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Digital Printing

By Steve Noble and Marci Kinter

Introduction

The use of digital printing applications and integration of these applications into traditional print markets is rapidly expanding. Digital, unlike the traditional print processes, is a direct to output device process thus it does not employ a "pre-press" operation as would be associated with traditional commercial printing technologies, i.e., screen or lithographic printing. Instead, the image is created on the computer and transmitted directly to the output device.

The other distinct difference between the use of digital applications and traditional print is the relationship between the equipment and ink delivery system. Output devices such as inkjet printers, are developed with a specific ink and ink delivery system in place which is unique to each digital press. The type of equipment chosen is also driven by the product produced. These factors work to limit product substitution options for most systems.

Equipment options for digital printing are shaped by substrates and the inks that are used. Liquid ink-jet, wet/dry toner systems, solid ink-jet, thermal-transfer and photographic devices are the primary technologies used today. Common digital products include items such as bus wraps, building wraps, in-store displays, reproduction of photographic images, as well as fine art prints to list just a few. Determining when to use digital printing instead of a traditional printing process is highly dependent on the number of prints needed as well as the production speed of the output device.

Ink delivery roll-based digital output devices use a substrate delivered on a roll (as in traditional web printing) and printed after it is fed into the machine. Roll-based devices allow you to print on flexible surfaces including paper, vinyl, fabrics and thin plastics. It is also possible to print on various types of papers that are used in thermal image transfer processes such as dye sublimation.

Flatbed devices allow direct printing on rigid substrates, which can range from the common, such as poster board, foam board or rigid plastics; to the uncommon, including metal, glass, wood and other substrates. Printing directly on these rigid substrates may eliminate the mounting processes required of many images printed on roll-based units.

<u>Liquid Inkjet Technology</u>

There are two primary types of Inkjet technology that are used to produce an image. The first is *drop-on-demand.* Using this method the heads form ink droplets by applying pressure to the nozzle chamber. This action forces the drop of ink out of the nozzle onto the media or print surface as is needed to create the image. There are two types of drop-on-demand ink jet heads, piezo and thermal.

The second type of Inkjet technology is c*ontinuous.* Using this method, the ink is continuously under pressure forming a stream of droplets. The droplets required to form the image are channeled to the media, while the unused droplets are recycled.

Highly important to successful inkjet digital imaging is the print head, which literally "jets" the ink onto the substrate. Piezo heads release ink by applying pressure to the head's nozzle chamber, forcing a drop of ink onto the print surface as needed to create the image. With thermal ink heads, a heating element creates a gas bubble in the nozzle chamber; the bubble yields the pressure needed to force a droplet of ink onto the media.

Inkjet printer inks can be aqueous, solvent-based, or UV curable. The print head dictates the ink type that will be used. Aqueous inks are common but production speeds are limited because of the rate of drying for the inks. For high production speed applications, some printers choose to switch to solvent-based inks, which dry through rapid evaporation.

UV inkjet units use ultraviolet light to cure the ink. While many devices applying UV inks are flatbed devices, designed for rigid substrates, it is important to understand that UV inkjet inks can be used only on devices that are capable of curing UV ink. Without the proper UV light, the ink will not cure and will remain in a wet-state for an indefinite period of time.

Highly important to successful digital imaging is the print head. The two most common types of print heads are piezo and thermal. Piezo heads release ink by applying pressure to the head's nozzle chamber, forcing a drop of ink onto the print surface as needed to create the image. With thermal ink heads, a heating element creates a gas bubble in the nozzle chamber; the bubble yields the pressure needed to force a droplet of ink onto the media.

As in all types of printing, the ink is distinctly important to the creation of a print that has reliable and accurate color, durability and longevity. In today's digital inkjet markets, two ink delivery systems have gained prominence and represent nearly 100 percent of inkjet graphics created worldwide.

Due to issues associated with cost and technology, most entry-level wide-format digital printers use either dye or pigment inks. Dye-based and pigment-based ink systems are both aqueous systems, meaning they are water based. Aqueous ink systems are used on indoor signage and other indoor types of prints that require protected (laminated) usage. For outdoor uses, or to increase the durability of the print, the print must be laminated.

As mentioned earlier, UV inks require specific output devices in order to be cured. Once cured, the finished print offers high durability, even outdoors, without the need for

lamination or other steps necessary to protect the print. Currently, UV ink is the ink system that allows for printing on the widest variety of substrates, including products intended for outdoor use.

Solvent-based ink also offers higher durability and is generally less expensive than UV. However, when purchasing a digital printer using a solvent-based ink system, it is important to consider that the use of solvents could lead to significant air emissions, triggering the need to comply with air quality regulations. Without proper ventilation, the fumes from these systems may also be a concern for worker safety and health.

Digital Printing Process

Capturing an Image

Many graphic projects begin with "analog" images such as 35mm slides, transparencies or reflective art. To produce a "digital" image, these elements must be converted to digital files that are then manipulated on a computer system with digital imaging software. This step is usually accomplished by scanning the analog image. The scanner measures reflected or transmitted light from the analog image, assigning numerical values to the colors or tones in the image to create a digital copy. With the image "translated" into a series of numbers, the information can be stored on a computer hard disk or other electronic media such as a removable drive, or CD/DVD.

The graphics produced through the use of these applications can be divided into two primary groups or "graphic types," object oriented and bit-mapped. At the completion of the design and layout phase, all elements have been assembled into one file. This file may include both object-oriented and bit-mapped graphics saved in various file formats. The file is then ready to be managed based on the requirements of the selected output device and can now be reproduced.

Producing the Image

Once the image has been captured, it is then transferred to the printing station. The computer directs the speed of the head technology as well as the machine to produce the image. As with all printing processes, digital prints dots, which in turn trick your eye into seeing a continuous image. Digital technology prints in four color process.

Finishing the Image

Lamination is often used to "finish" digital prints. Using special media, inks and/or laminates, images can be produced which withstand indoor humidity, sunlight and most outdoor weather conditions. Also, adhesives are available which provide the opportunity to apply digital images to various surfaces.

If you are looking for additional information on the digital printing technologies and Health, Safety and Environmental issues visit the Digital Printing and Imaging Association's website at www.sgia.org/govt or the Photo Marketing Association International website at www.pmai.org/environ.

Specific questions about technology, equipment, vendors can be posted on the PrinTech listserv. To subscribe, simply follow the instructions on the PNEAC web site at www.pneac.org.

For more information or to contact someone from PNEAC please visit www.pneac.org and post your request using "Ask PNEAC".

Authors:
Steve Noble
Manager for Environmental Activities
Photo Marketing Association International
snoble@pmai.org
517.788.8100

Marci Kinter
Vice President of Government Affairs
Specialty Graphic Imaging Association
marcik@sgia.org
703.385.1335

Other PNEAC Contacts:
Gary Miller
Waste Management and Research Center
gmiller@wmrc.uiuc.edu
217.333.8940

Gary Jones
Printing Industries of America / Graphic Arts Technical Foundation
garyjgatf@aol.com
412.741.6860

Wayne Pferdehirt
Solid & Hazardous Waste Education Center
pferdehi@epd.engr.wisc.edu
608.265.2361

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