



The Optical Scanning Resolution Myth for Wide format scanners

Does high optical resolution equal higher quality scans?

Optical scanning resolution has been an industry indicator of quality in the digital imaging industry for many years and is quite frequently used to compare the quality in various large-format scanners. With advancements in scanning technology, scanner manufacturers have built scanners with increasingly higher optical resolution and use these specifications aggressively as a competitive weapon. As has been pointed out in reports and other articles, normal scanner users still scan documents using a scanning resolution range of 200- to 400 dpi. As a result, we must ask ourselves what benefits do these customers receive when they come across new scanners on the market that have considerably higher optical resolutions in the typical range of 500- to 600 dpi?

Also, is higher optical resolution a measure of higher scanning quality? And, while most scanning is still performed in the narrow resolution range of 200- to 400 dpi, how does this affect the scanning quality for the consumer?

Let's use the three leading scanner vendors as an example: Context, Colortrac and Graphtec. Note that Context scanners are also sold under different brand names, such as GTCO Calcomp, Vidar and Océ, therefore results from Context scanners also apply to other Context brand names.

Resolutions for Scanning

A white paper from Open Archive ("S.E.A. Your Paper," written by David J. Wilson) recommends the following scanning resolutions:

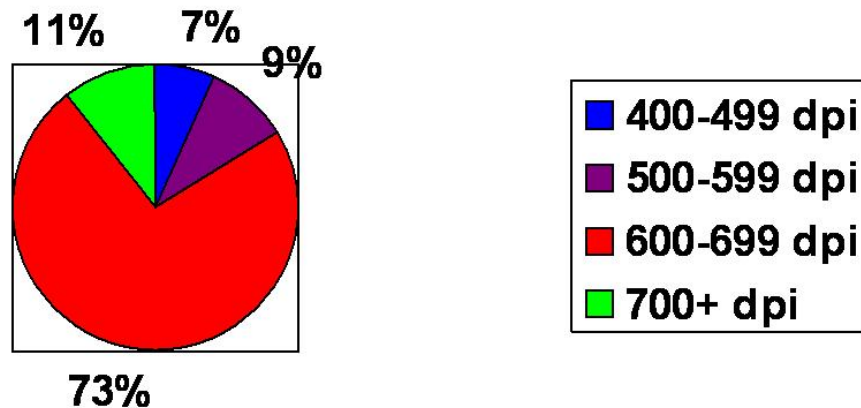
| Application | Optical Resolution Requirements |
|-------------------------|--|
| Archival | 200 dpi |
| Raster Editing | 200- to 300 dpi |
| Raster-to-Vector | 200- to 500 dpi |
| Scan to Print | 200 dpi |

A similar paper from Autodesk, "Scanned Drawing Cleanup with Autodesk Raster Design," recommends 200- to 400 dpi for black and white scanning and between 75- to 600 dpi for color scanning.

A quick survey of available scanner models from October 2008 reveal that 7% of scanners have an optical resolution between 400- to 499 dpi, 9% between 500-599 dpi and 73% between 600-699 dpi and 11% have 600 dpi or higher optical resolution:



Scanners Group by Optical Resolution



The Optical Resolution Myth

First of all, let's rid ourselves of the myth that optical resolution is equal to scanning quality. Optical resolution is a physical characteristic of a scanner system and it describes the ability of a system to distinguish, detect and/or record physical details. However, there is more to the story than just the sensor in a scanner system, so when considering scanning quality we also have to consider the optical system, mirrors, CCDs, glass plate and illumination systems of the scanner. Furthermore, when scanning is not performed at the highest optical resolution, we must consider how the scanner manufacturers perform the actual scaling to a selected scanning resolution. All these factors introduce errors and reduce scanning quality; therefore optical resolutions are an **indicator** of scan quality not a measure of it.

The use of line pairs per mm (lp/mm) is a well-recognized method to measure spatial resolution. With the lp/mm measure, all quality factors, such as lenses, optical system, scaling and image processing, are taken into account, making the use of lp/mm a better way to measure scanning quality.

We use the lp/mm test with scanning resolution in the range from 100- to 600 dpi. In particular, we are interested in measuring how many line pairs per millimeter



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each scanner can resolve in scanning resolutions between 200 dpi and 400 dpi – the most used scanning resolutions in the industry.

LPPMM Comparison at Optical Resolution

Using lp/mm as a measure of optical resolution, you can get a more accurate picture of how scanners compare.

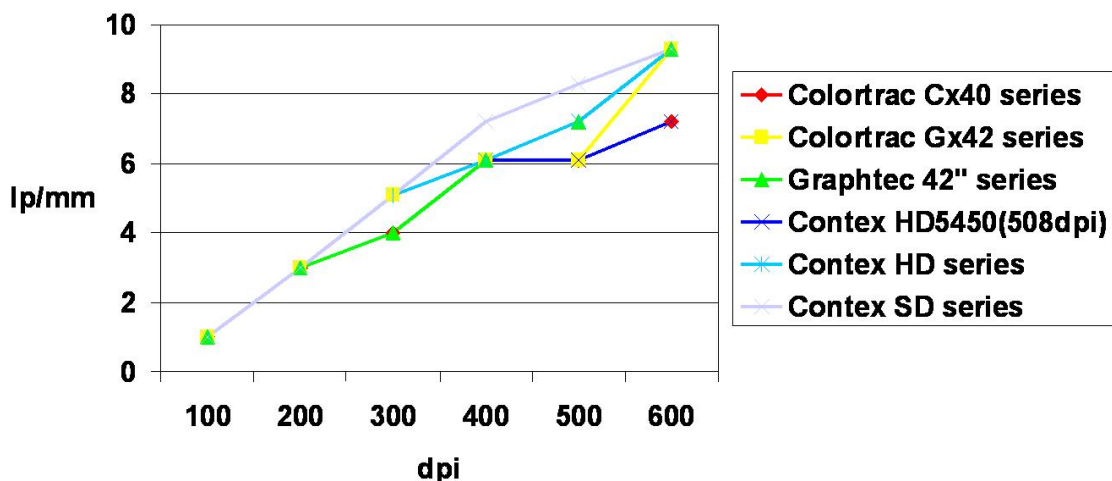
| Scanner models: | Optical resolution | Lp/mm |
|------------------------|--------------------|---------|
| Colortrac – all models | 600dpi | 7.2-9.3 |
| Graphtec – all models | 600dpi | 9.3 |
| Contex HD5450 scanner | 508dpi | 7.2 |
| Contex HD series | 600dpi | 9.3 |
| Contex SD series | 1,200dpi | 14.3 |

The lp/mm results show that a 600 dpi optical resolution does deliver a higher result, with the exception of the Colortrac Cx40 that falls behind the others.

LPPMM at Scanning Resolution from 100- to 600 dpi

Using the information for scanning at the optical resolution is not representative of how scanners are used. The majority of all scans are conducted between 200- to 400 dpi and in order to make the comparison valid, the scans must be performed at the same resolution. The result indicates that at 200-400 dpi, a higher than 400 dpi optical resolution scanner does not perform better.

Lp/mm @ 100-600dpi





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Note: Between 200- to 400 dpi all scanners follows approximately the same line.

If you plan to scan at up to 400 dpi, all of the scanners with a 400 or higher optical resolution delivers the same quality. If you plan to scan at a maximum of 500 dpi, you can see that all scanners with an optical resolution of 500 dpi or higher deliver the same results.

Stanley Adams Group Recommend

There are no significant benefits of using a higher optical resolution scanner for a mainstream scanning application. In the critical scanning range of 200- to 400 dpi, all scanners that exceed 400 dpi optical resolutions show identical results. The lesson here is that consumers who are looking to buy a scanner should not put too much emphasis on the optical resolution of the different models because all models deliver comparable results. Users should determine their maximum scanning resolution needs then choose a scanner with an optical resolution that is the same or higher, but should also consider the scanner's other features that meet their needs, as well.

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About the Author

Henrik Vestermark is an independent consultant and professional who has worked in the wide-format scanner and printer industry since 1988. His expertise includes all aspects of the wide-format digital capture market, and particularly focuses on the wide-format scanner industry.