

Optimization of barcodes and matrix codes, based on experiments

A linear barcode or 2D code can be insufficiently readable for various reasons. The ISO/IEC 15416 standard evaluates most relevant parameters and their value range to achieve certain quality classes, such as symbol contrast. However, scanners prefer in some cases values that are outside of the norm, such as wider bars as gaps, maximum permissible degree of gloss, a maximum brightness value, etc. Problems with barcodes often occur simultaneously with a change in technology, new base material, new printing system. If reading errors occur afterwards, there are a multitude of possible causes.

You can then proceed as follows.

1. determine characteristics in a variable sample group
2. determine legibility in the relevant scanners
3. calculate the individual influences on the read power or, if necessary, combined influences
4. optimisation

Characteristic determination in a variable sample group

For example, readability might depend on the width ratio between bars and gaps. Consequently, the influence of this characteristic should be analysed.

Determination of readability in the relevant scanners

Scanners do not give any value of how well they can read a code. But we can measure, for example, how long the scanner needs for a reading. Each value of the bar deviation is assigned an individual readability value.

Berechnen der Einzeleinflüsse auf die Leseleistung

The functional relationship between the readability and the bar deviation can then be calculated as a polynomial, see *Abbildung 1*. The function shows that the highest readability is achieved with a bar deviation of $-15\mu\text{m}$. Even narrower or wider bars result in less legibility.

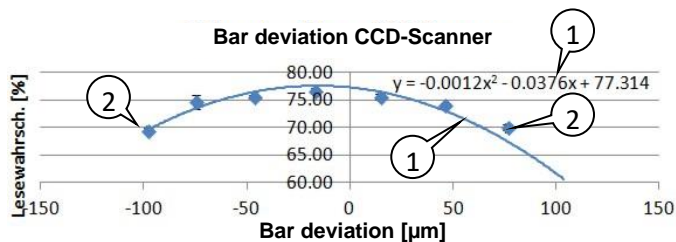


Abbildung 1: Polynom (1) of readability as a function of the bardeviation based on grid values (2)

If we have several characteristics to consider, such cases are calculated using matrices, for example.

Suppose we had the two features SC (symbol contrast) and Rmin, which would have to be considered equally. Then our solution equation could be with linear dependence on the following type:

$$L(SC, Rmin) = a_1 * SC + b_1 * Rmin + c$$

This would require readability in three different values for each characteristic for SC and Rmin. The parameters a_1 , b_1 , and c must be determined.

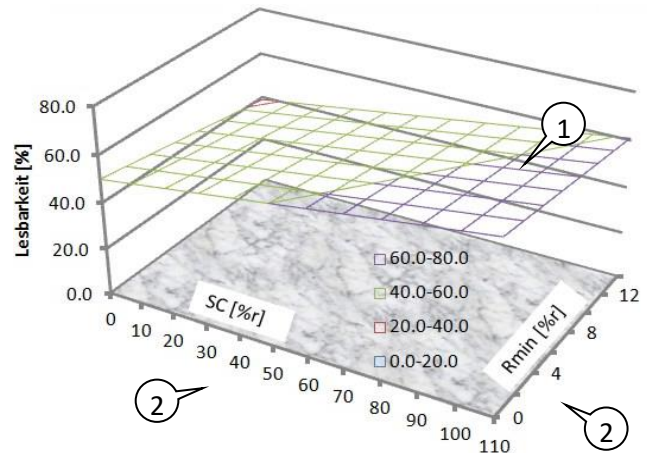


Abbildung 2: Readability as linear area function (1) of the symbol contrast (2) and Rmin (3).

At *Abbildung 2* we see graphically how the two parameters symbol contrast and Rmin influence readability as a linear area function. The graph allows a prediction of readability within and near the grid values.

In this example, too, one or both arguments may only have a positive effect on readability up to a certain value. A polynomial approach would therefore also be conceivable in this example. Ideally, we would have nine basic values at our disposal.

Optimisation

Since we now know the functional relationship between the features and legibility, targeted optimization measures are only possible in the first place, for example we can shift the tolerance field for the bar dimension by $-15\mu\text{m}$ and press the bars correspondingly narrower. We can get a base material with a higher brightness and increase the blackness. All three measures taken together should lead to a significantly higher leased result.

Services at Gausstec

With this short guide it should be possible to optimize the Barcode quality in the right direction and to significantly improve the reading result.

In case of doubt, you can count on the Gausstec laboratory and involve us in your task so that we can quickly find a solution on the table. It is an advantage to know which measures lead to a better result.

Einrichtung Barcodeoptimierung

Gausstec has the following facilities to determine the quality of barcode and matrix codes:

- REA-Vericube and TransWin32 Software
- Gloss measurement equipment ZGM 1120
- Digitalmikroskope VHX-500
- Photo printer with high pixel and contrast resolution

Your suggestions and questions regarding barcode optimization are important to us! Further information about Gausstec's services can be found on our website. Just give us a call.