



DataLase Solutions for Laser Marking in Corrugate Applications





Introduction to the Problem

Industrial lasers have a certain mystique about them. They are thought of as precise. Powerful. Elegant. But they are not bringing as much new capability as one might think. Many industrial lasers are cutting and marking tools at heart, and neither cutting nor marking started with lasers. They are an innovative way to do an old job.

So why have lasers become a prominent method to cut, etch, and mark? The answer is process improvement.

Older cutting and marking methods use direct contact, meaning that they add or remove material through physically touching the work surface. Lasers are unique in that they perform their function without surface contact.

This gives lasers a two key advantages:

Reliability—lasers neither wear nor clog when cutting and marking. Direct contact methods experience both issues, making them more unstable and prone to breakdowns.

Precision—light energy can be focused very finely and manipulated with exactness. This level of precision is difficult to achieve with direct contact methods. Lasers also maintain high precision throughout their lifespans as a consequence of their non-contact approach.



Lasers can create consistent, good quality results while reducing operating costs and, as a result, have become the preferred cutting and marking method in many production environments throughout the world.

One drawback of lasers is that they do not perform equally well on all surfaces. Some substrates do not respond to the laser in a useful way. These tend to be materials that are sensitive to high heat, such as fabrics, films, and papers. A second breakthrough would be required to bring laser marking to these substrates.

That breakthrough is laser-reactive materials, a category of chemical compounds that experience a molecular change when exposed to laser light. A subset of these undergo a color-change reaction—that is to say, turn a certain color—when exposed to a laser beam.

By manipulating which areas turn color and which areas stay as they are, lasers can form images on surfaces coated with these materials. In short, lasers can now “print” on any surface pretreated with laser-reactive material.

One of the most prominent laser printing applications is now corrugate cases. Corrugated boxes are used as shipping containers in very large-scale operations—food and beverage production, pharmaceutical manufacturing, eCommerce—where increased reliability and precision make a meaningful financial impact.

This white paper endeavors to explain the reasons behind the success of this process, known as laser case coding, and what manufacturers need to implement it.

Laser Case Coding— Process Improvements Over Direct Contact Methods

Consistent and High Quality

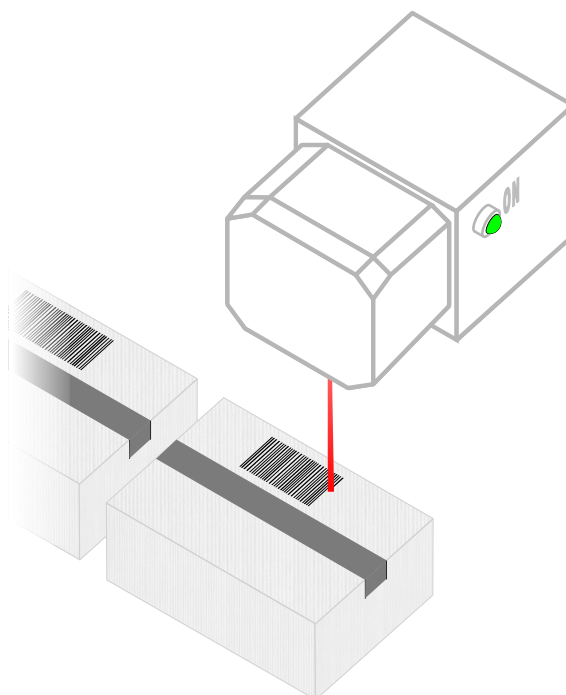
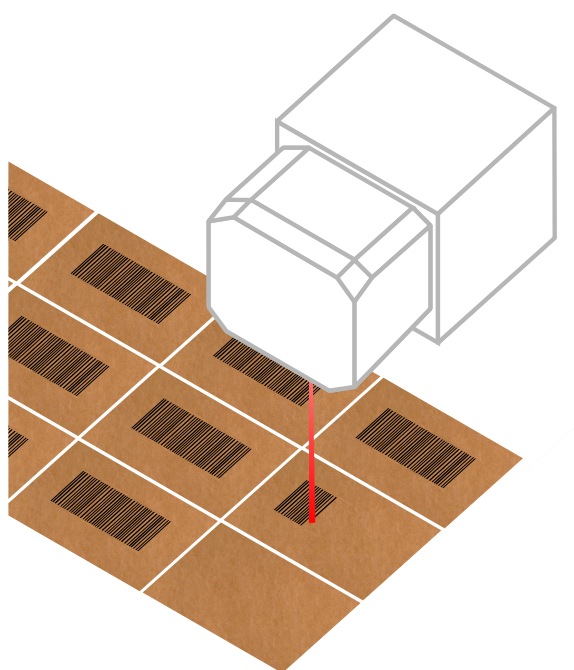
Laser marking is a dry process that does not make use of inks or melted materials, which can migrate and smudge on the line. As a result, laser prints are very consistent and precise.

As a non-contact marking technology, laser does not suffer from mechanical wear like that seen in print heads. The laser-formed image is also positioned in the same place each time, which creates a more polished look than print-and-apply labels.

Uptime Savings

Lasers are more reliable than inkjet printers and print-and-apply label systems. Manufacturers can use lasers to improve uptime, scale back maintenance efforts, and divert time and attention away from their marking equipment.

All of these activities create cost savings and improved productivity.



Streamlined Supply Chain

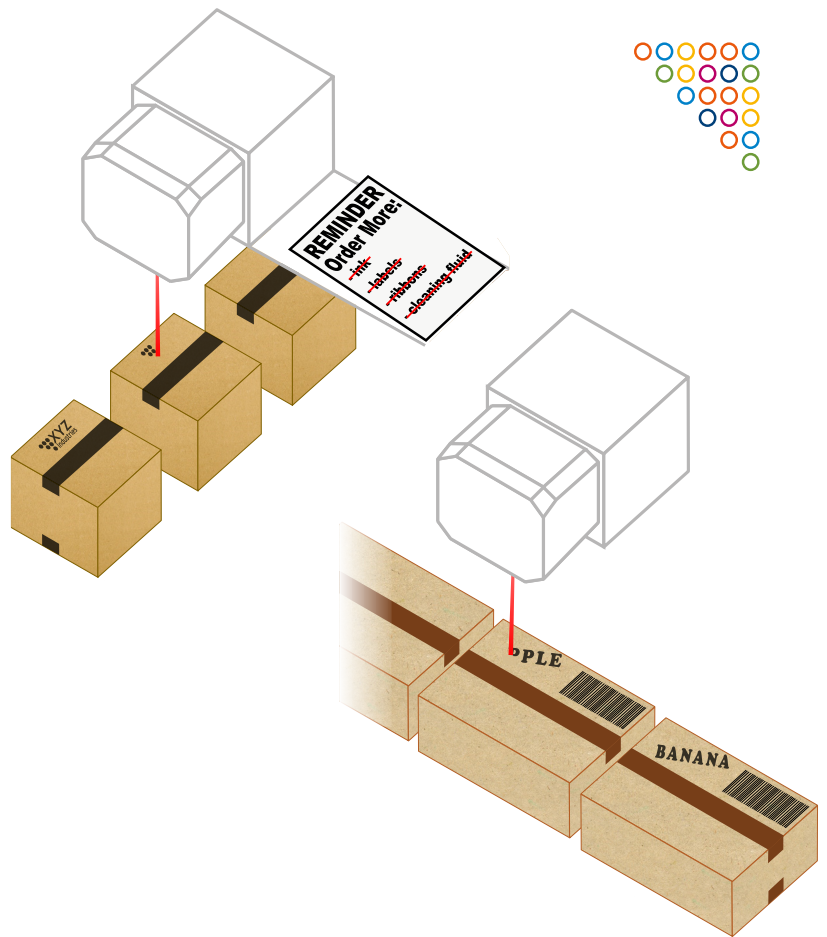
Lasers function without ink, ribbons, labels, or cleaning fluids. In addition to boosting reliability, this frees manufacturers from having to source and stock these materials, refill ink, replace label rolls, and dispose of waste products.

Laser users see a significant drop in site deliveries, which has a positive effect on both efficiency and the environment.

SKU Reduction

Lasers can print more than just barcodes and best-by dates—they can also create crisp, high-quality renderings of content information (item flavor, size, etc..) and logos.

Manufacturers can source generic cases and print content information on each one after packing.



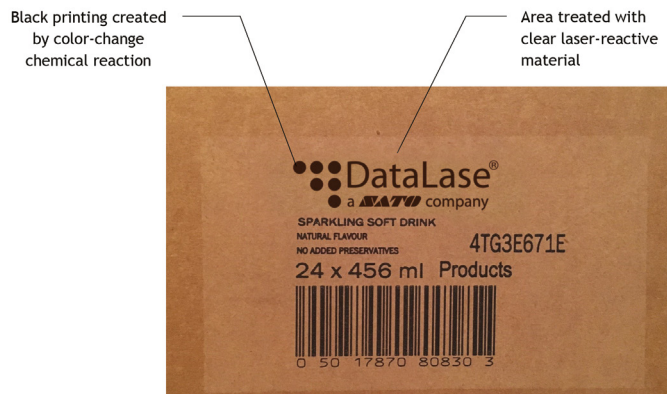
Laser Reactive Materials— What They Are

Laser-Reactive Materials

Pretreating boxes with laser-reactive materials enables manufacturers to laser image directly on corrugate surfaces. Without this pretreatment, lasers can mark only by burning or etching the target surface, a process known as ablation.

This method is not commonly used in corrugate applications, as ablation does not produce contrast sufficient for barcodes, 2D matrix codes, and other machine-readable symbols.

Laser-reactive materials are neither burned nor etched. They undergo a chemical reaction, resulting in a permanent color change, when irradiated with a laser beam. This process takes place cleanly and quickly, generates high contrast, and creates attractive images. Laser reactive materials are capable of generating high-quality barcodes, 2D matrix codes, and even promotional advertising images.



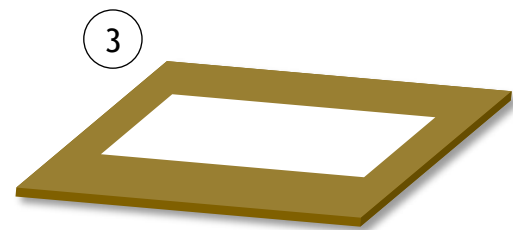
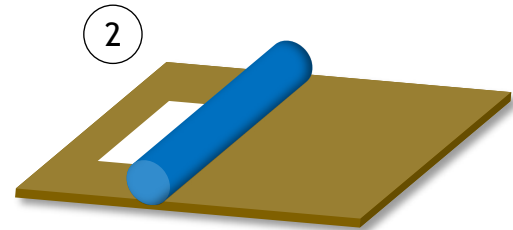
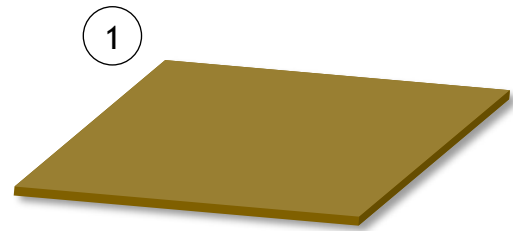
Manufacturing Steps



Producing a laser-coded corrugate box is a two-step process. First, the converter prints the laser reactive materials on the box surface. The converter then dries or cures the ink and ships the box to the end user, who uses a laser to mark it.

Printing

- 1) **Material Selection:** laser-reactive materials are compatible with most corrugate substrates but, as a precaution, compatibility should be confirmed beforehand. The appropriate laser-reactive material should be selected for the manufacturing process, as materials intended for post-print (printing after corrugating) applications differ from those intended for pre-print (printing before corrugating) applications.
- 2) **Patch Printing:** a conventional print process, such as flexography or gravure, applies a patch of laser-reactive material to the substrate. This takes place during the box manufacturing step. Laser-reactive materials are not applied at the packing site.
- 3) **Finishing:** the laser-reactive material is dried or cured using ambient/ forced air or UV light. It is now ready for laser imaging.

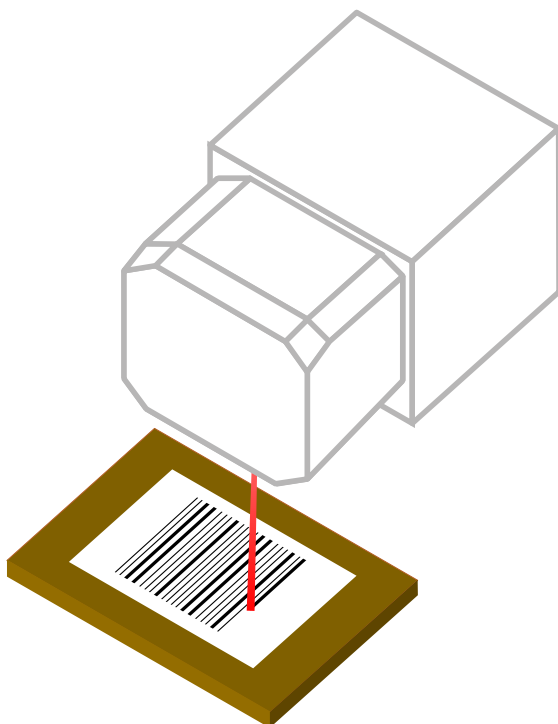


Imaging

A low-power CO2 laser activates the color-change reaction on the patch, creating black regions on the printing area. The black areas form codes (including GS1 types), text, and images.

Laser control software determines the printed content. Nothing about the patch (except for the outer dimensions) influences what can or cannot be printed.

Laser markers can interface with data management systems in order to print unique codes, real-time date information, and even 1-to-1 advertising content targeted at individual customers



FAQ



What equipment and supplies are needed for laser case coding?

A CO2 laser marker must be installed on each line. The laser should be rated at 30W or higher for best results. Laser reactive materials are supplied as printing inks. Typical formulations include water-based flexographic, solvent-based gravure, and UV flexographic.

Who supplies these products?

Both lasers and laser-reactive materials for case coding applications are available today. CO2 laser markers are standard pieces of equipment and, in principle, any off-the-shelf CO2 laser marker will be compatible with laser-reactive materials. A select number of manufacturers have considerable experience tuning lasers for corrugate marking.

Numerous printing ink manufacturers, including top global companies, supply and support laser-reactive inks for case coding applications. The box converter will apply and dry/cure this ink during the box manufacturing process. End users source pre-coated, ready-to-image boxes—they do not apply laser-reactive inks on their packing lines.

What does it cost?

Depending on the end user application and how the laser reactive patch is printed on the box, direct consumable costs can often be lower than inkjet and print & apply labels. That said, laser case coding offers a far lower total cost of ownership in virtually every application because it brings significant uptime to the production line.

Total cost of ownership figures for laser case coding begin to diverge (drop lower) from that of other marking methods (which go higher) in applications requiring a 4" x 6" / 100x150mm printed area in volumes of several million boxes per year. This divergence becomes more pronounced as print area and/or volumes increase.

How fast can the laser coding system print boxes?

This varies considerably depending on the amount of information and/or graphical content that needs to be printed. Simple alphanumeric codes, barcodes, 2D codes, and graphics all vary in the amount of time required to laser image.

Current use cases have achieved throughput rates of 30 boxes per minute, moving at 35 meters per minute, in mass production scenarios.

Research shows that higher throughput rates—up to 45 boxes per minute—are possible under the right conditions.

What health and safety considerations are there?

Laser-reactive materials are non-toxic and non-hazardous. They are approved for use on packaging in North America, Europe, and Japan and do not require special handling or disposal procedures.

Ink manufacturers provide information specific to the regions they serve. Lasers have been commonplace in production environments for twenty years. Best practices for laser safety are now well established.

Each laser should be equipped with safety guarding, a low-cost polycarbonate shield. Laser manufacturers can supply suitable guarding that conforms to the buyer's safety requirements.

It is good practice to use fume extraction with any laser installation. The color-change reaction will produce a small amount of off-gassing that should be captured and disposed of. The exact composition of these byproducts depends on the ink formulation. Ink manufacturers can provide information specific to their formulations.



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Author Information:
Joseph Tolsma

DataLase Ltd.
Business Development Manager,
North America
Tel: +1 (312) 848 6299
jtolsma@datalase.com



Unit 3, Wheldon Road, Widnes, Cheshire, WA8 8FW, UK
 +44 (0) 151 423 9360  info@datalase.com