

# ANTI-COUNTERFEITING TECHNOLOGY GUIDE

Prepared by The European Observatory on Infringements of Intellectual Property Rights, EUIPO,  
with support from the Anti-Counterfeiting Technologies Expert Group and the Impact of Technology Expert Group





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## Foreword

As new opportunities are opened up by globalisation and the power of the internet, it is increasingly important for businesses of all sizes to understand the full range of tools at their disposal to protect themselves against IP crime.

Counterfeiting is, unfortunately, on the increase and the international criminal gangs who profit from this trade respect neither borders nor legality. They are always ready to prey on the vulnerable and take advantage of any lack of coordination.

The harm caused by IP crime hits company profits, tax revenues and endangers the public as has been shown so graphically by the rise in fake medicines and personal protective equipment in the wake of the Covid-19 pandemic.

This means that the problem must be attacked by enforcement authorities working together effectively, preferably with IP crime returning to become a priority in the fight against international crime.

However, companies both large and small also need to maximise their protection against fakes by taking advantage of the numerous technical solutions out there to protect ownership rights and supply chains.

This Anti-Counterfeiting Technology Guide is aimed at traders and enterprises of all sizes and guides them through the main types of anti-counterfeiting technology including electronic identification or tracking devices, how to place markers on products or packaging, and other chemical, physical, mechanical, and digital tools.

It shows the most cost-effective and practical ways of protecting IP rights, describes implementation requirements and costs in clear terms and should be an invaluable guide for both experts and those exploring market opportunities for the first time.

Christian Archambeau  
Executive Director  
EUIPO



## Acknowledgements & Disclaimer

### Acknowledgements

This Guide was prepared by the European Observatory on Infringements of Intellectual Property Rights on the basis of the research and documentation provided by the Italian Patent and Trade Mark Office, and with the support of contributions from members of the Observatory Anti-Counterfeiting Technologies Expert Group (EGACT), the Observatory Impact of Technology Expert Group, and guest experts from the European Observatory on Infringements of Intellectual Property Rights.

The EGACT produced the first version of the guide that explained the existing anti-counterfeiting technologies (knowledge base). The Observatory adapted that document into the present Guide for SMEs and general users. The Expert Group on the Impact of Technologies collaborated in the validation of some of the technologies.

The Observatory is grateful for the valuable support given by all the experts involved in reviewing this Guide.

### Disclaimer

The views expressed in this Guide do not represent the official position of the European Union Intellectual Property Office (EUIPO). It should be noted that none of the views expressed in this discussion paper can be attributed to all members of the expert groups, the expert groups as a whole, or to any single contributing expert.



# CONTENTS

## ABOUT THE ANTI-COUNTERFEITING TECHNOLOGY GUIDE

|                        |   |
|------------------------|---|
| Introduction & Summary | 5 |
| How to Use This Guide  | 6 |
| Glossary               | 8 |

## 01 ELECTRONIC TECHNOLOGIES

|                  |    |
|------------------|----|
| RFID             | 10 |
| Passive RFID     | 11 |
| Active RFID      | 13 |
| BAP              | 15 |
| PUF              | 17 |
| NFC              | 19 |
| Electronic Seals | 21 |
| Magnetic Stripes | 23 |
| Contact Chips    | 25 |

## 02 MARKING TECHNOLOGIES

|                              |    |
|------------------------------|----|
| Optical Memory Stripe        | 28 |
| Machine-Readable Codes       | 30 |
| One-dimensional Barcodes     | 31 |
| Two-dimensional Barcodes     | 33 |
| Security Holograms           | 35 |
| Traditional Holograms        | 36 |
| Complex Holograms            | 38 |
| Inks                         | 40 |
| UV-Sensitive Inks            | 41 |
| IR-Sensitive Inks (Infrared) | 43 |
| Magnetic Inks                | 45 |
| OVI and Iridescent Inks      | 47 |
| Thermochromic Inks           | 49 |
| Reactive Inks                | 51 |
| Penetrating Inks             | 53 |
| Encrypted Images             | 55 |
| Watermarks                   | 57 |
| Microtexts                   | 59 |
| Guilloche/Rainbow Printing   | 61 |
| Unique Identifier Marks      | 63 |
| Copy Detection Patterns      | 65 |

## 03 CHEMICAL & PHYSICAL TECHNOLOGIES

|  |    |
|--|----|
| DNA Coding                                   | 68 |
| Chemical Encoding & Tracers                  | 70 |
| Glue Coding                                  | 72 |
| Surface Fingerprint & Laser Surface Analysis | 74 |

## 04 MECHANICAL TECHNOLOGIES

|                                    |     |
|------------------------------------|-----|
| Labels                             | 77  |
| Fabric Labels                      | 78  |
| Adhesive Labels                    | 80  |
| Labels with Micro-Engraved Clichés | 82  |
| Ultra-Resistant Labels             | 84  |
| Ultra-Destructible Labels          | 86  |
| Void Labels                        | 88  |
| Tags                               | 90  |
| Laser Engraving                    | 92  |
| Anti-Alteration Devices            | 94  |
| Seals                              | 96  |
| Security Threads                   | 98  |
| Security Film                      | 100 |

## 05 TECHNOLOGIES FOR DIGITAL MEDIA

|                    |     |
|--------------------|-----|
| DRM Systems        | 103 |
| Digital Watermarks | 105 |
| Hashing            | 107 |
| Fingerprinting     | 109 |

## 06 SHARED LEDGER TECHNOLOGIES (BLOCKCHAIN)

|   |     |
|---|-----|
| Shared Ledger Technologies (Blockchain) | 112 |
|---|-----|

## 07 ISO STANDARDS

|                          |     |
|--------------------------|-----|
| ISO 22383:2020           | 116 |
| ISO 22383:2020           | 119 |
| Other Relevant Standards | 120 |

This Guide is fully interactive. Wherever you are in the document, you can click on any of the chapter headings at the top of the page to go to that chapter or on any of the section headings to go to that section and, wherever you see the name of a technology in bold, you can click on it to go straight to the relevant chapter. In addition, the following buttons are available on each page:





# ABOUT THE ANTI-COUNTERFEITING TECHNOLOGY GUIDE

## Introduction & Summary

Globalisation has brought new business opportunities, but it has also brought big threats to industry, exposing supply chains to fraudsters, attacks and disruption. As a result, the production and distribution of counterfeit goods have become an urgent and increasingly critical worldwide issue. According to a 2019 study by the Organisation for Economic Cooperation and Development and the EUIPO on trends in illicit trade, within the past 3 years the value of counterfeit goods had reached USD 509 billion, equal to 3.3 % of global trade <sup>(1)</sup>. Correspondingly, in a survey conducted the same year, the most common reason IPR-owning SMEs gave for registering IP Rights was copy prevention<sup>(2)</sup>.

Technology offers numerous solutions to protect ownership rights and defend legitimate supply chains. However, the market for anti-counterfeiting technologies is broad and complex. The technologies are evolving fast and information about them is not easily accessible. **That is where the Anti-Counterfeiting Technology Guide (or ACT Guide) comes in.** It covers all the main types of anti-counterfeiting technology currently on the market, gives a clear definition of each, describes their main characteristics and sets out practical implementation requirements at a glance.

The ACT Guide is intended for all traders and businesses – including small and medium-sized enterprises (SME) – that are interested in learning more about anti-counterfeiting solutions. It doesn't matter what industry you operate in, how long you've been operating, or whether you've never even heard of anti-counterfeiting technologies before. Whatever your circumstances, this Guide aims to help you decide which technologies are the best fit for your business.

### What do we mean by anti-counterfeiting technologies?

In general terms, anti-counterfeiting technologies provide tools to help determine whether a product is genuine or fake, or has otherwise been subject to fraudulent activities <sup>(3)</sup>. They may use different methods to do this – from attaching remote sensors to products to embedding covert identifiers within them – but, essentially, they do it by performing one or more of the following functions:

- authentication
- tracking/tracing
- anti-tampering/anti-alteration.

Definitions of these essential functions are given in the [Glossary](#).

Anti-counterfeiting technologies differ according to the combination of essential functions they perform, the methods they use to perform them and their mode of inspection – whether they can be verified by human senses or whether a special device is required. However, the characteristic shared by all anti-counterfeiting methods is the use of specific marking devices, known as markers. These are joined inseparably to the products (by various techniques) and contain the specific information that enables the technology to perform its essential function.

<sup>(1)</sup> OECD/EUIPO (2019), Trends in Trade in Counterfeit and Pirated Goods, Illicit Trade, OECD Publishing, Paris/European Union Intellectual Property Office: <https://doi.org/10.1787/g2g9f533-en>

<sup>(2)</sup> As indicated by 59 % of respondents. EUIPO/KPMG Spain (2019), [2019 Intellectual Property SME Scoreboard](#), European Union Intellectual Property Office, p. 72.

<sup>(3)</sup> Authentication solutions can help protect against product fraud in a broad sense. In addition to the infringement of intellectual property rights (IPRs), this can include: deception of consumers; deception of purchasers of new goods or replacement parts; violation of national, regional or international regulations; and false claims regarding IPRs, origin of the product or details of manufacture.

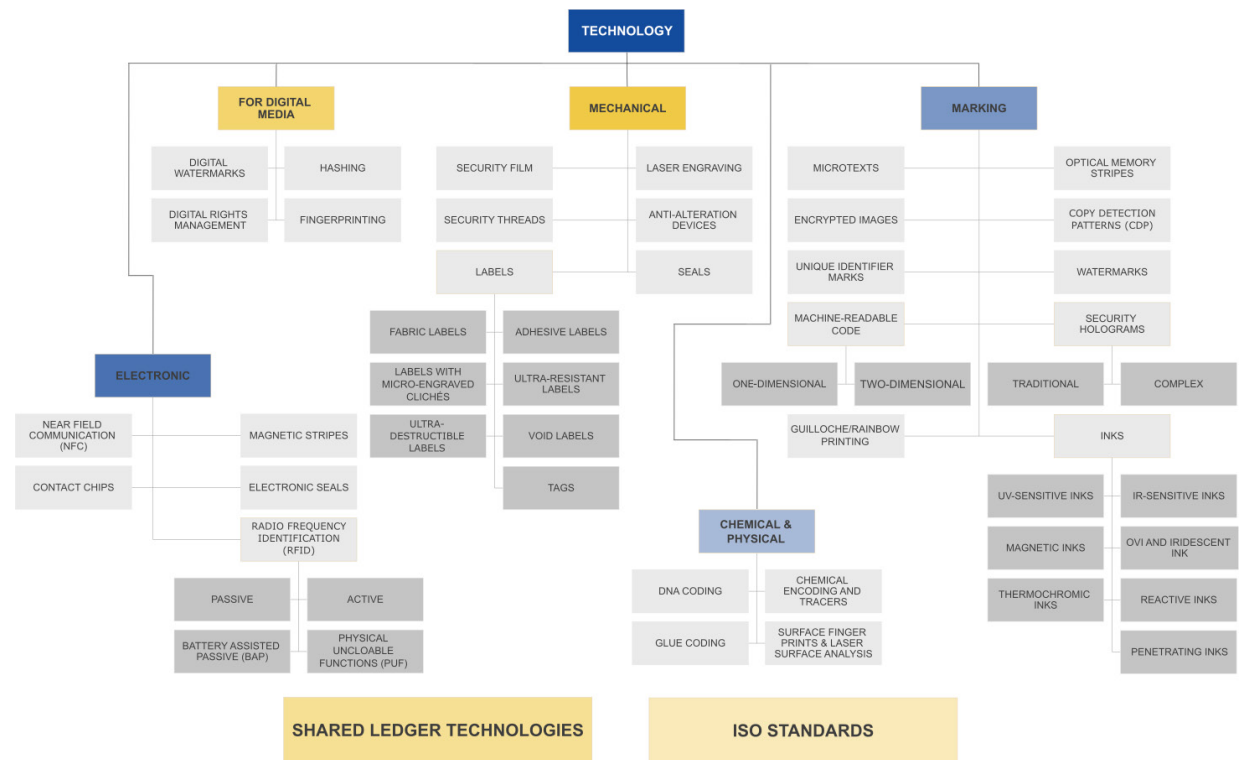


# How to Use This Guide

The ACT Guide has been designed as an anti-counterfeiting road map. It provides an overview of the various solutions currently available and sets the groundwork for building an anti-counterfeiting strategy. Each chapter is dedicated to a different area of anti-counterfeiting technology: chapters 1-5 each cover a different category of technology, classified according to method; while chapters 6 and 7 cover additional tools and industry standards that could contribute to a more effective all-round anti-counterfeiting strategy.

You can start from the beginning of the Guide and work your way through chapter by chapter, or you can dip in and out of the chapters that you are most interested in.

- The anti-counterfeiting technology categories (and chapters) are:
- **Electronic technologies** – where an electronic identification/authentication/tracking device is associated with the product.
  - **Marking technologies** – where a visible or invisible marker is incorporated into the product.
  - **Chemical & physical technologies** – where chemical or physical processes or substances are used to mark and verify the product.
  - **Mechanical technologies** – where material elements or processes are applied to the product for authentication and/or anti-tampering purposes.
  - **Technologies for digital media** – where information is embedded in or extracted from digital files, computers and electronic devices.
- The additional tools and standards are:
- **Shared ledger technology (blockchain)** – a tool that can be used in combination with other technologies to boost overall anti-counterfeiting defences.
  - **The latest ISO standards** on anti-counterfeiting technologies – which provide guidelines and best practices for choosing authentication solutions.





Each of the anti-counterfeiting technologies presented in this Guide has special features that aim to meet specific product protection needs. There is no one-size-fits-all solution. Businesses will have different anti-counterfeiting needs depending on their particular product, environment and mode of operation. Not all of the technologies will be suitable for your business, and some will be more suitable than others. Or perhaps you will want to combine several technologies to meet complex requirements and/or increase effectiveness.

Therefore, as you read this Guide we recommend that you consider and compare the anti-counterfeiting technologies on the basis of the ISO guidelines presented in chapter 7. In summary, they are:

- the design and manufacture of the markers,
- the inseparability of the marker from the product,
- the visibility of the markers,
- whether certain properties need to be verified using human senses, specific equipment or laboratory tests,
- whether significant changes to the production chain are needed to implement the technology,
- compatibility with other technologies,

And for the purposes of traceability:

- whether particular information can be read automatically,
- whether individual items can be uniquely identified.

## Chapter Layout

The information in each chapter is laid out in two or three levels:

- Each chapter begins with a general introduction to the category.
 

05

**05 ANTI-COUNTERFEITING TECHNOLOGIES FOR DIGITAL MEDIA**

Digital media is any data presented in a machine readable format. It includes digital images, digital codes, QR codes, electronic labels, video games and databases. The anti-counterfeiting technologies targeted for use with digital media essentially consist of different methods for embedding and identifying information on digital files, computers and electronic devices to help companies identify and track their intellectual property content.
- Each technology (or standard) in that category is then described in detail.
 

04

**04 LABELS**

Identification label is any physical element that contains identification data and product information and is placed on a product or its packaging.

The most commonly used materials for labels are paper and plastic. Labels are used on a wide range of products and are available in many different sizes and shapes. Labels are often used to provide information about the product, such as the manufacturer's name, the product name, the date of production, and the expiration date.

Labels can be combined with other technologies for enhanced security. For example, labels can be combined with digital media technologies to provide a secure and tamper-evident way of identifying products.

**Types available:**

  - Identification labels
  - Identification codes
  - Identification images
  - Labels
- In a second section, details are given in paragraphs as follows:
 

05

**05 DNA CODING**

Every DNA strand contains a unique sequence of genetic information. This information, when called a genetic fingerprint, is unique to each individual organism. The unique DNA code is used to identify individuals and to track the genetic health and evolution of a population. DNA coding uses the unique DNA code to identify individuals and to track the genetic health and evolution of a population. DNA coding uses the unique DNA code to identify individuals and to track the genetic health and evolution of a population.

The detailed description of the technology, or type of technology, is given in 2 sections:

- A highlight of the main features.
 

**DNA Coding**

Every DNA strand contains a unique sequence of genetic information. This information, when called a genetic fingerprint, is unique to each individual organism. The unique DNA code is used to identify individuals and to track the genetic health and evolution of a population. DNA coding uses the unique DNA code to identify individuals and to track the genetic health and evolution of a population.
- The main characteristics are set out in simple tables for quick consultation.
 

| Feature        | Yes                                 | No                       |
|----------------|-------------------------------------|--------------------------|
| Identification | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Traceability   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Security       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

| Feature        | Yes                                 | No                       |
|----------------|-------------------------------------|--------------------------|
| Identification | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Traceability   | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Security       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |

In a second section, details are given in paragraphs as follows:

- Description:** more technical and detailed explanation of how the technology works.
- Uses:** the most common and suitable uses of the technology.
- Implementation:** general information on the possible impact that the adoption of the technology may have on production processes.
- Cost:** high level information, where available, on the economic impact of implementing that technology.

It is also worth bearing in mind that the various technologies have different levels of maturity and require different levels of experience to handle them; both of these aspects may have a significant impact on reliability and cost.

Finally, the ACT Guide is intended merely as an informative aid: it does not rank the various technologies or attempt to offer a universal anti-counterfeiting solution. Although the Guide is based on the current state of the art, it cannot claim to

be an exhaustive compendium of all the technologies out there. The inclusion of a category or type of technology in the Guide should in no way be construed as a form of endorsement or recognition of its effectiveness or usefulness.





# Glossary

## • Anti-counterfeiting functions

|                                    |   |
|------------------------------------|---|
| authentication                     | Process by which the claimed identity and attributes of a product are verified.   |
| tracking/tracing                   | Process of determining the intended locations or the current or past locations of a unique item along the supply chain. |
| anti-tampering/<br>anti alteration | Mechanism or technique to prevent meddling with a product in order to alter, falsify or somehow interfere with it.      |

## • Appearance of the anti-counterfeiting technology

|                    |   |
|--------------------|---|
| invisible (covert) | Not immediately discernible to the average person and visible only with additional tools/training.                    |
| visible (overt)    | Discernible to the average person with no tools/training and difficult to reproduce/replicate, such as a tamper seal. |

## • Connection to server

|                      |  |
|----------------------|--|
| connection to server | A relationship in which one program (the client) requests a service or resource from another program (the server). |
|----------------------|--|

## • Product and packaging

|           |   |
|-----------|---|
| product   | Goods, or component of goods to which the technical solution applies.   |
| packaging | The wrapping material around a consumer item that serves to contain, identify, describe, protect, display, promote and otherwise make the product marketable and keep it clean. |

## • Product size (for physical products only)

|                       |                      |
|-----------------------|----------------------|
| very small products   | less than 2 cm       |
| small products        | between 2 and 10 cm  |
| medium-sized products | between 10 and 50 cm |
| large products        | more than 50 cm      |

## • Reading device

|                |   |
|----------------|---|
| reading device | any electronic device that can scan, capture, process and/or interpret the data contained in an anti-counterfeiting marker. |
|----------------|---|

## • Type of product

|                  |   |
|------------------|---|
| physical product | in general, a product is defined as a 'thing produced by labour or effort' or the 'result of an act or a process'.  |
| digital product  | a digital product is any product which users can purchase and access through their computers, phones and tablets without any physical installation requirement. |



# ELECTRONIC TECHNOLOGIES FOR ANTI-COUNTERFEITING

# 01

Electronic anti-counterfeiting technologies all involve associating electronic data devices with goods in one way or another. These devices enable the goods to be uniquely identified, authenticated and tracked, either by providing specific product information themselves or providing access to a database where the relevant data is stored.

There are five types of electronic anti-counterfeiting technology, but the most widespread are those based on radio frequency identification (RFID) and near field communication (NFC) devices, which perform remote recognition of objects, animals or people.

RFID

NFC

Electronic  
Seals

Magnetic  
Stripes

Contact  
Chips



# RFID

RFID uses radio frequency technologies to recognise objects, animals or people remotely. It does so through electronic tags that, at their most basic, assign a unique identity to whatever they are attached to and transmit it via radio frequency channels. This unique identity, along with any other data that may be stored on the device, can be picked up by readers. RFID readers can be connected to the internet, allowing the data to be monitored in real time.

RFID tags therefore play a key role in enabling product traceability as they provide for the unique identification of products in real-time throughout the entire supply chain. They are also reasonably versatile: they can both authenticate and identify whole products as well as their individual parts. For these reasons, RFID technology is suitable for use in internet of things (IOT) solutions and is widely used in anti-counterfeiting devices. One particularly common example is in 'smart labels', where RFID tags are embedded into [adhesive labels](#) to make them 'smart'.

There are several different types of RFID technology. However, all RFID systems consist of the same three key elements.

- **Tags** – these are attached to the goods and include an antenna and a microchip that contains product data (e.g. unique identifiers or URLs of websites that contain further information). The extent to which the solution is secure from reproduction and tampering depends on:

- the communication protocol; and
- the way the information stored in the tag is protected (e.g. by a code, password or encrypting algorithm).
- **Readers** – these are used to query the tag, receive response information and transfer it to the data processing system. RFID readers are specific to the type of RFID tag adopted.
- **A data processing system** – this is connected to the readers via the internet. The system uses the identification codes from the tags to obtain and manage all the available information associated with the objects.

The costs associated with implementing RFID systems vary according to the functions you want them to perform and therefore the type of device used.

## Types available:

- Passive RFID tags
- Active RFID tags
- BAP
- PUF

# 01

> RFID\_



## 01

## Passive RFID Tags

Passive RFID tags are most commonly seen in the form of smart labels. They are usually made of adhesive paper or plastic and can be affixed to a variety of products for brand protection and anti-counterfeiting, among other purposes. They carry valuable information that is used to track goods from the warehouse to the point of sale, allow customers to leave a shop without having to queue to pay for a product and allow sales staff to check inventory without leaving the customer's side.

> RFID\_  
> Passive RFID Tags\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

It is suitable for:

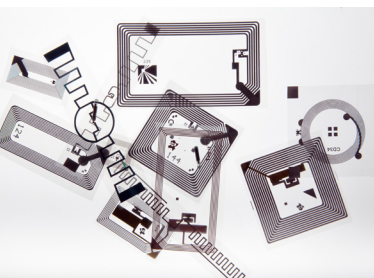
|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |



# 01

## Description

Passive RFID tags consist only of an antenna and an integrated circuit (a microchip). They are called 'passive' because they do not have an internal power source; instead they are powered by the electromagnetic signals transmitted from an RFID reader. Once activated, the tags send identification data back to the reader, which in turn communicates the data to a computer where they are processed and verified. The identification data stored in the RFID tag memory usually include a unique code, for example an Electronic Product Code (which complements barcode information with such details as type of goods, manufacturer, etc.) or an owner code. Passive tags can be read-only or read-write, in which case, as the name suggests, the stored data can also be modified and/or rewritten.

This technology has limited power and a low read range. Depending on the operating frequency used, passive tags need to be within centimetres (low frequency) or a few metres (high and ultra-high frequency) of the reader in order to operate.

## Uses

Passive RFID tags have many possible areas of application as they can be incorporated into a wide range of products, from non-metallic small objects to [adhesive labels](#). When they are embedded into [labels](#) they become 'smart labels' and are affixed to the exterior of a product. However, they can also be embedded into products directly. Some common uses are: credit cards, buttons, bottle caps, keys, sheets of paper, banknotes and entry tickets.

The authenticity of the product is verified by reading the data stored in the RFID tags. This is done by staff at retail outlets, through the use of the appropriate equipment; products cannot be authenticated independently by consumers.

## Implementation

In view of the variety of possible forms, sizes and uses of passive tags, implementation requirements are highly context and case-specific.

If you want to use passive RFID tags in smart labels, then you do not need to make any changes to the production process; you just have to choose the most suitable type of label from the range available, and affix it to the product you want traced and authenticated.

If, however, you want to incorporate passive RFID tags directly into your products, you will need to make specific changes to the production chain.

## Cost

Implementing a passive RFID tag system will require initial investments in equipment management systems, readers and (possible) changes to the production process. However, passive RFID tags themselves are generally small, inexpensive devices, with costs starting from a few euro cents per tag.

> RFID\_  
> Passive RFID Tags\_



## 01

## Active RFID Tags

Today the use of active RFID tags to remotely track and monitor the real-time location of objects and even people is relatively widespread. These types of tags can be used to do remote inventory and ensure that objects remain in their correct place, thereby providing anti-theft protection as well. They can also be used to control access to offices and large areas (for example conference halls or amusement parks) without the need for credentials.

> RFID\_  
Passive RFID Tags  
> Active RFID Tags\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input type="checkbox"/>            |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

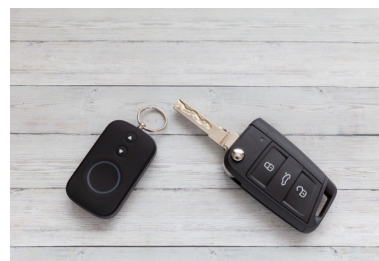
|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



# 01

> RFID\_

- > Passive RFID Tags
- > Active RFID Tags\_

## Description

Active RFID tags have their own power battery and a transmitter and a receiver alongside their antenna and integrated circuit. The battery enables them to have large memories, which are often rewritable, and sensors. They typically use high frequencies (ultra-high frequency and super high frequency), which allow them to operate at much greater distances than [passive](#) and [semi-passive tags](#) (up to 200 metres from the reader, depending on their antenna and the energy available in their batteries) and are best for supporting the additional services they offer. Most active tags are covered with some sort of shell to protect their features from the environment.

All of these features make them larger in size than passive tags, and more expensive.

## Uses

The size, cost and functions of active RFID tags make them suitable for use with high-value goods, especially in the industrial sector – for example in the mechanical industry. The additional functions that active RFID tags offer – such as radiolocation and the measurement of environmental parameters like temperature – also make them particularly attractive to logistics operators. They are often used for product tracking both within companies and between them, being widely affixed to freight containers.

## Implementation

Any changes that may need to be made to the production process to implement this technology will depend on how you decide to attach the active RFID tag to the product. If you attach it to the exterior of the finished product, only minor changes will be needed (e.g. adding an attachment process to the end of the production chain). If, however, you decide to embed the active tag into the product – so as to make it less visible and easily accessible (and thus removable or replaceable) – you may need to make significant changes to the production process, although these will depend on your particular product and the mode/place of embedding.

## Cost

Implementing an active RFID tag system will require initial investments in equipment management systems, readers and changes to the production process. The cost of the devices themselves is in the tens or hundreds of euros per tag. This is because active RFID tags can be reused and are designed for 'high-value' applications.



# Battery-Assisted Passive (BAP) or Semi-Passive Tags

These RFID tags have a small battery that powers only the microchip. This gives them the advantage of larger, potentially rewritable memories, as well as the ability to run and store information from environmental sensors (among other possible types of sensor). Because of these features, BAP tags are typically used in the 'cold chain', that is, ensuring the temperature of products (food, pharmaceuticals or other healthcare products) remains at a constantly low level from the manufacturer to the end user.

#### It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

#### It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

#### It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

#### It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input type="checkbox"/>            |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

#### It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

#### Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

#### Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



# 01

> RFID\_  
Passive RFID Tags  
Active RFID Tags  
> BAP\_





# 01

- > RFID\_
  - Passive RFID Tags
  - Active RFID Tags
- > BAP\_

## Description

BAP tags are also known as semi-passive tags because although they have a battery (like [active tags](#)), they do not have a transmitter. Instead their signals are activated by a reader (like [passive tags](#)). The battery powers the microchip, which allows BAP tags to offer similar additional features to active tags (e.g. environmental sensors and a larger, potentially rewritable memory). They also have a longer read range than passive tags, and can operate a few dozen metres from the reader (but usually no more than 30).

As with active tags, the main disadvantages of BAP tags are their limited battery life and the adverse environmental impact of battery replacement and disposal. However, these disadvantages could be overcome by using solar energy or inertial systems to power the battery, much like solar-powered wristwatches.

## Uses

Owing to their larger memory capacity and sensors, BAP tags are often used to record movement of objects and measure external temperature and pressure (in addition to tracking and authenticating).

## Implementation

Any changes that may need to be made to the production process to implement this technology will depend on how you decide to attach the BAP tag to the product. If you attach it to the exterior of the finished product, only minor changes will be needed (e.g. adding an attachment process to the end of the production chain). If, however, you decide to embed the BAP into the product – so as to make it less visible and easily accessible (and thus removable or replaceable) – you may need to make significant changes to the production process, although these will depend on your particular product and the mode/place of embedding.

## Cost

Implementing a BAP RFID tag system will require initial investments in equipment management systems, readers and changes to the production process. The cost of the tags themselves is around a few euros per tag and depends mainly on the cost of the battery. These costs may be reduced by using small solar-powered rechargeable batteries or inertial systems to charge the batteries.



## 01

# Physical Unclonable Function (PUF)

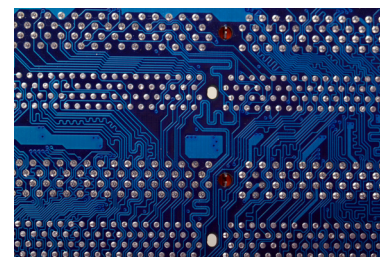
Every RFID tag contains a chip. Every chip is unique, thanks to random, uncontrollable microscopic imperfections in the molecular structure of the material used to produce the chip. This uniqueness can be used to prove authenticity. PUF technology generates unique identifiers from the microscopic imperfections in chips. These identifiers can be stored in a secure database, where they are cross-checked to authenticate originals and detect cloned chips. PUF technology can be used with the chips on RFID tags in order to enhance the protections these tags offer against counterfeiting.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |



It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

> RFID\_  
Passive RFID Tags  
Active RFID Tags  
BAP  
> PUF\_



# 01

- > RFID\_
  - Passive RFID Tags
  - Active RFID Tags
  - BAP
- > PUF\_

## Description

PUF technology is a new approach to unique chip identification, authentication and the generation of 'on-chip' keys (cryptographic keys for secure information exchange). There are several different types of PUF, but the most suitable for identifying and authenticating the chips embedded in RFID tags is silicon-based PUF technology. It generates wholly random unique identification codes for the chips based on their intrinsic physical variations. These codes represent a unique signature, enabling the chips to be subsequently identified and verified.

## Uses

PUF technology is applied to the chip in an RFID tag. Therefore, it can be used in the same situations and for the same purposes as the particular type of RFID tag ([passive](#), [active](#), [semi-passive](#)) it is identifying and authenticating.

## Implementation

Any changes that need to be made to the production process to implement this technology will depend on how you choose to attach the tag to the product.

## Cost

The costs associated with PUF technology reflect those of the RFID tags (passive, active, semi-passive) it is used on.



## 01

## Near Field Communication (NFC)

NFC technology is currently available in most smartphones and smartwatches, where it allows users to link a credit card to their device and make payments when the device is close enough to an NFC-enabled payment machine. It is also used for paying on public transport and authenticating products. NFC transactions are normally concluded within seconds.

> RFID  
> NFC\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



## Description

NFC technology is a set of communication protocols for secure wireless communication between electronic devices less than 10 cm from each other. It derives from contactless card and [RFID](#) technologies. However, unlike these technologies, it moves away from the rigid distinction between reader and tag and passive and active devices. An NFC system can both send and receive queries, and – operating as a tag – it can work in both active and passive mode. NFC devices can be set either to communicate only when specific conditions are met, or to communicate in the same way as contactless cards do – fairly indiscriminately; in both cases, they operate at a frequency of 13.56 MHz.

In contrast to RFID system readers, which can read a large number of tags simultaneously (a useful function in logistics, for example), NFC readers can communicate with only one tag at a time. This makes NFC technology particularly suited to securing transactions such as credit card payments.

## Uses

NFC tags can be embedded into objects as small as payment cards and possibly even paper labels. Consequently, they can be used with a diverse range of products and materials.

As many smartphones already come with NFC tag readers built in, consumers can use this technology to check the authenticity of products themselves (unlike with RFID tags).

## Implementation

In view of the variety of possible applications of NFC tags, any changes to the production process should generally be considered on a case-by-case basis.

If you want to integrate NFC devices into [labels](#), then you do not need to make any changes to the production process; you just have to choose the most suitable label from the range available, and affix it to the product you want traced and authenticated.

If, however, you want to embed the NFC device directly into your product, then you will need to make specific changes to the production chain.

## Cost

Implementing NFC technology requires initial investments in management systems and in possible changes to the production process. NFC tags themselves cost in the range of a few dozen euro cents per tag – slightly more than [passive RFID tags](#). This is because NFC tags offer more functions than passive RFID tags.

# 01

> RFID  
> NFC\_



## 01

## Electronic Seals

A broken seal is a universal indication that an object has potentially been tampered with. Electronic seals add an extra layer of security by recording advanced product information and allowing for real-time tracking and monitoring. They are frequently used on closed freight containers, as they can store and provide data such as electronic signatures, the complete route information, the container ID and details of the cargo being carried. They also trigger alarms when tampered with. The data contained in an electronic seal can be transmitted, read and verified by third party applications – for example during customs inspections.

**It can be used for:**

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

**It is suitable for:**

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input type="checkbox"/>            |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

**It can be used for:**

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

**It goes on:**

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

**It is:**

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

**Reading device needed:**

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

**Connection to server needed:**

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

> RFID  
NFC

> Electronic Seals\_



## Description

Electronic seals, also called eSeals, are embedded into mechanical seals or barrier systems. They build on [RFIDs](#) to provide digital data capture, storage and readability functions in addition to their physical anti-tampering functions. This means they are able to offer higher security and control than normal [mechanical seals](#), as they are able to self-monitor and be monitored in real time.

The two main objectives of an electronic seal are to guarantee:

- [integrity](#) – by clearly showing that the container to which it is applied has been opened; and
- [identity](#) – by uniquely identifying the container to which it is applied.

In some cases, the seal may also have a degree of mechanical strength that makes it difficult to remove.

The quality of an electronic seal can be assessed according to the following characteristics:

- [non-duplicability](#) – a quality seal is not easily duplicated;
- [reliability](#) – once opened, it should not be possible to reseal and it should be clear that it has been opened;
- [verifiability](#) – an operator must be able to verify the authenticity and integrity of a seal, either visually or by using a specific device.

## Uses

eSeals are used mostly to guarantee the integrity of goods during transport. They are generally designed to seal large packing units (e.g. freight containers) as they reveal possible tampering and alterations of the goods during the journey. The integrity of the seal can be checked either through visual inspection of its mechanical component or by using ad hoc devices (readers) that access the information stored in the electronic section of the seal.

## Implementation

You do not need to make any changes to the production process if you want to use electronic seals, as this technology is mainly applied during product transportation.

## Cost

The costs associated with electronic seals will depend on the type of RFID tag(s) used ([passive](#), [active](#), [semi-passive](#)) and the individual functions that the eSeals deliver.

# 01

> RFID  
> NFC  
> Electronic Seals\_



## 01

# Magnetic Stripes

Magnetic stripes are most commonly found on the back of payment and identification cards – most typically credit and debit cards. They contain data that is read when the striped part of the card is swiped through a card reader.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input type="checkbox"/>            |
| large products        | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

- > RFID
- > NFC
- > Electronic Seals
- > Magnetic Stripes\_





# 01

- > RFID
- NFC
- Electronic Seals
- > Magnetic Stripes\_

## Description

Magnetic stripes usually consist of a single layer of PVC (polyvinyl chloride) covered in tiny magnetic resin particles. Data is written and stored in magnetic stripes by modifying the magnetism of the particles, forming a unique sequence of bits. This sequence can subsequently be read through physical contact with a special device (e.g. by 'swiping'), which interprets it. As the information is written into the physical make up of magnetic stripes, it cannot be modified.

Magnetic stripes are mainly placed on cards. There are [internationally defined standards](#) that cards must comply with in order to support this technology. These cover size, flexibility, position of the magnetic stripe, magnetic characteristics and data formats.

## Uses

Magnetic stripes are most widely used on financial cards. However, they can also be applied directly to a valuable object (where physical characteristics and conditions of use allow), in order to guarantee its authenticity and track it (e.g. as a post-sales service for customers).

If the main purpose of the stripe is to ensure security, then it is preferable to apply the stripe directly (and inseparably) to the product.

## Implementation

If you want to use cards to associate magnetic stripes with your products, then you do not need to make any changes to the production process.

If, however, you want to apply a magnetic stripe directly to your product, you will need to make specific changes to the production chain.

## Cost

As this technology is so well-established and widespread, the costs associated with implementing it are not high.



## 01

## Contact Chips

This technology works by embedding a microchip into a plastic card. The microchip contains unique product data, which is read by dipping or inserting the part of the card with the chip in it into a card reader. Contact chip technology is most commonly used for hotel room keys and pre-paid cards.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input type="checkbox"/>            |
| large products        | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input type="checkbox"/>            |



It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

- > RFID
- > NFC
- > Electronic Seals
- > Magnetic Stripes
- > Contact Chips\_



# 01

## Description

Contact chips come in two forms – memory cards and microprocessor cards. These differ according to the characteristics of the microchip.

- **Memory cards (memory-only smart cards).** Here, the microchip contains a permanent memory component, in which data can be read and written through a set of functions in a pre-programmed wired logic circuit printed in the chip during production. The logic circuit includes a mechanism that protects access to the stored data, typically via a set of access permissions. These types of card offer secure data storage capabilities only.
- **Microprocessor cards.** Here, the microchip contains a microprocessor and therefore has computing power comparable to small laptops. These 'smart cards' process, store and protect information via complex cryptographic algorithms.

## Uses

Memory cards are used mainly to store data that does not require a high level of protection. They can be used in the exact same situations as [magnetic stripe](#) cards.

Microprocessor cards are used to store and protect data that requires strong authentication mechanisms and a higher level of security in general.

## Implementation

As contact chips are embedded in cards only (not objects), you do not need to make any changes to the production process if you want to associate contact chips with your product(s).

## Cost

The costs associated with contact chips will be determined by the type of microchip used. Memory-only smart cards are simpler and therefore cheaper.

- > RFID
- > NFC
- > Electronic Seals
- > Magnetic Stripes
- > Contact Chips\_



# MARKING TECHNOLOGIES FOR ANTI-COUNTERFEITING

# 02

As their name suggests, marking technologies work by marking products with unique security features, mostly graphic patterns or codes.

Optical  
Memory Stripe

Machine-  
Readable  
Codes

Security  
Holograms

Inks

Encrypted  
Images

Watermarks

Microtexts

Guilloche/  
Rainbow  
Printing

Unique  
Identifier  
Marks

Copy  
Detection  
Patterns

The main purpose is to authenticate rather than identify individual products. The security they provide against reproduction and tampering comes either from the nature of the technology itself (e.g. the chemical and physical characteristics of an ink) or the information it contains (e.g. in a graphic pattern). In the first case, security is provided by a visual indication of attempted alteration while, in the second, security comes from the difficulty of cloning or reproducing the information.

In some cases – where a unique code (e.g. a barcode) makes up part or all of a marking technology (or can be incorporated into it) – they can also support product traceability by making it possible to register products as they move along the supply chain.

There are several different types of marking technologies. The most widely used are those that can be inspected visually on account of their variety, low cost per item and simple verification procedures – in many cases, verification can be performed by a visual inspection or via a smartphone.



# 02

## Optical Memory Stripe

An optical memory stripe is effectively a laser reading device that is able to store data and images up to a relatively high capacity (up to 4 MB). Importantly, it is a read-only device, meaning that the data it stores about a particular product cannot be updated during that product's 'lifetime'. The optical memory stripe can either be placed on a plastic card (such as electronic identity cards) or, if the material allows, directly affixed to the product it is identifying and tracking.

> Optical Memory Stripe\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |



It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



# 02

> Optical Memory Stripe\_

## Description

This technology offers a high degree of security, as it is based on the WORM (write once, read many) data writing method, which does not allow data to be deleted, replaced or rewritten.

All optical memory stripe solutions currently on the market are patent protected.

## Uses

This technology is most widely used for document authentication.

## Implementation

If you want to use a card to associate an optical memory stripe to your product, no changes need to be made to the production process.

However, if you want to affix an optical memory stripe directly to your product, you will need to ensure that you have the appropriate processes in place to do this during production.

## Cost

As the optical memory stripe solutions currently available on the market are patent protected, their cost is totally controlled by the patent holders.



## Machine-Readable Codes

# 02

Machine-readable codes, also commonly known as barcodes, are identification codes that, as the name suggests, are designed to be readable by technologies such as optical scanning devices.

Optical Memory Stripe  
> Machine-Readable Codes\_

A barcode consists of a series of parallel black lines and white spaces or of dots and squares (or a combination of the two), of varying widths. Written into the codes are unique identifiers or product-related data, such as the date and place of manufacture, owner, origin, expiry date, etc.

camera – which decodes the binary information in the barcode.

The data contained in the codes are analysed and extracted by a reader – current devices include a laser beam or a smartphone

Some optical security features may be ‘bound’ to machine-readable codes in order to automate the smartphone identification and authentication process. Alternatively, machine-readable codes may be embedded into other visual security features, which, when scanned, can provide additional verification instructions or product information and enable traceability.

### Types available:

- One-dimensional barcodes
- Two-dimensional barcodes



## 02

## One-Dimensional Barcodes

One-dimensional barcodes are composed of a single row of bars in which data are coded horizontally. Both the overall size of the barcode and its shape are key features that guarantee the readability of the data, including in adverse physical conditions or when the label is damaged. In some cases it is possible to increase the amount of data contained in the one-dimensional barcode by making it wider. However, the width quickly reaches a limit beyond which reading the code becomes difficult.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

> Optical Memory Stripe  
> Machine-Readable Codes\_  
> One-Dimensional\_





# 02

Optical Memory Stripe

> Machine-Readable Codes \_

> One-Dimensional \_

## Description

There are several standard types of one-dimensional barcode. They are almost always accompanied by a plain text version of the code to give a 'human-readable' label as well. Each type of barcode has a particular set of permitted characters (e.g. numerical, alphanumeric, special characters) and, in some cases, a maximum number of characters or digits (e.g. Code 128 can encode up to 128 different symbols, Code 39 up to 39, etc.). Other types of barcode have fixed code lengths, e.g. EAN 13 has a fixed length of 13 digits, UPC A has a fixed length of 12 digits.

When one-dimensional barcodes are scanned, the reader will connect to the relevant database to retrieve the information.

## Uses

One-dimensional barcodes are widespread throughout the world and can be used on almost all kinds of goods.

## Implementation

One-dimensional barcodes can easily be attached to products either via [adhesive labels](#) or by printing them directly onto the products or packaging. If you want to print barcodes directly onto your product(s), you will need to ensure that you have the appropriate processes in place to do this during packaging/printing or at any other relevant stage of the production chain.

## Cost

Costs are limited to the price of printing the barcodes and, where applicable, the adhesive labels. Generating barcodes is quick and easy, as is installing a barcode system.



# 02

## Two-Dimensional Barcodes

Two-dimensional barcodes, also known as matrix barcodes or matrix codes, consist of a series of dots, spaces and squares. They can store a variety of data and have a larger capacity than one-dimensional barcodes. Data are stored in both the horizontal and vertical axes of the graphic image, which can be printed, embedded on a digital screen or otherwise presented for scanning and analysis.

Optical Memory Stripe

> Machine-Readable Codes\_

One-Dimensional

> Two-Dimensional\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



## Description

While the product data contained in [one-dimensional barcodes](#) is only retrievable when the relevant database is available, due to their large capacity, two-dimensional barcodes can encode internally all the information required to identify a product. Therefore, when scanned, they can immediately deliver a data file with the encoded information. Two-dimensional barcodes can also encode a unique URL, allowing relevant product-level or item-level (if the barcode is serialised) data to be retrieved from the cloud.

There are various types of two-dimensional barcodes, but the most widely used are QR codes and 2D Datamatrix.

QR codes by themselves do not offer protection against copies. They can, however, be combined with other authentication technologies (such as [holograms](#), [copy detection patterns](#) or [unique identifiers](#)), to provide automated authentication via a smartphone scan.

## Uses

Due to their higher capacity, the use of two-dimensional barcodes is rapidly spreading in all sectors where one-dimensional barcodes are already being used. They can be applied to almost all kinds of goods.

## Implementation

Two-dimensional barcodes can easily be attached to products either via adhesive labels or by printing them directly onto the products or packaging. If you want to print two-dimensional barcodes directly onto your product(s), you will need to ensure that you have the appropriate processes in place to do this during packaging/printing or at any other relevant stage of the production chain.

When permitted users scan a code that contains a unique URL, they will typically retrieve dynamic information about the product. Therefore, you will also need a content/client management platform to manage the codes, the data associated with each code and the specific interaction levels for each different category of user. The platform may collect data about the scans performed; an analysis of that data can be used to detect counterfeiting and illicit activity.

## Cost

Costs are limited to the price of printing the barcodes and the price associated with any supporting/backing labels used.

# 02

- > [Optical Memory Stripe](#)
- > [Machine-Readable Codes](#)
- > [One-Dimensional](#)
- > [Two-Dimensional](#)



# SECURITY HOLOGRAMS

# 02

The term 'hologram' is generally used to identify optical devices that work on the basis of variable diffractive images (diffractive optical variable image devices, or DOVIDs).

Holograms are true optical devices: the visual effects of the images they show change as the lighting and viewing angle vary. It is precisely by varying the viewing angle that three-dimensional images are created.

Holograms are created using a photographic technique that records the light scattered from an object and then presents it in a way that appears three-dimensional (holography). Holograms cannot be reproduced by colour printers, scanners or cameras. Their complexity can be increased by inserting several images and effects.

Holograms have several fields of application, from visual arts and decoration to security. In the field of anti-counterfeiting, holograms are used to authenticate products. Successful authentication of a hologram requires knowledge of the original hologram, which is used as a comparison. Any difference between the two could mean that the hologram being examined might be counterfeit, and so each change or update needs to be considered.

## Types available:

- Traditional holograms
- Complex holograms

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms\_



# 02

## Traditional Holograms

Traditional holograms are three-dimensional images that provide a visual way of authenticating a product or a document, as the presence of one is intended (and generally understood) to reliably indicate authenticity. Holograms can be incorporated into adhesive labels or they can be printed directly onto a product or its packaging.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms\_

> Traditional\_



## Description

There are various types of traditional holograms and methods for making them:

- **2D - 3D holograms (multi-layer):** the 3D effect that these provide is not an optical illusion but rather the depth of several layers of 2D holograms.
- **3D holograms:** the image in these holograms has three dimensions of length, breadth and depth. The 3D effect is produced by a 3D physical model that comes out of the holographic plane; the holographic image is the full set of information on the wave front emitted by an illuminated object.
- **Dot-Matrix:** this is one of the most widely used hologram technologies for anti-counterfeiting. A design comprising many tiny dots, each of which is a separate diffraction grating, creates an impression of a 2D or a 3D image. The dots measuring several tens of microns in size are far too small to be seen by the naked eye.
- **Hot Stamping Foil (HSF):** this is a dry printing method of lithography in which pre-dried ink or foils are transferred to a surface at high temperatures. It is widely used to secure paper and plastic products but is applicable to other materials as well.
- **Holograms obtained via a de-metallization process:** aluminium is deposited onto the hologram and then selectively removed in a graphic pattern. It is possible to make printouts that have metallised and transparent parts on the same film, thereby providing additional protection or design improvements.

## Uses

Traditional holograms can be applied to all types of materials, including paper, plastic, fabrics and 'tamper-evident' materials (e.g. **destructible labels**).

## Implementation

If you want to incorporate traditional holograms into **labels**, you do not need to make any changes to the production process. However, if you want to print holograms directly onto your products, you will need to carry out a feasibility check and, if feasible, make the appropriate changes to the production chain.

## Cost

The costs associated with traditional holograms vary according to the type of hologram, the size, the physical processes involved and the technique used to attach the hologram to the product.

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms\_

> Traditional\_



# 02

## Complex Holograms

Complex holograms have the same visual appearance as traditional holograms but contain a variety of hidden information in the form of 'cryptograms'. This combination of visible and invisible security features increases the level of protection they provide.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

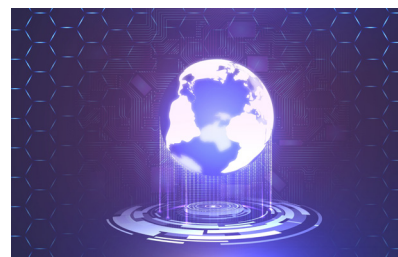
|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms\_
- Traditional
- > Complex\_



## Description

Complex holograms deliver two layers of authentication: visible and invisible. The traditional holographic image that is visible to the naked eye enables immediate authentication. Within that image there is information invisible to the naked eye, in the form of hidden or micro-text, or even encoded information (cryptograms), which can only be read using specific tools such as special lenses, microscopes, lasers or CD players.

## Uses

As with [traditional holograms](#), complex holograms have many possible areas of application and can be attached to various materials, although they are mainly used with paper and plastics.

## Implementation

If you want to incorporate complex holograms into [labels](#), you do not need to make any changes to your production process. However, if you want to print complex holograms directly onto the surface of your products, you will need to carry out a feasibility check and, if feasible, make the appropriate changes to your production chain.

## Cost

The costs associated with complex holograms vary according to the type, size and technique used to attach the hologram to the product, as well as the complexity of the solution chosen.

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms\_

Traditional

> Complex\_





# INKS

Ink-based technologies are typically used for product authentication, but they may also be used for identification and tracking if a unique product identification code is included in the marking.

Most of these technologies are inexpensive and relatively easy to apply. They are very effective and are most commonly used to authenticate paper products, such as paper valuables and documents.

There are several different types of ink that can be used to mark products for anti-counterfeiting purposes. They may be distinguished by their:

- reaction to chemicals

- reading procedure
- reading tool
- specific characteristics.

Anti-counterfeiting inks may also be visible or invisible. Invisible inks are used to:

- avoid altering the appearance of the product
- avoid interference with subsequent product processing
- prevent easy detection by potential counterfeiters.

## Types available:

- UV-sensitive inks
- IR-sensitive inks
- Magnetic inks
- OVI and iridescent inks
- Thermo-chromic inks
- Reactive inks
- Penetrating inks

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_



## 02

## UV-Sensitive Inks

This technology uses photosensitive ink that is visible to the naked eye but changes colour or disappears when exposed to ultraviolet light (UV light). This is thanks to its fluorescent pigments, which show up one shade in daylight and another under UV light. The ink can only be detected using specific devices, such as a 'Wood's lamp' – a light source that emits electromagnetic radiation mainly in the ultraviolet range but also, to a negligible extent, in the visible light range.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Optical Memory Stripe

&gt; Machine-Readable Codes

&gt; Security Holograms

> Inks\_  
> UV-Sensitive\_



## Description

Fluorescent pigments are photochromic and luminescent inks which have been used since the 1960s to manufacture the paper for paper valuables and stamps. They react to different light wavelengths and become active when exposed to UV radiation.

Some companies offer colour-coded microcapsules (containing UV-sensitive ink), which are applied to the surface of a product or inserted directly into it. These microcapsules can only be read by an electron microscope.

Some types of UV-sensitive inks, such as photochromic and 'white' multispectral inks, are very difficult to find. Their markings are therefore very difficult to reproduce and, as such, provide heightened protection against counterfeiting.

## Uses

UV-sensitive inks are ideal for securing official documents, paper valuables, postage stamps and plastic packaging, but they can be applied to all types of materials.

## Implementation

If you want to print UV-sensitive ink directly onto the surface of your product(s), you will need to put the appropriate processes in place to do this during production. The printing process will need to be adapted to ensure that the ink is applied in the desired position.

## Cost

The costs associated with UV-sensitive inks vary according to the type of ink used but, in general, photochromic and 'white' multispectral inks are more expensive than the other, more common types of inks.

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

> UV-Sensitive \_



## 02

## IR-Sensitive Inks (Infrared)

IR-sensitive inks are completely invisible to the naked eye and must be detected with a specific infrared reader. They are applicable to all types of material and are used in anti-counterfeiting to prevent unauthorised photocopying. One of the more common applications of IR-sensitive inks is to hide barcodes or stop them from being reproduced.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

> IR-Sensitive\_



## Description

IR-sensitive inks can be both transparent and opaque. Among the most commonly used ink types in this category are the so called 'meta-material' inks, which are pairs of different colours that appear to be the same in daylight but become mismatched when observed under infrared light.

## Uses

While IR inks are applicable to all media, they are most typically printed on banknotes, paper valuables and documents to guarantee authenticity. They are generally more robust and longer lasting than [UV-sensitive inks](#), which can lose effectiveness with age.

## Implementation

If you want to print IR-sensitive ink directly onto the surface of your product(s), you will need to ensure that you have the appropriate processes in place to do this during production. The printing process will need to be adapted to ensure that the ink is applied in the desired position.

## Cost

The costs associated with IR-sensitive inks vary significantly according to the type used and the product they are applied to. It is therefore difficult to give a general idea of the investment required.

# 02

- > Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks\_
  - > UV-Sensitive
  - > IR-Sensitive\_



# 02

## Magnetic Inks

Inks in this category contain metallic pigments that react strongly to magnets. These 'magnetic flakes' can be detected and read by special devices. Magnetic inks are most commonly used for serialisation and numbering on banknotes and cheques. However, they can also be used to encode documents with a magnetic bar code, via which the information can be read and the documents can be authenticated.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

> Magnetic\_



# 02

## Description

The most well-known magnetic ink technology is MICR (magnetic ink character recognition), which is used in many countries to number cheques (the set of characters running along the bottom). It is specified by the ISO 1004 standard.

MICR numbers are magnetised on the plane of the paper with their north pole on the right. Their stylised, rounded characters make them easy for people to recognise and machines to read, as their shape produces a unique waveform that can be easily identified by character recognition systems. The magnetic ink (normally containing iron oxide) ensures that the MICR numbers are reliably read by character recognition devices even when they have been written over or otherwise obscured by conventional ink marks, such as cancellation stamps.

## Uses

Magnetic inks are mostly used on banknotes, documents, cheques, stamps and credit cards.

## Implementation

If you want to print magnetic ink directly onto the surface of your product(s), then you will need to make sure you have the appropriate processes in place to do this during production. The printing process will need to be adapted to ensure that the ink is applied in the desired position.

## Cost

The costs associated with magnetic inks vary significantly depending on the use. It is therefore difficult to give a general idea here of the investment required.

- > Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks\_
  - UV-Sensitive
  - IR-Sensitive
- > Magnetic\_



# 02

## OVI and Iridescent Inks

Optical variable inks (OVI) and iridescent inks are made with pigments that show up as two different colours when viewed from contrasting angles. The usual colour pairs are red-green, gold-silver and green-blue. OVI is considered to be the best type of ink to prevent document forgery as it is so complicated to reproduce – copiers and scanners cannot replicate the colour change effect.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

Magnetic

> OVI and Iridescent\_





## Description

The inks in this category work by reflecting the various wavelengths of the visible light spectrum differently, depending on the angle at which they hit the surface. When looking at the ink from different angles, the human eye perceives this effect as a change of colour. As colour copiers or scanners copy a document at a fixed angle relative to the document's surface, they can reproduce only one of the colours seen by the human eye.

A similar effect is obtained with iridescent inks. These are special pearled, pearlescent or mother-of-pearl inks that contain transparent pigments composed of thin mica particles. When viewed from different angles, the colour intensity of these inks appears to change.

## Uses

OVI and iridescent inks are mostly used on banknotes, official documents, such as professional licence certificates, and on paper valuables in general.

## Implementation

If you want to use OVI or iridescent inks, you may need to adapt the printing stage of your production process. This will depend on how and where you apply the ink and what the desired effect is.

## Cost

It is difficult to give a general idea of the costs associated with inks in this category as they vary significantly according to which ink is used, how and where. That said, it is worth noting that OVI can be a very expensive ink and is generally used only in small areas of a document to mark emblems, identity marks, etc.

# 02

> Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

Magnetic

> OVI and Iridescent\_



## 02

## Thermochromic Inks

Thermochromic inks change colour when exposed to variations in temperature – even one as minimal and temporary as caused by finger rubbing. The colour change may be reversible, with the ink returning to its original colour when the temperature regains its initial level, or irreversible. Some inks turn clear when heated, revealing the colour of the background below.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks\_
  - UV-Sensitive
  - IR-Sensitive
  - Magnetic
  - OVI and Irisdescent
  - > Thermochromic\_



## Description

There are many different types of thermochromic ink: some change colour when heated, some change colour when cooled, some change temporarily and some change permanently. Some thermochromic inks consist of microcapsules that lose their colour to the point of transparency when the temperature rises above a certain level and revert to their original colour when the temperature drops again. When the ink is transparent, the background below it will show clearly through.

The point at which thermochromic inks become transparent depends on the temperature, colour, concentration and thickness of the dye. However, the standard temperatures at which the inks lose 95 % of their colour are 6°C and 31°C.

## Uses

These inks are used on a diverse range of products and packaging. However, it should be noted that their colour sensitivity may deteriorate (or even disappear) in the event of prolonged exposure to high temperatures (above 50°C), to UV light, to certain fluorescent lights, or even excessive exposure to sunlight.

## Implementation

If you want to print thermochromic ink directly onto the surface of your product(s), you will need to make sure you have the appropriate processes in place to do this during production. The printing stage will need to be adapted to ensure that the ink is applied in the desired position.

## Cost

Given the diversity of thermochromic inks available and their wide-ranging uses, it is difficult to give a general idea of the costs involved in implementing this technology.

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

Magnetic

OVI and Irisdescent

> Thermochromic\_



# 02

## Reactive Inks

As their name suggests, these types of ink react in various ways when they come into contact with aqueous solutions, solvents and other chemical agents. The reaction can take several forms, such as erasure, discolouration, colour transformation, running, staining and smudging, all of which provide a clear indication of attempted alteration.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

Magnetic

OVI and Irisdescent

Thermochromic

> Reactive\_



## Description

Reactive inks are an effective way to detect and prevent document counterfeiting. They provide an immediate, visible indication of any tampering using liquid or chemical substances. For example, if a document is covered in an ink that disappears or changes colour when certain reagents are applied to it, then any attempt to use such substances to alter the characters or numbers on the document will be evident from the reaction.

There are three main types of reactive ink:

- **Erasable inks:** these use water-soluble dyes and resins; as a consequence they can be used only in typography or in dry offset printing. Some countries use erasable inks as the backgrounds on their cheques.
- **Solvent-sensitive inks:** these react to solvents or to chemicals such as bleach, alcohol or acetone, which are often used in alteration attempts. When exposed to the solvents or chemicals, these inks will run, change colour or cause a stain to develop, thereby revealing the forgery.
- **Fugitive inks:** similarly to solvent-sensitive, these inks react to water or an aqueous solution. The ink will run so the printed area becomes smudged, thereby revealing the forgery.

## Uses

Reactive inks are mainly used on documents, cheques, paper valuables, etc., in particular to prevent the alteration of numbering.

## Implementation

If you want to print reactive ink directly on the surface of your product(s), you will need to make sure you have the appropriate processes in place to do this during production. The printing process will need to be adapted to ensure that the ink is applied in the desired position.

## Cost

Given the variety of reactive inks available, it is difficult to give a general idea here of the costs involved in implementing this technology.

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

Magnetic

OVI and Irisdescent

Thermochromic

> Reactive\_



# 02

## Penetrating Inks

Penetrating inks, or 'bleeding inks', permeate right through the paper substrate of a document. Any attempt to mechanically erase the document's contents will reveal the ink and cause visible damage.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks\_
  - UV-Sensitive
  - IR-Sensitive
  - Magnetic
  - OVI and Irisdescent
  - Thermochromic
  - Reactive
- > Penetrating\_



## Description

Penetrating inks are particularly fluid and, when in contact with the support, penetrate deep into the fibres, creating a weak stain around the print, which is also visible on the back of the document. They are generally used in letterpress printing.

Another technique is to mix with the ink a coloured oil able to penetrate deep into the pores of the paper, generating a coloured stain around the number. Any attempt to scrape the number from the document or correct it would leave the stain on the document, making the counterfeiting of the serial number clearly noticeable.

## Uses

Similar to [reactive inks](#), penetrating inks are most commonly used to combat the counterfeiting of documents, cheques, paper valuables, etc. They are mainly used in letterpress printing and to secure document numbering.

## Implementation

If you want to use penetrating ink, you will need to adapt your printing process to ensure that the ink is applied in the desired position.

## Cost

The costs associated with penetrating inks can vary significantly according to how and with which type of document the ink is used. It is therefore difficult to give a general idea of the investment required.

# 02

Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks\_

UV-Sensitive

IR-Sensitive

Magnetic

OVI and Irisdescent

Thermochromic

Reactive

> Penetrating\_



# 02

## Encrypted Images

This technology works by incorporating encrypted information into photographs or the background of documents. The encrypted information, which is printed in encoded format, is not detectable by the naked eye. It only becomes visible when viewed through a special decoding lens (special viewer) or laboratory equipment (usually a scanner or video camera connected to a computer equipped with specific image processing software).

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- > Encrypted Images\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

It is suitable for:

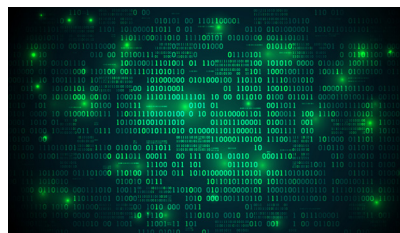
|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |





# 02

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- > Encrypted Images\_

## Description

This technology requires a specific image encryption device to encrypt all or part of the data in an image. A marker algorithm indicates an area of the encrypted data, which is later saved (ideally) on a server. The encrypted image is then used as a marker on the product. An image decoder application takes the information from the server to decrypt the image.

## Uses

Encrypted images are mostly applied to documents, cheques, paper valuables and travel documents. On passports, for example, personal information, such as the holder's name or passport number, can be incorporated into the holder's photograph; alternatively/additionally, the name of the country can be incorporated into the background of the pages.

## Implementation

If you want to use encrypted images, you will need to install the dedicated software programs required to generate them and adapt your production, printing and/or packaging process accordingly.

## Cost

The costs associated with encrypted images vary according to how and where they are used. That said, they are generally in line with the costs of printing traditional images.



# 02

## Watermarks

Watermarks are designs or patterns that are embedded into paper during the production process. They are produced by applying pressure to the substrate in the form of a pattern or text. This causes the paper to compress and thin only in those areas where pressure was applied. More light is able to pass through the thinner parts of the paper, thereby showing up the watermarked image without the need to incorporate any other materials.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Optical Memory Stripe

> Machine-Readable Codes

> Security Holograms

> Inks

Encrypted Images

> Watermarks\_



# 02

## Description

Dry watermarks are made by passing a device called a dandy roll over a slightly moistened sheet of paper. The roll is covered in thick paperboard, on which the wording or figure to be transferred to the paper is designed in relief with wires, gels or other devices.

## Uses

Watermarks are most commonly applied to banknotes but they are also rather widely used on other paper valuables, tickets, identity documents, etc.

## Implementation

The use of watermarks requires major changes to the paper sourcing process, as your paper needs to be compatible with watermarking technology. It should also be considered that this technology requires extensive experience and can only be applied by highly trained and specialised staff.

## Cost

The costs associated with watermarks are highly dependent on the cost of the paper they are being applied to. The costs of specialised staff must also be considered when implementing this technology.

- > Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- Encrypted Images
- > Watermarks\_



# 02

## Microtexts

This technology consists of reproducing a text or an entire document on a miniaturised scale, with the resulting text only being able to be read by sophisticated equipment. For example, microtexts can be inserted into documents by replacing a line segment with a sequence of characters of less than 0.2 mm in size. To the naked eye (and copiers and scanners) the text will appear as a solid line. Micro-images can also be inserted.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- Encrypted Images
- Watermarks
- > Microtexts\_



## Description

Microtexts are printed from specialised machine or laser-engraved matrices, using particular inks and techniques. They require sophisticated graphic equipment because the precise details must be reproduced with extreme precision. A better print quality than common offset printing plates is generally needed, given the miniscule scale of the text produced.

## Uses

Microtexts are most typically used in banknotes, but they are also widely used for packaging, either printed on the shipping documents or on the packaging itself.

## Implementation

If you want to print microtext on a product's shipping document or packaging, you do not need to make any changes to your production process. To print the microtext you will need the sophisticated graphic equipment described above. Alternatively, the printing process can be contracted out to specialised companies.

## Cost

The costs associated with microtexts vary according to how, where and on what they are used. It is therefore difficult to give a general ideal of the investment required.

# 02

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
  - Encrypted Images
  - Watermarks
- > Microtexts\_



# 02

## Guilloche/Rainbow Printing

This technology takes its name from the French word 'guilloche', which is the name for an ornamental design made from engraved metal plates. Here, the plates are mechanically printed onto the surface of a product by specialised machines that generate a repetitive pattern of engraved linear or wavy lines, with colours that fade into each other and with relief effects that are hard to reproduce.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

It is suitable for:

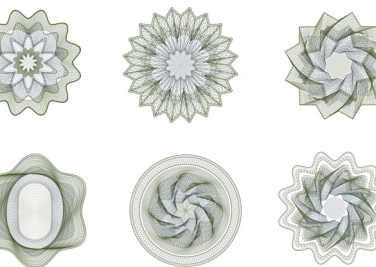
|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- Encrypted Images
- Watermarks
- Microtexts
- > Guilloche/Rainbow Printing\_



## Description

Guilloche patterns are created using highly sophisticated software. Each element in the pattern can be assigned a predetermined colour shift, creating the illusion of synchronous animation.

A similar technology is rainbow printing, which is sometimes combined with guilloche. The rainbow colouring process is a special form of offset security printing that subtly merges the colours into each other, resulting in a gradual colour change. This special print cannot be reproduced by photocopiers or scanners.

## Uses

Guilloche and rainbow printing are mostly used for banknotes, documents, certificates and other paper valuables.

## Implementation

To apply this technology, you will need graphic equipment that is able to reproduce the precise details and printing plates (which may also be engraved with lasers) faithfully and to use particular inks and techniques to deliver a better print quality than common offset printing plates. Sophisticated software can also be required to generate guilloche patterns.

## Cost

It is difficult to give a general idea of the costs associated with this technology, as they vary significantly according to how, where and on which product it is used.

# 02

- > Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
  - Encrypted Images
  - Watermarks
  - Microtexts
- > Guilloche/Rainbow Printing\_



# 02

## Unique Identifier Marks

This technology essentially works by inserting visible or hidden identifiers into products or documents. Where visible, the identifiers have the appearance of unintended ink spots or smudges. They are generally produced by random and practically non-replicable chemical and physical processes. For example, a particular printing technology can be used to randomly generate a series of small, coloured patches, which will serve as an exclusive, original and unique identifier, much like a fingerprint. A numerical code is assigned to each individual identifier (its signature) and stored in a reference database.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- Encrypted Images
- Watermarks
- Microtexts
- Guilloche/Rainbow Printing
- > Unique Identifier Marks\_





## Description

There are many different methods for creating unique product identifier marks. However, in all cases, special recording equipment is installed on either the printing or the production line to capture an image of each product's identifier and store it together with the encoded signature in a database. In some cases it may also be possible to print the encoded signature as part of a [2D barcode](#) on the item. This would support identification and tracking of the marked products as well.

## Uses

This technology can be applied directly to documents and packaging. Alternatively, the pre-recorded identifiers and/or encoded signatures may be printed onto [labels](#).

## Implementation

The changes that need to be made to the production process in order to implement this technology vary significantly depending on the type of product and the methods used to generate the unique identifier and associate it with the product. If you want to apply unique identifier marks directly to your product(s), you will need to install the specific hardware in your production line to record the signature of each identifier. However, if you wish to use [adhesive labels](#) with a built-in, pre-recorded unique identifier, only limited changes to the production process will be necessary.

## Cost

Given the diversity of methods available for applying this technology, it is difficult to give a general idea of the costs involved in its implementation. That said, the cost for pre-recorded unique identifiers printed onto labels is usually around a few euro cents per item.

# 02

- > Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
  - Encrypted Images
  - Watermarks
  - Microtexts
  - Guilloche/Rainbow Printing
- > Unique Identifier Marks\_



# 02

## Copy Detection Patterns

Copy detection patterns, also called secure graphics, are small, random or pseudo-random digital images to be printed on packaging, products or documents to detect counterfeits. The technology is based on the principle that every time a digital image is printed or scanned – regardless of the quality of the scan or the photocopying technology used – some of the information contained in the original image is lost. Copy detection patterns (CDPs) are designed to maximise this information loss when it is printed or copied. Because a counterfeit copy detection pattern will have been copied or scanned at least once more than the original, the resulting counterfeit image will contain less information than the original image. Authentication is, therefore, done by an algorithm comparing the amount of information in the scanned copy detection pattern with the original.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

Digital image of CDP  
(once printed, typical real  
size is 2 to 4mm)



©Justin Picard, 2020

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
- Encrypted Images
- Watermarks
- Microtexts
- Guilloche/Rainbow Printing
- Unique Identifier Marks
- > Copy Detection Patterns\_



## Description

Copy detection patterns, also called secure graphics, are small random or pseudo-random digital images that are designed to be sensitive to printing and copying. The images are usually generated by specific software modules before printing. They can be scanned using a mobile phone camera or scanner, and authenticated via a mobile phone app. Copy detection patterns can also be inserted into **2D barcodes** (e.g. QR codes or data matrices) for enhanced security, which facilitates smartphone authentication and improves traceability.

## Uses

Copy detection pattern technology can be applied to documents, products and packaging.

## Implementation

As the copy detection pattern integration process is essentially digital, you will not need to make any major changes to production or logistics operations if you want to implement this technology.

## Cost

It is difficult to give a general idea of the costs associated with copy detection patterns, but they typically do not scale up in direct proportion to the quantities of objects to be secured.

# 02

- Optical Memory Stripe
- > Machine-Readable Codes
- > Security Holograms
- > Inks
  - Encrypted Images
  - Watermarks
  - Microtexts
  - Guilloche/Rainbow Printing
  - Unique Identifier Marks
- > Copy Detection Patterns\_



# CHEMICAL AND PHYSICAL TECHNOLOGIES FOR ANTI-COUNTERFEITING

# 03

Chemical and physical anti-counterfeiting technologies use special substances to mark and verify objects. They exploit the inherent randomness of the patterns produced when certain chemical processes or substances are applied to materials, serving as markers.

The main purpose of these technologies is authentication without simultaneous unique product identification. Specialised hardware or laboratory tests are needed to read and verify the markers they create. This makes it very difficult for third parties to reproduce similar markers.

The costs involved in creating and affixing the chemical and physical markers are generally low. However, the specialised automatic reading devices, when needed, can be expensive. Therefore, it is worth bearing in mind that immediate on-site verification is often not possible. Instead, testing has to be carried out by laboratories, which requires more time.

There are four types of chemical and physical technologies:

DNA  
Coding

Chemical  
Encoding and  
Tracers

Glue  
Coding

Surface Fingerprint  
& Laser  
Surface Analysis



## 03

## DNA Coding

Every DNA strand contains a unique sequence of genetic information. This information, also called a genetic fingerprint, is unique to each single living organism. The uniqueness of DNA makes it ideal for forensic investigation and its use in determining paternity and detecting genetic health conditions is well known. DNA coding uses the same underlying idea to combat counterfeiting. It implants a unique DNA code into a product or package, rendering it traceable, identifiable and verifiable. This technology is compatible with all material types and can therefore be applied to products as diverse as bottles containing alcohol and their labels, perfumes, refined fuels and banknotes.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input type="checkbox"/>            |
| large products        | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



# 03

> DNA Coding\_

## Description

DNA coding implants molecules containing specifically generated DNA codes (or DNA markers) into individual items or products. The basic DNA sequence may be modified to create an almost unlimited number of unique markers, which can be used to individually identify each of the articles being protected. DNA markers can be applied to all types of material, meaning that they can be applied both to products and their packaging. The tags are invisible to the naked eye and are stable and permanent. They have a low environmental impact and are non-toxic. The DNA is quick to apply and only the tiniest amount is needed – the DNA to material ratio is absolutely miniscule – which leaves the product properties unaffected. Specific tests must be carried out by specialised laboratories to detect and verify the implanted DNA codes.

This technology provides a legally recognised security system that can be used in court proceedings to prove wrongdoing under national laws. However, specific forensic tests may be required to support the information provided.

The most widespread solutions currently available on the market are patent protected.

## Uses

DNA coding has been successfully used in the mechanical, food, pharmaceutical, textile and petrochemical industries, as well as by credit institutions. Popular applications include marking refined fuels, perfumes, clothing and all kinds of packaging.

## Implementation

Given the diversity of product types that DNA coding can be used on, it is difficult to specify the requirements for implementing this technology. Any changes that need to be made to the production process will depend on the type of product to be tagged and the tagging method.

## Cost

As the DNA coding solutions currently available on the market are patent protected, their cost is controlled by the patent holders.



## 03

## Chemical Encoding and Tracers

This anti-counterfeiting technology uses miniscule particles with specific chemical or physical properties to authenticate and secure products and packaging. These particles can be attached to any type of surface and are invisible to the naked eye. However, the unique properties of the particles – a colour reaction to light, for instance – can be detected using special equipment. The particles can be applied in specific patterns to serve as a marker of origin, or to certain components to serve as a marker of quality. For example, if an item of clothing is supposed to be 40 % cotton, a chemical tracer could be added to the cotton yarn at the beginning of the production process. Later on, even years after the garment was purchased and used, a special reader would still be able to measure the amount of chemical tracer present to verify the cotton content.

DNA Coding

> Chemical Encoding  
and Tracers\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



## Description

Chemical encoding and tracers work by attaching specific and distinctive tiny chemical particles to raw materials and finished products that, when detected, attest to the material/product's authenticity. They are nanometres (nm), that is, billionths of a metre, in length and can only be identified using specific readers. The chemical particles are coded, with all decoding done in a laboratory.

Several different chemical encoding and tracing methods exist. Some use chemical compounds with optical properties, such as luminescent particles, to authenticate the product, while others use compounds with physical properties, such as magnetically attractable particles.

## Uses

This technology has a very broad area of application as the chemical particles it uses can be attached to a wide variety of different materials, including paper, cardboard, plastic, leather, glass, yarn and fabrics.

## Implementation

The diversity of applicable materials and methods for chemical encoding and tracers makes it difficult to specify the requirements for implementing this technology. Any changes that need to be made to the production process will depend on your product/material, the method you choose and the particle attachment technique.

## Cost

As the resources required for chemical encoding and tracing will depend greatly on the particular method and product used, it is difficult to provide a general idea of the costs involved in implementing this technology.

# 03

> DNA Coding  
> Chemical Encoding  
and Tracers\_





## 03

## Glue Coding

Glue coding is a process that applies heat to a polymer causing spontaneous, random and unique bubbles to form in it. The specific position, size and shape of the polymer bubbles are different every time, making each particular combination as unique as a snowflake. Each set of bubbles is recorded in a reference database that is accessible only to the product owner. These one-of-a-kind three-dimensional patterns are therefore essentially impossible to replicate, making them ideal for defending against and detecting counterfeiting.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input type="checkbox"/>            |
| large products        | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

DNA Coding  
Chemical Encoding  
and Tracers  
> Glue Coding\_



## Description

Glue coding is a physical and chemical process that generates unique identifiers made up of thousands of miniscule polymer bubbles in random shapes and sizes. Each set of bubbles represents a unique and non-replicable 3D pattern, much like a fingerprint. This places glue coding among the most secure of all the anti-counterfeiting techniques that generate unique identifiers, as the probability of producing two identical configurations is one in several billion.

The process can be applied to very small pieces of polymer (a few millimetres), which are then affixed to the product or its packaging, where they serve as the item's "signature" or seal of authenticity. All polymer bubble signatures are logged in a secure reference database. In order to verify a product's authenticity, a special reading device will analyse its signature both two-dimensionally and three-dimensionally, and compare it to the signatures in the database.

## Uses

This technology can be used to secure a wide variety of products against counterfeiting, as it is compatible with many different types of material.

## Implementation

It is difficult to give specific implementation requirements for glue coding as the technology can be applied to such a wide range of different materials. Any changes that need to be made to the production process will therefore depend on your product/material and the corresponding attachment method.

## Cost

As the resources required for glue coding will depend greatly on the particular product and attachment method, it is difficult to give a general idea here of the costs involved in implementing this technology.

# 03

DNA Coding  
Chemical Encoding  
and Tracers

> Glue Coding\_



## 03

## Surface Fingerprint & Laser Surface Analysis

The surface of every product can be unique due to microscopic structural differences caused by physical processes or the use of chemical substances. This technology exploits those differences by assigning to each one a code, in a random and stable pattern like a fingerprint, that identifies the product. The codes are recorded in databases, which can be cross-referenced in order to verify the product's authenticity.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

DNA Coding  
Chemical Encoding  
and Tracers

Glue Coding

> Surface Fingerprint  
& Laser Surface  
Analysis\_



## Description

Surface fingerprint technologies and laser surface analysis are employed to generate a unique identifier based on the effects of a physical random process which, due to its nature, cannot be reproduced or copied.

The composition of the surfaces of the materials is analysed using techniques that identify the structural differences distinctive to each surface. On the basis of these differences, identifiers are generated which allow the product to be uniquely identified.

For example, by analysing the structural differences that are generated on silicon films (so called 'wrinkles'), unique identifying codes can be randomly created. These codes are univocal, like human fingerprints, and reproducing them is technically impossible.

A method based on this principle is used to produce labels that are easily readable with an optical reader. It consists in coating a substrate of nanoparticles with silicon polymers. The desiccation of the substrate causes it to shrink and to produce structural differences or 'wrinkles' on the polymer coating. By analysing these 'wrinkles,' it is possible to randomly generate unique identification codes. A special device is needed to read the code and compare it with those previously stored in a reference database.

## Uses

Surface fingerprint technologies and laser surface analysis are applicable to a wide variety of products as the analysis of structural features can be applied to different types of materials.

## Implementation

Changes to the production process depend closely on your product type, which determines the techniques for attaching the marker to the products.

## Cost

The costs of these anti-counterfeiting solutions depend on the particular method used and cannot be calculated precisely in advance.

# 03

DNA Coding  
Chemical Encoding  
and Tracers  
Glue Coding

> Surface Fingerprint  
& Laser Surface  
Analysis\_



# MECHANICAL TECHNOLOGIES FOR ANTI-COUNTERFEITING

# 04

Mechanical technologies work with the physical properties of materials to prevent counterfeiting and create effective anti-tampering barriers.

When used alone, they perform simple authentication functions.

When used in combination with other technologies, they can also perform identification and tracking functions.

For example, unique identification codes may be included in a label to allow for the product to be traced.

Most mechanical solutions take the form of various different types of label, which can be classified according to their physical properties (i.e. the material used and/or the way in which they are attached to the product). Labels usually need to be authenticated via an automatic reading device, such as a barcode reader. However, for other types of mechanical solutions, such as laser engraving, authentication can be performed visually.

The cost per item of mechanical solutions is generally medium to low and, in the specific case of labels, implementation times are very quick, as often only limited changes to the production process are required.

Labels

Laser  
Engraving

Anti-Alteration  
Devices

Seals

Security  
Threads

Security  
Film



# LABELS

# 04

An identification label is any physical element that contains identification data and product information, and is placed on a product or its packaging.

> Labels\_

The most commonly used materials for labels are paper and plastic film, which most often come with information printed on the front and an adhesive layer on the back (adhesive labels). However, there are numerous different types of labels. Materials vary, as does the type of adhesive, the type of support used (e.g. silicon paper), the printing technology, the level of resistance to atmospheric agents or the type of use.

clothing or footwear). When assessing implementation options, it is worth considering whether it may be cheaper to incorporate certain solutions into the artwork that is going to be printed directly onto the cardboard, plastics or shrink sleeves, so that no changes need be made to the normal production process.

Identification labels may be placed on all types of packaging and containers, including cardboard boxes, glass bottles, jars or plastic bags, or directly on the product itself (for example, in the case of

Labels can be combined with several other technologies for enhanced security. When they are combined with [radio-frequency identification \(RFID\) tags](#) or [near-field communication \(NFC\)](#) devices, they become 'smart labels'.

## Types available:

- Fabric labels
- Adhesive labels
- Labels with micro-engraved cliché
- Ultra-resistant labels
- Ultra-destructible labels
- Void labels
- Tags



# 04

## Fabric Labels

These types of labels usually come in the form of a small piece of fabric bearing the brand name, company details and some product information – origin, size, content, washing instructions, etc. They are an effective way to identify products, especially when combined with other security features, such as a barcode or a hologram. For enhanced anti-counterfeiting capabilities, they can even be combined with an RFID tag to become 'smart labels'. Fabric labels can be woven or printed, with the logo or wording being woven into the piece of fabric or printed on top of it, respectively.

### It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

### It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

### It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

### It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

### It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

### Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

### Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |



> Labels\_  
> Fabric Labels\_



## Description

Fabric labels are highly versatile in that they can be combined with several other security features to produce labels of varying degrees of sophistication. The simplest labels merely display product information and identification codes (usually [barcodes](#)). The more complex labels incorporate more advanced security features, such as [holograms](#), [security threads](#) and tracer fibres. The most complex – ‘smart labels’ – incorporate [RFID tags](#) or even [NFC](#) devices for when the goods are particularly valuable.

Standard label sizes usually vary between 20 mm and 70 mm, depending on the type of product and the marketing needs. Woven labels are the most common type used for clothing and accessories, as their fine thread allows for more details to be included in words and patterns. Printed labels are also used for clothing, and are most commonly attached to or directly printed on the inside of the product.

## Uses

Fabric labels are mainly used for textile and leather products in general, and for apparel and footwear in particular.

## Implementation

If you want to implement this technology, you will need to revise the way in which labels are attached to your products, in order to ensure robust stitching is used. It is recommended that stitching is done in such a way that removal will result in visible damage to the product. As with other types of labels, partly or fully automated solutions are available for those fabric labels that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs associated with simple fabric labels are quite low; costs associated with ‘smart labels’ largely depend on the characteristics of the additional technologies involved.

# 04

> Labels\_  
> Fabric Labels\_





## 04

## Adhesive Labels

An adhesive label is a small piece of paper or other material that is designed to be affixed to another larger piece of paper or object via a layer of adhesive on its back. Like fabric labels, adhesive labels that are affixed to products bear printed identification codes – generally barcodes – and product information.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

> Labels\_  
Fabric Labels  
> Adhesive Labels\_



## Description

Adhesive labels may be made with a variety of different materials and attached to a variety of different supports. Like fabric labels, they can be combined with other, more advanced security features, such as custom [holograms](#), [optical variable ink \(OVI\)](#), tracer fibres and [RFID tags](#).

The adhesive is usually made of rubber, acrylic or an acrylic blend depending on the type of product and the environment the product is exposed to. Rubber adhesives work well on most kinds of surfaces, but are less resistant to temperature and UV light than other adhesives. Acrylic is less suitable for plastic surfaces, but more resistant to solvents and lasts longer. Acrylic blend adhesives offer the highest resistance, but they are also prone to wearing off under exposure to heat and UV light.

## Uses

Adhesive labels can be used on a very wide range of products and can be affixed directly to both product and packaging.

## Implementation

Implementing this technology will require changes to be made to the stage in the production process at which labels are attached to the product. As with other types of labels, partly or fully automated solutions are available for those adhesive labels that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs associated with simple adhesive labels are very low; costs associated with 'smart labels' largely depend on the characteristics of the additional technologies involved.

# 04

> Labels\_  
    Fabric Labels  
    > Adhesive Labels\_



## 04

## Labels with Micro-Engraved Clichés

Here, micro-engraved clichés are hot printed onto labels. A cliché is a metal matrix that is engraved to reproduce designs, images, photos, etc. Micro-engraved clichés have an extremely fine texture on their surface, with random or repeated designs that can be personalised. Once transferred onto the label through a hot-printing process, this fine texture creates optical refractive effects, which change form and colour when viewed from different angles, similar to a hologram.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- > Labels\_
  - Fabric Labels
  - Adhesive Labels
- > Labels with Micro-Engraved Clichés\_



## Description

This technique is based on hot printing, a printing process where a die (or matrix) is heated and pressed onto a foil placed between the die and the object to be printed – the label in this case. Through hot printing, the fine texture engraved in the matrix is transferred in detail and colour onto the label, not only enhancing its attractiveness, but also providing a fair level of protection against counterfeiting. This is thanks to the characteristics of the cliché, which make it difficult to reproduce. The effect is similar to that of a [hologram](#), just with a different look and texture.

Micro-engraved patterns can consist of random repeated designs and can be customised with logos, thereby improving the counterfeit-deterrent effect.

## Uses

Labels with micro-engraved clichés can be used in a wide number of sectors, both on products and packaging.

## Implementation

Implementing this technology will require changes to be made to the stage in the production process at which labels are attached to the product or packaging. As with other types of labels, partly or fully automated solutions are available for those labels with micro-engraved clichés that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs involved in implementing labels with micro-engraved clichés are generally fairly low and are substantially lower than those involved in implementing holograms.

# 04

- > Labels\_
  - Fabric Labels
  - Adhesive Labels
- > Labels with Micro-Engraved Clichés\_



## 04

## Ultra-Resistant Labels

Ultra-resistant labels are made out of very strong, tear-proof materials that can withstand extreme temperatures. They are often combined with 'hidden' security elements such as RFID tags, codes that are invisible to the human eye, etc. Their durability and adaptability mean they work well indoors, outdoors and in hostile environments, and are particularly well suited to sectors such as shipment, transport, outdoor storage and industrial machinery.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

&gt; Labels\_

Fabric Labels

Adhesive Labels

Labels with

Micro-Engraved

Clichés

> Ultra-Resistant  
Labels\_



## Description

Ultra-resistant labels can be made out of a wide range of special plastic materials, such as vinyl, nylon, polyester and polyethylene. These materials are able to withstand extreme temperatures (e.g. as low as - 40°C and as high as + 250°C), and are unaffected by solvents, detergents, oil, dirt, UV and seawater. Polyester and polyethylene are also elastic, so labels made out of these materials can stick to curved surfaces too. Non-plastic materials such as aluminium may also be used.

## Uses

This technology is particularly suited to labelling heavy-duty equipment and freight containers, and for use as non-alterable hazard or warning signs. Labels that can resist very high temperatures (up to 250°C) are typically used on hot surfaces such as industrial machinery or furnaces.

## Implementation

Implementing this technology will require changes to be made to the stage in the production process at which labels are attached to the product or packaging. As with other types of labels, partly or fully automated solutions are available for those ultra-resistant labels that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs associated with ultra-resistant labels are usually fairly low. However, the costs will vary depending on the type of material you use.

# 04

## > Labels\_

Fabric Labels

Adhesive Labels

Labels with  
Micro-Engraved  
Clichés

> Ultra-Resistant  
Labels\_



## 04

## Ultra-Destructible Labels

Ultra-destructible labels are made from very fragile materials (often paper or PVC) and applied with extremely strong glue. This combination ensures that any attempt to remove the label is destined to fail; if anyone tries, the label will break into small pieces that cannot be fully removed. This makes them a particularly effective anti-tampering technique.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

&gt; Labels\_

Fabric Labels

Adhesive Labels

Labels with  
Micro-Engraved  
ClichésUltra-Resistant  
Labels> Ultra-Destructible  
Labels\_



## Description

Ultra-destructible labels come in a wide range of sizes and can be applied to various different types of supports. They can also be customised and given unique numbering. The more fragile an ultra-destructible label is, the greater its effectiveness. However, the more fragile it is, the greater the difficulty of handling and applying it also.

## Uses

This type of label is particularly suited to products covered by warranty, such as electronic equipment, and is used equally in assistance and repair centres and in shops. These labels are also well suited to the food sector, where they are used as guarantees of freshness on jars and similar.

## Implementation

Implementing this technology will require changes to be made to the stage in the production process at which labels are attached to the product or packaging. As with other types of labels, partly or fully automated solutions are available for those ultra-destructible labels that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs associated with ultra-destructible labels are fairly low, but will vary according to the material used.

# 04

## > Labels\_

Fabric Labels

Adhesive Labels

Labels with  
Micro-Engraved  
Clichés

Ultra-Resistant  
Labels

> Ultra-Destructible  
Labels\_





# 04

## Void Labels

This type of label works by depositing some of its colour onto the product in the form of the standard word 'void', a custom text (e.g. 'opened') or a logo. Therefore, when the label is removed, it leaves a visual indication of attempted tampering. If the message or logo is erased from the product, then the same alert message will still show up in negative when the label is re-affixed.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

> Labels\_

Fabric Labels

Adhesive Labels

Labels with  
Micro-Engraved  
Clichés

Ultra-Resistant  
Labels

Ultra-Destructible  
Labels

> Void Labels\_



# 04

## Description

The distinctive feature of void labels is that the alert message or logo remains invisible until the label is removed. Once the adhesive film has been removed from the surface of the object, the label's integrity cannot be restored and any tampering will be evident.

## Uses

These labels may be applied to goods sold under warranty, leased goods and goods undergoing servicing or repair in order to show evidence of unauthorised interference. They also provide an effective way to control and monitor product integrity along the entire supply chain, from manufacturing to retail sales.

## Implementation

Implementing this technology will require changes to be made to the stage in the production process at which labels are attached to the product or packaging. As with other types of labels, partly or fully automated solutions are available for those void labels that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs associated with void labels are fairly low, but will vary according to customisation.

## > Labels\_

Fabric Labels

Adhesive Labels

Labels with

Micro-Engraved

Clichés

Ultra-Resistant

Labels

Ultra-Destructible

Labels

## > Void Labels\_



# 04

## Tags

Tags can be made of various materials and their main purpose is product identification. However, they can also provide wider brand protection, especially when combined with other technologies (for example, RFID, inks, holograms) However, their ability to authenticate products will largely depend on how securely the tag is attached to the product. They are therefore most effective when used in combination with another technology.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |



It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

> Labels\_

- Fabric Labels
- Adhesive Labels
- Labels with Micro-Engraved Clichés
- Ultra-Resistant Labels
- Ultra-Destructible Labels
- Void Labels

> Tags\_



## Description

Tags are effective ways of identifying products and proving authenticity, particularly when combined with more advanced technologies, such as [holograms](#), [RFID tags](#), [OVI inks](#) or tracer fibre. They are usually attached to the product by resistant threads – nylon strings, chains, etc. However, the limit of tags lies in how strong the threads are.

## Uses

Tags can be attached to almost any type of product.

## Implementation

Implementing this technology will require changes to be made to the stage in the production process at which labels are attached to the product or packaging. As with other types of labels, partly or fully automated solutions are available for those tags that do not need to be applied manually, depending on the quantity to be applied.

## Cost

The costs associated with tags are fairly low, but will vary according to type of material, attachment and combination with other technologies.

# 04

## > Labels\_

- Fabric Labels
- Adhesive Labels
- Labels with Micro-Engraved Clichés
- Ultra-Resistant Labels
- Ultra-Destructible Labels
- Void Labels

## > Tags\_



## 04

## Laser Engraving

This technology uses a special type of laser to cut very closely spaced grooves of varying depths into any type of support or surface. Images, logos, text or identification codes can be superimposed on top of the engraving, where they will take on new colours when viewed from different angles. Often confused with holograms, these images are very difficult to replicate. A major advantage of this technology is that the marking is inseparable from the product and is therefore very difficult to tamper with.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input checked="" type="checkbox"/> |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

&gt; Labels

&gt; Laser Engraving\_



## Description

There are three main laser engraving techniques:

- annealing – also known as laser surface stamping, which marks ferrous metals and titanium by heating the surface and causing oxidation underneath, discolouring the metal in the shape of the marking;
- real laser engraving – a technique that removes material from the surface of the product in the shape of the marking (this is especially used for metals, plastics and ceramics);
- deep laser marking – a highly specialised procedure whereby markings are performed at a specified depth in the surface of the product (which is usually made of metal).

## Uses

Laser incisions can be made on a wide range of different materials: paper and paperboard, labels, leather, film, rubber, foam, wood, fabrics, PET, PVC, glass, stone, iron, nickel, steel, stainless steel, aluminium, electrical components, etc.

## Implementation

Given the diversity of factors involved in laser engraving – type of product to mark, material and engraving technique – it is difficult to give specific implementation requirements here. However, it can be said that considerable changes would need to be made to the production process.

## Cost

There are also quite significant costs associated with laser engraving, although they will depend on the particular context, material and technique used.

# 04

> Labels  
> Laser Engraving\_



# 04

## Anti-Alteration Devices

Anti-alteration devices 'mechanically' prevent a product from being altered in its original packaging. Although specific devices could potentially be made for all types of product, the most common example is the anti-topping-up or anti-refill cap – a device comprising one or more small balls that is inserted down the neck of a bottle. This system allows liquid to be poured out of the bottle, but not poured in, preventing any topping up or refilling.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices\_



# 04

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices\_

## Description

This technology is widely applied in the alcoholic drinks industry to prevent the counterfeiting of wines and spirits. When empty drinks bottles are sent for recycling they are often intercepted, filled with cheap imitations and resold as the original, valuable product. Anti-alteration devices in the form of anti-refill caps stop this from happening by placing one-way valves in the necks of bottles and so making it impossible to pour liquid back in.

Anti-alteration devices can also be combined with shrink sleeve labels placed on the caps and lids of bottles and jars, in order to further prevent tampering and alteration.

## Uses

By their nature, these devices are intended to be used specifically with the product/products for which they have been designed.

## Implementation

Any changes that need to be made to the production process in order to implement this technology will depend on your product and the type of device used.

## Cost

It is difficult to give a general idea of the costs associated with anti-alteration devices as they will vary according to the type of product and particular device used.





# 04

## Seals

A seal is any device that hermetically closes a package to protect the content from tampering. Seals can be made of plastic or metal and can be as simple and cost-effective as a screwcap on a bottle. They are usually easy to install and remove, but the level of security they offer depends to a great extent on the experience and ability of the person inspecting them.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



- > Labels
- > Laser Engraving
- > Anti-Alteration Devices
- > Seals\_



# 04

## Description

The general properties of a seal are:

- identity – every seal has a unique identifier;
- non-duplicability – seals are very difficult to reproduce;
- reliability – they provide a high level of security.

Although there are various different types of mechanical seals, they all share the following characteristics:

- their integrity is established through visual inspection;
- they reassure the user as to the security of a product by providing visual evidence of any tampering;
- they do not record information about the time or place of any tampering;
- they are unable to check their own integrity, unlike [electronic seals](#).

## Uses

Seals are highly versatile and can be used on a vast range of different packages in a variety of sectors. They are even used in transport to secure freight containers.

## Implementation

As seals are generally applied to the packaging rather than the product itself, the changes that need to be introduced in order to implement this technology will affect the wrapping and packaging stage – not the production process.

## Cost

While it is difficult to give a general idea of the costs associated with mechanical seals because of their diversity and versatility, it can be said that they are much lower than the costs associated with electronic seals.

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices
- > Seals\_



# 04

## Security Threads

Security threads are threads of various materials (metal, fabric, polymers) that are woven into or otherwise attached to products to enable authentication and prevent tampering. The diversity of the thread materials means that this technology can be embedded into a range of products. Additional security features – such as special coatings or microprinting – may be applied to the thread for more advanced protection against counterfeiting.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |



Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices
- > Seals
- > Security Threads\_



# 04

## Description

The different types of security thread can be grouped according to material and function:

- metal threads – these are embedded directly into the product to prevent it from being reproduced, e.g. banknotes;
- miscellaneous threads (polypropylene, fabric, etc.) for attaching and/or sealing – these are used, for example, to attach tags to clothes or products and as micro-seals for warranty purposes;
- polymeric threads – these are threads of varying thicknesses that may be:
  - metal-coated (fully or partly);
  - painted with special light-sensitive pigments;
  - microprinted with digits and text;
  - magnetised to include hidden information detectable only by magnetic readers.

## Uses

Security threads can be used to secure products in diverse sectors. However, they are most commonly embedded in banknotes.

## Implementation

If you want to embed metal threads into your products, then you will need to incorporate an embedding step into the production process. If, however, you want to use the other types of security thread – those that attach tags or contain printed information – then you will not need to make any changes to the production process; these types of thread are normally applied to the finished product or the packaging.

## Cost

The diversity of materials and modes of application for security threads makes it difficult to give a general idea here of the costs associated with their implementation.

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices
- > Seals
- > Security Threads\_



# 04

## Security Film

The main purpose of this technology is to secure data printed on documents and packaging. It does so by using pressure or heat to apply a plastic film to the pages or other surfaces that need to be protected. The plastic film will have specific security features built in via its application process – for example printed, tactile or colour elements – for extra protection.

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input type="checkbox"/>            |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It is suitable for:

|                       |                                     |
|-----------------------|-------------------------------------|
| very small products   | <input type="checkbox"/>            |
| small products        | <input checked="" type="checkbox"/> |
| medium-sized products | <input checked="" type="checkbox"/> |
| large products        | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input checked="" type="checkbox"/> |
| digital products  | <input type="checkbox"/>            |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input checked="" type="checkbox"/> |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input type="checkbox"/>            |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input type="checkbox"/>            |
| no  | <input checked="" type="checkbox"/> |

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices
- > Seals
- > Security Threads
- > Security Film\_



## Description

The following are the three most common processes used to build security into the film.

- Overprinting – security elements are typically printed on the back (inner side) of the security film or between the adhesive layer and the film to protect them from damage and tampering (they are usually printed by screen printing, rotogravure or flexographic printing).
- Embossing – the security film is embossed with tactile elements, such as thin lines, complex thin-line patterns or micro-prints.
- Embedding through binding – this technique usually protects photographs and printed personal identification data in passports. To prevent tampering, the film is embedded in the passport book through the binding, so that a strip of the film forms a small margin on the adjacent page, at the back of the document.

Another two, less common, processes are the use of iridescent film, which has a brilliant, pearlescent effect and changes colour when viewed from different angles, and back-reflecting film, which is made visible by a specific viewing device that uses coaxial light.

## Uses

Security films are mostly used on documents – for example passports and ID cards.

## Implementation

If you want to use security film, you will need to incorporate a step in the production process to apply the film to the parts of the document that need to be protected.

## Cost

As there are so many options for implementing security film, it is difficult to give a general idea here of the costs involved.

# 04

- > Labels
- > Laser Engraving
- > Anti-Alteration Devices
- > Seals
- > Security Threads
- > Security Film\_



# ANTI-COUNTERFEITING TECHNOLOGIES FOR DIGITAL MEDIA

# 05

Digital media is any data presented in a machine-readable format. It includes digital images, digital video, MP3 audio, electronic books, video games and databases. The anti-counterfeiting technologies designed for use with digital media essentially consist of different methods for embedding and identifying information in digital files, computers and electronic devices so as to protect, identify and track their intellectual property content.

There are four types of anti-counterfeiting technologies for digital media which fall into two main categories: digital rights management (DRM) systems and automatic content recognition technologies.

**DRM systems** are designed to combat large-scale counterfeiting of audiovisual works. They are used by copyright and other associated rights holders to protect, exercise and manage their rights in the digital environment.

**Automatic content recognition technologies** in general aim to identify content that is in a media file or being played on a device. They are developed for a variety of purposes, intellectual property protection being just one of them. The automatic content recognition technologies that can be used to secure digital media against counterfeiting are **digital watermarks**, **hashing** and **fingerprinting**. They respectively incorporate, calculate and generate information related to specific digital content (text, image, sound, video) that can subsequently be detected or extracted in order to identify its nature, origin and source.

DRM  
Systems

Digital  
Watermarks

Hashing

Fingerprinting



## 05

## Digital Rights Management (DRM) Systems

DRM systems control who accesses and uses digital content. Most people have probably come across one, perhaps without even realising it, thanks to the growing popularity of online streaming and gaming. When streaming platforms limit the number of devices per account, or when games companies require users to input a product key before playing, that is a DRM system at work, protecting the digital copyrighted content.

> DRM Systems\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input type="checkbox"/>            |
| digital products  | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |





# 05

## > DRM Systems\_

## Description

DRM systems are designed to combat the large-scale, unauthorised copying and distribution of digital copyrighted content that takes place via the internet. They use two core processes to help copyright and associated rights holders protect and control access to their digital property:

- inclusion of metadata: data (such as the purchaser's name or account information) that can only be read by specific software are embedded in the digital files;
- encryption: the digital content is written in a code legible only by devices or software that have an encryption key, which is made available offline or online depending on the authentication procedures.

By encoding and encrypting digital files, DRM systems make these files very difficult to duplicate (outside of the managed environment) and ensure that their use is limited (to certain periods of time or specific uses) and subject to the terms of the access licence granted to end users.

## Uses

DRM systems target the counterfeiting of digital content such as audio and video files, e-books, software and computer games. They are mainly used to:

- certify the lawful use of digital files and/or full ownership of copyrighted content, making it possible to distinguish authorised copies from pirated copies (authentication);
- ensure legitimate access to content by embedding special digital markers in the original file or by distributing the file in a protected format;
- control pirated copies by making it possible to track the initial holder of the original files (tracking);
- control payment for the services.

## Implementation

If you want to use a DRM system, you will need to put processes in place to make sure that, during production, the metadata is generated and embedded in the digital file, and/or that its content is encrypted.

## Cost

The costs associated with DRM systems are highly context-specific, making it difficult to give a general idea of the resources required.



# 05

## Digital Watermarks

Watermarks are one of the oldest authentication techniques around and are well known for their use on physical products, such as paper money. Now watermarks also exist in the digital world. For instance, a video purchased on a video-on-demand (VOD) website will bear a personalised watermark containing the client's ID, allowing unauthorised distribution of copyrighted content to be tracked.

DRM Systems

> Digital Watermarks\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input checked="" type="checkbox"/> |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input type="checkbox"/>            |
| digital products  | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input checked="" type="checkbox"/> |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |



## Description

A digital watermark is a piece of information that is permanently embedded in a digital file, certifying its authenticity and source. That information may be visible (for example, a television channel's logo in the corner of a video), or invisible (for example, an imperceptible alteration of pixels in a certain segment of a video). An invisible digital watermark can only be decoded by a computer program or a machine.

Digital watermarks may be private (detectable only to those who have the original unmarked file or know how to interpret the meaning of the marking), or public (detectable and clearly comprehensible, even to those who are not familiar with the original content).

Watermarks can also be either fragile or robust depending on their resistance to alteration, that is, their ability to withstand changes made to the data in which they are embedded. Robust watermarks will still be able to prove or guarantee file ownership even after the content of the file has been significantly modified. Visible watermarks are in general less robust.

## Uses

Digital watermarks are primarily used in the field of multimedia content production. They are embedded in DVDs, CDs, software, e-books, TV programmes and, increasingly, in online content of all kinds (audio, video and image files, as well as texts and documents).

There are several different types of digital watermarks, each of which has a different specific function and purpose.

- **'Content-ID'** watermarks identify protected content by creating a unique ID that is associated to a specific copyrighted work.
- **'Owner-ID'** watermarks show information about the copyright holder.
- **'User-ID'** watermarks prevent and/or track the source of unauthorised copies.
- **'Network-ID'** watermarks trace the commercial path of the file by adding information related to the broadcaster or distributor.
- **Generic watermarks** are used for more general tasks, for example, to indicate whether a file is for internal, promotional or public use, whether it is copyrighted or free to use, whether it is complete or incomplete, etc.

## Implementation

If you want to use digital watermarks, you will need to ensure you have the processes in place to embed the information in your digital files during production. You will also need to develop and implement a watermark tracking database and detection method.

## Cost

The more robust the watermark, the higher the cost. Moreover, assigning a unique watermark to each copy of a given product is costlier than having one watermark for all copies. The costs involved in setting up the watermark recognition software and maintaining the reference database, if needed, should also be considered.

# 05

DRM Systems

> Digital Watermarks\_



# 05

## Hashing

Hashing is a process that uses an algorithm (such as MD5, SHA-1 or SHA-2) to create a unique identifier – a ‘hash’ – for a file on the basis of its data. Two identical files will always have the same hash. Likewise, two different files will always have different hashes, even if the difference between the two files is minimal. The hashes of files found to infringe copyrighted material can be added to ‘black lists’, which can be used by cloud storage services to detect, block and take down unauthorised files.

DRM Systems  
Digital Watermarks

> Hashing\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input type="checkbox"/>            |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input type="checkbox"/>            |
| digital products  | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input checked="" type="checkbox"/> |



# 05

DRM Systems

Digital Watermarks

> Hashing\_

## Description

The purpose of hashing is to identify different copies of the same digital file. First, an algorithm is used to assign a unique string of characters, called a 'hash', to the digital file, and that hash is stored in a hash database. A second digital file is then put through the same hashing process, and the resulting hash is compared with the one already stored in the hash database to determine whether the files match exactly.

## Uses

Hashing is primarily used to index content, secure passwords, detect malicious files such as viruses, or block illegal content, such as the promotion of acts of terrorism or exploitation of minors. With respect to copyrighted material, hashes serve to identify, compare and prevent the upload of digital content that has already been taken down due to copyright infringement.

## Implementation

It is difficult to provide specific implementation requirements for hashing as there are several different hashing techniques and algorithms that can be used, all of which require different amounts of computational power. Most hashing methods are cryptographic (in which two different files, although very similar, will have completely different hashes) but perceptual hashing methods also exist (in which two almost identical files, for instance similar images, will have similar hashes). That said, the advantage of hashing is that it can be applied to already existing content. Hashes can be shared and used by all the different parties using the same hashing process and the same hash database. The disadvantage, however, is that hashing only recognises the same identical file, not its content.

## Cost

Hashing requires limited investment as open source solutions are available. Furthermore, as hash databases only store a string of characters rather than the entire file, they require fewer computational and memory resources.



# 05

## Fingerprinting

Just like its human equivalent, digital fingerprinting captures and registers the identification features that are unique to a specific digital file. The technique has been adopted by video sharing sites to allow creators to digitally fingerprint their original videos. These fingerprints are then stored in a reference database. Using specific software, each and every new or unknown content is analysed, and fingerprints are generated and compared with all those stored in the database to see if there is a match and to detect illicit use.

DRM Systems  
Digital Watermarks  
Hashing

> Fingerprinting\_

It can be used for:

|                                |                                     |
|--------------------------------|-------------------------------------|
| authentication                 | <input checked="" type="checkbox"/> |
| tracking/tracing               | <input checked="" type="checkbox"/> |
| anti-tampering/anti-alteration | <input type="checkbox"/>            |

It can be used for:

|                   |                                     |
|-------------------|-------------------------------------|
| physical products | <input type="checkbox"/>            |
| digital products  | <input checked="" type="checkbox"/> |

It goes on:

|           |                                     |
|-----------|-------------------------------------|
| product   | <input checked="" type="checkbox"/> |
| packaging | <input type="checkbox"/>            |

It is:

|           |                                     |
|-----------|-------------------------------------|
| visible   | <input type="checkbox"/>            |
| invisible | <input checked="" type="checkbox"/> |

Reading device needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |

Connection to server needed:

|     |                                     |
|-----|-------------------------------------|
| yes | <input checked="" type="checkbox"/> |
| no  | <input type="checkbox"/>            |



## Description

The main aim of fingerprinting is to facilitate content recognition. It does not add any information to the digital file. Instead, fingerprinting methods analyse the unique, inherent properties of a digital file (such as audio waveforms or video characteristics) and generate a string of values to describe them – the 'fingerprint'. This may represent words from a text, a unique section of an image or the soundwaves of part of a song, depending on the file type. The strings of values are stored in a database, which can then be used to detect matches with other third-party content that has also been fingerprinted. Fingerprinting technologies are even able to identify similar and altered files, such as a film recorded from a TV screen or a cover version of a song.

## Uses

Fingerprinting is used to record when and where videos (complete videos, parts of videos or even very short excerpts) have been shown, or when audio files have been played. It is also helpful for forensics to determine whether a file has been manipulated. This technology can also be used to track viewing habits, monetise videos (for example, via collecting societies or advertising services) and detect illicit content. It can also be used for text files.

## Implementation

If you want to use fingerprinting, you will need to choose and set up a fingerprint generation method, database, detection method and tracking system. Fingerprinting is sometimes used in tandem with other complementary content recognition technologies.

## Cost

A variety of fingerprinting solutions are available, including some open source solutions. Although fingerprinting databases store only strings of characters rather than entire files, the most robust fingerprinting technologies will extract a significant number of unique features from the file, and will therefore need more computational resources to create, store and process them.

# 05

DRM Systems

Digital Watermarks

Hashing

> Fingerprinting\_



# SHARED LEDGER TECHNOLOGY FOR ANTI-COUNTERFEITING (BLOCKCHAIN)

# 06

A good way to reinforce your defences against counterfeiting is to combine anti-counterfeiting technologies and tamper-proof packaging with shared ledger technology. This technology provides a reliable means of tracing all the transactions that take place throughout a supply chain, from production to the shop floor. It is built around a decentralised peer-to-peer system and is essentially a database (ledger) of verified asset exchanges that is stored simultaneously on all the computers connected to the network. As it does not depend on a central server, it has no single point of failure. Shared ledger technology is the underlying concept of blockchain.

Blockchain applications are still fairly new, having only started emerging over the last few years. While best known for its use in financial transactions (Bitcoin is perhaps the most famous manifestation of a blockchain), the technology has the potential to adapt to other markets, and businesses are exploring uses that could meet a wide range of cross-sectoral needs: payment processing, digital IDs, contract and dispute settlement, insurance, record keeping, as well as [securing supply chains against disruptions and illicit trade](#).

The interesting aspect of blockchain is that it removes the need for trust between parties involved in a transaction – no matter whether it's a financial operation or the shipment of goods. Whereas physical transactions are based on and require the mutual trust of all parties involved (e.g. in a supply chain, trust must flow both ways between the brand owner, manufacturer, carrier, logistics operator, distributor, retailer, etc.), the digital transactions that occur in a blockchain are executed rapidly, securely and transparently by a 'trustless' mechanism without any of the parties having to even know each other, let alone trust one another. This is because trust is embedded in the way the blockchain network works, and therefore no explicit chain of trust or, more importantly, trusted intermediary, is necessary.

Every new transaction that appears on a blockchain is validated by all network participants and 'cryptographically sealed' with its own hash (an encrypting algorithm) to form a new block in the chain (hence the name). Each new block also contains immutable encrypted information from the previous block, which makes blockchain transactions relatively easy to audit. Because all the data in a blockchain is shared among all participants, anyone can check the records and their history at any time, making it almost impossible to cheat the system. This means that, as long as the connection between physical product and the digital transaction is robust, blockchain can be used for tracking and tracing the ownership and authentication history of a product, detecting counterfeits at an early stage and identifying their origin.



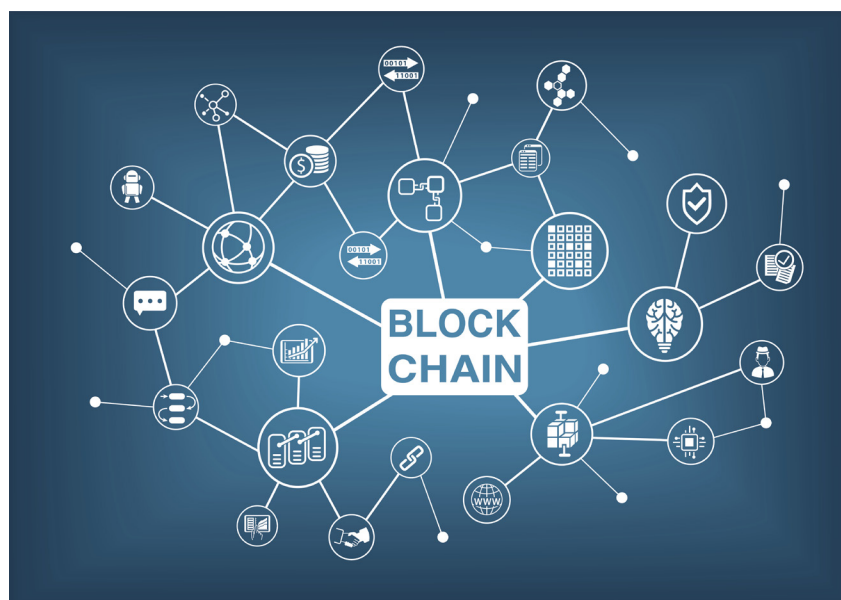


# 06

## Shared Ledger Technology (Blockchain)

Shared ledger technology is a form of digital data storage that is intended to create faster and more secure ways to transmit, receive, track and perform transactions. Blockchain is the most famous form of shared ledger technology. It uses a decentralised architecture, with no need for trusted intermediaries. All data related to a transaction, including its origin, must be validated by all participants in the blockchain. Once validated, the transaction data is encrypted and stored in a new block. A copy of the encrypted data is also included in the subsequent block, forming the link in the chain. Once data has been added to a block, it can never be erased, enabling participants to verify the entire history of a transaction. The idea behind blockchain came from the need to find a way to secure digital currencies from the risk of replication. That led to the creation of Bitcoin, the world's first 'cryptocurrency', which utilises strong cryptography to allow online payments to be sent directly from one party to another without going through a financial institution.

> Shared Ledger  
Technology  
(Blockchain)\_





## Description

Blockchain is a type of 'shared ledger' technology, where all computers participating in the network (nodes) have an identical copy of the ledger (which is essentially a database of transactions). Any time a new transaction is added to the ledger, a record of that transaction appears in every participant's copy as well. Blockchain's decentralised architecture means that, aside from keeping real-time duplicate copies of the ledger, each node in the system also verifies every transaction that takes place before it can be added as a new entry. Therefore, blockchain is not dependent on a single internal or external entity for validating, monitoring or checking transactions, or changing data; that is all done by the network. These features ensure the consistency of all the existing data in a blockchain. Furthermore, as all the data stored in a blockchain is available to everyone from the very beginning, previous transactions can easily be checked and traced.

The term 'blockchain' comes from a combination of 'block' and 'chain', where:

- a block is the record of a transaction (e.g. the transfer of physical assets from one participant of the network to another); and
- the chain is the infrastructure linking the blocks altogether.

The chain component works via a 'hash' function – an algorithm that encrypts the transaction data by transforming it into a fixed-length string of letters and numbers. The hash function is irreversible, meaning it is basically undecipherable. Once a new transaction has been verified, the data gets

hashed. Each new block contains its own unique hash and the unique hash of the previous block, linking the two together and creating the links in the chain. This makes it easy to uncover any tampering in a blockchain as the tamperer would have to change the hash in the next block to cover their tracks, and then the hash in the next block after that, and in the next block after that, and so on. And they would not have to do that in only one ledger, but in all the ledgers in all the nodes connected to the blockchain.

Blockchain systems are classified according to accessibility (public or private) and editability (permissioned or permission-less).

- In **public permission-less blockchains**, anybody can participate in the network, and read and write the data without needing permission. These blockchains are inherently transparent, as all actions on the network must be validated by, and be visible to, all participants. Any action not visible to all participants cannot be properly validated. In **public permissioned blockchains**, anybody can read the data, but only selected participants can write it.
- In **private blockchains**, permission is needed to join and participate in the network. Participants may be assigned a mix of read and write permissions. This ability to assign a variety of permissions to network participants is particularly useful for contexts such as health care, where certain actions and information need to be kept private, but where participants benefit from the security of a shared infrastructure.



# 06

> Shared Ledger  
Technology  
(Blockchain)\_

## Uses

Although blockchain is still a rather new technology, there are some solutions already being used for anti-counterfeiting. Among other things, such solutions allow companies to create their own product IDs and monitor their own supply chains. There is no single standard for using blockchain to combat counterfeiting, but examples can be found in sectors such as luxury goods, diamonds, agri-food, electronics and pharmaceuticals.



## Implementation

To give you an idea of how blockchain could be implemented in practice, here is an example of how it would be used to secure a pharmaceutical supply chain.

- The participants in the chain are the manufacturer, the packager, the wholesaler, the distributor, the doctor, etc. A participant may be a device, a person or an entity. Each participant is assigned a key denoting their specific activity in the network. The participant's original identities are hidden and they are known only by these keys – 'manufacturer', 'packager', etc.
- Medicines are the 'assets' in the chain. Each medicine is given a unique key (or hash). The medicine's ID is attached to it in the form of a QR Code.
- A specific blockchain network must be chosen to store the transaction records. Bitcoin Blockchain (the pioneer network), Ethereum, Hyperledger and BigchainDB are some examples of networks available on the market.
- All the required transactions are stored on the blockchain. Once the information for a certain transaction has been entered into the blockchain, it can never be changed.
- Participants use a mobile app to make transactions via the blockchain.
- When a new medicine is produced, the manufacturer creates a unique hash to

be assigned to it (a unique ID). The medicine is registered on the blockchain. It will be considered as a digital asset on the blockchain network and its hash will be used to track it at any point or time throughout the network.

- The medicine ownership can easily be transferred to another participant via a mobile app. Possible scenarios are:

- the wholesaler purchases the medicine from the manufacturer – the manufacturer physically transfers the medicine to the wholesaler and a transfer transaction is simultaneously registered on the blockchain;

- the wholesaler sells the medicine to another wholesaler, a distributor or a pharmacy – the same transfer and registration process applies;

- a doctor purchases the medicine from the pharmacy – the doctor will use the app to get the medicine's ID, and, by tracing its journey through the blockchain from manufacturer to pharmacy, will be able to see whether the medicine is genuine or counterfeit:

if the medicine is genuine, its entire product history will be shown;

if it is counterfeit, no record will be displayed.

## Cost

Identifying the general costs involved in setting up a production-scale commercial blockchain solution is not easy, as each solution is highly specific to the particular context and scale of implementation. The main factors that influence costs are the type of blockchain network being used (public or private) and the transaction volume and size. It is also worth bearing in mind that blockchain solutions require a significant amount of energy to power their processing speeds and performance, and as such are a great deal more energy intensive than centralised peer-to-peer networks.

However, blockchains do save money in other areas. As blockchain-based solutions provide ways for contracts and payments to be executed smoothly and securely without involving third parties, they remove the third-party verification and transaction costs associated with current physical contracting and payment procedures.

# 06

## > Shared Ledger Technology (Blockchain)\_



# ISO STANDARDS FOR ANTI-COUNTERFEITING TECHNOLOGIES

# 07

If anti-counterfeiting solutions are to be truly effective in securing supply chains, helping public authorities ensure legal trade and fostering consumer confidence, then they must comply with the relevant internationally established performance requirements, otherwise known as ISO Standards.

ISO is the International Organization for Standardization. It is based in Geneva and is the world's largest and most international standard-setting body, issuing technical standards that cover almost every industry <sup>(1)</sup>. Its members are the national standards bodies of most of the world's countries.

ISO Standards are sets of rules and criteria that have been internationally agreed by experts. They come in a variety of forms (e.g. product standards, guidelines, codes of practice and test methods), but at their core ISO Standards are effectively formulas that describe 'the best way of doing something'. They are numbered according to the format 'ISO nnnn:yyyy – title', where nnnn is the number of the Standard, yyyy the year of publication and title is the title of the Standard.

There are a number of ISO Standards aimed at ensuring anti-counterfeiting technologies are fit for purpose. Most are geared towards technology providers and contain criteria on how to design and implement solutions. However, there are two ISO Standards that are intended for users. They are:

- **ISO 22383:2020** – a set of guidelines to help enterprises decide which authentication solution is right for them by defining performance criteria and providing methods for assessing effectiveness;
- **ISO 22384:2020** – a set of guidelines to help brands establish and monitor a plan to protect their products against different types of fraud, such as counterfeiting, copying, refill, grey market, etc <sup>(2)</sup>.

Two of the Standards geared towards technology providers are also worth a brief mention. These are: ISO 16678:2014 (guidance on making object identification systems and authentication systems more interoperable) and ISO 22381:2018 (guidance on making independently functioning identification and authentication systems interoperable).

ISO Standards are subject to strict copyright restrictions; only abstracts and informative sections of the documents are publicly available. To access the full content of an ISO Standard, you would have to purchase the Standard from ISO or an associated national standard body.

With that in mind, this chapter presents an overview of the areas and principles covered in particular in ISO 22383:2020 (which is the most relevant in the context of this Guide) and gives a brief introduction to the other Standards mentioned, with the aim of providing a starting point for discussions, decision-making and possible implementation.

ISO  
22383:2020

ISO  
22384:2020

Other  
Relevant  
Standards



# ISO 22383:2020 – Security and resilience – Authenticity, integrity and trust for products and documents – Guidelines for the selection and performance evaluation of authentication solutions for material goods

ISO 22383:2020 provides guidance for organisations on how to go about selecting the most appropriate 'authentication elements' (devices used as part of an authentication solution) to validate the authenticity of their material goods and sets out criteria that can be used to analyse and compare different options. This Standard does not prescribe any one exclusive means of authentication. The guidance it contains is universally applicable, irrespective of material good, environment or authentication technology used.

## Description

ISO 22383:2020 is part of a wider framework of standards relating to authenticity, integrity and trust for products and documents. It is a set of guidelines designed to help organisations identify which category or categories of 'authentication element' they should be using to combat counterfeiting. It does this by:

- laying down the **basic principles** involved in defining an anti-counterfeiting strategy;
- describing the different **categories** of technology that exist;
- presenting **performance criteria**; and
- showing how these criteria can be used to **assess the effectiveness** of authentication elements and overall solutions.

### >> Basic Principles

According to the Standard, the factors that will determine the most suitable authentication elements and solutions, and therefore form the foundation of the anti-counterfeiting strategy, are:

- an assessment of the counterfeiting-related risks;
- the context of implementation and usage; and
- technical, logistic and financial criteria.

These factors (a full list of which is included in the document) provide the basis for defining the performance requirements

for authentication elements and solutions, and for assessing their effectiveness.

This assessment should also consider both processes involved in an authentication solution: the creation process (in which the authentication elements are defined, made and integrated into or onto the product) and the inspection process (in which the elements are verified by trained inspectors with the appropriate tools, where tools are needed).

The Standard recommends following a 'security-by-design process' to design the solution.



07

&gt; ISO 22383:2020\_



# 07

> ISO 22383:2020\_

## >> Categorisation of Technologies

The Standard identifies three categories of technology – ‘overt’, ‘covert’ and ‘forensic’ technologies. These can be analysed and compared based on the following characteristics:

- **provision of knowledge:** the way in which general or good-specific knowledge is provided to the inspector;
- **sourcing and production of authentication elements and tools:** the types of security measures in place to audit providers and protect production processes against knowledge transfer and theft;
- **inspection:** whether inspection is carried out via human senses, an authentication tool or forensic analysis.

## >> Performance Criteria

The Standard sets out performance criteria for rights holders to use to evaluate how well authentication elements and solutions may perform in relation to the risks identified in the risk assessment. The performance requirements are defined by comparing the performance criteria to the risk assessment.

For **authentication elements** performance criteria include:

- **physical characteristics** (size, material, flexibility, viscosity, durability and resistance to environmental conditions, etc.);
- **attack resistance** (resistance to tampering and alteration, data breaches, interception of communication and obsolescence);
- **integration process** (how secure the process of integrating the element to the material good is).

For **authentication solutions** performance criteria include:

- **location and environment for the authentication process** (availability of power resources, environmental conditions such as temperature or humidity, exposure to hazards, etc.);
- **authentication parameters** (the time it takes to process authentication, accuracy rate and speed, the time it takes to get a result, etc.);
- **security policy** (the measures that need to be taken to secure all components of the solution, the supply chain, etc.);
- **compliance with relevant regulations** (including governmental or those issued by regulatory agencies – especially if the solution is intended for implementation in international markets).





# 07

> ISO 22383:2020\_

## >> Effectiveness Assessment

The effectiveness of an authentication element or solution can be assessed by evaluating how well it meets the requirements that have been defined for each set of criteria. ISO 22383:2020 simplifies this assessment by providing a grid in the annex that contains all the performance criteria and allows the user to indicate the performance requirement for each one, as well its relevance.

## Uses

ISO 22383:2020 is intended for all organisations that need to be able to validate the authenticity and integrity of material goods with authentication elements and solutions anywhere in the supply chain. It can be used by organisations of any type and any size. Authentication solutions can be used for anti-counterfeiting, preventing product fraud and preventing diversion.

## Cost

The current cost of ISO 22383:2020 is CHF 118 (EUR 110) per copy. All the latest pricing and purchasing information can be found on the ISO website and the websites of its national members.



# ISO 22384:2020 – Security and resilience – Authenticity, integrity and trust for products and documents – Guidelines to establish and monitor a protection plan and its implementation

ISO 22384:2020 provides guidelines to help organisations establish and monitor the effectiveness of a plan to protect their products against different types of fraud (including counterfeiting). It outlines how to set up processes for assessing relevant threats and risks, how to select and combine individual countermeasures, and how to implement them.

## Description

ISO 22384:2020 is based on the premise that the product security and supply chain integrity measures offered on the market represent only part of a solution. In order to ensure effective and long-term protection, organisations should also introduce technical, organisational and legal measures for countering product security-related threats and risks.

This Standard provides guidance on how to go about developing, implementing and monitoring a comprehensive product protection plan that covers the entire product lifecycle and supply chain, from the concept phase, right through design, manufacturing, distribution and services to disposal. It sets out guidelines for assessing common product security-related risks and threats (including counterfeiting, piracy, cybersecurity threats and damage to brand reputation); describes how to evaluate possible countermeasures and select the most appropriate; and gives support for implementation and regular assessment of effectiveness.

## Uses

This Standard is intended for all organisations that need to be able to validate the authenticity and integrity of material goods. It can be used by organisations of any type and any size.

## Cost

The current cost of ISO 22384:2020 is CHF 88 (EUR 82) per copy. All the latest pricing and purchasing information can be found on the ISO website and the websites of its national members.

07

ISO 22383:2020

&gt; ISO 22384:2020\_





# 07

## Other Relevant Standards

Most of the ISO Standards on anti-counterfeiting technologies provide guidance that is geared towards technology providers rather than users. The two Standards that are most relevant for the purpose of this Guide aim to establish common rules and criteria so as to foster the development and implementation of solutions that are interoperable and, therefore, more widely usable.

ISO 22383:2020

ISO 22384:2020

> Other Relevant  
Standards\_

### Description

The two ISO Standards geared towards providers of anti-counterfeiting technologies that are worth mentioning are:

- ISO 16678:2014 – Guidelines for interoperable object identification and related authentication systems to deter counterfeiting and illicit trade.  
This Standard provides guidelines for improving the interoperability between object identification systems and authentication systems. It does not focus on specific solutions, but instead describes the different processes, functions and functional units by using a generic model to illustrate what the solutions have in common and where greater interoperability can be achieved.
- ISO 22381:2018 – Security and resilience – Authenticity, integrity and trust for products and documents – Guidelines for establishing interoperability among object identification systems to deter counterfeiting and illicit trade.  
This Standard provides guidelines for making the object identification and authentication systems described in ISO 16678:2014 interoperable with other, independently functioning object identification systems and related authentication systems.

