



Starting and Maintaining a Linear / 1D GS1 Bar Code Verification Service

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Table of Contents

1. Introduction	5
1.1. Scope	5
2. Target Audience	5
3. What is the purpose and value of verification?.....	6
4. Setting up and maintaining a GS1 Bar Code Verification Service	6
4.1. People	7
4.1.2. Recruitment	7
4.1.3. Training.....	7
4.2. Standardised Processes	8
4.2.1. Policies	9
4.2.2. Standard Operating Procedures	9
4.2.3. Systems.....	10
4.2.4. Customisation.....	10
4.2.5. Develop promotion material	11
4.3. Equipment	11
4.3.1. Physical environment	11
4.3.2. Verification Devices.....	12
4.3.3. Non verification specific equipment.....	12
4.3.4. Reference materials	12
4.4. Promoting your Verification Service	13
4.4.1. Routine	13
4.4.2. Reminders	13
4.4.3. Mandates.....	14
4.4.4. Benefits of GS1 Verification	14
A.1 Selecting a Verifier.....	16
A.2 Verification devices	19

1. Introduction

Hundreds of thousands of companies around the world rely on GS1 standards to conduct business and meet consumers' expectations. That means that if a bar code cannot be properly decoded it's more than just time at the cash register or the warehouse that is lost.

Today, 100% reliable GS1 Bar Codes are an absolutely vital part of the supply chain. As a result users around the world increasingly require assurance that products they purchase that carry GS1 Bar Codes conform to GS1 standards simply because it helps to ensure better reading rates, accuracy and efficiency.

Providing a common approach to the delivery of a GS1 Bar Code Verification Process increases consistency, confidence and helps to establish credibility and assurance that products are in conformance to GS1 General Specifications and thus will perform as intended.

1.1. Scope

This implementation guideline provides the basic structure or framework for establishing and maintaining a GS1 Bar Code quality verification operation/service. The guideline is intended to be used when a Member Organisation (MO) intends to establish a service and then once established, maintain such a service. The following should be considered when setting up a GS1 Bar Code Verification Service:

- staffing considerations,
- training and education,
- general operational considerations,
- creation of procedures / guidelines,
- recommended basic reference documents and guides,
- equipment requirements such as ISO conformant verification devices and other optional tools, gauges & equipment.

Beyond the set up and maintenance of such a service is the actual process of conducting a GS1 Bar Code Verification process. As this process is very technical in its nature, the provision of how to complete an actual GS1 Bar Code Verification is provided within the document, GS1 BarCode Verification Process which can be found on the GS1 Global Office website (<http://www.gs1.org/barcodes/support>). The GS1 Bar Code Verification Process document includes the details that are needed to create the output of the verification testing as well as the detailed process on what needs to be done.

2. Target Audience

The Target Audience are those GS1 Member Organisations that are considering or have decided to offer a Verification Service or a Member Organisation (MO) with an existing service that can be benchmarked against what is described in this document.

3. What is the purpose and value of verification?

A bar code's primary function is that of carrying data from the point at which it is originated to the point at which the data has to be captured. The bar code is therefore a vital link in the data communication chain of any application. A failure of a bar code leads to human intervention that is costly and has been proven to cause errors. These errors are carried through the supply chain and there is a cumulative, increased cost effect of data errors in the long term.

Verification of bar codes is, therefore, a useful tool to add to quality control procedures in order to ensure that the bar codes will scan correctly throughout the supply chain.

Verification aims to check that the symbol is able to fulfil its function, by:

- Enabling the symbol producer to measure his output, monitor his production processes and to apply feedback in order to correct any quality deviations
- Predicting the scanning performance likely to be achieved by a symbol.
- Providing packaging designers with feedback from verification to make sure that symbol size, position and colour will not result in point-of-use difficulties.
- Allowing the receiver of bar coded products to assess the likelihood of bar codes causing scanning problems in handling and inventory control systems, or at the point-of-use
- Allowing the party on whose product or item that the bar code is being applied assurance that his customers will accept the symbols

It is important to note that only a sample of symbols in any batch or production run will normally be verified, and 100% sampling is neither expected nor necessary, because of the relatively consistent quality levels achieved by the production processes usually used for bar codes. Ideally, the sampling basis will be determined by the statistical procedures used for the organisation's Quality Control programme.

Verification then assists the symbol producer and receiver in setting an agreed quality level for acceptance, allowing them to agree on the acceptability or otherwise of a given symbol.

Verification carries these tasks out by measuring how close the symbol is to "perfect" in relation to both the symbology specification and certain attributes which are related to the printing or reading of the symbol, and by reporting a quality grade which correlates with the likely scanning performance of the symbol.

4. Setting up and maintaining a GS1 Bar Code Verification Service

When establishing a GS1 Bar Code Verification Service it is necessary to gather equipment, reference documents, create procedures and train personnel. Organisations considering setting up a GS1 Bar Code Verification Service can use the recommendations in this guideline as a step-by-step guide.

Once a service has been established, there is also a need to maintain the service to ensure the level of quality is maintained and that the service maintains alignment with the evolution of the GS1 standards.

For organisations that already have a GS1 Bar Code Verification Service in place, a gap-analysis between the existing service and the guidance contained in this document is recommended. This will help provide ideas and priorities for an implementation / migration plan considering the activities described below

The following are key areas of focus that a service should provide and recommendations on what is needed to set up / maintain a service:

- People
- Standardised Processes
- Equipment

4.1. People

People are the foundation of any GS1 Bar Code Verification Service. They are charged with learning the standards and then applying the assessment of these standards to the verification of bar codes submitted to the service.

Ensuring that the staff are properly trained and are technically capable of conducting the testing correctly is an essential component of providing a verification service.

4.1.2. Recruitment

The following personal attributes should be considered when recruiting verification staff:

- Superior attention to detail
- Superior oral and written communication
- Ability to follow detailed procedures, but at the same time be flexible enough to respond to unusual situations
- Superior judgement to recognise circumstances that require assistance / escalation
- Bar Code knowledge

4.1.3. Training

4.1.3.1. Training new staff

Training new staff is essential for providing a solid foundation to provide consistent verification tests. Ideally new staff members should begin their training with the basics and develop their skills progressively through the various GS1 symbols that are specified in the standards.

A training development plan is recommended that initiates development of skills across the various bar codes beginning with GS1 linear symbols and then progressing to GS1 2D symbols.

Tools that can be leveraged to support the training of a new staff member include:

- Theoretical training that provides a sound knowledge of the relevant GS1 specifications, ISO/IEC standards and the theory of verification
- GS1 Bar Code structures and applications based on the GS1 General Specifications and GS1 implementation guidelines
- All related GS1 training on Bar Code Quality, Verification and the Completion of the GS1 Global Office Bar Code Modules
- Operating, calibrating and maintaining a bar code verifier
- GS1 procedures and technical criteria to assess conformance
- Shadowing more experienced staff during their initial training program

Once their training has been completed a new staff member should be able to demonstrate ability to:

- Correctly conduct verification tests and assess compliance with the GS1 specifications that relate to each symbology tested as demonstrated by returning the results on the Calibrated Conformance Test Card
- Accurately interpret verification reports
- Accurately explain how to correct the full range of faults and failures that a verification test might reveal in each symbology tested
- Manage verbal and written communication with users in the context of bar code verification testing and reporting including how to explain borderline grades and how to improve quality dependent on the parameter where quality is low (e.g., contrast, print quality)

Sufficient supervision and mentoring should be provided to ensure that the tester is not solely responsible for reporting test results until competency has been demonstrated to the satisfaction of MO management.

4.1.3.2. Maintaining skills and knowledge

Once staff have achieved a level of proficiency in their development, processes need to be put in place to ensure that their knowledge is properly maintained. Additions and changes to the standards require constant attention and staff need to be provided with constant updates.

Member Organisations and others should ensure they instigate a process for updating their knowledge as the standards evolve.

Leveraging external education opportunities is also recommended. Offers to work with verifier manufacturers or other industry organisations will help build understanding with the interpretation of verification results.

4.2. Standardised Processes

Each service should have a standard operating process. Generally a service should follow some key process steps to ensure a consistent approach.

At a high level the verification process should include the following basic steps. Each service may have additional standard operating procedures surrounding each step but all services should follow this basic model as a minimum.



Figure 1: Basic Verification Process Flow

The specific details of the verification process are contained in the document: GS1 Bar Code Verification Process. It is important that the process that is implemented follows a common set of procedures to ensure that there is consistency amongst the GS1 testing services.

4.2.1. Policies

The GS1 Bar Code Verification Service processes must recognise, and not conflict with, company-wide quality management processes (e.g. ISO 9001). A register of qualified individuals and approved trainers must be maintained by the MO conducting the tests.

GS1 Bar Code Verification Reports can only be issued by GS1 Member Organisations or authorised third parties. The ISO methodology and the reports are intended to be used by end-users.

Other policy considerations should include:

- Define a policy to charge for the verification service, to receive products for testing, storage and returning of products/samples.
 - Special attention is needed for products that are under development or for other reasons are deemed confidential or private by the submitting company.
- Define key performance indicators (KPIs) of the process.

4.2.2. Standard Operating Procedures

Each service should develop, document, implement and maintain an internal standard operating procedure as well as recording the fulfillment of all requirements described in this document.

These procedures could include but are not limited to:

- Operator checklists and instructions, or descriptive method sheets, to be followed to assure consistent and accurate verification

- A process to record any regular verifier or equipment maintenance such as keeping copies of calibration reports or noting in a calibration log pertinent information (such as date, operator, values, etc.) of the verifiers calibration
- A procedure for keeping file copies of the actual verification reports for potential customer follow up, retesting, comparison or dispute settlement
- Tests shall be conducted in compliance with ISO/IEC 15416 Information technology – Automatic Identification and data capture techniques – Bar Code print quality test specification – Linear Symbols. These tests must include additional checks as necessary to assess the compliance of the tested bar codes with the relevant sections of the GS1 General Specifications
- Final test results should be based on a final, filled production sample as substrate (thin white print on clear plastic) or product fill (dark liquid behind white ink) may have a major impact on parameters such as symbol contrast or defect.
- Conduct regular internal audits
 - Periodically (e.g. once a month or once per one-hundred reports issued) some bar code verification reports should be audited by a different person in order to confirm the accuracy of the technical analysis.
 - Results of these audits can be used as input for training, to harmonize technical interpretations and to identify opportunities for improvement.

4.2.3. Systems

Each service will require its own systems to be developed. The following provides some aspects of a system that should be considered when developing a verification system.

- A tracking system to identify where samples/products received for testing originated from
- An invoicing system, if the service is to be chargeable
- A filing/storage system for historical verification reports. This could be used if any questions arose in the future as a result of the verification, eg. vendor/customer dispute, legal action, etc.

Even when testing a small number of symbols per year, integrating the verifier to other systems such as membership databases could be beneficial. Operational activities such as, typing the bar code number, automatic population of a report template and generation of any cover letter can easily be automated to improve accuracy and efficiency to the process.

When the number of tests performed per year increases (e.g., more than 600 tests per year), full automation of systems should be considered:

- Perform a comparison with other companies, solutions providers and GS1 Member Organisations which have already automated their process to understand the possibilities, advantages and challenges.
- Consider fully integrating the verifier with existing systems. Many verifiers have the functionality to allow full integration of the test results with reports templates and administrative systems.

4.2.4. Customisation

The aim is to provide a verification service that has a consistent approach across the global environment. However there is sometimes a necessity to customise the non-technical components of the verification service reporting to meet your local market requirements. The use of common

technical components is essential to instill confidence and provide a path of resolution if an issue exists.

Customisation may take effect in a number of areas of the service you provide and may depend on local demands; however some areas that may require some local customisation include but are not limited to providing:

- Outputs of the verification service in your local language
- Local variation of the GS1 Bar Code Verification Service from the current version of the GS1 General Specifications
- General and technical comments and recommendations
- A list of Frequently Asked Questions (FAQs) for technical staff

4.2.5. Develop promotion material

Printed and online promotional material will assist in raising awareness for the GS1 Bar Code Verification Service. The following should be considered when promoting the service:

- Produce a basic service description, including the benefits for users, retailers and industry (for reference see Section 4.4.4, Benefits of GS1 Verification). It can be published on the GS1 Member Organisation web site and/or printed out as a flyer to be distributed at events or potentially by retailers to their suppliers
- Highlight that a GS1 Bar Code, validated with full conformance to the GS1 Specifications, has been shown to scan 25% faster than the average bar code used in retail supply chains
- Produce and publish a Frequently Asked Questions for members

4.3. Equipment

There are a number of different aspects to the provision of equipment to run a testing service. These include:

- The physical environment that the service is conducted in
- Verification devices
- Non-verification specific equipment

4.3.1. Physical environment

The physical environment where the verification service is conducted can impact the outcome of the verification report, not only with regards to results but ensuring the service meets the timely demands of the customers requesting the use of the service.

Some of the aspects of providing a suitable physical environment for the provision of a verification service include:

- Separate from the work areas of other staff.
- A dedicated, properly illuminated, climate controlled and ergonomic verification station or laboratory area
- Sufficient and secure space for the storage and handling of the anticipated number of samples
- Safe and comfortable for staff
- Sufficient lighting

4.3.2. Verification Devices

The minimum equipment necessary to implement the GS1 Bar Code Verification Service is:

- At least one ISO compliant verifier (ISO 15426-1) to cover the full range of linear bar codes to be tested to the GS1 General Specifications.
- The verifier's manufacturer approved operations manual, any applicable calibration cards, service and maintenance instructions.
- Ruler or calliper calibrated with at least 0.5mm of precision.
- It is also helpful to have one or more of the GS1 Calibrated Conformance Test Cards as a base line for certifying / confirming verifier performance as well as a test tool for checking operator performance. These are available from the GS1 US website (<http://www.gs1us.org>)
- For further information on Verification devices, please refer to Appendix A.2

4.3.3. Non verification specific equipment

There are other tools, gauges and pieces of equipment that can be useful in your verification process. These can include, but are not limited to:

- A sheet of clear glass raised clear of any surface to be used for unformed translucent substrates
- Printer, if applicable, for generation of verification results, optionally using the GS1 Report Template
- Omni and/or Bi-Directional scanners to simulate real-world scanning (not a replacement for the use of Verifiers)
- A ruler or measuring scale to measure symbol and label packaging position, placement and height
- Any available gauges, overlays or templates for measuring overall symbol size (Magnification), necessary Quiet Zones, layout characteristics, etc. such as:
- GS1 Symbol Contrast Gauge – 005444 (see <http://www.gs1us.org>)
- GS1 Symbol Templates – 005437 (<http://www.gs1us.org>)
- Magnifying glass, optical comparator, inspection lamp (useful for closer symbol inspection of defects, voids, split bars, etc)

4.3.4. Reference materials

In addition to the above procedures and guidelines, it is advisable to keep a library of reference materials and documents useful in the verification process. This reference library should include copies of the following:

- DVD on Bar Code Verification produced by GS1 Global Office
- GS1 Calibrated Conformance Test Cards (as needed)
- GS1 General Specifications (latest version, see www.gs1.org)
- GS1 Bar Code Verification for linear symbols (see www.gs1.org)
- The AIM Layman's Guide to ANSI, CEN and ISO Bar Code Print Quality (<http://www.aimglobal.org/>)

The following reference material will be useful to a more sophisticated service:

- ISO/IEC 15416 Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols
- ISO/IEC 15417 Information technology — Automatic identification and data capture techniques — Bar code symbology specification — Code 128
- ISO/IEC 15419 Information technology — Automatic identification and data capture techniques — Bar code digital imaging and printing performance testing
- ISO/IEC 15420 Information technology — Automatic identification and data capture techniques — Bar code symbology specification — EAN/UPC
- ISO/IEC 15421 Information technology — Automatic identification and data capture techniques — Bar code master test specifications
- ISO/IEC 15426-1 Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specifications — Part 1: Linear symbols
- ISO/IEC 16390 Information technology — Automatic identification and data capture techniques — Bar code symbology specifications — Interleaved 2 of 5
- PANTONE formula guide - coated/uncoated (<http://dev.pantone.com/>)
- Flexographic Image Reproduction Specifications and Tolerances (FIRST) Book – Flexographic Technical Association (<http://www.ftastore.com/>)

4.4. Promoting your Verification Service

Once the Verification Service is in place, it is important to promote this service to the community and gain their support. To gain this support an active effort is needed to promote the benefits that a GS1 verified symbol can bring. This section outlines some high level benefits that should be considered when developing the marketing material necessary. Each market is different, so the messaging needs to be tailored to suit the needs and perceived values that will have the biggest impact on the local community.

A verification service must be promoted among potential users so that they are aware of the service and off the benefits that testing offers. Promotion of verification services may be grouped into three categories:

- Routine – the service is kept in the view of members
- Reminder – users of the service are reminded when reports have expired
- Mandates – major retailers may require (mandate) the use of verification reports by their suppliers

4.4.1. Routine

MOs should actively encourage users to take advantage of the service by:

- Routinely listing it among core services offered in MO literature
- Actively advertising it in MO newsletters, on web sites etc.
- Ensuring that it is covered in all standards training sessions
- Instructing staff to actively educate members about the service and encourage use of it
- Reporting notable successes of the testing service and unusual examples of faults found.

4.4.2. Reminders

Records of tests should be retained and checked each month for

- Tests that are a year old
- Tests on artwork that are a month old

Reminders should be sent to the companies that requested the tests urging them to request new tests and explaining

- That a year-old test is no longer valid because packaging now in use will come from different print jobs than the packages that were previously tested so bar code properties may well have changed even if there have not been design changes
- That artwork reports are tentative because the real bar code will have different reflective properties from the artwork so a sample of the real bar code should now be tested to ensure that no changes have occurred

4.4.3. Mandates

Studies of bar code and data quality in various countries have revealed a consistent relationship between bar code quality and data quality. Bad data costs businesses much more than they lose through delays at checkouts. This realisation may prompt retailers to insist on verification reports on the products they receive from suppliers.

The cost to retailers to fix the problem is nil. All they have to do is tell their suppliers to provide verification reports. The cost to the MO may be considerable if the volume of tests required is very large so that extra staff has to be hired and more equipment and workspace obtained.

Once a retailer begins to require verification reports the MO should appoint a staff member responsible for the relationship with that retailer to constantly support and encourage the reporting requirement and to pass back to suppliers information about improvements made and problems experienced.

4.4.4. Benefits of GS1 Verification

4.4.4.1. Specific Benefits for GS1 Member Organisations

- Better member relationship if bar codes are used correctly.
- Better trained staff on bar code testing and use.
- Opportunity to link product description to the company allocated numbers.

4.4.4.2. Specific Benefits for consumers

As barcode scan rates improve, data does not have to be manually entered. This means:

- reduced chance of delays or waiting time in queue
- accurate product registration and accurate charge of the shopped items
- increased supply chain effectiveness which results in higher service levels to the end consumer

4.4.4.3. Specific Benefits for supply chain stakeholders

- Fast and accurate data capture at every point of the supply chain, including goods receiving, warehousing, picking, despatch and Point-of-Sale information
- More efficient supply chain
- Better quality bar codes improving scan rates

- Correct bar codes and therefore correct data in systems
- One test and bar code solution for all manufacturers giving confidence to retailers and other users
- Faster product to market by reducing lead time due to packaging re-printing
- Errors corrected at art work stage, prevents printing of wrong bar code
- Improved customer relationships
- No need to reprint the barcode that would lead to product recall, loss of packaging material, re-printing costs, poor speed to market
- Reassurance and confidence that the bar code will perform as intended at all stages of the product passage down the supply chain
- One bar code testing standard accepted globally
- Scannable bar codes facilitate accurate, real time stock management
- No loss of sales due to poor scanning and consequent loss of sales data

A.1 Selecting a Verifier

GS1 is often asked for advice on the selection of equipment. Whereas GS1 is commercially impartial the following informative information is provided.

ISO/IEC 15426 Compliant?

Compliance with this standard is a pre-requisite.

Consistency of performance?

GS1 initiated a Verifier Conformance Testing Project because of concerns expressed in certain areas of the market place that verifiers were unable to perform consistently. The perception was that different verifiers gave substantially different results when measuring the same symbol. A precisely defined test programme was performed under the auspices of GS1 and concluded that:

- All verifiers tested demonstrated the capability of consistent performance.
- Operators of verifiers require proper training and instruments require regular calibration in accordance with manufacturer recommendations.
- Most verifiers tested were capable of conforming to GS1 requirements.
- No major difference in accuracy was noted between hand-held and automatic scanning, but automatic scanning gave a somewhat narrower spread of results.

Will the primary use of the verifier be for monitoring production?

If the verifier will be used in the press-room, a simpler verifier able to give indications of bar width gain or loss may be sufficient - either by means of LEDs which show in broad steps how much gain or loss is occurring and in which direction, or by displaying the data in numerical form.

Is a printout of the data required?

If the verifier is to be used by Quality Control personnel, a more detailed analysis of both quality grades and traditional bar width gain/loss measurements will be required. The unit should almost certainly incorporate either a printer or means of downloading data for record-keeping and trend analysis.

Will the primary use of the verifier be to check that the finished symbol meets customer requirements?

This may be in the manufacturer's premises, on the packaging line or in the warehouse; it may be at an intermediate distribution point; or it may be in the customer's receiving operation. In such cases the primary need is for a report of overall symbol grade. In addition reporting of parameter grades is useful. The ability to provide a permanent record of results is highly desirable, both as evidence of compliance and in order to assist subsequent analysis of symbol characteristics.

Is film master verification required?

In the special case of film master verification, both the construction of the device (ability to measure by transmitted light) and its measurement accuracy (which ideally needs to be ± 2.5 microns) are of equal importance.

What type of verifier?

There are many types of verifier, and almost as many ways of categorising them, but for practical purposes it is most convenient to group them into two classes, related to where they are to be used and the extent to which all their possible functions are required.

The first group, often referred to as "Class A", contains the "full-function" type of verifier, is well suited to a Quality Control laboratory. A Class A verifier performs a full range of measuring functions and provides comprehensive analytical reports on the symbol, enabling the cause of problems to be diagnosed. Its use requires a good degree of knowledge of the technology and the operator must therefore be specially trained. Its measurement accuracy may be substantially higher than the average; its cost almost certainly is, and the time taken to perform the necessary scans and output the results may be relatively long – but in the expected conditions for which such an instrument is purchased this is unlikely to be a problem. This type of verifier may have motorised optical heads to improve the evenness of movement, or be based upon camera technology, to achieve the multiple scanning requirements, and to enable accurate dimensional measurements to be performed; they may have interchangeable measuring apertures and light sources to enable measurement of symbols with a wide range of X dimensions and meet the illumination needs of differing application standards. Certain Class A instruments are intended to be used in conjunction with a personal computer with special verification software for the symbol analysis and display/printing of results, linking to databases, etc.

The second group, often referred to as "Class B", contains all the simpler easy-to-use devices, intended for use in the pressroom or on the receiving dock by relatively less well-trained operators. At their simplest they are used just to check rapidly that the symbols are of the desired grade or better, and – particularly in the pressroom - to obtain an indication of bar width gain or loss and of contrast to help the press operator to fine-tune his machine. Typically they have a single light source and measuring aperture, though by the use of plug-in wands or mice a degree of interchangeability may be achieved. Some instruments use laser beam illumination which facilitates multiple scans of the symbol, though the effective measuring aperture may not be circular in shape and its size may not be precisely known; they may also be more limited in their reflectance measurements.

There is a group of specialised verifiers designed for mounting on printing equipment - some are designed for high-speed presses, others for on-demand printers - which monitor the bar codes produced by the equipment and provide continuous analysis of key parameters, notably element widths, to enable the operator to control the printing process very speedily. Some of these devices are even able to feedback control instructions automatically to improve symbol quality and reprint defective labels.

A particular verifier may be hard to fit neatly into either class, but whatever the prime purpose of the verifier, checking the features below will help to determine the suitability of manufacturers' products for the particular need. There will almost certainly be a **relationship between the features supported and the price** of the instrument. If budgets are restricted, over-specification of the instrument should be avoided. Equally, under-specification will only lead to frustration:

- Does the verifier support the ISO/IEC methodology?
- Has the verifier been tested for conformance with ISO/IEC 15426-1?
- What is the optical arrangement (wand, mouse, motorised head, etc)?
- What wavelength light source does it use? The *GS1 General Specifications* require 670 nm ± 10 nm.
- What measuring aperture(s) is/are available? Different apertures from the set (6 mils, 10 mils, 20 mils) are called for depending on the symbols tested and intended application.
- What form of output is available (e.g., LEDs, display, printout of details and individual scan profiles, PC connection, etc.)?
- Is it portable or does it require a fixed location?

- Can it perform scan averaging (to meet the 10 scan requirement)?
- Does it provide traditional measurement of bar width gain/loss?
- What symbologies is it capable of verifying?
- Automatic white balance?
- Does it support the GS1 Application Identifier standard?
- Does it offer a pre-selection of barcode types?

Useful contacts:

AIM (Association for Automatic Identification & Mobility) is the global association of companies providing equipment and supplies for the automatic identification market. They maintain a classified list of members in the form of a web based Buyer's Guide.

Association for Automatic Identification and Mobility (AIM):

Web: <http://www.aimglobal.org/>

Other useful web-addresses	
<p>AXICON Web: www.axicon.com</p> <p>LABEL VISION SYSTEMS Web: www.lvs-inc.com</p> <p>REA ELEKTRONIK Web: http://www.rea-verifier.com/</p>	<p>RJS a division of PRINTRONIX Web: http://www.rjs1.com/</p> <p>STRATIX CORPORATION Web: www.stratixcorp.com</p> <p>WEBSCAN Web: www.webscaninc.com</p>

A.2 Verification devices

What is a verifier? How does it differ from a scanner?

A verifier is a precision measuring instrument designed to provide consistent and repeatable measurements of a symbol and to analyse these measurements in relation to the likely scanning performance of the symbol under a range of conditions. It has to be calibrated before use and be controlled regularly to maximise the repeatability and consistency of its measurements.

A bar code scanner simply decodes the pattern of bars and spaces into the data encoded in the symbol. It does not measure any of the parameters that affect how a bar code can be decoded.

Why not just use a scanner to check readability?

No two bar code readers are the same. The optical arrangements available for scanners vary widely, ranging from light pens or wands to CCD scanners and hand-held or omnidirectional laser scanners and from manually-operated to automatic, unattended devices, any of which might be found at the various points in the distribution chain to the retail store or warehouse through which the product passes. Inevitably, these show quite noticeable differences in their scanning performance. Also, in order to maximise their performance, manufacturers of bar code readers build all kinds of clever features into their decode algorithms to help the equipment decode even poor quality symbols, reliably and as rapidly as possible. However, not all of these works in the same way and two different readers might well have different degrees of success with the same symbol.

So test scanning a symbol with, for example, a wand reader will not give any reliable indication of whether it would read with a laser scanner, nor even that any other wand reader could read it successfully. Nor does it help you understand whether the symbol deviates from perfect and if so what is wrong with it. At best, it can be used as a "go/no-go" test of whether a symbol can be read by that scanner (only), and to check the data content; it is risky to extrapolate any wider conclusions. But a verifier bases its assessment on the use of a standardised reference decode algorithm specified as part of the symbology specification, and on calibration of its optical response. Both of these enable consistent and objective quality assessments to be made irrespective of what type of scanner will be used in the application.

What verification does – and its limitations

The job of verification is to check how closely a bar code adheres to its specification, and to highlight the ways in which and the extent to which it deviates from the ideal. Receivers of bar coded goods can therefore estimate how successfully they are likely to perform in the scanning environment in which their application operates, and the producers of the symbol can check how acceptable it is likely to be to their customers and adjust their production conditions, to the extent that they can be controlled at an economical cost, to get as close as possible to the perfect symbol.

The use of a verifier will confirm adherence to specifications in many respects, particularly those related to the symbol's scanning performance, but it cannot provide total assurance that every aspect of every symbol is as required. In general terms, a verifier checks the features of a symbol that ensure that it can be read, but cannot cover its general formatting. Here are a few examples:

- Verifiers do not check every aspect of the symbol quality (e.g., bar height, correct usage of the numbering system). Verification services therefore need to manually assess them (e.g., whether excessive truncation has been performed, determine that the GS1 Company Prefix used is valid.)

- Without additional software linking the decoded data to a database, the data content of a symbol cannot be confirmed.
- The verification device cannot confirm the intended symbol dimensions. Many of the simpler verifiers cannot measure in dimensional terms though they can be accurate when measuring the relationships of element widths. This restriction is valid for low end wand verifiers (or similar models). More sophisticated verifiers are able to measure absolute symbol dimensions with a very high accuracy. This dimensional verification is usually offered by verifiers including a detailed traditional evaluation.
- If the symbol generation software does not automatically format the human-readable interpretation from the same data encoded in the bar code, then it is necessary to check that the two correspond. This should be manually performed if the verifier software does not have the capability.
- Because only a sample of the symbols produced is actually verified, the quality of all the symbols in a production batch cannot be guaranteed beyond the statistical confidence limits associated with the sampling rate used.
- Even a perfect symbol at the time of production can be damaged or otherwise affected in its passage through the supply chain (scratched, frozen, made wet, etc.).

The use of a verifier has therefore to be supplemented with a visual inspection and other appropriate checks, such as confirming the GS1 Company Prefix via <http://www.gepir.org>, in order to perform the complete verification process

Equipment conformance standards

Equipment conformance standards are aimed at giving users additional reassurance about the consistency of measurement of their instruments and those of their trading partners' or suppliers'. They are also considered important supporting standards to the basic verification process.

ISO/IEC 15426-1, entitled "Information technology -- Automatic identification and data capture techniques -- Bar code verifier conformance specification-- Part 1: Linear symbols", published in 2006 defines the basic requirement for a verifier to report the same results (within close but reasonable tolerances)

Comment: Verifier manufacturers whose equipment adheres to these standards are able to ensure that many of the arguments between suppliers and customers can be avoided, simply because there should be a good deal less variation in results. Variations will never be totally eliminated because the tolerances available on the measurements may just tip a symbol over a grade threshold, but the reasons should be clear when the details are examined.

Tolerance for Symbol contrast is +/- 8% both for overall symbol grade and for individual parameter measurements, when verifying a set of test symbols of known grades specified in the standards. The test symbols have been produced to great accuracy with various deviations from ideal for individual parameters (Defects, Decodability, Symbol Contrast etc.) and have been measured to a very high precision to show the values that should be given by the verifier. A subset of these symbols is available as the Calibrated Conformance Standard Test Card. Alternatively, equipment manufacturers may recommend specific conformance requirements. These should be adhered to and manufacturer guideline should be observed. This may include retesting verifiers by manufacturers to confirm conformance. The standards also define the functions the verifier must perform and a number of optional ones.