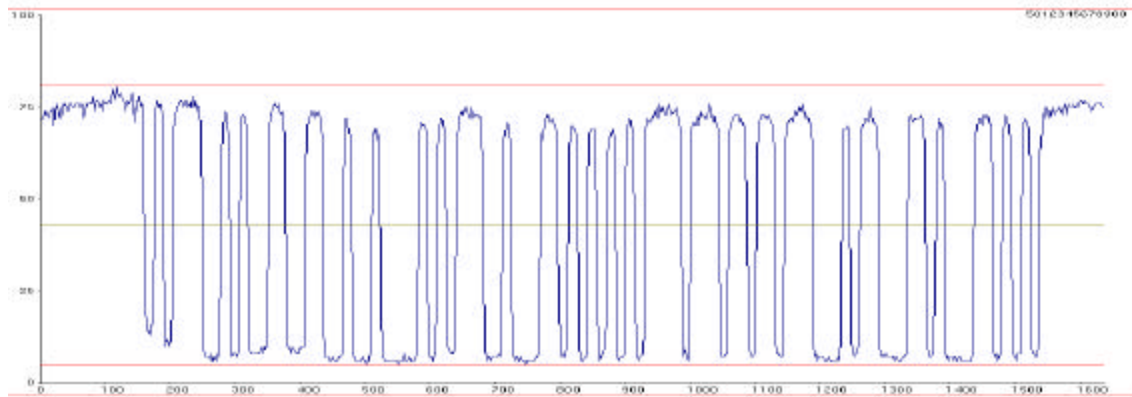


ISO 15416 (formally ANSI X3.182-1990)
Bar Code Print Quality Guideline – Overview

The ISO Print Quality Guideline recommends a method of measuring the quality parameters of a printed bar code symbol. In order to grade the eight individual parameters associated with ISO, a Scan Reflectance Profile (SRP) is generated mapping out the reflectance characteristics of an entire bar code symbol.

Scan Reflectance Profile



The eight parameters of ISO are graded as follows:

<u>“Pass/Fail”</u>	<u>4.0 (A) through 0.00 (F)</u>
Decode	Symbol Contrast (SC)
Minimum Reflectance (Rmin)	Modulation (MOD)
Edge Contrast Minimum (ECmin)	Defects
Edge Determination	Decodability

The lowest grade received by any individual ISO parameter becomes the overall ISO grade for that Scan Reflectance Profile.

ISO/ANSI Grading Scale Conversion

A = 4.0 - 3.5
B = 3.4 - 2.5
C = 2.4 - 1.5
D = 1.4 - 0.5
F = 0.4 - 0.0

Ten scan grades are required to calculate the overall grade of a bar code symbol. These ten grades are then averaged to determine the final ISO grade for the symbol.

It is important to use the correct measuring aperture size to calculate the ISO parameters. The nominal diameter of the measuring aperture should be specified by the user application, in order to suit the intended scanning environment for the bar codes. If the measuring aperture size is not specified, the following table should be used as a guide:

MEASURING APERTURE

X Dimension or Narrow Element Inches (mm)	Measuring Aperture	
	Diameter inches (mm)	Number
0.004 (0.102) - < 0.007 (0.178)	0.003 (0.076)	03
0.007 (0.178) - < 0.013 (0.330)	0.005 (0.127)	05
0.013 (0.330) - < 0.025 (0.635)	0.010 (0.254)	10
0.025 (0.635) - X	0.020 (0.508)	20

“Pass/Fail” 4.0 or 0.0 (“A” or “F”) Parameters of ISO (ANSI)

DECODE:

Each bar code symbology has a specific decode algorithm. If a symbol is decoded correctly, it will receive a 4.0 (A) grade. If not, it will receive a 0 (F) grade. The ISO grade of Decode checks for:

- Valid Characters
- Correct start and stop characters (patterns)
- Correct check digits (when applicable)
- Legal quiet zones (i.e. blank space before and after a bar code)
- Correct number and format of characters

MINIMUM REFLECTANCE: (Rmin)

The reflectance value of the darkest bar within a bar code symbol must be less than or equal to half the reflectance of the lightest space.

EDGE CONTRAST MINIMUM: (ECmin)

The Edge Contrast Minimum is the minimum difference in the reflectance value between any particular space (including quiet zones) and its adjoining bar within a bar code symbol. The smallest difference that is found across a bar code symbol must be at least 15%.

EDGE DETERMINATION:

In order to calculate the grade of Edge Determination, the Global Threshold (GT) of the bar code must first be determined:

$$GT = Rmin + (SC/2)$$

Once the Global Threshold is established, the elements of a bar code are defined as:

- BAR: Any point on the SRP at or below the Global Threshold.
- SPACE: Any point on the SRP above the Global Threshold.

If the number of elements for a bar code symbology is invalid, the symbol will receive a 0 (F) grade for Edge Determination.

Parameters of ISO Graded 4.0 through 0 (ANSI Graded “A” through “F”)

SYMBOL CONTRAST: (SC)

The difference between the largest (including quiet zones) and smallest reflectance values within a Scan Reflectance Profile.

$$SC = R_{max} - R_{min}$$

The grade for Symbol Contrast is determined by:

- (A) 4.0 \geq 70%
- (B) 3.0 \geq 55%
- (C) 2.0 \geq 40%
- (D) 1.0 \geq 20%
- (F) 0 < 20%

MODULATION:

Modulation relates to how a scanner “sees” wide elements in relationship to narrow elements, as represented by reflectance values in the Scan Reflectance Profile. Scanners typically “see” narrow spaces as being less reflective than wide spaces. The closer the grades of Edge Contrast Minimum and Symbol Contrast, the higher the Modulation grade.

$$MOD = EC_{min} / SC$$

The grade for Modulation is determined by:

- (A) 4.0 \geq .70
- (B) 3.0 \geq .60
- (C) 2.0 \geq .50
- (D) 1.0 \geq .40
- (F) 0 < .40

DEFECTS:

Defects are voids found in the bars or spots found in the spaces and quiet zones of a bar code symbol. Defects are measured by the ratio between the maximum element reflectance nonuniformity and symbol contrast.

Element reflectance nonuniformity is the difference in reflectance between the highest peak and lowest value within an element (bar or space) of the bar code symbol. When an element consists of a single peak or valley, its reflectance nonuniformity is zero.

$$\text{Defects} = ERN_{max} / SC$$

The grade for Defects is determined by:

- (A) $4.0 \leq .15$
- (B) $3.0 \leq .20$
- (C) $2.0 \leq .25$
- (D) $1.0 \leq .30$
- (F) $0 > .30$

DECODABILITY:

Decodability is the measure of accuracy of the printed bar code symbol against its appropriate reference decode algorithm. Each symbology has published dimensions for element widths and margins of tolerance for errors in the printing and reading process. Decodability measures the amount of margin left for the reading process after printing the bar code. A higher grade will be assigned to those bar code symbols having little deviation from their respective nominal values.

Ink spread, jagged edges, etc. contribute to lower Decodability grades.

The grade for Decodability is determined by:

- (A) $4.0 \geq 62\%$
- (B) $3.0 \geq 50\%$
- (C) $2.0 \geq 37\%$
- (D) $1.0 \geq 25\%$
- (F) $0 < 25\%$

For additional questions, please contact:

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