

Inkjet Resolution

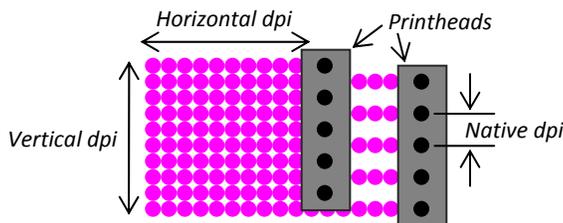
Inkjet manufacturers use many different terms when specifying image resolution. Industry standard definitions do not exist so terms such as native, apparent and addressable can be misleading or inconsistently used. This paper will provide common definitions for each of these terms and explain what they mean relative to printer capability and the impact on image quality.

An inkjet printer generates images by laying down rows of dots. The size of the dot and the spacing between the dots make up the resolution. Higher resolution improves detail and generally produces better image quality, but many other factors can impact quality like dot gain, shape and placement. A close look at how the printheads lays down the rows of dots will provide a good understanding of resolution and inkjet technology.

Vertical, Horizontal and Native Resolution

As the carriage travels back and forth across the page, the printheads jet ink. The dot spacing in the direction of carriage travel is typically referred to as horizontal dpi. The horizontal dpi is a function of the carriage speed in inches per second and the firing frequency of the jets.

$$dpi_{Horizontal} = frequency (hz) / carriage speed (ips)$$

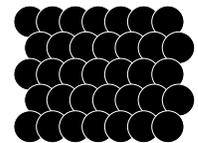


Vertical resolution is the dot spacing in the direction of the media path and is dependent on the native resolution of the printhead. Native resolution is most commonly used to describe the space between the nozzles within a printhead. The nozzle spacing is converted to dots per inch to find the native resolution of the printhead. For example: the print heads in the VUTEK GS series have a nozzle spacing of .00555" which equals a native resolution of 180 dpi (1/.00555 = 180). By aligning the printheads to interlace rows and printing over multiple passes, the vertical resolution can be increased in multiples of the native resolution. The result is called vertical resolution.

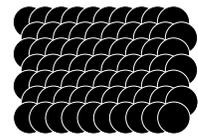
True and Addressable Resolution

One definition of true resolution is the number of dots that can be lined up in an inch without any overlap. The magenta dots in the figure above are an example of true resolution. However this is not practical because of the white space between dots. Until technology is developed to fire square drops, there

must be some overlap to achieve optimal color density. Additional overlap is also required to account for error in drop placement. More accurate drop placement will minimize the need for overlap resulting in less ink usage and the ability to print even fine text. The practical definition of true dpi used by VUTEK is the number of dots that must be lined up to eliminate white space and account for dot placement error. Some inkjet printers have the capability to accurately place dots with closer spacing and more overlap. This is called addressable resolution which will achieve a higher quality image and greater color density but uses more ink due to the excessive overlap. For printers limited to a single drop size, this is an effective way to improve image quality and extend the range of possible applications although the use of true resolution from a smaller drop is ideal.



True dpi



Addressable dpi

Apparent Resolution

Image quality is further improved with light color inks by reducing graininess and is most noticeable in images containing smooth gradients, skin tones and pastels. An 8 color system has twice as many gray levels as a 4 color system; therefore a true 540 dpi image in 8 colors will look the same to the human eye as a 4 color image at 1080 dpi. Since the images would appear the same, it is said that a 540 dpi image printed in 8 colors has an apparent resolution of 1080 dpi. One common misconception is that 6 and 8 color systems have an expanded gamut. This is not true since the pigments in the light and dark inks are the same. However, light colors do improve color reproduction, especially in the mid-tones which gives the appearance of a wider gamut.

Conclusion

In an effort to communicate image quality, manufacturers use many terms to describe printer resolution. Understanding how resolution is determined eliminates confusion and provides insight into printer design and operation.