Digital Color Printing and the NexPress Approach

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Abstract

An overview of the emerging field of digital color production printing will be presented, emphasizing technology enablers for customer satisfaction. The architecture and technical enablers for the NexPress approach will be discussed.

Introduction

There are three major types of production color printing systems: conventional offset, direct imaging or computer to press, and digital printing. Conventional offset, where plates are made using optical exposure through a film master, has been the dominant technology for production color printing for the last 25-plus years. A recent version of conventional offset is where the plates are directly imaged from digital data, then mounted on the press. In digital imaging (or computer-to-press), the plates are imaged from digital data directly on the press. A dominant example of a press using direct imaging is the Heidelberg Quickmaster DI, introduced in Drupa 1995. In digital printing, digital data are transformed into printed pages without using plates or masters. Technologies commonly used in digital printing are electrophotography and ink jet.

Industry Trends

The major industry using production printing equipment is commercial printing, with revenues estimated by CAP Ventures at around $126 Billion in 2002. Of this, conventional offset is estimated at $94 Billion. Of the remaining $32 Billion, direct imaging is estimated at $2.7 Billion, and digital color imaging at $19B. The balance is served by digital black-and-white imaging. Digital color imaging is the fastest growing segment of this industry, growing at more than 20% per year. The reasons for this high growth rate are the new products and services digital color imaging can provide. Firstly, digital printing allows short runs (less than 500) for color and quick turn-around. The turn-around time for jobs can be shorter than 24 hours, as opposed to weeks for traditional offset color printing. Thus, digital printing allows printing on-demand, where you can print what you need, when you need it, reducing obsolescence and waste. Secondly, since no master is used in digital printing, each print in a production run can be different, allowing versioning (targeting lots by, for example, demographics or zip-code), customization (uniquely assembling static pages for each individual with annotations), and fully variable printing, allowing true one-to-one database publishing.

For static printing, digital color printing is best at run lengths of less than 500, and produces image quality approaching offset lithography. The ranges of run-length possible for variable data printing is much larger, as this application cannot be served by offset lithography.

What print-shop owners like about digital color printing are
(1) The flexibility it offers for short-runs and variable data,
(2) The ease of use compared to offset presses, and
(3) The document orientation it allows.

However, print-shop owners also note the following improvement opportunities for digital color printing:
(1) Reliability and uptime
(2) Print quality and consistency, and
(3) Workflow ease.

NexPress 2100 Architecture & Design

The architecture and design of the NexPress 2100 press is intended to overcome the above limitations of digital color printing. The print engine architecture resembles very much that of a lithographic press, with one heavy-duty printing module for each of the colors. Within a printing module, a 600dpi, 8-bit LED array exposes a charged imaging cylinder. The photo-active element of the imaging cylinder is an organic photoconductor. After exposure, the latent image is developed in a toning station with rotating magnets, using a two-component developer with dry ink. The toned image is transferred to a blanket cylinder and then to the receiver, using electrostatic transfer at both nips. The blanket cylinder insulates the imaging cylinder from the being scratched by paper roughness or edges, and from paper debris related failures. In addition, the blanket is compliant, which improves the robustness of transfer to a wide variety of receivers, including rough receivers. The receiver starts at one of the three input trays, and immediately travels past a sensor that checks for double sheets. From here, the receiver moves through a paper

conditioner, which removes moisture from the paper, thus pre-shrinking it to ensure good front-to-back registration. A bypass route is provided, so that transparencies and other receivers that do not need the paper conditioner can be diverted. The receiver is then placed on a transport web, and passes through the four imaging modules, where it picks up the four separation images in register. The image is fused using heat and pressure. Robust design of the fuser ensures no productivity loss for coated and uncoated papers in the specified range of weights, from 80gsm to 300gsm.

For duplex printing, the receiver is guided to the duplex paper path underneath the imaging modules after the first side is printed. Front-to-back registration is ensured by using the "Same Edge Perfector" (SEP) technology, where pages are flipped on the long edge, so that the same edge of the receiver is used for registering the front and the back side. Robustness of the paper path is ensured by minimal start-stops or direction changes of the receiver. After printing, the job is output to a tray that sits on a rollaway cart, so that large jobs can be easily moved to a binding or packaging station. Pages can also be sent to a proofing tray.

One design principle used in the NexPress 2100 for maximum uptime is the use of "Operator Replacable Components" (ORC's) for the components that fail most often. These can be replaced easily by the operator in minutes, thereby eliminating the need for service calls for these failures.

The brains behind the NexPress 2100 is the NexStation™, a multi-functional digital front-end that serves as a complete worflow solution, houses the diagnostics system and provides press management. It supports 100% variable-data printing at full speed, employing Adobe® Extreme open architecture, and does not convert submitted files to proprietary formats. This architecture is built around universally accepted PDF and Postscript® file formats. PDF workflow enables seamless, automated page or fully collated printed-piece workflow. The processing architecture, based on an NT-based platform, is scalable to meet the changing needs of the customer. Job-ticket-based job submission, imposition and collation, together with in-RIP processing of OPI, color management, trapping, compression and variable-data integration provide maximum productivity.

The NexPress 2100 has a simplex speed of 2100 A3 pages per hour, or 4200 A4 pages per hour. The duplex speed is half of the simplex speed. This makes it the fastest cut-sheet color digital press in the market.

Extensive testing of the NexPress 2100 within NexPress Laboratories and in customer locations confirm the value proposition stated earlier in this paper: design of a color digital press with high reliability and uptime, print quality and consistency, and workflow ease.

Biography

Arun Chowdry received the B. Tech degree in Electronics from the Indian Institute of Technology, Kharagpur, India, and the PhD degree in Electrical Engineering from The Johns Hopkins University. From 1974 to 1998, he was at Eastman Kodak, working on various aspects of electrophotography and its applications. He has been at NexPress Solutions LLC, a joint venture between Eastman Kodak and Heidelberg, since its formation in 1998. He is currently Chief Technical Officer and Vice President, NexPress Solutions LLC. Dr. Chowdry is a member of IS&T.