Understanding ISO/IEC 15426-1 (CEN/ANSI In the USA)

Like most barcode scanners, barcode verifiers read a narrow path through the bar code and convert reflected light into a Scan Reflectance Profile: bars are represented by troughs and spaces are represented by peaks. Barcode verifiers analyse this data to provide information about a bar code's quality.

The analysis can be either Traditional, or conforms to ISO/IEC 15426-1 (This is equivalent to EN 1635 and ANSI standards X3.182-1990 and ANSI/UCC5 standard) GS-1 and all major UK retailers now insist on ISO/IEC compliant verification The ISO/IEC standard specifies seven major parameters that should be measured and graded, the average of all seven parameters provides an overall grade for the bar code. In ISO terminology 4 is best, 0 is Fail, in ANSI terminology A is best, F is Fail.

Interpreting Barcode Verification Results

Verifiers assign a single grade that is the average of all the results and scans for a particular bar code. Because the quality of the bar code can differ depending on which part of the code is scanned, the ISO/IEC standard recommends that each bar code being verified should be scanned ten times. Ten Scan Reflectance Profiles are required to determine Overall Grade:

Overall Grade	What This Means
3.5 or better (A)	Bar codes which achieve this result should scan easily first time with most scanning equipment. The aim should be to produce codes of this quality whenever the printing processes and materials allow.
2.5 - 3.5 (B)	Codes of this quality may read after a single scan. If a second scan is required, the probability of success is very high.
1.5 - 2.5 (C)	This is the minimum quality that most bar codes should achieve. It means that re-scanning might be required to get a successful read. Flatbed scanners, which read the bar code at several places, are recommended with codes of this quality.
0.5 - 1.5 (D)	This is only acceptable for ITF-14 bar codes printed on to fiberboard.

How Changes in ISO/IEC Parameters Help Diagnose Print Problems

The cause of low grades could be caused by one factor, or a combination of problems. The following table shows some of the possibilities. The verifier may also report average Bar Width Gain or Loss. This is useful on long print runs to monitor the performance of the printer.

SYMPTOM	CAUSE
Decode Failure	Excessive Bar Width Gain Excessive Bar Width Loss Irregular Bar Edges (When excessive) Uneven Inking / Voids / Specs
Inconsistent Results	Irregular Bar Edges

SYMPTOM IS INCREASING	CAUSE
Edge Contrast	Slight Bar Width Loss
Modulation (MOD)	Slight Bar Width Loss
Minimum Reflectance (Rmin)	Bar Width Loss
Maximum Element Reflectance Non-Uniformity (ERN)	Voids / Specs
Element Reflectance Non-Uniformity (ERN max)	Uneven Inking

SYMPTOM IS DECREASING	CAUSE
Edge Contrast (EC)	Bar Width Gain Excessive Bar Width Loss Uneven Inking
Modulation (MOD)	Bar Width Gain Excessive Bar Width Loss Uneven Inking
Decodability	Bar Width Gain Bar Width Loss

ISO/IEC Parameters

DECODE

Has the bar code been created correctly? Do the bars and spaces represent the correct characters? Is the check digit correct? Are the light margins sufficient? If the verifier can successfully decode the bar code, it is graded as 4. If the bars and spaces can not be understood, it receives the failing grade 0

RESULT	GRADE (ANSI Alphabetical Equivalent)
Yes	4 (A)
No	0 (F)

SYMBOL CONTRAST (SC)

Symbol Contrast is the difference between the lightest and darkest part of the bar code: that is, the difference between the highest and lowest values in the Reflectance Profile.

RESULT	GRADE (ANSI Alphabetical Equivalent)
>= 70%	4 (A)
>= 55%	3 (B)
>= 40%	2 (C)
>= 20%	1 (D)
< 20%	0 (F)

MINIMUM REFLECTANCE (Rmin)

Minimum Reflectance is the darkest part of the bar code. All of the bars have a low reflectance value, and this is the lowest value in the Reflectance Profile.

To ensure sufficient difference between the bars and the spaces, the bars must not be more than half the reflectance of the lightest space (Rmax)

RESULT	GRADE (ANSI Alphabetical Equivalent)
<= 0.5 x Rmax	4 (A)
> 0.5 x Rmax	0 (F)

EDGE CONTRAST (EC)

Edge contrast is the difference between the reflectance of a space and an adjacent bar. It is the lowest value for all edges in the Reflectance Profile.

When this is low, it’s unlikely that the code will be read when it’s scanned.

RESULT	GRADE (ANSI Alphabetical Equivalent)
>= 15%	4 (A)
< 15%	0 (F)

MODULATION (MOD)

Modulation is the ratio of Edge Contrast to Symbol Contrast.

MOD = EC / SC

It is a measure of how a scanner sees the wide elements (bars or spaces), relative to the narrow elements

RESULT	GRADE (ANSI Alphabetical Equivalent)
>= 0.70	4 (A)
>= 0.60	3 (B)
>= 0.50	2 (C)
>= 0.40	1 (D)
< 0.40	0 (F)

DEFECTS

Defects are variations in reflectance of either the bars or the spaces. It is a measure of the ‘noise’ that results from unwanted dips and spikes in the Reflectance Profile. For example, artifacts that have been introduced by the printing process such as dark spots in the spaces or ink voids on the bars.

The value of Defects is the ratio of the maximum reflectance non-uniformity (ERNmax) to Symbol Contrast (SC)

RESULT	GRADE (ANSI Alphabetical Equivalent)
<= 0.15	4 (A)
<= 0.20	3 (B)
<= 0.25	2 (C)
<= 0.30	1 (D)
> 0.30	0 (F)

DECODABILITY

Decodability is a measure of how easily distinguishable the different sizes of bars and spaces are in a bar code. The better a bar code is printed, the more easily a scanner can identify bars and spaces, and the higher the grade assigned by the verifier.

Printing errors (or damage) could mean that a narrow bar might be mistaken for a wide bar. For each type of bar code it's possible to calculate the point at which a bar of one type could be mistaken for another. This is a measure of the bar code's tolerance. Decodability is the fractional amount of this tolerance remaining.

RESULT	GRADE (ANSI Alphabetical Equivalent)
>= 0.62	4 (A)
>= 0.50	3 (B)
>= 0.37	2 (C)
>= 0.25	1 (D)
< 0.25	0 (F)