

# Photofinishing in the Digital Age

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## Abstract

The photographic industry is in an inevitable transition to digital technology, driven by the widespread use of digital photography and the Internet. The revolution in digital photography will bring many benefits to consumers and change the way they capture, store, archive, share and print their images. Using these new capabilities, customers will demand a variety of products and services which are not offered today. Photofinishers will, in turn, need to meet new market demands by developing new business models and solutions. However, in order to be effective, these solutions will also need to support high volumes and scale in capacity to meet evolving production needs.

This article explores the HP vision of photofinishing in the digital age. Topics include new HP solutions and how, by creating a new consumer digital experience, digital photography combined with high volume digital photofinishing will take off and create important new business opportunities.

## Introduction

Ever since Henry Fox Talbot suggested in 1852 that gauze could be used to break up pictures into dots, photography has solved problems for the printing industry. Two years later, photography began to transform the production of wood engraved illustrations for magazines and newspapers. Photo-engraving, powderless etching and color separation all had their roots in photography.

Now it is printing's turn to solve the biggest problem facing the photographic industry: how to enable cost-effective printing of digital photos, while providing the consumer the digital experience.

## The Digital Photofinishing Revolution

One important lesson we learn from the past is that whatever *can* become digital – *will* become digital. Photofinishing is no exception.

There are strong driving forces, which trigger the transition of photofinishing to digital:

- Accelerated growth of digital camera adoption.
- Increasing popularity of Internet-based photo sharing communities and new high-value digital products and services, which increase the motivation of either capturing the photos digitally or scanning (digitizing) analog films.

- Growth of broadband communications infrastructure and performance, which will enable the rapid transfer of large digital files over the Internet.
- Advanced digital printing solutions, which provide high speed and quality with a low cost per print.
- Higher revenue and profit opportunities for photofinishers who embrace digital technology, from new high-value products and services they can offer consumers.

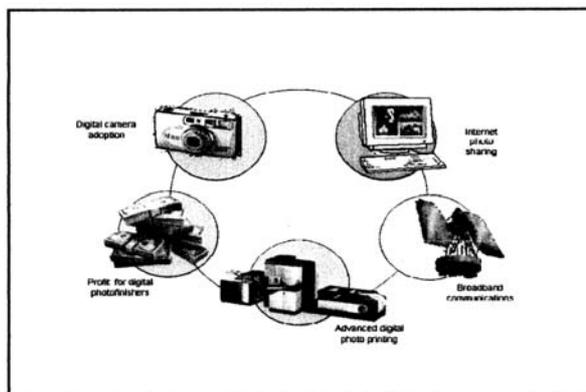


Figure 1. Driving Forces of Transition to Digital

Once consumers demand digital images, the fulfillment – or printing - of these images will become digital too.

HP recently introduced a new high-throughput digital printer, the hp indigo photo 9100. The prints produced by this printer have a quality which matches Silver photographic (AgX) prints and even surpasses some of their quality and durability attributes. The hp indigo photo 9100 operates is targeted at high-volume central labs and wholesalers. It produces rolls of various widths in all standard formats at a speed equivalent to over 12,000 4"x6" prints per hour.

## The HP Indigo Photo Print Technology

The hp indigo photo family of digital printers, based on HP's ElectroInk process, offers a unique combination of high quality prints and high speed.

We will now describe the ElectroInk-based printing process, and its unique features.

## The Printing and Finishing Process

The hp Indigo print engine performs the following operations sequentially:

1. Exposure of the electrostatically-charged electro-photographic Photo Imaging Plate (PIP), which is mounted on the imaging cylinder, by a scanned array of laser diodes. These lasers are controlled by the raster image processor that converts instructions from a digital file into 'on/off' instructions for the lasers.
2. Inking of the PIP by a Binaric Ink Development (BID) inking station.
3. Removal of excess liquids and ink particles from the non-image areas on the PIP surface.
4. Removal and re-circulation of the excess carrier liquid from the image and non-image areas of the PIP surface.
5. Transfer of the ink image to the blanket cylinder.
6. Heating of the ink image on the blanket.
7. The above operations are repeated six times – once for each color separation in the image - while the blanket collates all the images in perfect register.
8. Transfer of the heated ink image to the substrate in a one-shot operation.
9. Applying an ultra-gloss clear lamination layer on top of the printed image.
10. Finishing the printed image by applying matte texture (if matte order is required) and slitting to the final roll/s width/s.
11. The roll is loaded onto a high-speed hp xy cutter that performs high-speed paper cutting and order stacking of the 9100 prints, regardless of image size, orientation or position of the prints on the paper.

**The HP Indigo Photo 9100 Core Technology**

The three core technologies of Indigo's ElectroInk-based process are:

- ElectroInk
- Thermal offset transfer technology
- Color Switching

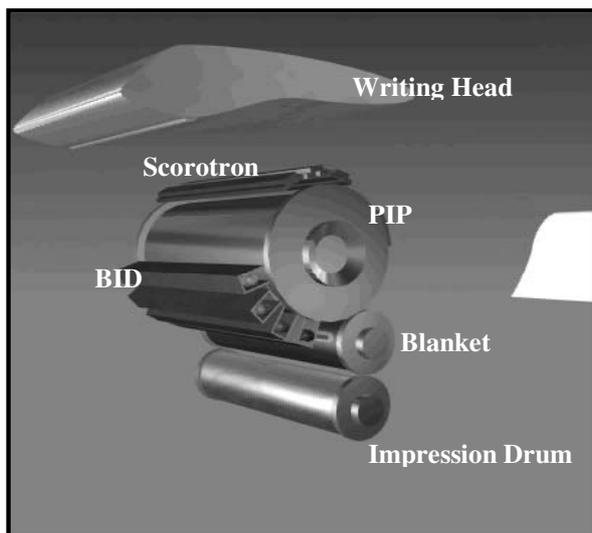


Figure 2. Liquid Electrophotography

**ElectroInk**

All hp indigo photo printers use ElectroInk, HP's unique liquid ink. ElectroInk contains electrically-charged ink particles, in an oil carrier. Unlike powder toner xerography, ElectroInk enables very small particle size, below 1 micron. This small particle size enables high resolution, high gloss, sharp image edges, and very thin image layers.

**Thermal Offset**

The hp indigo print process uses a blanket heated to approximately 100 °C. This causes the specially-shaped pigment-carrying ElectroInk particles to melt and blend into a uniform film. The blanket heat is not high enough, nor is the dwell time long enough, to heat the substrate as it comes into contact with the blanket. When the heated ink contacts the cooler substrate, the ElectroInk immediately solidifies, strongly adhering to and transferring to the substrate. The print is effectively dry as soon as it leaves the blanket, eliminating any risk of ink 'set-off' marking other copies. Print lamination and other finishing processes can be performed immediately.

**Color Switching**

hp indigo photo printing technology enables printing of all color separations in a single station. After one color separation has been created, the next one (a different color) is created in the same station.

Single station printing has several advantages, including compactness, reduced hardware cost, and improved mechanical accuracy. This translates, for example, to virtually perfect registration.

**The HP Indigo Solutions for Photofinishers**

Solutions based on the hp indigo photo 9100 provide high added value to the photofinishing industry. Relative to competing high-throughput solutions based on silver-halide processes, the hp indigo photo 9100 offers:

- End-to end digital solution
- Variety of products
- Low cost per print
- High durability of prints
- Silver and chemical free process

Now we will elaborate on each of these added value features:

**End-to-End Digital Solution**

**Prints from Digital Source:** Images are captured by digital camera or scanned from hardcopy into a digital file. The images are then uploaded (via a kiosk at the retail store or via the Internet) to the retailer or online photofinisher web site. The consumer takes advantage of the *digital choice* provided to him through *preview & select*, thereby allowing him to choose which images he would like to print in which sizes. In addition to traditional prints, the consumer can also order from a wide variety of other printed output products. Images are then sent directly to the Digital Imaging Processing System for state-of-the-art image enhancement, including smoothing, sharpening, and contrast enhancement. The system also uses an intelligent image

layout algorithm to optimize paper consumption and minimize waste.

The output of the hp indigo photo 9100 system is a 12" wide laminated printed roll. This roll is loaded onto an hp XY cutter that performs high-speed paper cutting and order stacking of the 9100 prints, regardless of image size, orientation or position of the prints on the paper.



Figure 3. End-to-End Digital Solutions

**Reprints and Enlargements:** Negative-film-strips are sent to the central-lab and scanned through a digital reorder station. The reordered/enlarged digital images are then sent to the hp indigo photo 9100 for printing and cut with the hp xy cutter as described above.

**Prints from Color Negative Films:** Analog film rolls are sent to the central lab and scanned through a high-speed film scanner. The digital images are then sent directly to the hp indigo photo 9100 system or uploaded to the retailer or online photofinisher. In this scenario, the consumer again has the digital choice of *preview & select* and can choose which images he would like to be printed. In this application, high-volume 4"x6" images can be printed 3-across on the 12" paper web and then cut automatically into 4" strips onto a separate 3-roll rewinder.

**Variety of Products**

Digital capture and scanning devices, as well as the Internet, are now providing consumers with a whole new digital experience. As such, consumers are no longer limited to printing all of their images in a fixed-size format. To enable a broader digital choice, photofinishers will need to offer consumers the option of *preview & select*. Consumers need to be able to select the images they would like to print and the products they would like to create. Through digital, an order can now include a mixed-format photographic prints (such as 11 4x6" images, 4 5x7" images and 3 copies of the preferred image in 8x10" format), as well as other *photo-related products*, such as photo-albums, photo-calendars on specialty papers and hp memories discs. Memories discs are burned CDs, which can be played on standard DVD players and allow consumers to enjoy a slide show of their digital images and video-clips with their choice of

music track. All in the convenience of their living room. Photofinishers will need high-throughput production tools to produce such products cost-efficiently. This variety of high-value products and services will enable retailers and online photofinishers to differentiate their offerings to consumers. As such, hp's solution suite of products (e.g. hp indigo photo 9100, hp indigo press 3000, hp memories disc creator) and services are the perfect solution for the photofinishing industry.

**High Print Durability**

- **ElectroInk.** There are no chemical reactions in the ElectroInk process, which is entirely silver-free. The encapsulation of the pigment particles within the ElectroInk polymer resin protects the pigments from oxidation and relative humidity effects, thereby providing outstanding darkfastness longevity. Being pigment-based, the hp indigo photo 9100 prints have excellent lightfastness compared to most dye-based silver prints.
- **Base paper.** The images are printed on a multi-layer base paper that is back-sealed and humidity insensitive. It is also pen-writable.
- **Ultra-gloss clear layer.** A lamination layer protects the print and makes it resistant to abrasion. The prints are waterproof, and fingerprints are wipeable.

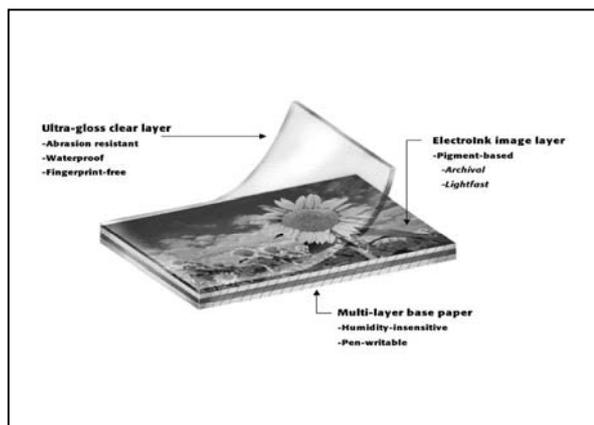


Figure 4. hp indigo photo 9100 high attributes

**Low Cost per Print**

The hp indigo photo 9100 solution enables photofinishers to produce high volumes of high quality prints in a lower total cost per print. The saving in the total cost per print (or total cost of ownership) is achieved by saving in some or all of the following cost elements:

- **Material costs:** Using non-AgX paper (without chemical emulsions, etc.), enables hp to offer a more competitive material cost to AgX relative costs.
- **Labor cost:** An end-to-end digital workflow enabled through the hp solution gives photofinishers a cost-effective path to providing consumers a rich, digital experience. Solution components such as the hp xy cutter and on-the-fly texture switching enable photofinishers to produce mixed-format orders and to switch between gloss and matte finishes without a

paper change, thereby eliminating significant labor costs and overheads.

- Paper waste costs: The hp indigo photo 9100 employs an intelligent image layout algorithm to optimize paper consumption and minimize paper waste
- Space/footprint costs: The hp indigo photo 9100 printer eliminates the need for a paper processor, chemical tanks and ancillary devices., thereby minimizing related footprint/space costs.
- Chemical handling costs: The hp indigo photo 9100 uses a chemical-free printing process, thereby eliminating special handling requirements for silver based chemicals.
- Solution buildup and design: As a leader in digital imaging and printing, as well as in IT infrastructure and services, hp provides photofinishers with design and integration of end-to-end solutions for streamlining workflows and designing for future capacity needs.

#### **Silver and Chemical- free Process**

The hp indigo photo 9100 printer prints ink on paper. This process doesn't use silver or chemical processing, thereby eliminating many of the

environmental issues (e.g. chemical disposal, silver recovery, etc), traditionally encountered with silver-based solutions.

#### **Conclusion**

Photofinishing is now experiencing the transition to digital. We believe that non-silver processes, such as hp's liquid electrophotography will play an important role in tomorrow's digital photofinishing market and will drive high-speed, high-quality and low-cost-of-ownership solutions for photofinishers.

#### **Biography**

**Yishai Amir** received his B.Sc. and M.Sc. degrees in Electronics Engineering from the Technion - Israeli Institute of Technology, and his MBA from Tel-Aviv University in Israel. Since 1995, he has held various management positions in Indigo, including Director of Industrial Printing Products and Vice President of Photofinishing. Currently, he is HP's Marketing Manager for Central Labs Solutions. e-mail: Yishai.amir@hp.com Phone:+972-8-9381345. Fax: +972-8-9381339.