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KNOWLEDGE ARTICLE

Choosing the right coding solution to future proof flexible film packaging lines

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The adoption of Data Matrix or QR codes, commonly known as 2D codes, is set to bring numerous competitive advantages to the food and beverage industry.

But set against the complex legislative requirements and rising costs manufacturers face today, future proofing production lines for 2D codes, adds further complexity in the drive for efficiency.



While the practice of coding flexible films using mechanical technologies, such as hot stamping and rotary coders continues across the food industry, digital coding solutions are now well established. They deliver greater productivity and more efficient traceability without compromising packaging design to ensure that it continues to meet the expectations of manufacturers, retailers, and consumers.

In a highly competitive global market, flexible film coding has been dominated by Thermal Transfer Overprinting (TTO) coding technology for many years. As new technologies, such as UltraViolet (UV) Laser, continue to emerge and develop, it can be challenging to make an informed decision about the best approach for future proofing the packaging line.

Flexible film will continue to play a vital role throughout the value chain and is one of the fastest growing categories

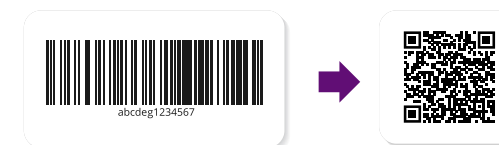


There is little doubt that flexible film will continue to play a vital role throughout the value chain in the years ahead due to its low cost and versatility. Despite the shifts in packaging films and formats that are occurring in all sectors, flexible film remains one of the fastest growing of all categories. The use of paper-based films is also increasing, however, and traditional UPC / EAN barcodes will begin to be replaced by a 2D Matrix or QR code now that GS1 has established a sunrise date of 2027.

Traditional UPC / EAN barcodes are set to be replaced by 2D Matrix or QR codes

Selecting the right coding solution is critical and despite the emergence of new technologies, there is no 'one size fits all' solution. TTO and UV Laser solutions are both designed to improve line efficiency and meet stringent regulatory standards as well as offering traceability and brand protection. And both technologies offer notable benefits in specific areas.

The high coding speeds offered by UV laser for instance will inevitably be an attractive proposition for some manufacturers, while the higher quality codes that can be achieved with TTO solutions on substrates of a specific colour or those offering low contrast will be of greater importance to others.



The question facing those responsible for coding flexible film packaging, therefore, is how to choose the right technology, to achieve maximum line efficiency today and meet the more complex challenges of tomorrow.

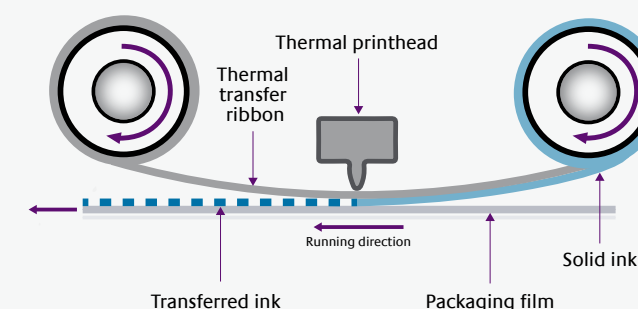
The first step in the decision-making process, is to understand what each technology offers and where its limitations lie.

Understanding the technology

HOW TTO WORKS

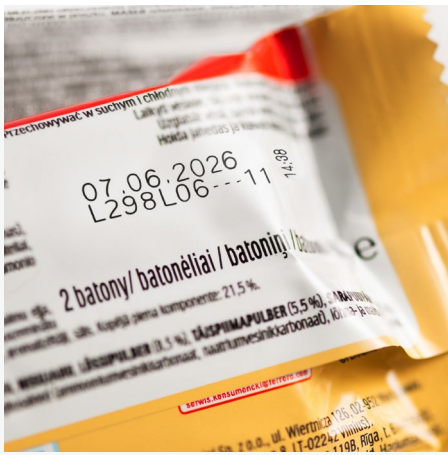
TTO is best suited to marking onto flexible films that are flat, before packs or pouches are filled, with the printer mounted close to the product packing station.

The main elements of a TTO printer are the thermal printhead, the inked ribbon and the roller, or a flat platen for intermittent applications. The ink is transferred from the ribbon to the flexible film packaging, after it is heated by the printhead.



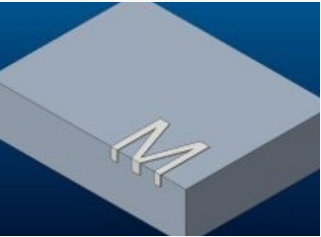
TTO: The ink is transferred from thermal transfer ribbons to the film layer.





HOW UV LASER WORKS

Unlike other laser technologies, UV Lasers use a specific wavelength which interacts with the substrate in a different way to other laser wavelengths and enables them to perform ‘cold marking’.



Other laser technologies use a thermal process that can damage packaging substrates, whereas UV Laser changes the material by photochemical reaction between the laser beam and the substrate—the code created may have a different colour, thereby producing a discernible mark.

This protects the integrity of the substrate surface, making the process well-suited to high-density polymers that are difficult to mark with other laser wavelengths or thin and delicate films where the oxygen or moisture barrier of the film needs to be preserved.

TTO or UV Laser: Choosing the best solution for your application

There is no single technology or coding solution that will meet the demands of every packaging line and substrate in use, so it is important to consider the range available objectively and establish which will offer the optimum results for your applications. The key factors to consider in this decision-making process are outlined here.

PRINT QUALITY

Arguably the most important consideration for decision makers, is that among the digital coding solutions available, only TTO has been developed specifically to code flexible film. With a typical output of 300 dpi, this method offers high print quality that blends in with the overall design of the pre-printed film. In addition to printing variable information such as best-before dates, barcodes and promotional information, it can also help reduce pre-printed stock by printing static information, such as the product name.

One commonly cited advantage of UV Laser over TTO technology is the fact that it codes flexible film with a permanent mark. This offers advantages when it comes to brand protection and will be particularly important in some sectors such as pharmaceuticals. UV Laser typically prints at over 300 dpi, however, the legibility of UV Laser codes could be unsatisfactory on certain colour substrates and those offering low contrast. UV Laser is also limited by its inability to print in colour.



Markem-Imaje **SmartDate®** X65 thermal transfer coder is used to print on flexible film before filling

SPEED

Achieving consistently high-quality codes at high line speeds is one of the key challenges on food packaging lines. Numerous variables such as print size and the complexity of packaging design as well as machine speed and product flow will all affect the result. The speed at which data can be transferred securely will also affect line speeds.

These are all factors which should be considered when assessing the potential benefit of high-speed coding solutions and it is important to recognise that in some cases, it will not be possible to realise the potential benefits of the fastest coding solutions.

In general, UV Laser solutions can code up to 2500 packs per minute (PPM), which makes them ideally suited for fast-paced applications such as marking individual chocolate bar wrappers. TTO can achieve speeds of up to 1,800 millimetres per second (mm/s) and a pack rate of up to 455 PPM on a wide range of substrates.

DOWNTIME

UV Laser solutions do not need consumables and therefore can be operated with minimal downtime. While TTO solutions require the ribbon to be changed periodically, the changeover can be completed in as little as 30 seconds. Most manufacturers consider this short period of downtime to be an acceptable trade-off, given the other numerous advantages that TTO technology provides.

COST

In common with all technologies, UV Laser solutions include ‘wear parts’ such as the laser tube. In normal operating conditions¹, a UV Laser tube is likely to need replacing every five years and the cost is significant, typically around 10% of the overall cost of the unit. In contrast, TTO units generally require annual printhead replacements and ongoing consumables, which contributes to the overall operating cost.

Even when all other factors appear equal, ultimately, a manufacturer’s purchasing decision will often come down to the total cost of ownership (TCO). Depending on the application and the supplier, UV Laser solutions can have a higher TCO, sometimes up to six times more compared to TTO solutions.



Markem-Imaje **SmartLase®** UV500 is a five watt UV laser coder which enables chemical-free permanent cold marking of challenging material.

However, it is important to consider the specific needs and long-term goals of the application, as both technologies offer unique advantages.

OPERATOR SAFETY AND SET-UP

In general, laser technology requires significantly greater consideration to install safely and effectively. UV Lasers, classified as Class 4—the most hazardous classification—necessitate particular attention. It cannot be assumed that the film will always be in place to act as a barrier, preventing the laser from potentially harming a line operator. Therefore, all UV Laser solutions require appropriate guarding, an effective extraction system, and thorough operator training. Depending on the guarding, the overall system can achieve Class 1 classification, ensuring it is eye-safe under normal operating conditions.

However, When using TTO, the ribbon and the printhead need to make contact with the material, which means the path of the film has to be diverted. This may have an impact in some applications.

In most cases, UV Lasers have larger dimensions than TTO, but some systems can have similar sizes. However, due to the additional space required for the guarding, installing a UV Laser solution in the same position as a TTO is not practical.

Class 4 UV Laser requires guarding, extraction, operator training and PPE

¹Normal operating conditions: Two shifts per day, five days per week, for 40 weeks each year, on average.

FUTURE PROOFING

The adoption of Data Matrix or QR Codes is arguably the most significant change in the packaging landscape for many years. Capable of storing circa.7,000 characters, these new codes will serve the traditional barcodes’ purpose, providing product identification and traceability information but will also have the capability to be used in many new ways that will benefit the entire value chain, from manufacturers to brands, retailers, and consumers.

The ability to maintain current line speeds while printing these complex codes is key to future proofing every flexible film packaging line.

TTO coding technology is ideally positioned to facilitate this major shift, while in some cases, depending on the manufacturer, certain benefits of UV Laser, will be negated, simply because the print time for 2D codes can be up to five times slower than 1D lines of text.



And finally

It is also important to recognise that maximising the efficiency of coding primary packaging is only one of the challenges for many manufacturers.

Flexible film packaging will typically be placed in secondary packaging such as cartons and subsequently tertiary packaging such as pallets. These will almost certainly require other printing and coding technologies and if a manufacturer can source all of these from a single coding partner, significant cost savings can often be achieved through dedicated procurement programmes.

Meanwhile, waste and risk can be reduced, particularly if the supplier can provide a seamlessly integrated, networked information management solution along with verification systems to oversee and verify the coding at each stage.

The only way to effectively future proof the coding operation on packaging production lines today, is to partner with an impartial, technology agnostic supplier, and ideally a global solution provider like Markem-Imaje, capable of providing advantageous economies of scale, maintenance, and ongoing support from installation to end of life, as well as other benefits such as Advanced Service Exchange.

For an unbiased analysis and assessment of the best coding solution for your applications, contact our team who can provide expert advice for all primary, secondary, and tertiary packaging coding requirements.



At a glance

TTO

Cost effective, efficient and reliable, TTO is the technology best suited to a wide range of applications and the only solution developed specifically for flexible film packaging.

UV LASER

Suitable for high-speed applications, UV Laser can prints indelible codes on specific types of materials which makes it particularly useful for anti-counterfeiting.

PROS	✓ High print quality (300dpi) ✓ Safe (no guarding required) ✓ Colour ribbon options ✓ Easy integration to OEM equipment ✓ Suitable for majority of market applications ✓ TrueType font capability ✓ Low maintenance ✓ Considerably lower capital expenditure	✓ Excellent print quality resolution and contrast ✓ Wide area marking ✓ Exceptional mark durability ✓ Print speeds of up to 2500 ppm ✓ Low maintenance and almost zero down time
CONS	✗ Necessary to print on a flat surface ✗ Lower speed than UV Laser ✗ Downtime during consumables change	✗ Larger dimensions than TTO in general ✗ Slower pack rate if 2D barcodes (Depending on the manufacturer) ✗ Requirement for guarding ✗ No colour print capability ✗ Physical footprint of laser controller ✗ May not print on all substrates/applications ✗ Requires an extraction system ✗ May not have TrueType fonts capability ✗ Considerably higher capital expenditure

About Markem-Imaje

Markem-Imaje, a wholly owned subsidiary of Dover Corporation, connects products and protects brands through intelligent identification, traceability, and consumer engagement solutions.

We offer the industry's most comprehensive range of marking and coding systems seamlessly integrated with trusted software, services, and consumables. Over 50,000 customers worldwide partner with us to help them unlock the power of information in codes.

With decades of proven expertise provided through the most extensive global network, we empower our customers to optimize supply chain efficiencies, achieve sustainability and compliance objectives, keep products safe and engage their consumers.

This is intelligence, beyond the mark.

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