

In-Line vs. Off-Line Label Inspection

Risk of Off-Line-Only Inspection

MICROSCAN®

In-Line vs. Off-Line Label Inspection

Risk of Off-Line-Only Inspection

Customers face fines, supplier disqualification, and damaged reputation when erroneous labels escape into the supply chain. Off-line label spot checking can guarantee the quality of a new label, and can assess the quality of production labels over a given period of time, but do not catch individual errors that may occur during production, such as misprints, printer maintenance problems, debris or foreign matter entering the line, improper movement of goods, or sequential data printing errors. When production errors are discovered using off-line spot checking, entire runs of labels (since the last label that was verified for quality) may need to be inspected and discarded costing time and money. Some customers, however, don't believe in-line inspection is as reliable as off-line, due to uncontrolled barcode verification conditions during production, so many implement off-line only. Without in-line inspection and barcode verification, however, label production operations are essentially running blind and there is still significant error potential that can lead to serious costs and other negative impacts. This white paper provides information about in-line and off-line inspection and the risks of off-line-only label verification, and also discusses:

- Costs associated with poor-quality labels;
- Common causes of poor-quality labels;
- Implementation of a verification system to eliminate poor-quality labels;
- In-line and off-line inspection systems;
- Advantages of implementing an in-line label inspection system.

Barbie LaBine, Microscan Systems, Inc.

The Cost of Noncompliance



Figure 1:

Potential labeling problems

Poor quality labels have the potential to cause huge losses in time and money for a manufacturer. When a shipment of high-quality product is rejected at the customer because of missing or inaccurate product data, a manufacturer stands to lose much more than the potential earnings from the product's sale. There may also be material costs if products need to be scrapped, or material, shipping, and re-palletizing

costs if products need to be returned and reworked. Customers may impose fines on their suppliers to ensure manufacturer compliance or to account for the resources required to handle improperly-labeled product. Or, customers may simply charge back a portion of the manufacturer's invoice for receiving the noncompliant product. Finally, shipping delays caused by label inspection and re-labeling by the customer can negatively impact revenue and reputation.

Many retailers impose fees per label (for instance, \$5 per incorrect label) or per shipment of products (for instance, \$200 per shipment). Chargebacks issued to vendors for product label noncompliance can also be incurred for as much as 15% – 20% of the supplier's invoice, which, for large shipments, can result in losses in the tens of thousands (\$10,000 – \$20,000 or more) per invoice. With the adoption of globally-regulated standards like GS1 and ISO, the market has observed a new trend in which retailers issue separate fines for label print quality (missing or unreadable product label data) and barcode structure (improperly-structured data per standards such as GS1). There are even greater long-term risks associated with supplying inaccurate labels, such as the deterioration of customer-supplier relations and the possibility of losing supplier status for repeated compliance violations.

The Most Common Causes of Unreadable Barcodes

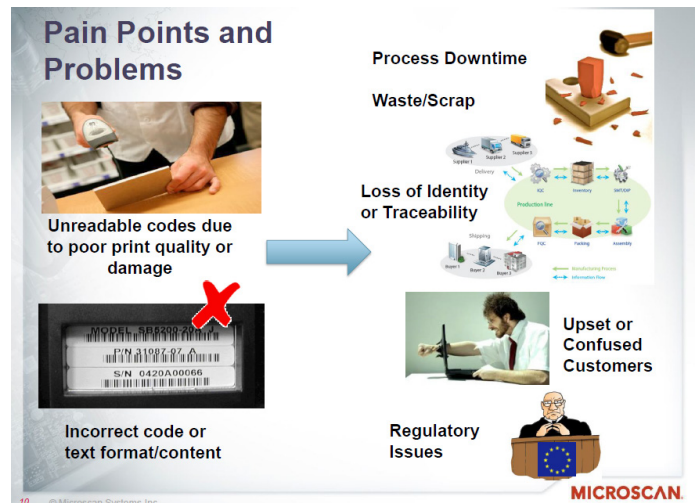


Figure 2:

Consequences of poor-quality product labels

Item identification and data acquisition through barcodes is critical to the function of automated operations, from ensuring that the correct components are used in the assembly of a smart phone to recording accurate patient data for samples in a laboratory. When poorly-marked or damaged barcodes result in no-reads or other failures, loss of data can have disastrous effects on product integrity and corporate reputation – not to mention potential legal implications and serious risks to consumer welfare. Understanding the root cause of unreadable barcodes and using technology appropriately to prepare for or resolve these issues is not difficult, and it can mean the difference between success and failure in automation applications. Please read Microscan's white paper "[The Most Common Causes of Unreadable Barcodes](#)" for additional information about the many factors that can undermine barcode readability.

Verification Systems

Verifying product labels for proper data structure and print quality before products ship is a simple insurance policy against losses and fines. By implementing barcode and print quality verification systems in their operations, manufacturers are able to guarantee legibility and standards compliance with precision, rejecting noncompliant labels before they escape into the market. Verification systems also allow manufacturers to automate the process of label quality checking, reducing potential human errors and supporting leaner operations. Using machine vision cameras and sophisticated software, verification systems automatically compare label features to predefined parameters, grading to standards such as GS1 and ISO and providing compliance results at required tolerances for specific labeling requirements. Manufacturers who integrate standards-based inspection with equipment save additional time and cost associated with training staff for specific standards knowledge, allowing the verification system itself to be the standards expert.

Implementing a verification system is the first step to safeguarding the ROI of goods shipped to customers. But for truly lean operations, manufacturers must look more closely at internal labeling operations and the advantages of systematic implementation of verification at critical stages. Label quality issues can emerge at many points throughout the supply chain, from initial label or package design to product distribution. Data structuring errors can be produced when a barcode or text string is created. Readability issues can result from adjustments made to a symbol during label artwork design. Print quality issues can be caused by printing inconsistencies or label damage during the manufacturing and distribution process.

For the leanest operations, verification should be incorporated wherever it has the potential to save cost. Even before product is shipped to the customer, there are several stages in manufacturing operations where time and material loss may occur as a result of label errors. A verification system implemented too far down the line may not catch a labeling error until an improperly-structured barcode is printed, requiring entire runs of printed labels or packaging to be scrapped. A verification system implemented at the printer may ensure that labels are printed correctly, but without additional verification down the line, damage or blemishes incurred as products move throughout manufacturing may allow illegible labels to escape out the door, resulting in customer fines. Establishing a lean labeling process means not only implementing verification, but implementing it in such a way that it effectively eliminates waste at every stage of manufacturing operations.

What Are In-Line and Off-Line Inspection?

In-line inspection systems are used while printing on a press or label printer to search for problems with print registration marks, streaking, or voids, so labels can be corrected quickly and have minimal impact on the job. These systems search for printing defects. Off-line inspection can detect blemishes and other marking problems. When flaws are detected, the line can be stopped and the issue can be corrected.

The difference between in-line and off-line verification is the location of the label in the production process when it is inspected. In-line inspection typically occurs during label printing. Off-line inspection often occurs after label printing, sometimes even after the label has been affixed to a product.

Off-Line Inspection Only



Figure 3:
Microscan LVS-9510 Desktop Barcode Verifier

Off-line inspection systems identify defects for operators or quality control technicians, who must determine and fix the label problem while the line is stopped. Downtime steadily accumulates as the scope of the problem is determined. Material is sorted or the label is replaced. Off-line inspection is usually carried out in a QC/QA setting to test the quality of the images prior to use (dur-

ing the label design or prepress phase) or to inspect a statistical sampling of the finished product. Off-line inspection is typically performed on only 5 to 10 percent of labels within an inspection run. Label error rates can be as high as 20 percent. For every 100 labels, 20 defective labels may eventually need to come off the production line if only off-line inspection is used.

In-Line Label Inspection

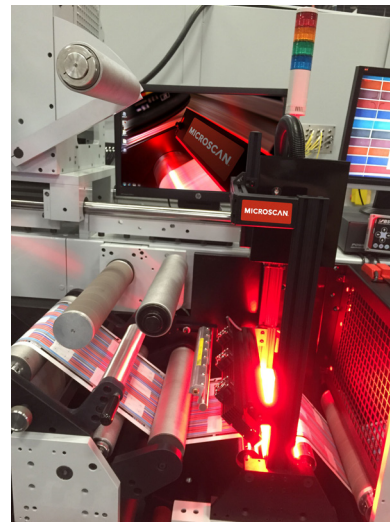


Figure 4:
Microscan LVS-7000 In-Line Label Print Quality and Inspection System

In-line inspection is used mainly for process control. It assists operators monitoring print quality in order to reduce material waste. The main goal of installing an automatic inspection system is to perform quality assurance and to detect all defects so they can be removed before shipment to customers.

In-line inspection provides a method for locating and flagging defects without stopping the line. Press corrections can be made on the fly. When major or continuous defects occur, the press may be stopped to reduce material loss.



Figure 5:
In-Line Label Inspection System

In-line verification ensures that every product ships with a high-quality barcode.

Benefits of in-line label verification are:

- Ability to grade (0.0 to 4.0) each symbol at the point of printing or marking
- Immediate symbol quality feedback
- Immediate warnings for low-quality or unreadable symbols
- Ability to observe trends in print quality or verification grades
- Optional logging of grades and captured images
- Reliable blemish detection on labels or surfaces with direct part marks
- Ability to verify the quality of printed text (optical character verification)



Figure 6:

Microscan AuoVISION software and VMI (Verification Monitoring Interface) grades and reports symbol quality.

Verify Label Print Quality In-Line After Printing or Applying to Product

In applications where the printer is the only element affecting label production, inspecting print quality is a matter of common sense. For the leanest possible labeling operation, an in-line print quality inspection system should be integrated as close to the point of label printing as possible. An in-line system at or

near the label printer is optimal in live production settings. In-line verification systems are uniquely engineered to check label print quality at production speeds and can be directly installed on the line to monitor labels as they are printed and applied.

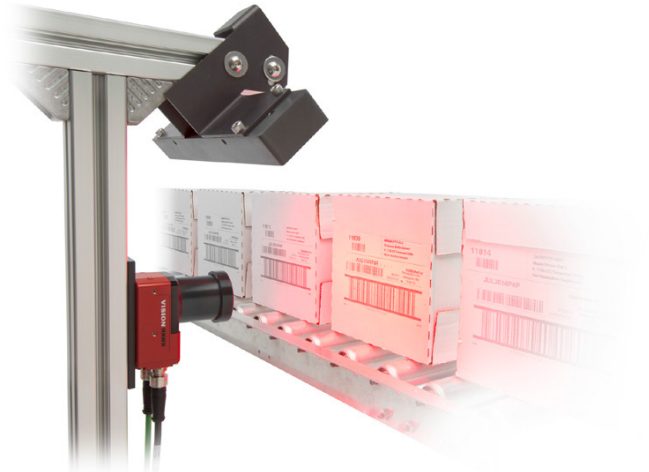


Figure 7:

A label verification system installed on a line ensures consistent symbol quality and print quality at full production speeds.

The earliest point at which an in-line system can be installed is during or directly after label printing. Print quality inspection systems that are integrated with label printers ensure optimal waste prevention by catching print quality errors before the label reel passes the point of rewinding.



Figure 8:

A Microscan LVS-7500 in-line verification system attached directly to a Zebra® printer ensures label accuracy while printing.

If quality issues are detected, the manufacturer can be sure that these issues are the result of inconsistencies in the printing method, having already ruled out data structure issues. The manufacturer can then adjust the printing method to ensure compliance.



Figure 9:
Microscan Vision MINI Smart Camera used for label inspection

Advantages of Applying Both In-Line and Off-Line Label Inspections

Each type of inspection system has advantages depending on how it's used. In-line inspection systems reduce the time spent setting up a job. Without in-line inspection, the operator will have to stop the press to look for defects, wasting time and material. An in-line inspection system can identify print problems on a press moving at speeds of 500 – 1,500 fpm (152.4 - 457.2 m/min). Subsequent off-line inspection allows time to analyze what may be wrong with an image that has been flagged by the in-line system.

Summary

Poor-quality labels result in material waste, potential fines, and loss of customers. By implementing both in-line and off-line label verification systems, label defects can be eliminated for nearly 100 percent reliability.

Microscan offers complete, all-in-one and custom-integrated in-line print quality inspection and barcode verification systems that can check individual labels and packaging for errors during production and at production speeds. Ensure data accuracy, print quality, legibility, correct placement and orientation, absence of blemishes and defects, color accuracy, and ISO/IEC compliance all at the speed of production.

The quality, legibility, and accuracy of marked text and barcodes can be easily checked with Microscan machine vision technology. Our intuitive AutoVISION machine vision software features powerful tools for both symbol quality verification and text quality verification (OCV). Using AutoVISION software, smart cameras, and lighting, a user can set up a complete verification system to determine barcode quality at any level of quality grading, including conformance to three global verification standards: ISO/IEC 15415 (2D symbols), ISO/IEC 15416 (linear symbols), ISO/IEC TR 29158 (DPM symbols). AutoVISION's OCV tool inspects the quality and confirms the legibility of printed text.

References:

1. Microscan® . (2015). The Most Common Causes of Unreadable Barcodes. Retrieved February 14, 2017 from <http://info.microscan.com/unreadable-barcodes>
2. Microscan® . Barcode Quality 101. Retrieved February 14, 2017 from <http://files.microscan.com/brochures/Barcode-Quality-101-Ebook.pdf>
3. Microscan® . (2015). Three-Step Verification for Lean Product Labeling. Retrieved February 14, 2017 from <http://info.microscan.com/lean-labeling>
4. Mc Loone, Chris (2007). In-Line Versus Off-Line Inspection. Retrieved February 14, 2017, from <http://www.packageprinting.com/article/web-inspection-systems-49863/all/>
5. Microscan® . (2015). Ensure Barcode and Printed Text Quality with Machine Vision. Retrieved February 14, 2017 from http://files.microscan.com/Webinars/2014-15-Oct_BRW-Microscan-Verification_webinar_PDF.pdf