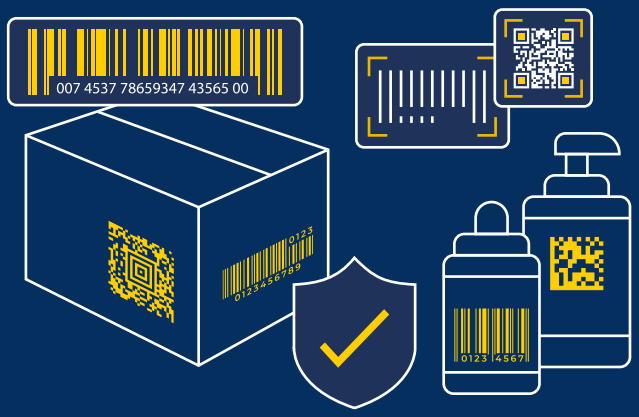
Schlafender Hase®

Barcode Grading in a Digital World



Barcodes, whether we consciously notice them or not, are ubiquitous and an intrinsic part of our lives. They are used in applications as far-ranging as encoding and scanning prices in retail, monitoring warehouse inventories, and managing complex logistics in global supply chains. With the move towards e-labeling in the Life Sciences industry, high-quality barcodes are an imperative. Furthermore, the FDA requires medical device manufacturers to include a Unique Device Identifier (UDI) barcode on each device. Barcodes are also playing an increasingly important role in ensuring the integrity of medical products by preventing counterfeits. In the 21st century, you could be forgiven for thinking it is raining barcodes.

Barcodes must be readable, which is why standards and parameters have been set up for their grading in order to verify their readability. As you will see, there is much more to grading digital barcodes than meets the eye.

Printed barcodes (for the purposes of this article, “barcode” refers to both 1D and 2D symbols) have long been graded against defined parameters. The earliest and most rudimentary of these was size. But size alone told us very little about other important characteristics affecting barcode readability. More useful standards were needed and therefore developed over time by the American National Standards Institute (better known as ANSI), by the International Organisation for Standardization (ISO) and by other global organisations such as GS1.

ISO created two international standards for barcode quality: ISO/IEC 15415 and ISO/IEC 15416. These were further expanded by GS1 to produce a set of general specifications that focus on healthcare and pharmaceutical industry codes (and some other applications), providing guidance for industry. It went beyond the original standards to provide comprehensive specifications and guidelines for implementation using ISO source material. As GS1 explains on its website, it all began with a barcode on a packet of Wrigley’s chewing gum, which was the world’s first barcoded product back in 1974. Today, the activities of GS1 go beyond barcodes to include, for example, standards for RFID chips.

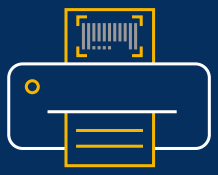
Where is the Challenge?

It's all about physical print parameters in a digital preprint world.

Barcode grading works by scanning the code printed on sheet using a defined light source (often a physical scanning device with an infra-red laser) pre-set with defined apertures and wavelengths. The grading process is intended to replicate real-life conditions for scanning once the packaging components are printed and distributed. The resulting grades are expressed as either A-F or 4-0, or, for some parameters, Pass/Fail.

This tried-and-tested method is currently the best way to predict the future performance of a *printed* code. Here, however, we must stress "***printed***", because our creation and workflow processes today are highly digitized. This is where we find a disconnect between our workflows (digital) and parameters for grading barcodes (generally related to print).

Poor contrast due to reduced ink density or a substrate that is too dark



Voids or marks in the codes due to debris or printing plate problems

Ink bleed due to poor preprint preparation, and/or using substrates

The perfect barcode is imperfect

Using physical print parameters to grade a digital barcode in a digital artwork document is therefore akin to trying to measure rainfall using a temperature gauge. Many of the parameters are simply unsuited to determining what we want to know.

The scan reflectance profile (SRP) is a case in point. According to ISO 15416 scan reflectance profile, which depicts reflectance (i.e. how well it reflects radiant energy, in this case light) across a linear 1D barcode, consists of nine parameters. Some of these are graded on a pass/fail basis, and others are graded from A to F (F being the lowest). Physical issues with ink, substrate, laminate, printing conditions, printing plate quality and so forth, can be reasons for a low grade or failure. The problem is that with the exception of "Decode", all parameters that make up the scan reflectance profile are physical, ink-on-substrate parameters that require a specifically defined light source and aperture. No software can replicate this, and therefore a digital barcode will obviously never fail due to these physical issues. But that doesn't make it perfect.

As a result, the ANSI/ISO A-F/4-0 grading system is rendered at best misleading, at worst, meaningless in many points for grading digital barcodes in our digital environment. Any attempt to derive an A-F/4-0 grade on this basis from digital components introduces risk, because it makes assumptions and guesses using complete unknowns: factors such as equipment quality, performance, printing material characteristics and environmental circumstances.

Where does this leave us?

For truly accurate results in a digital, preprint environment, you should choose barcode verification software that measures only those factors within your control when the digital barcode is being created. For example, quiet zones are within your control, and we can verify these accurately in a digital file. Magnification factor is another. It is these and other capabilities stemming from barcode verification software that make it so efficient and useful for verifying digital files, before physical print factors come into play. After all, we have far less control over print substrate characteristics. And yet, an unfortunate fact of life is that a brand owner must always bear the risk, even if a quality failure in printing have led to barcode illegibility.

Furthermore, for truly accurate results, the solution should use grading criteria and parameters adopted from both the globally recognized ISO and GS1 standards and specifications – but only those applicable to digital symbols. Crossovers do exist – such as in the "Decode" parameter (i.e. the readability in regard to bar sequence and spacing) – but again, no criteria should ever be applied (or claim to have been effectively applied) for non-digital factors beyond your control, such as grading ink on substrate.

Finally, the solution you choose should provide only the information you need that can be verified 100%. In printed files, physical scanners can be used to validate the barcode. But how do we validate a digital file? Here we have the capability to validate beyond the minimum requirements set by grading according to the ANSI/ISO A-F/4-0 grading system. Only a Pass/Fail grading provides 100% verification. When digitally verifying digital documents, we live in a binary world without grey areas of readability and averages: either a barcode is readable, or it is not.

And lastly, we would like to sound a warning. If a provider does claim to be able to verify print parameters using a digital barcode verification solution, it is worth asking questions such as: How does the software know the substrate characteristics? How are opacity, reflectivity and thickness of the laminate determined and accounted for? And how has the edge contrast on the printed symbol been measured?

Barcodes have been a boon for efficiency across virtually all industries. In regulated industries such as Life Sciences, we are today experiencing a particularly rapid growth in their use. This is coupled with the growth of highly digitized, integrated workflows. The most effective solutions are therefore those that not only have powerful capabilities to verify digital barcodes, but that also are capable of being integrated into complete existing workflows.

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Contact us

SCHLAFENDER HASE GMBH

St Martin Tower,
Franklinstr. 61–63,
60486 Frankfurt am Main,
Germany

Phone: +49 69 244 481 0

Email: TVT@sh-p.com

SCHLAFENDER HASE INC.

245 First Street Suite 1800 – 103,
Cambridge, MA 02142–1292,
USA

Phone: +1 617 607 4900

Email: us@sh-p.com