Marking & Coding

Solution Guide

Whether you are trying to keep pace with global regulations, national laws or industry guidelines, digital marking and coding brings many advantages to manufacturers seeking to optimize their operations. Aside from staying up to code, many adopt digitally controlled laser marking and coding systems because they deliver high quality and durable marks for traceability and consumer safety.

Anything from barcodes, UPC, part numbers/codes and batch codes, expiration dates and best before use codes. Durable marks on a variety of materials and surfaces require the optimized performance that only laser marking and coding systems can deliver. In this blog post we will cover all the advantages of digitally controlled laser marking and coding systems and why choosing the right solution is the key for enhancing your operations.

Advantages of Digitally Controlled Laser Marking & Coding Systems

Manufacturers rely on systems that can keep up with change, specifically in marking and coding applications as the packaging industry is constantly evolving. Apart from its high performance, a digitally controlled laser marking and coding system can also bring the following added benefits:

- ✓ **Performance** – produces high contrast, readily legible markings in various fonts and sizes as well as permanent, long lasting marks that hold up well to handling and harsh environments.
- ✓ **Digital precision and contro**l – scanning motors with high repeatability enable accuracy to achieve high mark quality. When coupled with a high-performance CO2 laser throughput speeds are increased, resulting in higher yields and added versatility.
- ✓ **Curved surfaces** – 3D marking heads and software enable marking on target surfaces of complex shaped parts in a fast and durable manner
- ✓ **Flexibility** – apply marks to a variety of materials and surface qualities with the ability to change patterns and parameters on-the-fly.
- ✓ **Non-contact** – only the laser beam comes into contact with the target material, a strong benefit when marking or coding delicate materials, or materials that need to remain sterile.
- ✓ **Ease of use** – digital controlled and easy to operate, requiring minimal onboarding and training. Most systems do not require formal certification for operation. Laser settings associated with specific materials and design files can be stored as a baseline for future projects making them easy to access and minimizes change-over time.

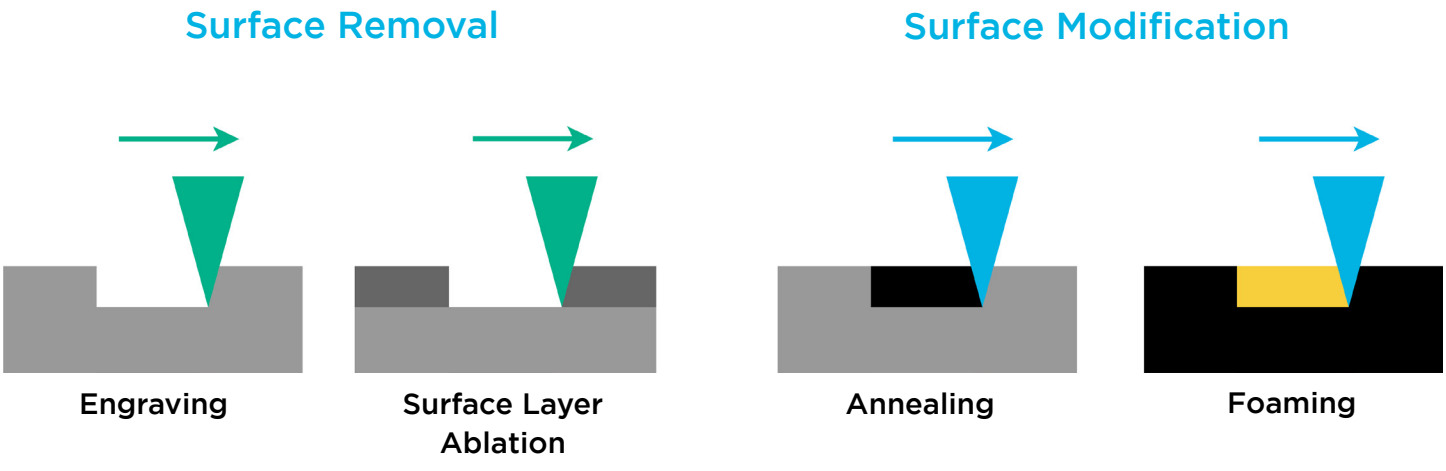
- ✓ **Uninterrupted production lines** – little to no maintenance required, significantly improving factory productivity with minimal machine downtimes. Traditional ink jet machine downtimes attributed to clogged nozzles, ink refills, and other routine cleaning ~~are eliminated~~.
- ✓ **Total cost of ownership** – low operational training requirements, high reliability, elimination of consumables (like ink), shorter downtimes associated with change-overs and maintenance lower the cost of ownership, and increased flexibility can offer new business opportunities

Types of Marks and Codes

There are different laser processes available to create markings with high visibility, contrast and quality on a variety of materials. In addition, these processes must ensure that markings can withstand harsh environments and long-term handling, material can be marked at production rates, and that the structural integrity of marked material is not compromised.

Key marking processes differentiated by the material being marked, laser power and laser wavelength are:

- ✓ **Engraving** – material is removed from the surface of the substrate leaving a visible depression
- ✓ **Surface Layer Ablation** – surface layers absorb the laser light and the material heats up and vaporizes. The remaining base layer is in high contrast to the surface layer, making highly visible marks
- ✓ **Annealing** – an oxide layer is created on ferrous metals (iron, steel, high-grade steel) and titanium through localized heating from the laser. The oxide layer is often black, but it can also have other annealing colors such as yellow, red and green, created from different temperatures of the heated layers.
- ✓ **Foaming** – Heat from the laser generates bubbles in the base material. The bubbles evaporate leaving a surface change in both color and texture.



Laser Types and Applicable Materials

Laser markers are offered with a variety of wavelengths to achieve the desired processing effect of the material being marked. Each of these materials has a characteristic absorption spectrum, meaning there are certain wavelengths of light a given material will absorb more readily than others. Better absorption means that the material will be processed more quickly and effectively. Since wavelength is one of the defining characteristics of a laser, system designers must pair the appropriate type of laser with the material they are looking to process for the best quality results and the fastest throughput. CO2 lasers have longer wavelengths, which pair nicely with plastics, natural materials like paper, and certain metal foils —some of the most popular materials in the packaging industry.

Importance in Beam Delivery

The heart of a marking engine is the galvanometer scanner. These scanners move a set of mirrors assigned to the XY-axis generated vectors, guiding the laser beam onto the material for processing. The high accuracy and throughput of the galvanometers are enabled by high bandwidth, servo driver boards. The final piece in a marking engine comes from the controller board. It coordinates all components by generating the mark pattern and synchronizing the mirror motion with laser activation and modulation. The controller is complemented by user-friendly software to quickly create job patterns from imported 2D and 3D drawings.

Cambridge Technology's Pro Series and Lightning™ II 2-axis scan heads feature 83xxK series galvos, analog and digital servo drivers, and beryllium substrate mirrors to achieve the most competitive combination of stability and speed. These same core components are available as individual parts for flexible integration options. For general purpose marking, the 62xxH series galvos provide similar speed and can be paired with value driven silicon mirror substrates and compact servo driver options like the 672. Cambridge Technology's beam delivery solution for marking and coding offer the following advantages:

- ✓ **Accurate:** High stability galvos provide a unified solution to meet accuracy requirements for a broad range of applications with wavelengths and focal lengths.
- ✓ High Throughput: A large range of galvo sizes are offered to drive specific apertures optimally using both standard silicon and high-performance beryllium substrates. Analog servo drivers are offered in both compact and high drive designs tuned for high speed. With zero tracking delay, the DC Digital Servo with State Space control drives galvos with unmatched speeds in marking applications.
- ✓ **Reliable:** Rugged galvo construction using high quality bearings with tightly tolerance motor construction achieves highly repeatable results over 1000's of hours of use with no adjustments.
- ✓ **Flexible:** Small and efficient galvos have flexible mirror mounting, connector and scan angle options. Servo Driver options include full featured, compact and dual-axis versions to best match to system integration needs.

Laser Controller

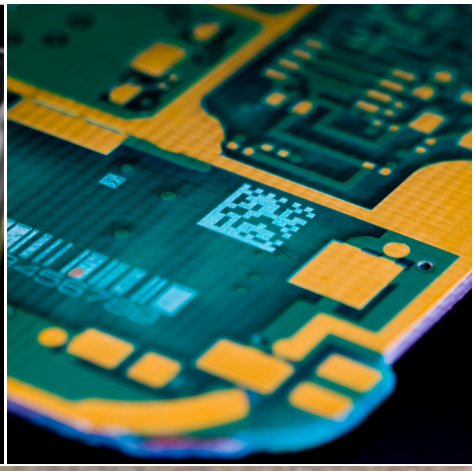
Servo Driver

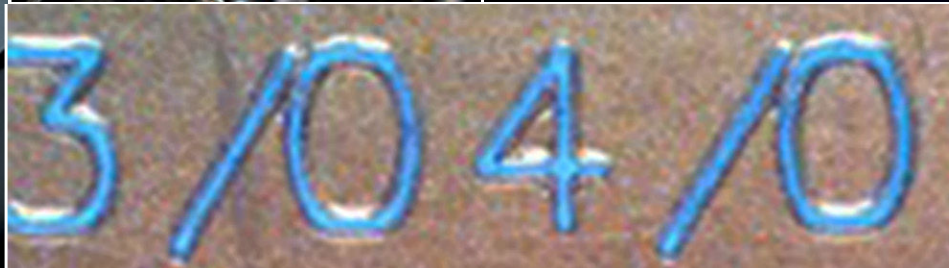
Matching Lasers with Laser Beam Technology

To complete a digital marking and coding solution, it's important to match the right beam steering technology to your laser. There are three key factors to keep in mind for this: wavelength of the coating, clear aperture of the beam steering technology and power handling of the mirrors. These key factors will not only prevent damage to the mirror and coatings due to excessive laser power but will also minimize the power loss due to lack of reflectivity and power clipping. Another reason to avoid power clipping is because the amount of power falling off the mirrors can also have a negative impact to other components and can result in harmful consequences. To avoid such situations, it's important to note that the definition of the input beam size and the clear aperture size is not the same and mixing the two can cause unexpected power clipping. Once you figured out the clear aperture size from your beam delivery vendor, get the laser beam size from your laser vendor and use that information to create the alignment between the two.

High Performance CO_2 Lasers

Not all CO_2 lasers are created equal, and price is often strongly correlated with the laser's performance and construction quality. Synrad high performance CO_2 lasers are built to withstand the rigors of real-world industrial environments and to perform consistently well from cold start-up through to normal operating temperature. The unique Synrad laser design protects against harsh conditions, even in excessive ambient temperatures. Synrad lasers are engineered to prevent optics contamination, gas leakage, as well as unstable output power during operation. These preventative features are critical to reliable operation of the laser, and help to ensure consistent and reliable operation year after year. optimized for specific pattern requirements.





Novanta Advantage

As part of Novanta, Cambridge Technology and Synrad bring unprecedented value to their customers. For starters, we are your single source for CO2 lasers and beam delivery bringing broad knowledge across all applications, avoiding technical and integration pitfalls. By having one vendor for your beam deliver and laser needs, you can avoid cross-company and compatibility conflicts as our products are tested to work together. This results in faster and easy integration. It is our broad expertise and resources that allow us to create custom solutions for challenging applications. We offer full support from concept through end user in-production operation, enabling system success.

Overall, digital marking systems bring optimized performance, flexibility, ease of use, cost savings and consistent performance for users looking to adopt to this technology. Its advantages bring high quality marks designed to pass the test of durability against harsh environments, flexibility to mark on a variety of materials and surfaces and consistent speed to maximize production line productivity. To learn about Novanta's digital marking and coding solutions contact us below.

Broadest selection of galvo motors configurable to meet demanding speed, accuracy and packaging needs

Proprietary technology delivers competitive advantage for system performance and long-term use

High performing CO_2 lasers deliver crisp, clear imagery and text for a wide range of materials enabling high volume processing and production lines

Tested to perform in marking & coding applications delivering high-performance

Global presence and expertise equipped with state-of-the-art application labs and on-site field support

Interested in speaking to one of our knowledgable representatives?

Contact Us Here