



GS1-128 and Print & Apply: Perfect Partners

BY SATO America

Historically, the driving force behind manufacturers placing barcodes on shipping cartons has revolved around the need to meet retail customer requirements. In other words, it was less of a “want to” scenario and more of a “have to” scenario. In many cases the decision about how to accomplish barcoding was simply a cost driven exercise. How could the organization meet the retailer mandate at the lowest cost?

In today’s world of supply chain optimization and supply chain partner information sharing, the barcode is more important than ever. Specifically, the expanding use of the GS1-128 barcode is driving many new barcode implementations. While retailer mandates still exist, a growing number of projects are now being driven by inward-looking goals such as increasing inventory visibility, improving partner data sharing, reducing work in process, eliminating errors, improving efficiency and other internal enhancements. In many ways the barcode has become an extremely valuable tool in the development of corporate supply chain and logistics strategies. Therefore, more emphasis is now placed on barcode readability both internally and externally. This also means the decision surrounding the barcode print technology is looked at more closely to ensure the best overall solution rather than simply the least expensive capital outlay.

In many ways the barcode has become an extremely valuable tool in the development of corporate supply chain and logistics strategies.

Two commonly selected production line barcoding technologies include thermal print & apply technology and inkjet printing. Inkjet is a non-contact means of printing

barcodes directly to shipping cartons. Print & apply uses a thermal print engine to produce a label that is then applied to the product through various means of either contact or non-contact technologies. The following pages will outline why thermal print engine based print & apply systems are a superior choice for companies considering an automated GS1-128 barcoding solution.

SUBSTRATE SPECIFICATIONS AND CONTROL

Both thermal print engine and inkjet barcode printing require the image to be printed dynamically to a receiving substrate. In the case of inkjet printing, the substrate is, generally speaking, a corrugated shipping carton. For thermal print engines, the substrate is some type of thermal transfer or direct thermal label. The key fact here is that corrugated boxes are not specifically designed for use with inkjet printing, whereas labels are very specifically designed to various application specifications for either thermal transfer printing or direct thermal printing.

Because corrugated cartons are not designed for inkjet printing, there is no way to specifically match an inkjet system or particular ink to a corrugated specification. A company can’t control such important factors as porosity, surface tension, recycled content quality, etc. These and other factors can greatly impact the ability to repeatedly print scan-quality barcodes. Many inkjet systems have the capability for operators to control ink dot volume in an effort to provide some sense of control. However, this control is not dynamic and cannot determine carton characteristics on a carton by carton basis. Yet, carton characteristics may be changing from delivery to delivery, pallet to pallet or even carton to carton. Lack of substrate control leads to lack of barcode print quality control.



Labels, on the other hand, are specifically designed not only for thermal printing in general, but also for very specific thermal transfer or direct thermal printing applications. Therefore, a printing environment can be matched to a label (direct thermal) or label/ribbon combination (thermal transfer) that offers a consistent substrate designed for the use. Since each label facestock and ribbon has a specification, there is no variation from label to label, roll to roll or delivery to delivery. Therefore, variability is eliminated resulting in more consistent, scan-quality barcodes.

MATERIAL HANDLING CONSIDERATIONS

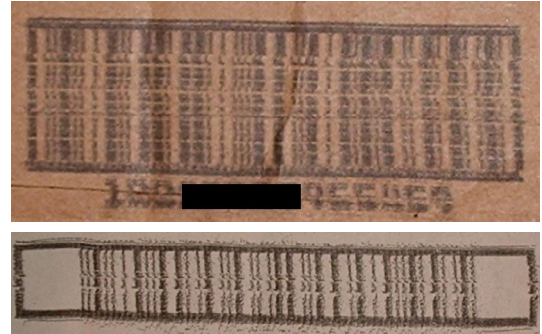
Whether inkjet printing or using thermal print & apply, material handling is important for successful operation. Inkjet printing barcodes, however, requires a much greater material handling effort with greater precision, less room for out of tolerance operation and, likely, higher costs. Inkjet printing is entirely non-contact, so ink drops must fly through the air to reach the carton. If the carton is bouncing, such as on a roller conveyor, the resulting barcode will appear wavy as in the following examples.



Note the wavy horizontal and vertical lines produced by an inkjet printer. Possible causes include use of roller conveyor, printheads not aligned parallel to carton surface and insufficient material handling.

If the carton is too far away from the printhead, the barcode will appear fuzzy, or out of focus. To a barcode scanner, these codes may not be readable. To the human eye, they will certainly not be aesthetically appealing. To ensure good quality inkjet barcodes, material handling must be precise. The conveyor will likely need to be a belt conveyor with the belt over a slider bed, not rollers. Box location relative to the printheads will need to be precisely controlled within a very

narrow window. Since corrugated cartons are not generally "square", it's very likely the inkjet printheads will need to move dynamically in/out with the carton surface to ensure a consistent distance. Many inkjet suppliers can provide an elaborately designed inkjet coding station that would install either in place of or in addition to existing conveyor space. Assuming the space exists for such a contraption, the budget may not.



In the above barcodes the fuzziness and blur are caused by the carton being too far from the printheads. Some nozzles also appear to be partially clogged.

Unlike inkjet printing, there is no need to be concerned about material handling for the printing surface in a print & apply application. The printing surface is the label. The thermal print engine component of the print & apply system has complete control of the printhead, the label and the ribbon (if used). Variability is minimized, ensuring consistent, quality barcode printing.

Inkjet printing barcodes requires a much greater material handling effort with greater precision, less room for out of tolerance operation and...higher costs.

The carton material handling requirements for print & apply applications, while important, are generally much less intensive and less costly than for inkjet printing. The majority of applications can be successfully achieved via a simple guiderail addition that will justify the carton to one side of the conveyor or to a consistent position on the conveyor. Most conveyor types are perfectly suitable for print & apply systems, so specially designed application stations are not required. A print & apply system's label application device can generally account for some normal variation in carton positioning. If carton positioning can not be made consistent, the print & apply system can then be specified with a sensing system to locate the carton during the label application process and properly apply the label.

CLEANLINESS

The cleanliness argument is pretty straightforward. Liquid, black ink can be very messy. It's rare to see an installed inkjet barcoding system that doesn't have a black ink stain on the floor, under or near the printheads. When ink leaks or spills, the plant has a liquid mess to clean up before it becomes a larger mess or even greater slip hazard.

Even if spills and leaks can be avoided for the most part, many piezo and thermal based inkjet systems create an ultra-fine mist of ink that ends up not only on the carton, but on the surrounding equipment, conveyors and floor. With print & apply systems, there are no troubling liquid components. The thermal transfer ribbon is a coated poly-based film in roll form that is easy to store, handle and install. The occasional label that may end up on the floor or on the conveyor can either be picked up or peeled off without much effort.



APPLICATION FLEXIBILITY

This section involves the many different ways a company can implement the technology to achieve the barcoding requirement mandated by the various supply chain partners or the internal requirements necessary to gain the most benefit from data collection and analysis.

Because a print & apply system utilizes a ribbon/label/adhesive combination engineered for the application, it is suitable for nearly all application surfaces.

One area to review is label placement on the product. Most labeled products, whether they are shipping cartons, shrink filmed trays, pallet loads, etc., have six potential labeling surfaces (4 sides, top and bottom). Most ink-jet barcoding systems will be limited to spraying barcodes onto the moving sides of the product. Some may be able to barcode down, onto the top of the product, but this would require another set of print heads if the top requirement was in addition to one or more sides. A print & apply system has great flexibility in what product face or faces can be labeled. The traditional side label or top label can, of course, be done. However, a print and apply system could also be configured to achieve any of the following labeling configurations:

- ☑ Leading panel and side panel with separate labels
- ☑ Side panel and trailing panel with separate labels
- ☑ Leading panel and side panel with single "corner-wrap" label
- ☑ Side panel and trailing panel with single "corner-wrap" label
- ☑ Side panel and top panel with single "corner-wrap" label
- ☑ Leading panel and top panel with separate labels
- ☑ Leading panel and top panel with single "corner-wrap" label
- ☑ Top panel and trailing panel with separate labels
- ☑ Top panel and trailing panel with single "corner-wrap" label

A company's barcoding requirements can nearly always be achieved with a print & apply system configured for one of the above application types.

A second area to review involves the material being coded. An inkjet barcoding system generally requires a porous surface such as a corrugated carton. There are some inkjet barcoding systems that can print directly on non-porous surfaces, but these systems will either have dry-time questions (in the case of liquid ink) or durability questions (in the case of solid or wax ink.) Both types of ink will have barcode scanning questions depending on the color of the surface being printed or the color of the surface showing through in the case of clear plastics. Because a print & apply system utilizes a ribbon/label/adhesive combination engineered for the application, it is suitable for nearly all application surfaces including, but not limited to the following.

- ☑ Corrugated cartons (white or brown)
- ☑ Shrink-filmed products such as trays or display cartons
- ☑ Stretch-filmed products such as pallets or other bundled items
- ☑ Wood products
- ☑ Home improvement products such as tile, ceramic, laminates, carpet, etc.
- ☑ Wax-coated cartons
- ☑ Coated and uncoated chip board containers
- ☑ Glass
- ☑ Plastics



Another issue of concern is product shape. Inkjet barcoding systems require a flat surface and a consistent distance from that surface to the print head nozzle. Without that consistency, a scannable barcode is not likely to be printed. Print & apply systems, on the other hand, are not dependant upon a product's surface characteristics. Because the label is printed while being controlled by the printer, the barcode quality can always be optimized. Additionally, a print & apply system can be configured with a number of different application devices to account for such things as cylindrical products, uneven/rough surfaces, convex or concave surfaces, damaged surfaces (like those found with re-usable containers), fragile surfaces, non-continuous surfaces (picture the top of a tray of water-bottles) and even mismatched surfaces such as those found where a tray transitions from the corrugated tray to the product.

For most company's products, there is a suitable print & apply barcoding solution available to overcome even the most unique challenges.

GS1-128 CONSIDERATIONS

The GS1-128 barcode is quickly becoming the "de-facto" standard data carrier of GTIN and other critical logistics information such as lot numbers, date codes, weight, etc. The GS1-128 barcode uses application identifiers to identify various pieces of data within the barcode. This allows the GS1-128 to be effectively used across a variety of industries with varying information needs. As an example, the Produce Traceability Initiative (PTI) specifies the use of the GS1-128 barcode to encode GTIN, lot/batch number and pack/harvest date.

A company's choice of barcode printing technology can have very serious implications on the effective use of the GS1-128 barcode. Specifically, the use of inkjet barcode printing equipment directly onto brown corrugated containers does not, and can not, meet the minimum "C" grade requirements of the GS1-128 standard.

GS1-128 verification involves the testing and grading of several parameters that impact the overall quality of the printed code. These parameters receive either a pass/fail grade or a letter grade of A(4), B(3), C(2), D(1) or F(0). The overall grade for a given barcode is determined by the lowest grade of any parameter. So, if all parameters grade out at "B", then the overall grade is "B". However, if just one parameter grades out as a "D", the overall grade is a "D" and the barcode does not meet the GS1-128 minimum "C" grade requirements.

Looking back at the application with inkjet printing on brown corrugated, the specific grading problem involves the parameter called Symbol Contrast. Symbol Contrast is the difference between the highest reflectance value (spaces or background) and the lowest reflectance value (bars). The grading parameters for Symbol Contrast are as follow:

- >/= 70% = A**
- >/= 55% = B**
- >/= 40% = C**
- >/= 20% = D**
- < 20% = F**

Per Section 5.5.3.3.11.1, Reflectance Parameters, of the GSI General Specification, black ink will generally have a reflectance value between 3% and 8%; while brown corrugated will have a reflectance value between 27% and 40%. With Symbol Contrast (SC) equal to maximum reflectance (Rmax) less minimum reflectance (Rmin), using even the optimum values of the aforementioned ranges results in a "D" grade.

$$\begin{aligned} R_{\max} - R_{\min} &= SC \\ 40\% - 3\% &= 37\%, \text{ or D} \end{aligned}$$

The conclusion is quite simple. Inkjet barcoding systems cannot be used to produce GS1-128 compliant barcodes on brown corrugated cartons.

Inkjet barcoding systems cannot be used to produce GS1-128 compliant barcodes on brown corrugated cartons.

The key advantage of print & apply systems is the use of white labels. The white labels create a high reflectance background (75%+) that allows the Symbol Contrast grade to easily fall within GS1-128 specifications. Thermal transfer printing also provides high grading capabilities on all the other graded parameters.

As the logistics world continues to adopt the GS1-128 barcode as its data carrier of choice, greater emphasis will be placed on the ability to effectively read those barcodes at all points in the supply chain. Thermal based, print & apply systems offer a more reliable means of generating GS1-128 compliant barcodes when compared to ink-jet based printing systems.



SUMMARY

To summarize, print & apply systems offer the following advantages:

- ☑ Complete substrate control provides for consistent print quality
- ☑ Print substrate consistency eliminates print surface variability
- ☑ Reduced material handling considerations provide less installation and operational complexity
- ☑ Cleanliness enhances safety and aesthetics, especially in a food environment
- ☑ Flexibility to barcode label nearly any product surface with minimal material handling
- ☑ Flexibility to barcode label a wide variety of materials
- ☑ Ability to print GS1-128 compliant barcodes regardless of product surface type

Whether automating barcode labeling systems for the first time or upgrading existing hardware, thermal based print & apply systems are the best choice to ensure consistent, reliable and compliant barcode operations.

Scan this QR Code
for more info >>>
or visit www.satoamerica.com/



For More Information Contact:

SATO America, Inc.
10350A Nations Ford Road
Charlotte, NC 28273

Telephone: 704 644-1650
Fax: 704 644-1662
Email: satosales@satoamerica.com
Web: www.satoamerica.com



SATO AMERICA CORPORATE

10350-A Nations Ford Rd
Charlotte, NC 28273
Phone: (704) 644-1650
Fax: (704) 644-1662
sales-sallc@sato-global.com

LABEL MANUFACTURING, SERVICE & SALES

UNITED STATES MEXICO CENTRAL AMERICA
CANADA CARIBBEAN