Introduction

As one of the key measures for ink jet print quality, it is important to understand how print resolution helps define the quality of the output in terms of dpi, effective dpi and greyscale. Over the past few years, digital ink jet has continued to push the boundaries of innovation with a steady stream of technological advances that has given ink jet in many cases better levels of performance, cost effectiveness and efficiency than other digital technologies. As a result, high speed piezo drop on demand ink jet has become the most significant front-runner in the digital print sector in recent years, with several companies launching digital ink jet presses offering highly efficient, high quality output.

Fundamentally, the basis of the print quality and productivity achieved from these new ink jet printers is largely determined by the type of print head that is integrated within the press and with that has emerged a new language to help define the quality of output. Typically, the most common methods of defining output quality relies on dots per inch (dpi), effective dpi and greyscale.

Dots Per Inch (DPI)

Print resolution, although not the only measure, remains one of the key methods of measuring print quality. For those more familiar with flexographic technology, this is commonly quoted in the form of lines per inch. In contrast, with ink jet technology, whether you are measuring print resolution for desktop devices or full scale commercial UV-curable presses, it tends to be quoted in Dots Per Inch or dpi.

Dpi defines the density of dots that can be printed across one inch to form printed text or graphics. The more dots printed per inch, the higher the print resolution of the image.
Greyscale

Closely related to dpi in terms of impacting and measuring print quality is the range of droplet size that is used in the printing process. This is often referred to as greyscale capability.

Today, all the latest ink jet print heads support greyscales. However, generally lower resolution (lower dpi) print heads will be printing more greyscales, with on average larger drops being used in order to create the required ink coverage.

Vertical v Horizontal

Print resolution can also be different in the vertical and horizontal axes of the image. For an ink jet press, the dpi running perpendicular to the travel direction of the printed substrate is fixed. In this case, the dpi is defined by the number of nozzles per inch within the print heads printing the image.

In contrast, when reviewing the dpi of the substrate travel direction, this is determined by a number of different factors including the jetting frequency of the print head, the number of greyscales being used as well as operational speed.

In instances where there are fewer greyscales being printed higher running speeds are then possible but print density and the consequent available colour gamut will be reduced. In addition, if you halve the print resolution in the material travel direction, it can be possible to double the speed recognising the print head has a defined jetting frequency. For this reason in some cases, dpi is defined in two axes for example as 600x300dpi. This means it prints at 600dpi in one axis and 300dpi in the other axis.
Print Head Technology

There are currently two dominant ink jet print head technologies being used within digital label presses, the Xaar 1001 and the Kyocera KJ4A.

The Xaar 1001 print head is used by most ink jet label press manufacturers. This print head has a native print resolution of 360dpi, typically operating at 25m/min with 360x360dpi and eight greyscales. Xaar has combined the greyscale capability with print resolution and quote “Effective” or “Apparent” print resolution. This is broadly calculated as the square root of the number of greyscales multiplied by the native dpi. Therefore, although the print head doesn’t actually produce 1,000 drops per inch, Xaar claim an “Effective” resolution of over 1000dpi. The print head has eight greyscales (a blank droplet where no ink is ejected is counted as one greyscale) with drop sizes between 6pl and 42pl (pico litre).

The Kyocera KJ4A print head, used by Domino, has a native resolution of 600dpi, operating at 50m/min with 600x600dpi and four greyscales (five including the “no drop”). This would imply an ‘Effective’ resolution of 1,340dpi. Within one square inch, therefore, the Kyocera print head can deliver up to 360,000 individual drops compared to just 129,600 typically larger drops from the Xaar 1001 print head.

The Kyocera KJ4A print head has four greyscales with drop sizes of between 6pl and 14pl. With more droplets available for printing, the average drop size is much smaller. As a result, it is justifiably claimed that fewer greyscales are required given the higher native resolution available.

Summary

There are of course many other factors that will determine the ultimate quality of the printed output including registration control, print density and ink flow for example. But ultimately, it is the underlying technology and capabilities of the print head that will determine print resolution and the level of detail that can be achieved in the printed image.

Generally speaking, the higher the native resolution of a print head, the greater the detail that can be reflected in the image, although it is possible for lower native resolution print heads to partly compensate for this through offering more greyscales.

When reviewing print quality and considering what print resolution is best, it is highly recommended to print a range of samples of images, text and graphics onto a number of different substrates to provide a full picture of what can be achieved and whether it matches the print quality required.

Digital ink jet lies at the heart of Domino’s 35 year history, having established a global reputation for the development and manufacture of digital ink jet printing technologies for a wide range of applications. To find out more about measuring ink jet print resolution or to discuss the latest ink jet technologies visit www.domino-printing.com or contact: Pierre Despres on Tel: +44 (0) 1954 782551 or email: pierre.despres@domino-printing.com