

HOW TO MEET THE RISING NEED FOR 100 PERCENT VALIDATION OF BARCODE READABILITY

I. Introduction

It has been more than six decades since Joseph Woodland invented what has become known as the barcode; when he and his friend Bernard Silver patented the concept in 1952, they called it “Classifying Apparatus and Method.” It’s come just a little way in the intervening years.

Some may say that the barcode is the quintessential image of the consumer society. It has revolutionized how business is done in every sector by enabling faster and more accurate inventory management. Indeed, today it is an essential part of efficient and detailed communication as goods and services move throughout increasingly far-flung global supply chains.

Yet, the barcode receives no respect in some circles. A 2012 *Wired* article, “Why the Barcode Will Always be the Mark of the Beast,” pokes fun at the urban legend that the advent of the barcode is a sign of the apocalypse. When the lead singer of R.E.M. railed against stickers being put on CDs to indicate potentially offensive content, he said, “sticker them all—make them as meaningless as the barcode!”

Meaningless as the barcode? Clearly there’s someone who doesn’t know of what he speaks. The barcode’s evolution over time to capture and deliver increasingly more meaning has brought it increased power and visibility, which has grown with both compliance standards and retailers’ and manufacturers’ reliance on it for their own processes and supply/value chain participation.

The combination of stricter compliance standards and



retailer-imposed chargebacks or manufacturer-imposed quality audits is driving a double need for more precision printing, regardless of the environment, and 100 percent validation of barcode readability. Fail to achieve these, and you’ll quickly see why the barcode is worthy of our respect.

II. Compliance, Change, and the Costs of Inaction

Typically there are two reasons companies change their approach to printing and barcode validation: one, they may choose to do it on their own (mainly to improve their internal processes that leverage barcode technology); or two, someone forces them to do it. Not surprisingly, the latter has been the principal agent of change in most industries.

Barcode quality is largely a compliance-driven issue, steered by customer mandate. If a supplier doesn’t produce its barcode labels to meet the standards its customer desires, it risks the relationship with the customer. Labels produced by the supplier are scanned at a customer location or distribution center; if they don’t scan properly, a bottleneck ensues. The need to ensure smooth operation—to validate the readability of barcodes—resulted in the development of quality standards, established by the customer or by a standards organization such as the American National Standards Institute (ANSI).

From the beginning of widespread barcode usage, industry recognized the need for establishing standards. Initial barcode standards were based on width alone, a system that quickly proved inadequate. In 1990, ANSI worked with the Uniform Code Council (UCC) to implement new standards, based on how barcode scanners work, so that the quality of barcodes became the focus of regulation, not simply size.

Under the ANSI standard x3.182-1990, a barcode's quality is assessed on eight characteristics and assigned either a number on a scale of 0 to 4, or a letter, A to F. (When UCC and ANSI applied the standard to UPC codes, a ninth characteristic was added to assess UPC quiet zones.)

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Symbols with a grade 4/A are the best quality and will in general give the best performance. This grade symbol is appropriate for systems in which the reader crosses the symbol once or is limited to a single path. A symbol with a grade 3/B may not perform to the level of grade 4/A, 2/C to the level of 3/B, and so on.

“In the beginning, when a supplier was told they had to produce a shipping label, they went out and bought the cheapest printer they could,” says Terry Whitmyer, director of customer applications at Printronix. “Wal-Mart wasn't going to pay you to produce those labels; neither was GM. So suppliers bought the cheapest printer they could, as well as the cheapest labels and ribbons to use in that printer. They found that barcode quality was poor, but in the early days no one scanned the label.”



Those days have passed. Now when we talk about compliance in the retail world (i.e., Sears, Kmart, Wal-Mart), compliance fines are associated with failure to produce readable barcodes. “They charge you per-box fines for every box where the barcode isn't readable, or they send it back to you for relabeling,” notes Whitmyer.

Another side of compliance is seen in the manufacturing sector. Consider automotive: if a supplier is shipping to GM, Ford, Chrysler, or one of their tier suppliers, it has to put a label on the product—a part label on the part and a shipping label on the container. “If you're a GM supplier and you send labels that they can't read, they can make your life miserable,” Whitmyer points out. “They're not going to send the parts back, because they need them to build cars or subassemblies. But they'll make you go through a quality audit to ensure that however you produced those bad barcodes, you won't do it again.”

These audits can be costly. For example, a small supplier shipping to one of the Big Three's tier suppliers found this out the hard way when they discovered that their product didn't scan. They produced labels and tested a few on their in-house scanner. However, when the labels got to the end user, they didn't scan correctly. That's why the ANSI standards are set: to produce a barcode that passes all the standards for quality, so that no matter whose scanner is being used, the code is always readable. In this case, the supplier had to put together a process that cost \$250,000 to ensure that this situation wouldn't occur again in order to retain the business.

Every time a barcode fails to scan, it is costly—at the receiving dock, through the manufacturing process, at the pick/pack station, and at the shipping dock.

Moreover, as products proceed through the enterprise, mistakes become more difficult—and more expensive—to correct, as labor is added to the barcoded item. These costs are then passed along, making the business less competitive.

These costs of inaction—chargebacks, audits, diminished competitive standing—are why it is critical for users to comply with the ANSI standard as they look at the barcode quality being produced by their printer. If something is not correct to the standard, even though the barcode may scan on site, that label should never be allowed to enter the supply chain.

For a host of reasons (e.g., burnt pixels on printheads, wrinkles and blemishes from ribbons and labels, media issues

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like wrong type or poor label design and construction), all printers can produce unreadable labels; the consequences faced for doing so become more severe over time. As such, companies would be wise to implement a more precise barcode printing solution, one that yields 100 percent validated barcodes 100 percent of the time.

III. Designed for Precision Printing

There are several reasons the print quality achieved by Printronix printers is unparalleled in the industry. “An important differentiator of our printers is the use of dual motor ribbon systems that enable more precise and accurate ribbon tension control for the full length of the ribbons; this helps tremendously



in eliminating the risk of ribbon wrinkle,” says Andy Edwards, Director of Product Development at Printronix. “Other types of printers are more subject to this problem because they use a clutch mechanism.”

Another key factor is Printronix’s “history control” of the printheads. The way printheads work is that across the width of the printer are hundreds of dots, tiny hitching elements. If it’s a 2DPI printhead, there are 203 hitching elements per inch; on a 4-inch printer, it’s four times that. Each of those hitches has to be pulsed to create heat and transfer the wax from the ribbon to the label.

The challenge with printheads is being able to manage that heat, because the hitching elements retain some residual heat. So what can happen on the previous dot row (the heads print one row at a time) is that residual heat is left over after the print.

“We have to manage and anticipate what has happened before, so that we can compensate in future printing in terms of dot rows,” says Edwards. “There’s a fairly sophisticated algorithm we use that is another differentiating feature of our printers.” Many printers, particularly low-end (i.e., lower cost) units, don’t have very sophisticated algorithms to handle this heat management issue, and that can compromise print quality.

A further point is Printronix’s printer construction: they are very rugged, robust and extremely stable, with die-cast frames and parts for consistent, solid performance. “The ribbon is only 6 or 7 microns thick—exceptionally thin—so any minor perturbation or misalignment of the ribbon can cause a wrinkle,” Edwards explains. “Because of this, a highly stable mechanical platform is important to ensure consistency from one unit to the next.”

IV. Fully Integrated Validation

In the past, when a company wanted to integrate barcode validation, they needed to employ a quality team that audited devices to ensure barcode quality and scannability of labels. Typically they did this audit in the morning at the end of the first shift, then at the end of the next shift, and so on. “They may have a team doing this, but what many don’t realize is that this process isn’t a 100 percent audit,” says Whitmyer. “What Printronix has done with its Online Data Validation (ODV) tool is to change the thermal barcode printer into a real piece of test equipment to ensure that 100 percent of the barcodes produced on that printer—that get into the supply chain—are 100 percent readable, no matter who is reading them, no matter what scanner is used. We are assessing the grade of every barcode

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produced.” This ensure a perfect barcode every single time.

Online Data Validation (ODV) analyzes every barcode printed with a Printronix thermal printer to assure that it meets the most stringent scanning standards. More importantly, it analyzes each barcode immediately after the label is printed with minimal effect on throughput. This 100 percent inspection of linear barcodes validates that the barcode image falls well within the barcode symbology specifications. ODV stops bad barcodes from getting into the production or distribution system, which could lead to a shutdown of operations; it improves supply chain operations by eliminating the need for costly human intervention in the validation process.



“Our ODV is unique in that our validator is integrated with the printer,” says Bill Brown, director of software engineering at Printronix. “It’s not just an independent piece of hardware that is reading barcodes and flashing a light when a bad barcode is discovered. It’s total integration: the validator and the printer know exactly how many and what types of barcodes are supposed to appear; they validate the data that is scanned with the printer to make sure that they match.”

How the ODV Tests Barcodes:

1. The ODV anticipates types of barcode symbology to be printed.
2. The printer prints the barcode. The barcode image is scanned and tested against the barcode symbology specifications.
3. If all the barcodes meet specifications, the label is ready for use. If the label does not meet specifications, ODV uses its datastream analysis to overstrike the “bad” label and print a “good” replacement one.

“When the verifier finds a bad barcode on the label, the printer has the ability to pull the whole label back into the printer and put a grid pattern over that label to ensure it won’t enter the supply chain,” notes Edwards. That’s another benefit of using motors on the ribbon spindles, because they can pull back the ribbon to the requisite length, whereas a clutch can only pull back about an inch.

The fact that the Printronix ODV is fully integrated is important. Other companies have bolted scanners or verifiers onto their printers, but it’s not very encompassing. In the case of Printronix, the printer itself controls everything.

“With competitors, there’s not much intelligence around the solution,” says Edwards. “For example, they may find a bad barcode, then stop the printer and wait; with our fully integrated solution, the bad code is identified and the printer then automatically takes corrective action.”

Further, with ODV Data Manager, part of the Printronix PrintNet Enterprise suite, a company can have multiple printers sending input with a single device managing them all. The ODV Data Manager runs remotely, so many companies integrate it into their manufacturing environment and use it as a database. It’s a powerful and effective means of documenting barcode validation.



For this new group, self-improvement is driving change. So whether it’s something as simple as putting a location label on a pallet or rack, the question is how to ensure that barcodes are easily scanned? They’re using ODV to make sure that 100 percent of the barcodes that go into their own supply chain are scannable.

In the end, a checklist of benefits for the Printronix ODV solution provides compelling rationale for change, regardless of have-to or want-to motivation:

- Integrates validator to printer seamlessly.
- Checks and collects barcode data to a unique file.
- Provides a closed-loop audit trail.
- Assesses quality for specific labels.
- Sends and stores in real time.
- Saves labor.
- Improves productivity.
- Provides 100 percent validated barcodes, 100 percent of the time.

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“It’s also a very flexible solution,” adds Brown. “A user can easily configure what grades or other parameters are desired in terms of validation. The information one receives back is also configurable, from simple pass/fail to detailed reporting.”

V. Looking in the Mirror

Whitmyer sees a different driver starting to effect change in barcode validation: the desire for self-improvement. “I’ve said that companies change their printing and barcode validation practice for two reasons: they’re told to or they want to. While being told to comply has always been a principal driver of change, I’m starting to see more companies changing as a means of improving productivity within their own enterprises. They’re looking in the mirror and seeing how a different approach to barcodes can improve the view.”