P2QM: Prepress & Press Quality Management

Yasuhito Shiraishi
Graphic Arts Division , Dainippon Screen Mfg. Co., Ltd
Kyoto, Japan

Introduction

P2QM is Dainippon Screen's approach to securing color management in digital workflows to meet the increasing trend toward short-run, low-cost, on-demand printing. Here we will focus on the creation of color proofs and digital targets while examining the changes taking place in the way color is managed in modern workflows. When matching printed sheets to the proof, besides the many device and system related concerns, there are other important factors that must be considered, including issues concerned with production schedules, costs, and operator skill levels. We will look at the effectiveness of implementing P2QM to deal with these conditions.

Film-Based Workflows

The general flow of color management processes in conventional film-based workflows can be seen in Figure 1. Color proofs are made from a chemical proofing system or an analog proofer, and color matching is then achieved by performing color adjustments at the press. There are three points that can be raised concerning this:

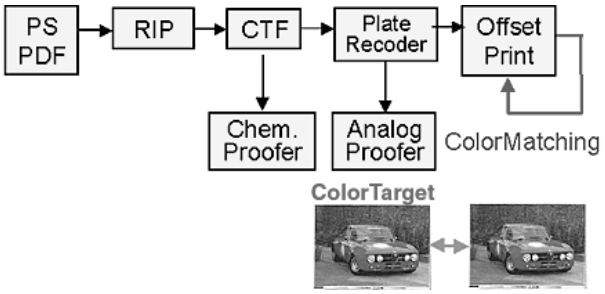

Figure 1. Film-based workflow

1) Outputting film for chemical proofing represents a cost-effective way to produce color proofs.
2) Using a flatbed proofing machine enables a close match to the quality of the final printed sheets, or even better quality.
3) Making color adjustments at the press is a flexible way to achieve color control.

Looking at 2 and 3 from another angle, we can see that the task of matching the press run to the quality of flatbed proofs has been dependent on operator craftsmanship and skill. We can also see that the intermediary stage of producing film consumes both time and resources.

CTP Workflows

In CTP workflows, where there is no stage that involves output to film, DDCP (Direct Digital Color Proofing) is widely used in place of simple film-based proofing. However, this raises other concerns. (Figure 2)

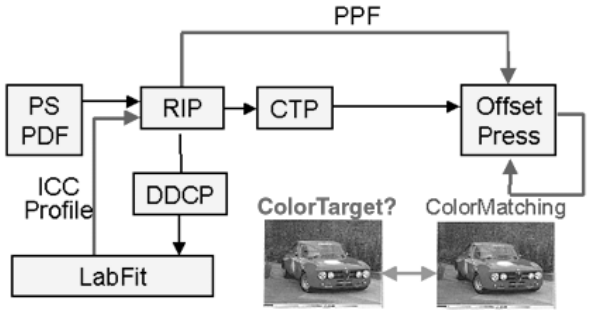

Figure 2. CTP workflow

1) As there is often no support for true halftone dot output and the stock used for proofing is often different from that which will be used for the final press run, there are certain limitations to how close the match can be to the final finish.
2) Color proofs that can match what the final sheets will look like need to be able to be produced digitally.

In regard to this second item, the direction of recent developments is toward using ICC profiles to control the differences between devices and other printing conditions, and constructing systems that can simulate the final press sheets. Dainippon Screen is positioned with the color management system LabFit for this.

One of the benefits available with a CTP environment is the use of CIP3 Print Production Format (PPF) data. This allows RIP'ed data to be used as the basis for ink coverage calculations that can be used for presetting the ink keys, greatly contributing to the automation of makeready. However, although ink key settings can be automated for printing, there is no guarantee that the settings will provide a close match to the color proof. Operators are still required to have the level of skill

required to determine correct color and make fine adjustments during printing.

Making Press Proofs in a CTP Workflow

For the occasions when a DDCP system is not enough for your proofing needs, it is necessary to produce proofs in an actual press run (Figure 3). It has become possible to do this due to the time reductions afforded by CTP and quicker presses.

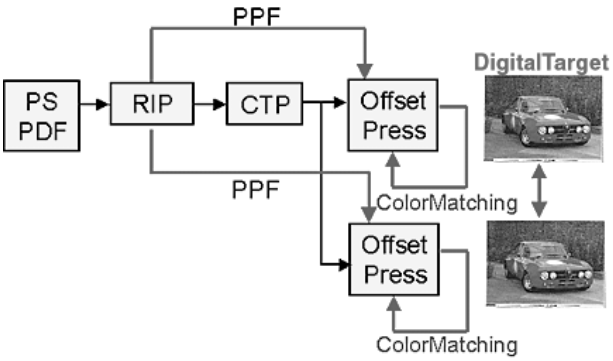

Figure 3. Offset Print Proof System

Naturally, press proofs are as close as you can get to the final press run, but there are still many factors that can result in color changes, such as the different skill levels of operators and other subjective factors during setup. Therefore, the press operator is still required to perform color matching to reproduce the quality of the press proof. Obviously, this results in a loss of productivity. The press will probably have to print at least 100 or so sheets even if, for example, only ten proof sheets are required. In other words, productivity is reduced and costs are incurred.

Toward Full Digital Workflows

Now that we have looked at the digitalization of color management in prepress and press, we can now look at how print quality is maintained during the press run. This is not as easy as it sounds, as it is necessary to achieve exacting numerical control over numerous elements on each individual press. And it is also not unusual for a printing operation to be using presses each made by a different manufacturer. So any color management solution must be able to work under these conditions. Despite the elimination of risks associated with analog instability in intermediate CTF and CTP stages, color proofing systems are required more than ever. The biggest issue currently facing color proofing systems is the fact that there are colors that cannot be reproduced in printing and therefore are not amenable to numerical control, thus resulting in a reliance on the skill and intuition of the operator.

The two major factors that need to be jointly examined as we move further toward full digital workflows are how to achieve the most efficient color management and how to best create color proofs.

Here are some of the issues you will need to resolve when you make the transition to a full digital workflow:
1. Now that we've implemented CIP3-based automatic presetting of the ink keys, what is the best way to maintain print quality across the press run?
2. How can we achieve color management between different makes of presses?
3. What is the best way to implement ICC profiles?
4. What is the best and most responsive way to color manage digital presses?

The Role of P2QM

Based on ICC and CIP3 international industry standards, P2QM has been developed by Dainippon Screen to provide total color management for all the stages in your workflow, from prepress to printed sheets. (Figure 4)

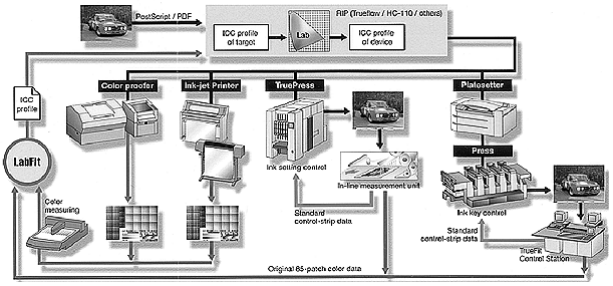

Figure 4. P2QM workflow

Consistent color management that covers presses of various makes can be achieved because your system will be compatible with internationally accepted ICC and CIP3 standards. The main benefit of this is that your system will have the flexibility and responsiveness to take advantage of all the developments being provided by increased digitalization.

Currently, two of the main tools that are being used to introduce an increased level of scientific accuracy to the art of printing are Screen's TrueFit and DCC systems. TrueFit is an inline density measurement system that is equipped to Screen's TruePress series of digital offset presses. DCC stands for Screen's Digital Color Console that provides the printed image analysis required to automate ink key settings. There is also the LabFit module that creates high quality ICC profiles to fingerprint each of your presses and provide stability for a range of different output conditions. Figure 5 shows a workflow in which P2QM has been implemented with the TrueFit, DCC, and LabFit components of P2QM.

The differences between the feedback loops for color management of digital offset presses and conventional offset presses are those of the separate TrueFit and DCC devices. However, as both devices basically control ink densities, the aims of the loops are essentially the same. The purpose of LabFit, on the other hand, is to work within the flow of data being feed back to the RIP, enabling consistently better matches to the digital targets by enhancing the data available to the RIP, and by providing better RIP'ed data for color proofing.

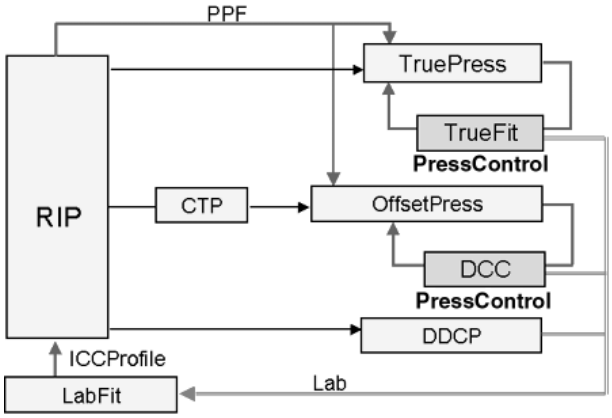

Figure 5. P2QM workflow

Therefore, there are two major feedback loops in a P2QM workflow. The function of one is to provide better press calibration in order to maintain print quality across and between different press runs. The other loop aims to ensure that the differences between your proofing systems and your presses are constantly color matched.

TrueFit

TrueFit is the inline density measurement system used to enable the highest levels of print quality consistency for the TruePress series of digital offset presses. (Figure 6)

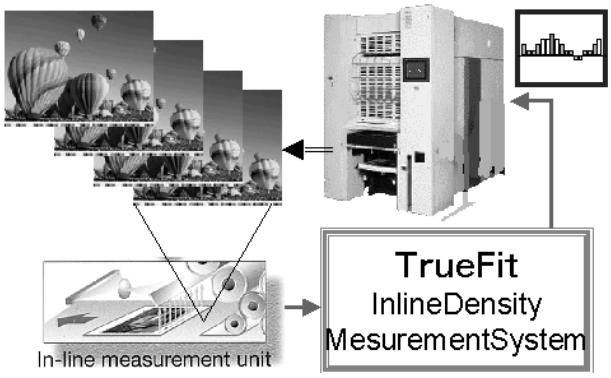

Figure 6. TrueFit

TrueFit is positioned above the paper delivery area of the TruePress and consists of a newly developed capture head and lamp unit. It reads the control strip on the printed sheets in real time as they are being delivered, enabling more efficient control of ink densities during printing. And because ink densities are being read and displayed on the operation panel in real time, constant ink density control can be achieved without needing to remove sheets for measurements. This streamlines and increases the efficiency of the operator's work.

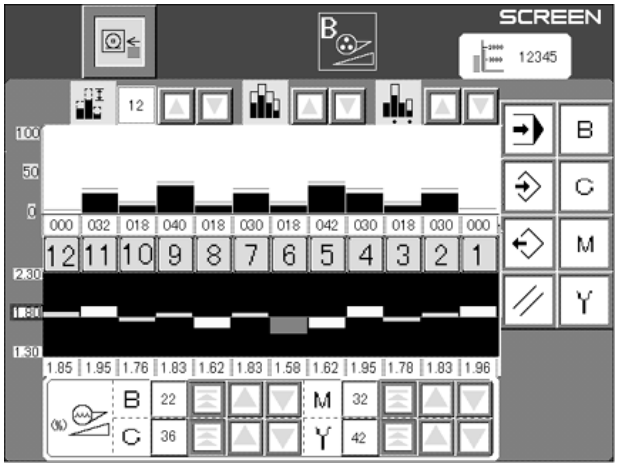

Figure 7. TrueFit Operation Panel

DCC (Digital Color Console)

The DCC is equipped with a one-shot digital camera specially developed by Screen to faithfully capture color images. It reads color data of the printed sheet and the color proof, or even the OK sheet, and analyses this to calculate CIP3 and ink key data. This has three main benefits (Figure8)

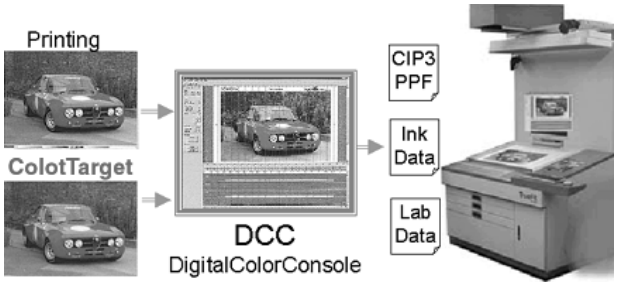

Figure 8. DCC (Digital Color Console)

1) Ink key data can be determined for the target print sheets based on CIP3 and color proof data.
2) Even when not using a color control strip, ink density data can be read right off the image areas on the printed sheets.
3) With Screen's LabFit color management system, LAB data can be generated by reading data off Screen's original 85-color strip. And LabFit also allows ICC profiles to be created and edited with ease, based on both printed sheets and color proofs.

Using 85-color Strips with LabFit

The 85-color strip used by LabFit is a special innovation that enables the ICC profiles that used to require large full-sized color bars of between 800 and 1,200 patches, to be created with slim strips of only 85 patches for process color printing. (Figure 9)

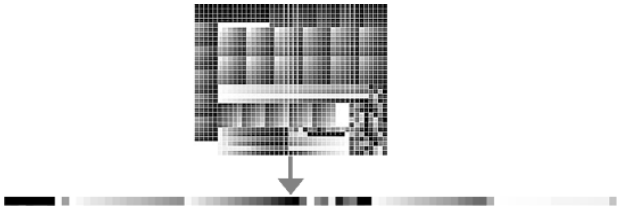

Figure 9. 85-Color Strip

The beauty of this reduction in the area required for color measuring is not only that it enables easier and faster color measurements, it also enables color strips to be placed in any available area on the printed sheets during normal production runs. In this way it becomes possible to regularly obtain LAB data off the printed sheets.

Color Management for Current Production Presses

P2QM also encompasses support for the color management of offset presses currently being used in production. It does this in the following three ways, each of which involves Screen's DCC:

1) Individual ICC profiles are created in LabFit for each of the main variables that affect printing (differences between various presses, papers, inks, etc.) as well as for the DDCP system, thus making color matching possible for all these differences.
2) CIP3 data is read off master prints and compared with the data of the digital target. This can then be feed back to the inking system.
3) The color proof and sheets pulled from the press during the actual press run can be measured and compared at the Digital Color Console. Any differences can then be feed back to the inking system.

Color Management for Current Production Presses – Output Characterization

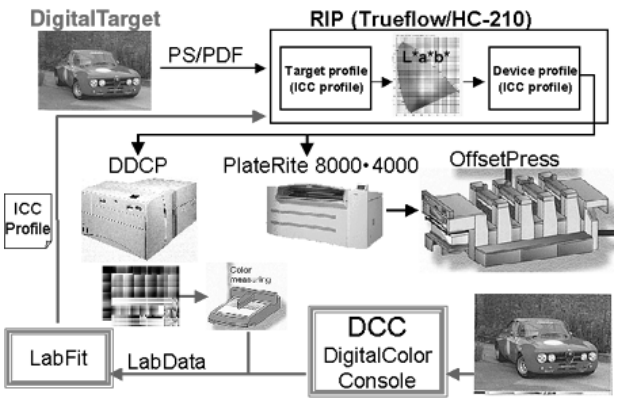

Figure 10. Output Characterization

LAB data is created at the DCC by reading sheets on which the LabFit 85-color strip has been printed. ICC profiles are then created by the LabFit application for all the various printing conditions. In the same way, LAB data is created by measuring a sheet that has been output from the DDCP and on which a LabFit color patch has been printed. LabFit then builds an ICC profile for the DDCP. Accurate color matching can then be achieved for the DDCP and the printed sheets by feeding back these ICC profiles to the RIP. (Figure 10)

Color Management for Current Production Presses – Matching To Digital Targets

The DCC is used to create CIP3 data for masters prints obtained from current production presses. (Figure 11)

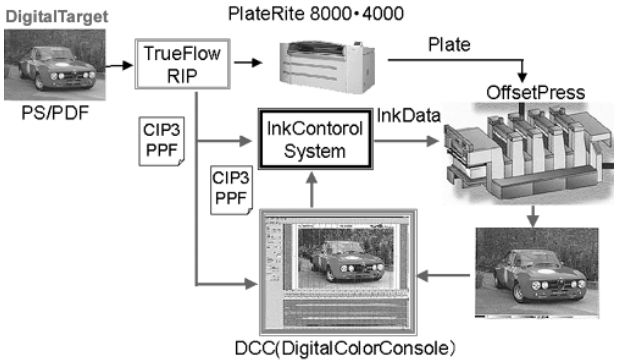

Figure 11. DCC PPF control

By comparing this with PPF data supplied by the RIP (Trueflow etc.), digital targets can be compared with master sheets.

In this way it is necessary to know what kind of on-press color corrections are anticipated when creating digital data. With this approach, ICC profile based operation becomes possible that includes prepress stages. (Figure 12)

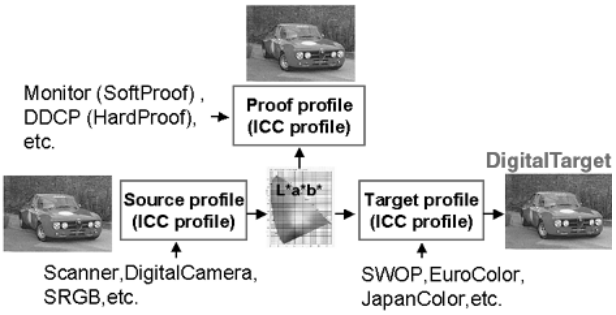

Figure 12. ICC Profiles

Because the changing elements in printing conditions can be controlled numerically, it becomes possible to achieve consistent print quality.

(Not all vendors currently support this. To enable this kind of operation, some allow ICC profiles to be embedded in image files. However, only a certain section of operations are currently being run this way.

There are high expectations of agreement on this issue with the implementation of the CIP4 JDF standard.)

Color Management for Current Production Presses – Matching to Color Proofs

The DCC is used to read PPF data off the color proof. This data is then compared with data obtained from sheets printed on the offset press, enabling constant matching with the color proof. (Figure 13)

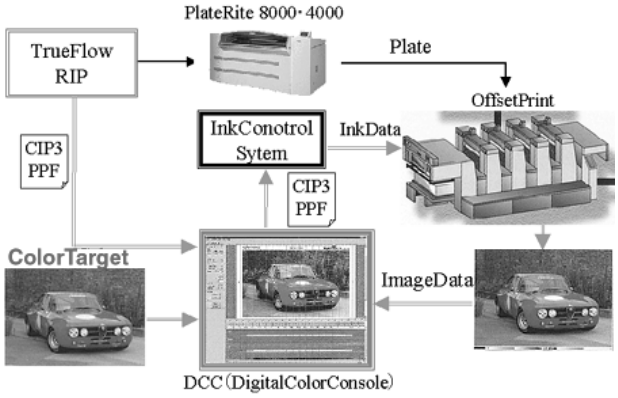

Figure 13. Matching to Color Proofs

Toward Integrated Control of Current Production Presses

When there are different printing presses being used in a single printing operation, there needs to be a way to integrate quality control to ensure that there is no inconsistency between the presses. (Figure 14)

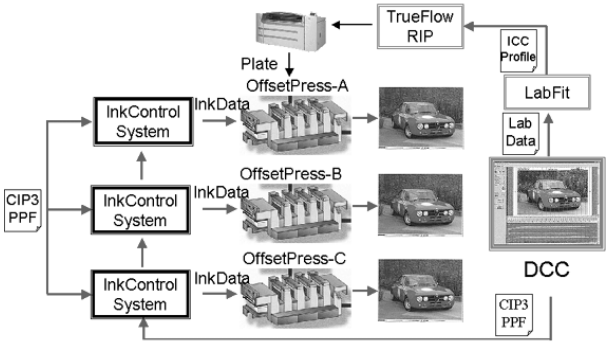

Figure 14. Integrated control of current production presses

PPF data and Lab data is created at the DCC by measuring printed sheets from each of the presses. The PPF data is compared with standard PPF data (obtained from the original RIP'ed data) and any differences can be compensated for by the color management system. This minimizes any inconsistent results between the presses and achieves stable print quality. Meanwhile, the LAB data is used to create ICC profiles for each of the presses and these are compared with the target profile to enable color matching to be performed before plates are output.

In this way, color matching that spans all the stages of printing, from prepress to press, can be used to secure the consistency of outstanding printing quality in your workflow. The triumph of P2QM is the span of the color management integration it provides.

Future Developments

Up till now, color proofing has featured prominently in our examination of printing workflow. However, with the increasing trend toward shorter production cycles, the question of how to best resolve questions related to color proofing will become even more important. The production time and operator skills required to match proofs to prints are must be focused on as the major hindrances to short production cycles.

With P2QM, Dainippon Screen is continuing to focus on solutions for full digital workflows, ensuring that color management can be streamlined to meet the increasing demand for short-run, low-cost, on-demand printing. Moving from CIP3 to the implementation of the CIP4 JDF standard will further increase the seamlessness of total quality management throughout the stages of prepress and press, and lead us closer to the development of extremely responsive systems that provide immediate printed output upon receipt of digital data.

Biography

Yasuhito Shiraishi graduated with a major in electronics from Doshisha University, Kyoto, in 1986. He then worked in the R&D Center at Konica Corporation, Tokyo, mainly involved with the development of CCD color scanners. In 1991 he joined the Graphic Arts Engineering Section at Dainippon Screen, Kyoto, where his work primarily focuses on the development of color management systems.