BARCODE TEST
GETTING IT RIGHT

BARCODE QUALITY STEP BY STEP GUIDE





Connecting the dots from the verification report to solving your barcode problems.

2022 Edition

Contents

Introduction

This booklet will explain how barcode verifiers can help improve the quality of both linear and 2D matrix barcodes. Quality in this context means print quality (which is the concern of two ISO/IEC standards), and the correct data content, and the correct size. When all of these criteria are met, a barcode can be said to be compliant.

Different user applications specify the sizes of the barcodes to be used, and their data content. Using a barcode verifier will help discover what the problems are, but the graded parameters that are defined by the ISO/IEC standards do not immediately tell you what needs to be corrected. This booklet will suggest ways of using the results to change and improve your printing process.

We have included an index to help readers find relevant content about parameters and other key terminology in context. A glossary provides a clear definition of key terms as they apply to the respective ISO standard.

Whatever your method of acquiring this booklet, thank you for your interest. I hope you find it helpful. Your comments are always welcome.

Linear barcodes

ISO/IEC 15416: 2016 defines the requirements for measuring the print quality of a linear barcode. The barcode must be scanned ten times across its height, and the verifier will measure seven parameters from each scan. The lowest parameter grade from each scan is used to obtain ten numbers that are then averaged to obtain the grade for the barcode. The parameters are as follows:

Decode, this checks the start and stop patterns, any check digits, the quiet zones and any other symbology-specific requirements. Decode is a Pass/Fail parameter.

Symbol Contrast (SC), which is the reflective difference between the brightest background (maximum reflectance) and the darkest bar (minimum reflectance).

Reflectance Minimum (Rmin), This checks that the darkest bar is less than half as reflective as the brightest part of the background.

Minimum Edge Contrast (ECmin), is the least difference between a bar and an adjacent space. This must be at least 15%.

Modulation (MOD), measures how evenly black and white the barcode is.

Defects, are irregularities such as voids in bars and spots in spaces and quiet zones.

Decodability, a measurement of the accuracy of the different widths of the bars and spaces. A good barcode has high decodability.

Reflectance margin, This is a measure of how close the symbol is to failing because the edges of the bars and spaces cannot be determined. This is not a graded parameter, but a value of less than 5% is of concern.

Grade	Rmin	SC	ECmin	MOD	Defects	Decodability
ISO 4 (ANSI A)	<0.5 Rmax	>70%	>15%	>70%	<15%	>62%
ISO 3 (ANSI B)		>55%		>60%	<20%	>50%
ISO 2 (ANSI C)		>40%		>50%	<25%	>37%
ISO 1 (ANSI D)		>20%		>40%	<30%	>25%
ISO 0 (ANSI F)	>0.5 Rmax	<20%	<15%	<40%	>30%	<25%

Linear barcodes

Correcting linear barcode problems:

Decode

Quiet zones must be large enough, and have nothing printed in them. Make sure that any keylines around the barcode are far enough away from the sides, and don't place the barcode too near an edge or fold on the packaging.

Missing or incorrect check digits trigger decode failure. Check digits are optional in some symbologies. Set the verifier to test for check digit only if they are required.

0 12345 67890 5

UPC-A Barcode

Damaged, incorrect or missing start/stop patterns downgrade the decode parameter. Excessive print gain also causes decode failure. Examine narrow bars and spaces. If they are not the same width, print gain is the likely cause. Check tolerance and print gain results in the verification report. Optimally, gain is at or near zero, or in low single digits.

Symbol Contrast

Low or failing Symbol Contrast grades have a straightforward solution: either the bars are too light or the background is too dark. Make adjustments accordingly. Avoid bars in red or reddish colors. Avoid green or greenish background colors.

Reflectance Minimum (Rmin)

A pass/fail parameter. Make the bars darker or make the background paler, or both.

Minimum Edge Contrast

Another pass or fail parameter. Check the darkness of the bar colour, and whether the substrate is causing blurred edges. Laminates are often to blame.

Modulation

Modulation measures uniformity of the barcodes blackness and whiteness. When spaces are too narrow they will not seem as bright as the quiet zones, so check the bar width reduction. Sometimes the white background needs to be made more opaque when using semi-translucent materials.

Defects

Defects are voids and spots in bars, or marks in spaces. They are usually obvious to the naked eye or with low power magnification. They may appear to the scanner as additional bars or spaces, and this confuses the decode process.

Poor quality substrates such as corrugated board can cause this problem. Ensure any labels are clean, and that any print heads are correctly maintained. If it is possible, increase the size of the code so that the defects are less significant. Poorly mixed or partially coagulated ink can cause voids and spots.

Modulation error

Decodability

Decodability is a measurement of the dimensional accuracy of the bars and spaces. There are two common causes. The most common is scaling a font-based barcode file. Another is a mismatch between the DPI setting for the barcode design software and the printing device. Check the resolution of the master artwork and the print head resolution for on-demand printed symbols.

Defects error

Bar growth error

The Scan Reflectance Profile

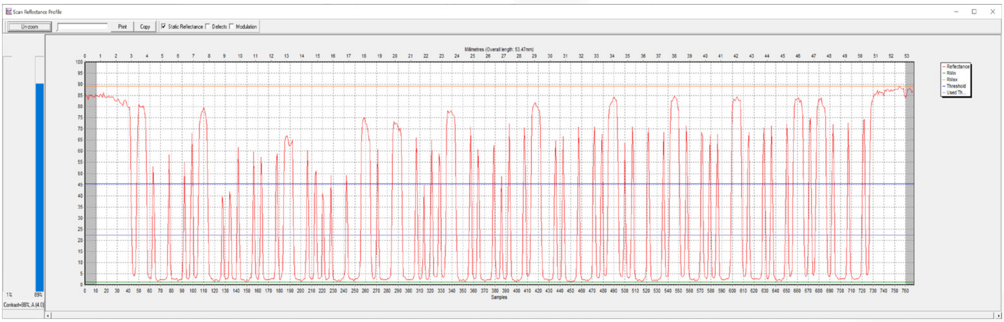
The basis of barcode verification is the scan reflectance profile. This is a graph showing the reflectance across the width of the barcode. The darkest bar has the minimum reflectance (Rmin) and the lightest space has the maximum reflectance (Rmax) The scan reflectance profile is a waveform showing the transition from light to dark from the left quiet zone, through the bars and spaces to the right quiet zone. In a high quality barcode, the spread from the highest background value to the lowest dark bars should be uniform.

A compressed scan reflectance profile results from barcodes with lower Rmax and/or higher Rmin values.

Excessive print gain will affect the uniformity of the scan reflectance profile, showing how narrow spaces have lower reflectivity than wide spaces.

The global threshold is the mid-point between the highest and lowest reflectance values. All of the values for the bars should be below the global threshold, and all of those for the spaces should be above it.

The scan reflectance profile of poor quality barcodes may show a waveform line that fails to cross the global threshold. This is when scanning fails and the Decode parameter will report the failure.



2D barcodes

ISO/IEC 15415:2011 defines the requirements for measuring the print quality of 2D (matrix) barcodes. The verifier uses one image of the barcode to grade the following parameters. Whichever parameter grade is lowest becomes the grade of the barcodes:

1. Symbol Contrast (SC) measures and grades how black and white the symbol is.
2. Modulation (MOD) measures the variation in the blackness and whiteness of the symbol across its complete area.
3. Fixed Pattern Damage (FPD) evaluates quiet zones, check digits, locator and finder patterns in the barcode. These are the features common to each 2D symbol type, regardless of the unique encoded data.
4. Axial Non-uniformity (ANU) measure and grades the uniformity of the height and width of the modules (squares or dots).
5. Grid Non-uniformity (GNU) measures and grades the dimensional uniformity of the placement of the squares or dots that should fall accurately on the ideal grid intersections.
6. Unused Error Correction (UEC) measures and grades the amount of remaining error correction regarding the user-selected error correction level designed into the barcode.
7. Reflectance margin. Reflectance Margin measures the variation in reflectance of the light and dark modules, taking into account whether those modules are correctly light or dark.

Correcting 2D barcode problems

Symbol Contrast

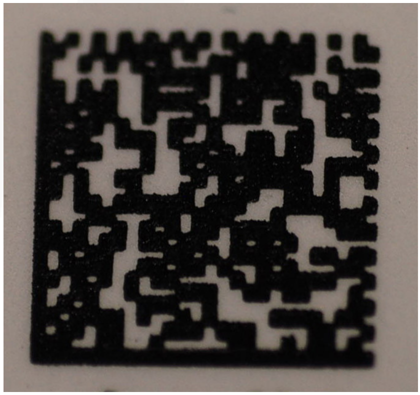
These barcodes are still tested under red light, like linear barcodes, even though they can be read by smartphones. This means that black and white is still the best colour combination. Ensure that a pure colour is being used for the black modules and that the background is uniform and pale.

Symbol contrast error

2D barcodes

Modulation

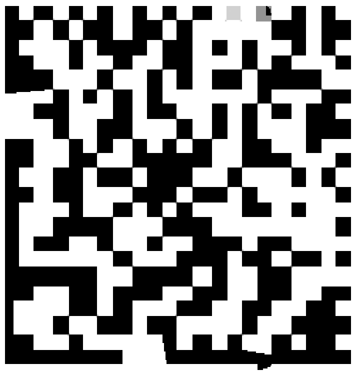
The black modules may be too large, meaning that the white modules appear to be less bright than they should. Check the size of the modules as the x-dimension may be too small, and then check the print gain. The print gain will often be determined by the on-demand printing technique together with the substrate, so investigate the print head resolution to discover which adjustments can be made. Glossy inks over a glossy substrate such as mylar can cause modulation problems.



Modulation error

Fixed Pattern Damage

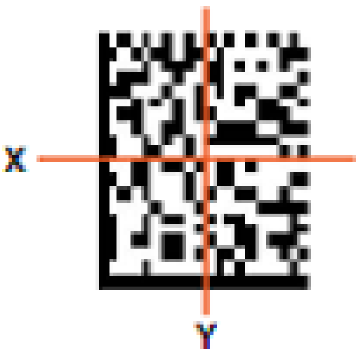
Damage includes quiet zones that are too small or encroached, missing or incorrect check digits or damaged finder patterns and clock tracks.



Fixed pattern damage

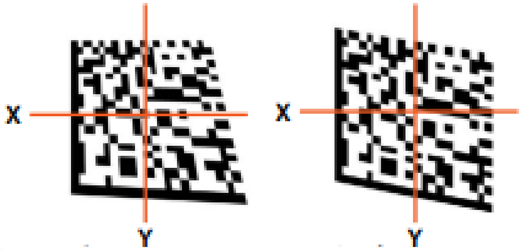
Axial Non-uniformity

The print process often causes stretched modules so that they are not perfectly square or circular. This may be caused by printing too quickly. Control excessive ANU by lowering print speed. Sometimes this will also require adjustment to print head temperature in thermal printing.



Axial Non-uniformity error

Grid Non-uniformity
GNU downgrades when square or dots in the symbol do not fall accurately in grid intersections. Causes include distortion of flexible substrate in the print process, during product insertion or subsequent handling.

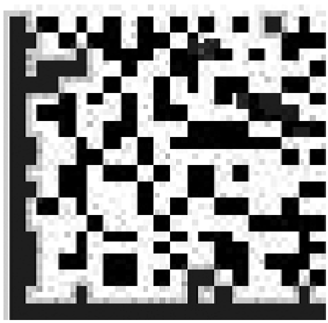


Grid Non-uniformity error

Unused Error Correction
Understanding the cause of downgraded UEC determines the solution. Prevent scuffed or scratched symbols by relocation to a less damage-prone area, protect with lamination or shrink-wrap, or handling with greater care.

Contrast Uniformity
Excessive print gain causes areas of lower contrast uniformity. Lower values for CU often accompany lowered Modulation grades. Print gain is a frequent cause. Silvered or highly reflective substrates can be a problem.

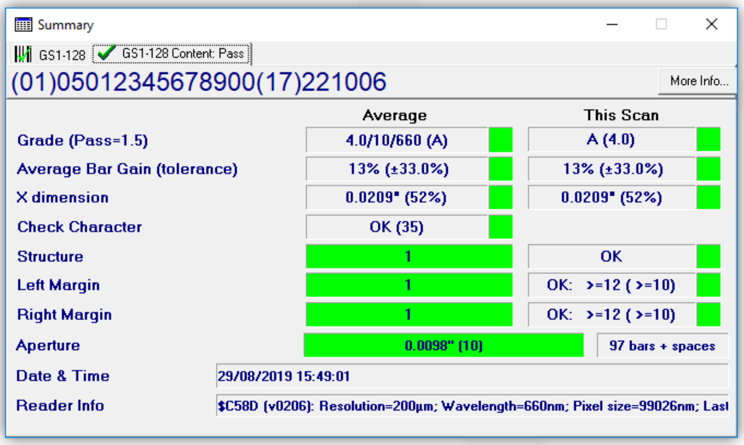

Margin error


Modulation error

Interpreting scannability from symbol grade

An ANSI “A” or ISO 4.0 Symbol Grade does not guarantee that a barcode will successfully scan everywhere. Nor does an ANSI “F” or ISO 1.0 Symbol Grade guarantee that a barcode will fail everywhere.

Symbol Grade is a guideline, a predictor but not a certification of scanning success. This is because scanning technology is an ever-changing, ever-broadening sea of varying optics, varying electronics and varying firmware, all of them aging and operated with varying degrees of rough handling, all in different and varying environments. The unit of measure for the verifier grade protocol is one scan. This is also known as “first read rate”. A barcode with Symbol Grade A will generally scan successfully on the first try.



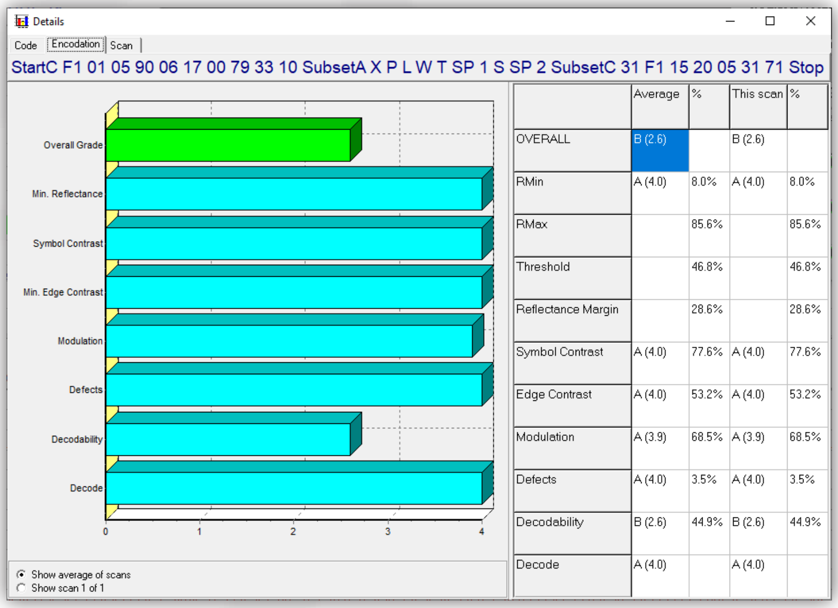
Symbols achieving a Symbol Grade B will not be as high quality as Symbol Grade A barcodes; one or more of the ANSI/ISO parameters is downgraded to a B; the unit of measure or first read rate will be lower. These symbols will likely require rescanning to be decoded successfully.

Symbol Grade C barcodes will need to be rescanned even more than Symbol Grade B barcodes. Rescanning means redundant scanning of the same symbol, and more frequent rescanning of different examples of the same symbol. It is important to understand that the performance of a single barcode does not necessarily predict the quality of an entire print run.

A symbol with a Symbol Grade D will require multiple scans in different parts of the barcode to decode successfully. When Symbol Grade D results can be anticipated, such as barcodes printed on corrugated, users should specify scanners that perform best in that application.

F grade symbols are unlikely to scan successful in most scanning environments. Users sometimes believe that F grade symbols are actually acceptable because the verifier was able to decode them. The significant thing is the Symbol Grade, not the successful decode. Verifiers and scanners differ in this regard.

How the Symbol Grade is obtained is an important consideration. The verification process should never be optimized. The test samples should be representative of the entire print run, usually drawn from the beginning and the end of the run, with in-process samples pulled periodically during the run.



The tested samples should always be in their final form exactly as they are ultimately presented to the end-user scanner. If they are shrink wrapped in final form, they should be shrink wrapped when they are verified. If they are inserted into a plastic case, they should be in the plastic case when verified. If they are on translucent plastic bottles with a colored liquid inside, they should be verified accordingly.

The process is every bit as important as the verification device itself. The verifier should be an ANSI/ISO compliant device. It is meaningless to use a quality testing tool with an unknown performance benchmark. And for the same reason, the verifier should be recently calibrated.

Barcode verifier

What is a barcode verifier and how to check barcode quality.
If you need to be sure that your printed barcode will scan everywhere, how can you check it? Using a scanner to test the barcode will only tell you if it can be read by that particular scanner, but a barcode verifier will allow you to grade each barcodes quality.

International standards for measuring and grading the printed quality of barcodes have been developed since the first American and European standards, ANSI X3.182 and EN 1635, were first published in 1990 and 1995 respectively. The latest ISO/IEC standards define the techniques required for both conventional linear barcodes, and two-dimensional barcodes such as Data Matrix, and QR Code.

Linear barcodes

These are the types of barcode found on product packaging and outer cases. They are made up of black parallel lines of different widths on a white background, with data encoded by the different widths of the bars and spaces. The width of the narrowest bar or space is called the x-dimension, and all the other bars and spaces are multiples of this width. The single width is also known as the module width.

Some linear barcodes are also made up by having shallow rows of barcodes stacked up together and each row is read separately as part of a complete symbol. These are two-dimensional but they are generally known as stacked linear symbols. The best example is PDF 417, and GS1 DataBar also has some stacked options.

All of these symbols can be read by conventional laser scanners, provided they are suitably configured, and were introduced before the more modern 2D barcodes that need to be read by CCD or camera-based systems.

(01)05012345678900(17)231206

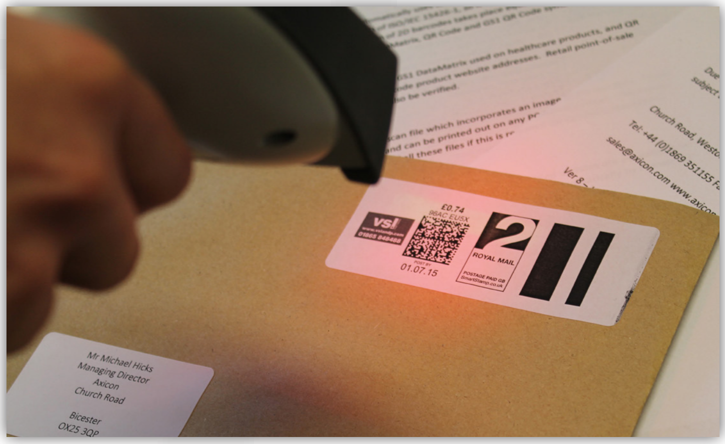
GS1-128 Barcode

Two-dimensional or 2D barcodes

These are the square or rectangular barcodes that look like miniaturised chess boards. They are made up of patterns of perfectly square black and white elements, which are called modules. The height and width of a module should be the same, and this is known as the x-dimension.

These cannot be read by conventional laser scanners, but CCD and camera-based scanners are designed to do this. These symbols can also be easily read by smartphone cameras used by customers.

These symbols can encode more data than linear barcodes, and they are increasingly being used on products to encode extra information such as the product's batch number, serial number, best-before or expiry date. Some of these barcodes are used to provide a link to a product specific web page that users can look at on their smartphone.



What a barcode verifier will do

As well as following the international standards for grading the printed quality of a barcode, a verifier will also tell you how large the barcode is by measuring its x-dimension, and decode the barcode so that you can check if this data is correct. Axicon verifiers will show if any check digits for the data are correct, and will display the extra information that many barcodes include. So you can see if any encoded dates are correct, check the serial and batch numbers, and so on very easily.

When checking GS1-128 or Code 128 barcodes the verifier will also make sure the data is encoded optimally, so that your barcodes can be as short as possible.

Sector-specific data requirement checks for the barcodes can also be switched on by the user, and these plugins have been designed to meet the needs of most industrial and trade sectors.

Barcode verifier

Linear barcode verification
Each barcode should be scanned in ten different places across the height of the barcode. Each scan line produces a graph of the whiteness and blackness of the barcode across its width, and each graph is called a scan reflectance profile or SRP. The ten SRPs are then used to measure the barcode and produce the results of the verification.

As well as showing the x-dimension, and the data content, the verifier will measure seven different parameters of the barcode:

1. How black and white it appears to a scanner (Symbol contrast).
2. Whether the dark bars have enough difference from the white spaces (Minimum reflectance).
3. The least distinct difference between a bar and a space (Edge contrast minimum)
4. How much the contrast between black and white varies across the barcode (Modulation).
5. The presence of white marks in the bars or dark marks in the spaces (Defects)
6. How accurate the different widths of the bars and spaces of the barcode are (Decodability).
7. Whether the quiet zones (the light margins on each side), the encodation of data, and the check digit are all correct (Decode).

The lowest grade for any parameter from each scan is used to get ten results, and these are averaged to obtain the grade.

The grading runs from 4.0 down to 0.0 with 4.0 is the best result, 1.5 is the pass grade for most barcodes, 0.5 is allowed for outer case barcodes printed onto brown corrugate, and 0 is a fail. The American ANSI standard was developed using alphabetic grading running from A to D, then F, so a pass grade of 1.5 or C is often required.

How the ANSI grades compare to the ISO/IEC grades

ISO/IEC grade	ANSI Grade
3.5 - 4.0	A
2.5 - 3.5	B
1.5 - 2.5	C
0.5 - 1.5	D
0.0 - 0.5	F

The international standards specify different aperture sizes (in effect sampling areas) for different sizes of barcodes, so ideally the verification result quotes this, as well as the wavelength of light being used for the measuring. This reporting will then show that the barcode has been correctly verified, with the appropriate adjustments.

A result of 3.8/06/660 means the grade is 3.8 (A), the aperture reference is 06, meaning a diameter of 6 mils or 150 microns, and the wavelength of light is 660 nm.

2D barcode verification

All verifiers must use a standardised lighting configuration, with light of a specified wavelength, to take an image of the barcode. This image is then analysed using a known sampling area (defined as the aperture reference) to measure seven different aspects, or parameters, of the symbol.

Unlike linear barcode verifiers, only one image is used. The seven parameters are each measured, and the measurements converted into grades 4,3,2,1 or 0, with 4 being best, and 0 being a failure. The parameter with the lowest grade becomes the overall grade for the 2D symbol.

The grade is then reported with the details of the aperture, the light, and the angle of illumination as follows:

N.0/aa/www/30/45/90

Where N.0 is the grade, aa is the aperture reference number, which refers to the diameter of the aperture measured in 1/1000s of an inch, www is the wavelength of light measured in nm, and 30 or 45 or 90 is the angle of the incident light used to illuminate the barcode.

Barcode verifier

The seven parameters are all briefly explained below:

1. Decode: This is the first step in the verification and applies the reference decode algorithm - the set of rules defined by ISO/IEC for decoding the symbol - to the image. If there is a valid decode, the grade is 4.0. If the barcode cannot be decoded, the grade is 0.0.
2. Symbol contrast: The symbol contrast is the difference between the darkest and lightest areas of the barcode. The quiet zones will normally be the lightest areas. This is measured in percentage terms, and the percentages are converted into five different bands – 4,3,2,1, or 0 (A,B,C,D or F).

3. Axial non-uniformity: All matrix 2D symbols should comprise perfectly square, and evenly spaced, elements. Axial non-uniformity is a measure of how square these elements are, with lower scoring symbols having rectangular modules. This is measured and then graded from 4 to 0.
4. Modulation: A barcode should be evenly black and white across its whole area. Modulation compares the least black-to-white area of the symbol to the greatest difference between the black and white elements. This is measured and then graded from 4 to 0.
5. Grid non-uniformity: Grid non-uniformity measures how the symbol is distorted in terms of how much the implied x and y axes are not at an angle of 90°. It is in effect measuring how twisted the image is.
6. Unused error correction: All matrix 2D symbols include error-correction characters that may be used to reconstruct damaged parts of the symbol. A perfect symbol will not require any use of the error-correction characters, and will receive a top grade of 4.0. The parameter is measured and then graded from 4 to 0.
7. Fixed pattern damage: The fixed patterns of a matrix 2D symbol are used by the scanner to find the barcode. If any of these are damaged the barcode will be more difficult to read, so any damage is measured and graded from 4 to 0.

For a Data Matrix or GS1 DataMatrix symbol, the verifier will look at the quiet zones, the L-shaped finder pattern, the clock track (the dotted line on the opposite two sides of the symbol), and calculate an average grade from seven different fixed pattern damage possibilities.

Other 2D matrix symbols have different fixed patterns, and the verifier will again assess these in accordance with the symbol specification.

What the results mean

A barcode with the highest grade of 4.0 (A) is expected to be able to be scanned faster and more reliably than lower grade barcodes. As the performance of barcode scanners has improved since their introduction, most users will accept barcodes with a grade of 1.5 (C) or better, but these lower grade barcodes may need more attempts to be read.

Higher quality barcodes will be readable by a wider range of scanners, and at a faster rate than those barcodes that are close to failing.

The verification report

The Axicon verification report will provide information about the size, the print quality and the data content of the barcodes. Size is not graded, but it is still very important. The size is given in terms of the symbol's x-dimension, which is the width of the smallest element of a linear barcode, i.e. the width of the narrowest bar or space. The size measurements provided for 2D symbols are the width (x) and height (y) of the individual square or circular module. The measurements should be the same, but they are often different.

The print quality grade will vary according to the printing process used, the colour of the bars, and the quality and colour of the substrate. On-demand printing, often used for 2D symbols that will incorporate data such as batch or serial numbers, and dates, is more variable, and lower quality symbols may be down to poor maintenance or the wrong choice of consumables. Consumables include the type of printer ribbon, if they are being used, and the type of label or substrate; choosing the wrong type can markedly reduce print quality.

The data in the barcode must also be correct if the barcode is to be compliant to any particular standard, such as the GS1 General Specifications. Different applications require certain sets of data to be present, and the verifier can be setup to use plugins to help you do this checking.

Verification Report

(01)03400936441460(17)131031(10)0W0036

Data Matrix - ECC 200

Print Quality: **3.0/08/660 (B) - Pass (≥1.5)**

Application Validation: **N/a**

Software Version:	2.1.0	Serial Number:	1559F
Scan Time:	14:15:31 16/06/2021 (+0100)	Factory Configuration:	19/03/2021
Decode Time:	14:15:35 16/06/2021 (+0100)	User Calibration:	16/06/2021
Computer Name:	CPOLLOCK-M	User Name:	cp

Minimum Reflectance	17%
Maximum Reflectance	88%
X Dimension	436 µm
Y Dimension	426 µm
X Print Gain	35 µm, 8%
Y Print Gain	4 µm, 1%

ISO Parameter	Grade	Percentage
Overall	3 (B)	
Decode	4 (A)	
Symbol Contrast	4 (A)	71%
Axial Non-Uniformity	4 (A)	2%
Grid Non-Uniformity	4 (A)	16%
Modulation	3 (B)	
Reflectance Margin	3 (B)	
Unused Error Correction	4 (A)	100%
Contrast Uniformity		38%
Fixed Pattern Damage	4 (A)	
Left "L"	4 (A)	
Bottom "L"	4 (A)	
Left Quiet Zone	4 (A)	
Bottom Quiet Zone	4 (A)	
Clock Tracks	4 (A)	
FPD Average	4 (A)	

Print Quality Standard: ISO/IEC 15415
Symbology Specification: ISO/IEC 16022
Verifier Conformance Standard: ISO/IEC 15426-2

Axicon Camera Verifier 2.1.0
Axicon Auto ID Limited www.axicon.com

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Barcode verifier

How to use the results
First of all check the size. Almost all specifications provide a range of sizes for a particular application, whether that is the retail point of sale, goods receiving at warehouses, patient wristbands, and so on. Many poor quality barcodes are simply too small, too small to be printed accurately, and too small for the scanners to read.

The print quality may be perfect, but the barcode could be the wrong size for its intended use.

Then look at the parameters and find the one with the lowest grade. If this is 'modulation', it is probably caused by the white spaces not being wide enough. Look at the measurement for 'average bar gain'. This is a measure of how much wider the black bars are than their perfect measurement, and it is given as a percentage. A positive figure suggests that the master artwork has not been correctly adjusted to take into account the printing process and the substrate being used.

Printers can usually provide advice on the amount of 'bar width reduction (BWR) that should be applied to the master image for a particular print process. Increasing the size of the barcode, as well as checking the BWR, will often improve the quality.

Sometimes the barcode fails completely with a 0 or F grade. This usually means that the quiet zones or light margins are not large enough, and the barcode cannot be reliably decoded.

How to improve barcode quality
1. Check the barcode is the right size for the application. Make sure linear barcodes are tall enough. Check the specifications if you are not sure.
2. Use pure black for the colour of the bars. Other pure colours can be used successfully but these must appear black under red light.
3. Provide adequate quiet zones to the left and right sides of linear barcodes, and on all sides of a 2D symbol.
4. When printing on-demand, check that the resolution of the print head can produce the desired width of bars or modules.
5. Do not print anything over a barcode such as a logo. 2D barcodes do use error correction techniques that can sometimes cope with this, but it makes reading the barcodes more difficult.
6. Use verification results over time to monitor the print production processes. Establish your own minimum quality grade (this may be higher than 1.5 (C)) that is appropriate for your particular product, so that you notice sooner any degradation in the quality.

Glossary

2D barcode	A data carrier that encodes information in the vertical and horizontal axis.
ANSI	A barcode quality testing method based mostly on reflectivity where grading is expressed alphabetically (A, B, C, D, F).
Aperture	Width of lens opening or photo-receptor; smaller (by specification) than the X dimension.
Axial Non-uniformity	Axial non-uniformity is a measure of how out of square the barcode is when checked against its horizontal and vertical axes.
Check digit	A pass/fail traditional parameter based on the presence (where applicable) of a correctly calculated security digit.
Data Capacity	The maximum amount of data a symbol can encode.
Decodability	A graded ANSI/ISO parameter based on the amount of tolerance remaining for the scanner after the imaging process.
Decode	A pass/fail ANSI/ISO parameter based on whether or not the correct pattern of bars and spaces are detected and known to be consistent with a valid barcode symbology.
Defects	A graded ANSI/ISO parameter based on the presence and size of artifacts in the spaces or voids in the bars of a barcode.
Edge contrast	The reflectance difference between adjacent bar and space; the minimum edge contrast is the smallest edge contrast within a scan reflectance profile.
Element	Module, X dimension: the smallest bar, square, dot or space in a 1D or 2D symbol.
Fixed pattern damage	The fixed patterns of a matrix 2D symbol are used by the scanner to find the barcode. If any of these are damaged the barcode will be more difficult to read.
Global Threshold	A horizontal or "equatorial" line exactly half way between the highest reflectance and lowest reflectance value on the SRP
GTIN	Global Trade Identification Number; identify trade items in various GS1 symbologies

Glossary

Grid Non-uniformity	Grid Non-uniformity (GNU) measures and grades the dimensional uniformity of the placement of the squares or dots that should fall accurately on the ideal grid intersections.
ISO	A barcode quality testing method based mostly on reflectivity where grading is expressed numerically (4.0 - 0.0)
Linear barcodes	Also called 1D barcode: parallel lines and spaces on one axis such as Code 128
Micron	Thousandths of a millimeter
Mil	Thousandths of an inch
Minimum reflectance	A pass/fail ANSI/ISO parameter based on whether the minimum reflectance value of at least one bar is less than or equal to one half of the highest reflectance value of at least one space.
Modulation	A graded ANSI/ISO parameter based on the ratio of the minimum edge contrast to symbol contrast.
Parameter	An attribute or characteristic of a specification, such as ISO 15415
Print gain	The physical spreading of a printed feature such as a bar due to ink wicking and/or impression force or pressure
Quiet zones	A pass/fail traditional parameter based on the presence of a minimum blank space preceding and trailing a barcode
Scan reflectance profile	A graphical representation of the light and dark reflectance values of a barcode symbol
Symbol contrast	A graded ANSI/ISO parameter based on a straight subtraction of the minimum reflectance value from the maximum reflectance value
Unused error correction	All matrix 2D symbols include error- correction characters that may be used to reconstruct damaged parts of the symbol
Verification	Testing and grading a symbol in accordance with applicable specifications
Verifier	Barcode test device that grades a symbol in accordance with an international standard

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THE BARCODE EXPERTS

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