Improving Image Quality with the *Kodak NexPress* Intelligent Calibration System (ICS)

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Kodak

NexPress SE

Digital Production
Color Platform

with Print Genius

Executive Summary

The **Kodak NexPress** Intelligent Calibration System (ICS) is an innovative add-on to the **Kodak NexPress** Digital Production Color press family. ICS enables the press operator to quickly and dramatically improve the flat-field uniformity of the press simply by scanning a series of printed calibration targets with a custom **Kodak** ICS document scanner. The ICS client application automatically processes the scanned images and recalibrates the press to ensure optimal uniformity in the output. ICS is a powerful tool that can help the operator improve image quality, minimize downtime, and extend part lives.

The Operator's Dilemma

Maintaining density uniformity on large-area flat fields is a challenge for digital press operators. One of the most common disruptors to print uniformity is streaks. Streaks are the result of variations in the process uniformity along the crosstrack direction that are then propagated along the intrack, or process direction *(see Figure 1)*.

A study by Susan Farnand of the Rochester Institute of Technology's Printing Industry Center, confirmed that in subjective evaluations of the print output from digital presses, "(t)he three most common comments dealt with uniformity, including things like grain, banding, and smooth gradations;...Lack of uniformity was the most common complaint for the prints made using digital equipment, with concerns regarding text and line quality ranking second."[1]

Given that digital presses will exhibit various levels of print non-uniformities over time, an effective method of resolving this issue is of paramount concern for digital press operators. The dilemma for the operator often comes down to weighing the benefits of improving image quality against the time lost for press maintenance.
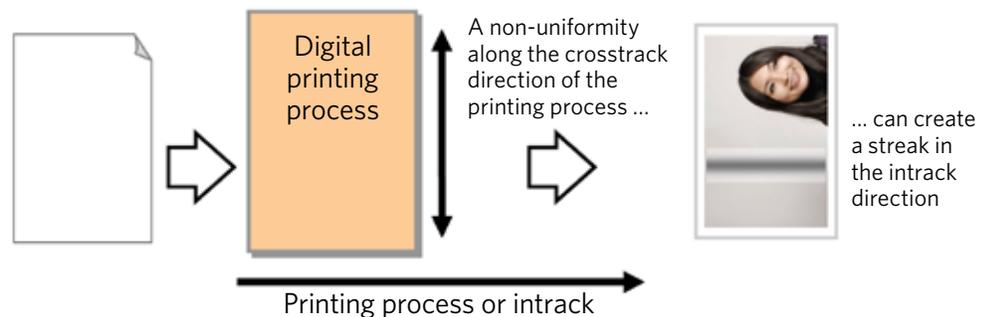

Figure 1. Orientation of Streaks along Intrack Process Direction

The dilemma is further exacerbated if the primary source of the non-uniformity cannot be readily identified by the operator. Service-navigation systems and online help diagnostics, such as the **Kodak NexPert** Operator Support System, play a critical role in enabling an operator to properly identify root causes of image-quality defects. However, the inexperienced operator may still misdiagnose the source of the problem, and this may lead to unnecessary parts replacement and increased downtime. Sometimes an operator will opt for replacing several parts at once to "shotgun" the problem and minimize the overall downtime. But this strategy often results in degrading the life of Operator Replaceable Components (ORCs).

What is needed is a simple method of removing the streaks and restoring uniformity without having to rely on the operator expertise to accurately diagnose all streak sources. This method should also be quick with a predictable process time and convenient enough to reduce the burden on the operator and optimize his time.

[1] "Minding the Gap: Evaluating the Image Quality of Digital Print Technologies Relative to Traditional Offset Lithography", PICRM-2008-08, pg 20)
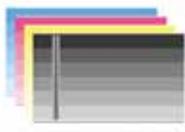
Introducing the *Kodak NexPress* Intelligent Calibration System (ICS)

The **Kodak NexPress** Intelligent Calibration System (ICS) is designed to help the press operator easily reduce the streak artifacts without opening up the press for maintenance. The philosophy of ICS is to create a broader feedback loop around the system based on evaluating the final printed output.

The principle of ICS is straightforward as shown in figure 2. A calibration target is printed for each of the four color modules. These targets are then scanned through a custom **Kodak** Scanner with an automatic document feeder.

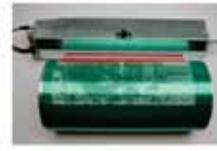| 1. Print	2. Scan	3. Process	4. Program	5. Verify
Targets are printed for each color channel.	Scanning is done offline with a scanner equipped with an automatic document feeder.	A sophisticated algorithm processes the data and updates calibration information.	Updated calibration data is automatically uploaded to the press.	Subsequent prints exhibit improved image quality.
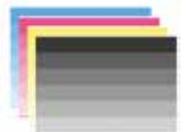
Figure 2. The ICS Process

The scans are analyzed and new calibration information is automatically sent to the LED Imaging Heads which control the exposure levels of each printed pixel for each color channel. The LED Imaging Heads have internal processing units that readjust the exposure output in response to the calibration data. Once the new calibration data is loaded, a verification target set can be printed to confirm the uniformity improvement. This differs from competitive presses that use lasers to write the image. With lasers, the laser is either on or off, allowing only 2 levels of density for each pixel printed. With the LED Imaging Heads, 8 bits or 256 levels of density variation can be written allowing precise calibration of each LED relative to the other LEDs on the Imaging Head.

The ICS software client *(see figure 3)* guides the operator through the process and all calibration operations are done automatically. The operator merely loads the prints, and ICS does the rest. The ICS calibration process is done is one operation. There is no iteration necessary.
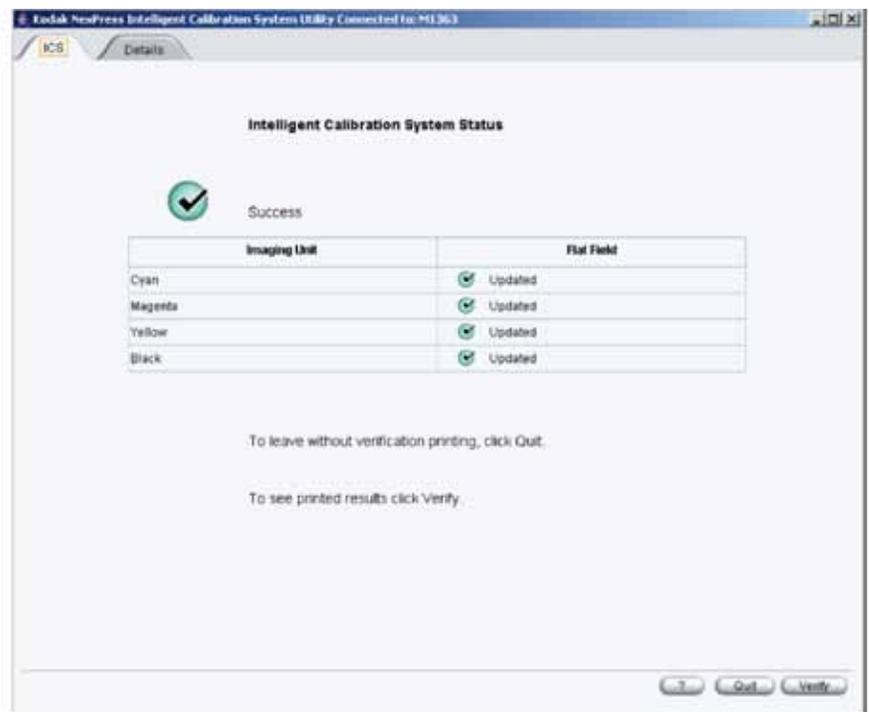
Figure 3. Screenshot from the ICS client

The ICS operation can be completed in about five minutes. ICS can be run as part of the normal start-of-shift routine, or on demand as the operator sees fit.

Depending on the initial state of the press, the improvement enabled through

ICS can be dramatic. Figure 4 shows the wide compensation range that ICS can cover. The response shown is the level of printed streaks in response to an increasing level of input exposure modulation.

With ICS off, the streak response increases with the input exposure modulation. With ICS activated, the streak response is maintained at a consistent lower level over the modulation range tested.

Since ICS operates on the printed target, the feedback loop for calibration incorporates the whole printing system response which leads to an optimized result on prints. In contrast, sensor systems that monitor responses from within the printing system may not incorporate all sources of process non-uniformities unless there is sensing done at the final post-fusing stage—as is done in ICS.
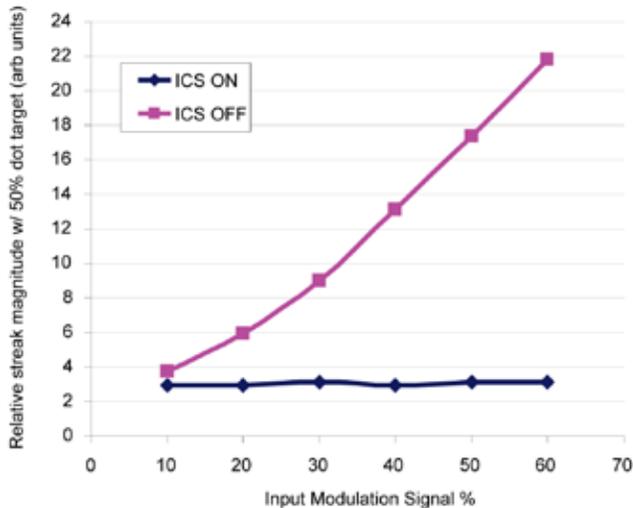

Figure 4. The ICS Compensation Range

Benefits of ICS

Consistent Image Quality

ICS enables a significant improvement in streaks on flat-fields—and a more predictable return to peak uniformity.

Simple & Convenient

ICS was designed with a simple "You press the button we do the rest" paradigm. The ICS application can be run by an inexperienced operator with minimal training.

Minimizes Downtime

ICS offers the convenience of improving image quality without opening the press. Operators can spend less time diagnosing the source of streaks and performing maintenance. ICS provides quick feedback with a verification print set.

Minimizes Parts Cost

ICS minimizes unnecessary parts replacement. ORC life can significantly improve using ICS.

Non-invasive

ICS does not require any hardware changes to the internal components of the press. The scanner has a small footprint and uses a standard USB interface. The ICS calibration can also be removed from the press at anytime.

Backward-Compatible

In keeping with the **Kodak NexPress** System modular concept approach, ICS can be implemented on older **NexPress** Press models—including the original **Kodak NexPress** 2100 Digital Production Color presses. The only requirement is that the software be upgraded to the latest System 11 version (some presses might need to have their computer upgraded to accomplish this).

Summary

The **Kodak NexPress** Intelligent Calibration System (ICS) is an elegant solution to the problem of minimizing streaks on flat-field prints while minimizing downtime. ICS enables a full-system feedback loop which operates on the final output print. The "intelligent" nature of ICS can improve the operator's productivity by automatically reducing streaks and subsequently reducing the need for troubleshooting and excessive parts replacement thus minimizing running costs as well.

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