PANTONE libraries are available for ColorMunki Design and ColorMunki Creates?
- PANTONE PLUS SERIES
- PANTONE® Goe™ Coated and Uncoated
- PANTONE® fashion + home paper TCX
- PANTONE® fashion +home cotton TPX

All Pantone libraries for ColorMunki Design and ColorMunki Create are up to date. There is no ColorMunki software or dataset available for previous Pantone library data.

COLORMUNKI™ PHOTO

Please note that ColorMunki Photo does not include digital PANTONE libraries.

APPENDIX A – PANTONE TECHNICAL UPDATE
Released August 1, 2003

Please note that this paper, released in 2003, is included as an appendix here as it gives a good overview of how the centroid for digital PANTONE data is achieved. The information outlined here refers to the now out-of-date PANTONE MATCHING SYSTEM, which has been replaced with the new PANTONE PLUS SERIES, released in 2010.

Pantone, Inc. remains committed to providing the graphic arts community with the most advanced, yet practical and affordable solutions for communicating and achieving accurate color. We continually monitor trends in the marketplace to identify areas of opportunity and to find new ways of improving our products to better serve end-users.

Based on current market trends and customer feedback, Pantone has made a decision to update the substrates used in the coated and matte versions of the following products:

- PANTONE formula guide coated/uncoated
- PANTONE formula guide coated, uncoated, matte
- PANTONE solid chips two-book set (coated, uncoated)
- PANTONE solid chips three-book set (coated, uncoated, matte)
- PANTONE metallic formula guide + chips coated
- PANTONE pastel formula guide + chips coated/uncoated

New versions of these products will be released as second editions. The pastel guide will be available in August 2003 and the solid color formula guides/chips and metallic color products will be released on October 1, 2003.

Coated and matte substrates used on the second edition publications are brighter and bluer than those used in previous editions. The weight of the coated stock has been increased from 60 lb cover to 80 lb cover to improve the usability and physical durability of the product. The new matte stock provides a flatter finish that is preferred by contemporary designers. The substrate used on uncoated publications remains unchanged, as it currently satisfies customer requirements.

Rationale for the change

Over the past decade the graphics community has continued to migrate toward brighter and bluer papers.

This migration has been driven by a number of factors:

☐ Research shows that paper brightness and color (whiteness) are major factors in the decision process when designers specify paper for print.

☐ Designers are increasingly involved in determining the paper used for printed pieces. A recent study conducted by a large U.S.-based paper manufacturer

found that designers currently have a measurable influence in the paper specification for over 90% of printed jobs.

 Papers used in the areas of prepress and digital printing are typically skewed toward the brighter and bluer regions of the spectrum.

Paper specifications

For your reference, we have provided mill specifications and L* a* b* values in Figure 1 for our coated, matte and uncoated publications. "1st Edition" refers to the current product on the market.

Coated Paper	Brightness	Gloss 75°	Opacity	Caliper	D50/2		
					L*	a*	b*
1st Edition	89	81	97	0.0052	94.38	-0.24	0.34
2nd Edition	96	80	97	0.0069	96.12	-0.29	-0.12

Matte Paper	Brightness	Gloss 75°	Opacity	Caliper	D50/2		
					L*	a*	b*
1st Edition	89	18	97	0.0059	95.13	0.09	1.23
2nd Edition	96	12	97.5	0.0059	96.24	-0.42	0.23

Uncoated Paper	Brightness	Sheffield Smoothness	Opacity	Caliper	D50/2		
					L*	a*	b*
	97	140-180	96-98	0.0067	97.44	0.07	0.27

**Figure 1.** (note: L* a* b* readings taken by Pantone)

Optical brighteners

The new coated and matte substrates contain higher levels of fluorescent whitening agents than previous editions. These materials convert ultraviolet light into visual blue light, which makes the paper appear whiter and brighter to our eyes. However, spectrophotometers simply see the paper as being bluer. A UV cut-off filter can be used whenever reflectance measurements are taken for color matching.   Figures 2, 3, and 4 demonstrate how the use of a UV filter reduces the effect of the optical brighteners. The curves of the second edition coated and matte paper stocks are more analogous to the first edition stock when a UV filter is employed.
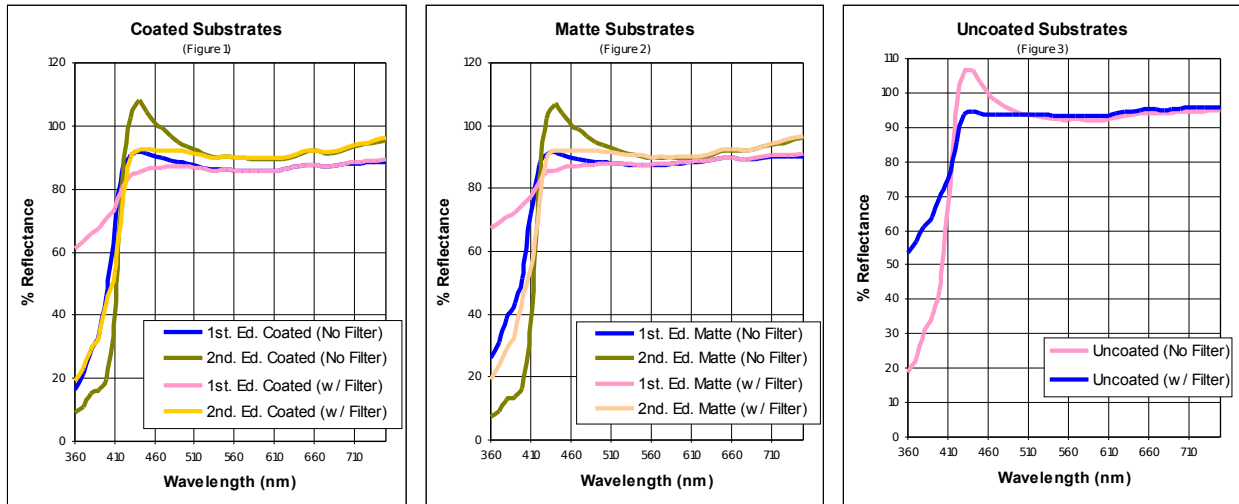
**Figure 2, 3, 4.** (note: reflectance measurements for coated, matte and uncoated substrates by Pantone)

Paper aging

PANTONE Color reference guides should be replaced on an annual basis to ensure accurate color communication. As with any printed piece, the color fidelity will diminish over time and is accelerated when exposed to any type of light. Figure 5 shows how light exposure affects the fluorescent whitening agents contained in the coated paper, resulting in a shift of the reflectance measurements. The largest shift occurs in the blue end of the spectrum. This effect is similar for matte and uncoated stocks. Over time there is a general yellowing of the paper, which may impact the visual appearance of printed color. This shift in color caused by aging and exposure to light is common to all paper stocks.
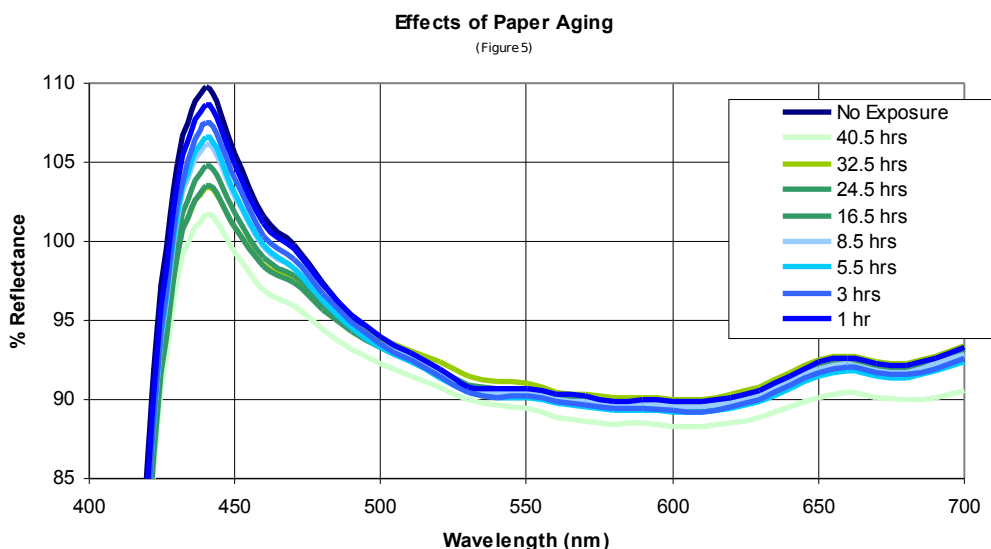
Figure 5. Reflectance measurements over time (D50 lighting)

Figure 6 shows a*, b* values and the total color difference over time. There is a larger shift in b* values vs. a* values as the bluing effect of the optical brightener is reduced over time.

Colorimetric Results Over Time
(Figure 6)
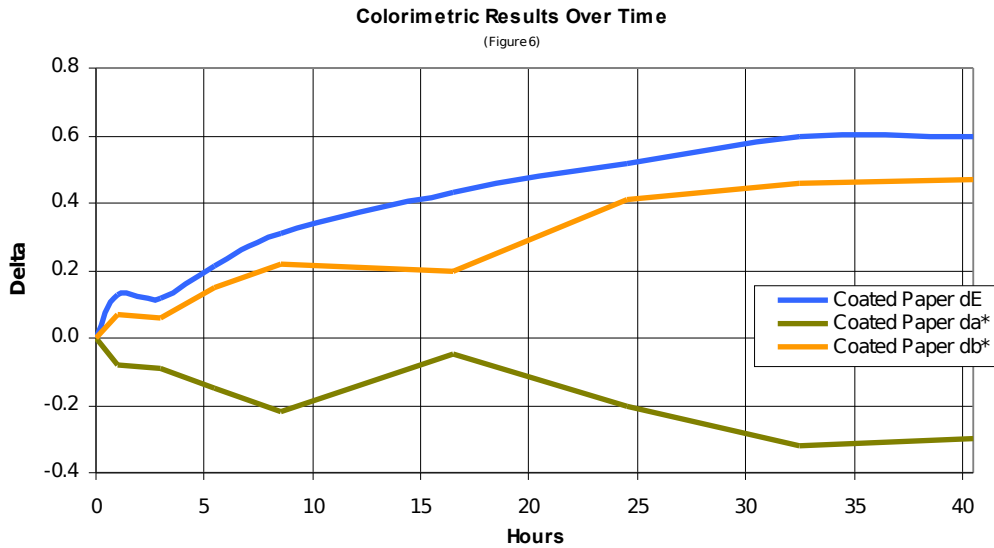
Figure 6. Colorimetric results over time (D50 lighting)

Gloss

Figure 7 indicates minimal gloss differences of the 14 PANTONE Basic Colors on coated paper. When the same colors are printed on matte paper, there is approximately a 50% reduction in gloss. This reduction in gloss on the matte paper provides more distinct steps in the appearance of PANTONE Colors on coated, uncoated and matte substrates.

COLOR KEY	
1	PANTONE Yellow
2	PANTONE Yellow 012
3	PANTONE Orange 021
4	PANTONE Warm Red
5	PANTONE Red 032
6	PANTONE Rubine Red
7	PANTONE Rhodamine Red
8	PANTONE Purple
9	PANTONE Violet
10	PANTONE Blue 072
11	PANTONE Reflex Blue
12	PANTONE Process Blue
13	PANTONE Green
14	PANTONE Black

Figure 7. First edition and second edition gloss values @ 60° for coated, uncoated and matte stocks.

Color

It is important to note that the PANTONE Basic Colors and ink-mixing recipes in our publications are not changing.

There are minimal differences for the basic colors on the coated stock; however, the variances may be somewhat larger in the lighter colors. The new matte paper shows larger variations due to the surface characteristics and ink absorption into the paper.

	COLOR KEY
1	PANTONE Yellow
2	PANTONE Yellow 012
3	PANTONE Orange 021
4	PANTONE Warm Red
5	PANTONE Red 032
6	PANTONE Rubine Red
7	PANTONE Rhodamine Red
8	PANTONE Purple
9	PANTONE Violet
10	PANTONE Blue 072
11	PANTONE Reflex Blue
12	PANTONE Process Blue
13	PANTONE Green
14	PANTONE Black

Figure 8. a* b* plot for 14 PANTONE Basic Colors printed on coated paper.

Figure 9. a* b* plots for 14 PANTONE Basic Colors printed on matte paper.