The Association for Automatic Identification
and Data Capture Technologies

Bar Code Quality Control
Why Verification

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To verify a bar code symbol means to test the accuracy or correctness of the bar code in comparison to a standard. Using a scanner to read the bar code is NOT verifying. The use of a scanner is simply validating that that particular scanner was capable of reading the bar code and its data and not truly verifying the correctness against a written industry standard or specification. Thus, bar code verification programs are widely used in the interface between bar code printing and scanning technologies to maximize reliability.

Millions of bar codes are printed throughout the world daily and put on all types of objects. (Note: Printing, in this document, refers to creating a bar code image by any imaging method onto any substrate) Numerous problems are created when a product label does not scan or, worse yet, when bad data results from the scan. How does this happen? Bar code labels often are not verified before they enter the automatic data collection system. As a result, the quality of both the printed symbols and the data in those symbols are potential problems rather than parts of a solution for rapid data collection.

A bar code symbol should be printed to the quality level specified by the industry application standard or that is appropriate to achieve desired scan rates. When this is not achieved, the result is lowered productivity and/or contaminated data. The common denominator between bar code printing and bar code scanning are the various specifications for bar code symbologies and the print quality guidelines issued by organizations such as AIM (Automatic Identification Manufacturers), EAN International, UCC (Uniform Code Council), AIAG (Automotive Industry Action Group), IHIBCC (International Health Industry Bar Code Communication Council), ANSI (American National Standards Institute), CEN (Committee for European Normalization), ISO (International Standards Organizations) and many others. Basically, these specifications define industry-specific requirements for the following bar code parameters.

- Symbology type or encoded pattern
- Allowed encoded characters and data content and format
- Special placement of encoded characters
- Data check digit and symbology check character (if applicable) placement and calculation
- Bar and space dimensions and tolerances
- Allowable ratio of wide-to-narrow elements (if applicable)
- Reflectance parameters ANSI/CEN/ISO scan reflectance profile grading parameters and/or print-contrast signal (PCS).

Any Industry or Association that deems it important enough to issue a bar code specification naturally requires a quality assurance step in the creation of the bar code image and the ability to verify adherence to that specification.

In the bar code industry, instruments (verifiers) have been designed to analyze the different specifications parameters in order to meet specific quality level requirements. As an example, film master (used for plate making in conventional wet ink printing) specifications require very accurate dimensional tolerances and therefore require a verifier that incorporates a precise measurement method as a main feature.

Another example involves the retail industry. Although aggressive scanning technology is usually used throughout most retail stores, bar codes should read “the first time” in order to maximize efficiency and reduce the risk of hand keying of data which opens the possibility of increased errors. Furthermore, the data must be scanned accurately to ensure that computer-assisted ordering and shelf management, advance ship notice, other EDI (Electronic Data Interchange) programs are supported properly. Faulty scanning means loss of time, productivity, possible decoding errors, and ultimately, money. A properly applied quality assurance (verification) program will minimize faulty or incorrect data entering the system. The question should not be, “Why verify?” but rather, “Which verification instrument applies to a particular bar code application?”

At the other extreme, some printed symbols may be created with a single print method and used in a very specific environment with known scanning equipment. A verifier may only be required to check items that can be corrected, such as encodation, data format, data length and symbol contrast, using light sources and spot size comparable to the scanning equipment

Now that we have covered why bar code verification is an important element in a data collection system, the question often arises “where should the verification process take place” and "how frequently should the bar code be verified".

For a bar code program to be successful, a consistent verification program is needed to ensure bar code print quality. This includes verifying throughout the print run, typically at the beginning, middle and end, and more importantly whenever a variable in the print process or imaging of the bar code has been introduced. Verification should also take place whenever the bar code has been changed, such as adding an over laminating or package contents fill. Further, when the package fill makes verification impossible, the bar code should be verified flat with both a white and black background and the worst achieved quality values be considered the verified results. In cases where the cost of printing a bad bar code is extremely high or where the print process is subject random failure, 100% inspection of the bar code is recommended.

If bar code symbol printing is not evaluated against published standards, bar codes, which are poorly printed, may enter the data collection system. These inferior bar codes may not read at all, resulting in a return to the slower, error-prone manual method of data entry, or the symbol may read only after numerous frustrating, time-wasting attempts; or the bar code symbols may read with errors resulting in contamination of the database. Any of these conditions destroy the benefits of a bar code based system as they waste money and effort.

It is important to clarify the distinction between two terms which are erroneously used interchangeably: Scanning and Verifying. Scanning is machine recognition of data encoded in a bar code symbol. (See Figure 1)

Figure 1 - Machine Recognition of Data

Verifying is not just scanning; it is technologically much more. Verifying is: 1) decoding the bar code symbol, 2) measuring all key aspects of the bar code symbol as defined by the bar code industry standard or specification and 3) visually inspecting the symbol to ensure proper bar code layout and placement on the package. Verification devices are precision instruments designed to decode bar codes and evaluate the symbol print quality against the published standard. Whereas, a scanner may not read a poorly printed symbol, verification instruments should be able to decode, measure and check formatting of even the most inferior symbol and indicate the area(s) that are deficient so that corrective action may take place.

One of the key factors of a bar code scanning system is producing a bar code, regardless of printing method, at the appropriate quality level necessary for the scanning system to perform at the desired first pass read rate.

To fully implement a bar code program, you will be using two technologies: the technology to print a bar code symbol; and, the technology to scan and decode a bar code symbol. Often, it is forgotten that the bar code symbol that is printed is the SAME bar code symbol that the scanner must decode. The only way to assure the two technologies will work together with the desired results is to be certain that products from both technologies conform to the specifications. (See Figure 2) Thus, verification to the bar code specification is the process that ensures that the bridge between printing and scanning is accurate.

PRINTING

Verify Adherence to Bar Code Specifications

SCANNING

Figure 2 - Bridge between Technologies

Within the Automatic Data Collection Industry, there are a number of companies that manufacture bar code verifiers that meet the ANSI/CEN/ISO guidelines and standards, and the more traditional average bar deviation or bar/space method of print quality analysis. There also exists an ISO guideline (ISO/IEC 15423-1) in verifying the verification equipment and NIST (National Institute of Standards and Technology) traceable standards exist to assist the user in determining if the verifier is operating correctly, as well as, assisting in the training of personnel required to operate the equipment. (See Figure 3)

Figure 3 – NIST Traceable Standard

Regardless of the approach taken, equipment used, or sampling plan, verification of bar code print quality should take place right after or when the bar code labels are being printed and before the bar codes enter into the scanning system (See Figure 4). For companies printing the bar codes for others to scan, the verification process must take place with the philosophy that any bad bar codes must be re-printed. For companies receiving printed bar codes from others, bar code verification should be used to confirm that quality is acceptable before allowing the bar code symbols into the system.

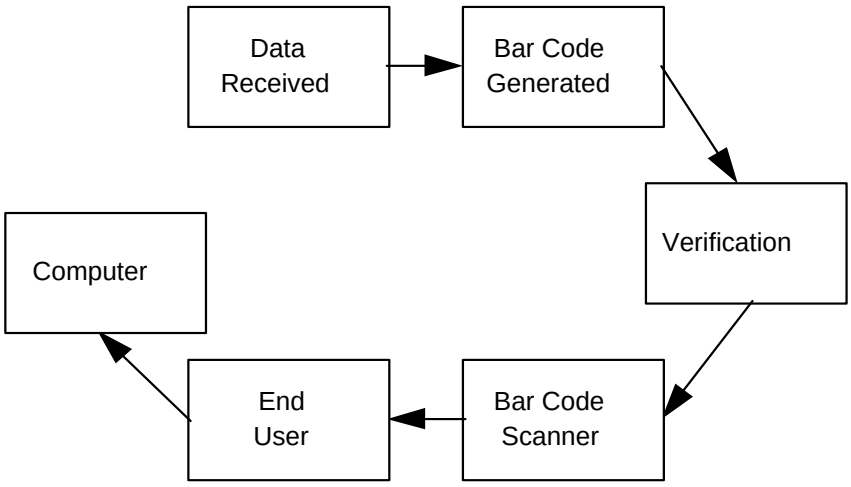

Figure 4 - When to Verify Bar Codes

Failing to verify the printed bar code symbol will destroy the bridge between printing and scanning and cause loss of real dollars due to incorrect data when codes read with errors, no data if the bar code doesn't read, or costly reprinting so the bar codes can be read. Rejected shipments may result in financial penalties or loss of business if the scanning source finds the codes unusable. However, with a bar code verification to specification program in place, your bar code systems will provide the benefits they were designed to deliver: Increased productivity and reduced costs.

Reference Documents

ANSI/AIM BC1 - USS Code 39
ANSI/AIM BC2 - USS Interleaved 2 of 5
ANSI/AIM BC3 - USS Codabar
ANSI/AIM BC4 - ISS Code 128
ANSI/AIM BC5 - USS Code 93
ANSI/AIM BC6 - USS Code 49
ANSI/AIM BC7 - USS Code 16K
AIM USS - Code One
AIM USS - PDF417
ANSI/AIM BC10 - ISS MaxiCode
ANSI/AIM BC11- ISS Data Matrix
ANSI/AIM BC12 - USS Channel Code
ANSI/AIM BC13 - ISS Aztec Code
AIM ISS - QR Code
AIM ISS - MicroPDF417
AIM ISS - Reduced Space Symbology (RSS)
AIM ISS - EAN.UCC Composite Symbology
AIM ISS - Aztec Mesas
AIM ISS - 93i
AIM ISS - SuperCode
AIM ISS - Guidelines on Symbology Identifiers
AIM Guidelines on MaxiCode Mode 0
AIM PDF417 Developer's Diskette
AIM Code One Developer's Diskette
AIM MaxiCode Developer's Diskette
AIM Data Matrix Developer's Diskette
Dot Code A
USS Telepen
USS Codablock F

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ANSI X3.182 - Bar Code Print Quality Guideline
Available from:
American National Standards Institute
25 West 43nd Street
New York, NY 10036
Phone: + 1 212 642 4900
Fax: + 1 212 398 0023
Web: http://www.ansi.org

ISO/IEC 15426-1: 2000 Information technology -- Automatic identification and data capture techniques -- Bar code verifier conformance specifications -- Part 1: Linear symbols
Available from:
International Organization for Standardization (ISO)
1, rue de Varembé, Case postale 56
CH-1211 Geneva 20, Switzerland
Phone: + 41 22 749 01 11
Fax: + 41 22 733 34 30
Email: central@iso.org
Web: http://www.iso.org

EN 1635 Bar Coding – Bar Code Symbol Test Specifications
Available from:
Commission for European Normalization
Avenue Herrmann-Debroux 40-42 B-1160
Brussels, Belgium
Phone: + 32 2 661 1951
Web: http//www.cen.be

Also available from National Standard Organizations in Europe

EAN Specifications
Available from:
EAN International
Rue Royale 145
B-1000 Brussels, Belgium
Phone: + 32 2 227 1020
Fax: + 32 2 227 1021
Web: http://www.ean.be

Also available from EAN National Authorities around the world.

U.P.C. Specifications
Available from:
Uniform Code Council, Inc.
7887 Washington Village Drive
Suite 300
Dayton, OH 45459-8605
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