About Plastic Card Printing

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Introduction

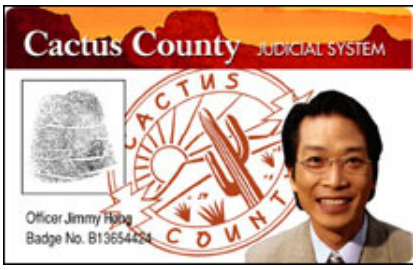
Plastic cards have become part of everyone's life, from credit cards to driver's licenses, membership cards to employee identification badges. Their standard size, portability and durability have made them the vehicle of choice for many applications.

Digital plastic card printers offer the ability to create custom cards ideally tailored to the application or to customize and personalize cards on demand, right at the point of issuance. Closely integrated with image capture systems (digital cameras, etc.) and computer database systems, the printer provides the delivery point of a highly integrated system. The printing process is fast (just a few seconds per card) so that cards are generated and personalized while the customer cardholder waits, quickly connecting the customer or cardholder to the issuing organization or program.

Digitally printed plastic cards provide numerous technological features, but start with a blank plastic card that can be printed with any combination of artwork, graphics, text, digital photograph, bar codes, logos, etc., limited only by the issuer's imagination. Additional machine readable information can also be encoded such as magnetic stripes and smart card chips.
Digital plastic card printing has replaced previous card generation methods and integrated the card delivery process into the electronic environment that runs and tracks the rest of your business or agency.

Photo Identification Cards

Photo identification cards are generally produced using either a traditional film based method or digital printing technology. The older, more traditional process for producing personal ID cards is a multi-step process.
Take an instant photo of the person, cut and trim the picture to fit the card.
Separately print the person's ID information on a card-sized piece of paper or card stock.
Laminate the picture and card together.
This process has been widely used in various applications including student ID cards, employee ID badges, club membership cards, and driver's licenses. But cards produced by this method are easily counterfeited or changed and generating the cards can be both time consuming and labour intensive.
Digital card printing is a one step process in which text, graphics and pictures are physically printed on a card directly from a computer system without any user intervention. These cards are usually the same size as a standard credit card and made of a plastic called Polyvinyl Chloride otherwise known as PVC. Plastic cards can be printed in monochrome or full colour, front side only or on both sides.



Digital access control card with photo image, hologram and fingerprint scan

Digital access control and stored value debit passenger card with photo ID and smart chip

Digital club membership card with photo ID, membership number and bar code

Digital Card Printing Advantages

Image Quality

The image quality of plastic cards produced with digital printing technology is far superior to those produced through the traditional manual method described above. The cards look better because digitized photo images are sharper and can be edited for colour quality. Placement of various graphical elements of the card is more consistent and text is clearer and more readable.

Flexibility

Plastic card printers can print text, line art, and photographic images. They can also encode magnetic stripes and provide smart card chip programming contact stations. All in a single step process. Card design software used to produce the cards provides users the flexibility to change designs, store and access multiple designs, create variable text fields, and implement data base programs to store images and track information.

Security

Plastic card printers can also apply various types of card protection materials to make cards resistant to tampering and alteration. These protection materials including hologram overlays make cards more secure because they cannot be easily reproduced or counterfeited.

Durability

Card protection materials such as overlay varnishes, over laminate patches, and secure card media each provide various levels of card durability by making the cards resistant to abrasion, UV light exposure, water damage, and exposure to liquid chemicals.

Economy

In-house printing of plastic cards using plastic card printer eliminates the need for, and costs associated with, producing cards using the time consuming, old-fashioned photographic cut/paste/laminate method. A plastic card printer is also more economical than jobbing out your card requirements to a lithographic printer or service bureau. Outside suppliers must mark up card production costs significantly in order to cover overhead and servicing costs, making them an economical alternative only for large volume applications.

Convenience

Printing your own plastic cards gives you the convenience of being able to produce cards when you need them, where you need them, letting you issue new cards on demand. Having your own card printer capability also makes it easy to make changes to card content or design quickly.

All plastic card printers feature the same basic printing operations; dye sublimation and/or thermal transfer printing. Both techniques involve a ribbon being heated as it passes under a thermal print head. The difference is that thermal transfer ribbons heat up and transfer ink onto the plastic card, and dye sublimation ribbons heat up and undergo a chemical change process that turns the ink into a gaseous state which then permeates the plastic card.

The ribbon used in colour dye sublimation printing is divided into three separate colour panels Yellow, Magenta, and Cyan (see Figure 1). This configuration is referred to as YMC.

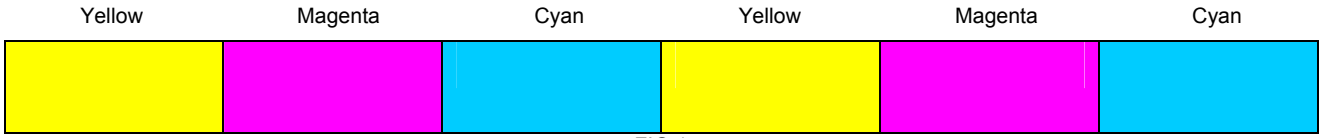


FIG.1

These three colours are the primary colours used in printing to produce all other colours including black.
The dye from the ribbon is applied to the plastic card via a multi-pass operation. This means the card will pass under the print head once for each of the three coloured ribbon panels - applying each colour separately.


Yellow

Yellow & Magenta

Yellow, Magenta & Cyan

The term Dye Sublimation is also referred to as Dye Diffusion. When the Dye on the ribbon is heated by the print head it is transformed from a solid to a gas and diffused onto the plastic card (the card is specially coated to absorb the colour dye). The hotter the elements in the print head, the more dye is converted to a gas and absorbed into the plastic card. At 300dpi the picture quality and continuous colour tones produced by a dye sublimation printer outperform most laser or ink jet printers with higher resolutions.

The advantage of dye sublimation is the millions of colours that can be created. The colours result from a combination of the panels on the ribbon. By combining these colours and varying the intensity of the heat, providing various shades of each colour, you are virtually unlimited in your colour selection.

Thermal Transfer differs from Dye Sublimation in that Thermal Transfer uses Ink rather than Dye. Both Dye Sublimation and Thermal Ink (sometimes referred to as Resin) can be combined in one ribbon (see Figure 2). This ribbon is referred to as a YMCK Ribbon. The letter “K” is the designator for the colour black in the printing industry.

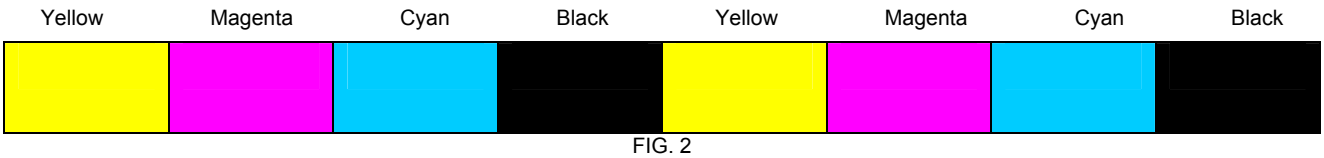


FIG. 2

Why do you need a separate black panel, when you can create black by mixing the three basic YMC colours together?

The answer to this question is simple. When black is created by mixing the YMC colours together it creates what is referred to as “Composite Black." Composite Black typically looks muddy or has a greyish tint when compared to Thermal Transfer (TT or resin) black. Composite Black is not recommended for printing bar codes since combining the three colours together does not produce the sharp edge many scanners require (this is invisible to the naked eye but can be observed under magnification). Composite Black is also invisible to IR scanners since there is no carbon in the dye. Since you may not know what type of scanner will be used, the rule is to always use TT (resin) black to print bar codes.

All printers are capable of printing in monochrome using a single colour ribbon. These ribbons are less expensive than full colour multi-panel ribbons and can be either dye or ink (thermal transfer). The most commonly used monochrome ribbon is "Black" but there are several other colours available including; Red, Green, and Blue.
Monochrome

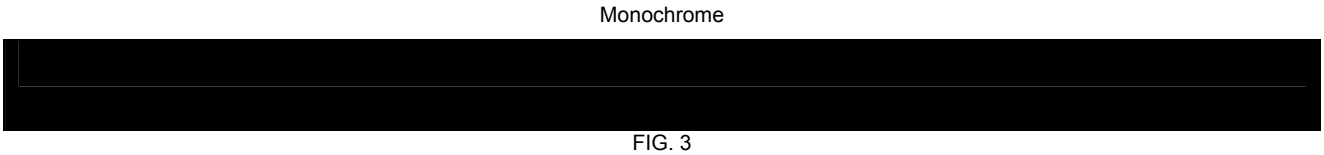


FIG. 3

Dye Sublimation ribbons are preferred when you are printing pictures, since they can produce many shades of grey for a smoother look and a better picture quality. A resin black picture normally uses a dithered grey scale (grey made from a combination of pixels which limits the number of shades), producing a coarser, grainy look to the image.

Thermal Transfer (resin) ribbons should be used to print text, bar codes or single colour graphics such as simple logos. Black monochrome ribbons are represented by the letter “K” followed by a lower case “r or d”, (Kr or Kd). The “r” designates a Thermal Transfer ribbon with resin ink. The “d” designates a dye sublimation ribbon.

Magnetic Stripe Encoding

Magnetic stripe cards have been in existence since the early 70's when they were used on paper and film-based ID cards as well as credit cards. Magnetic stripe technology is widely used throughout the world and remains the dominant technology in the United States for transaction processing and access control. Other technologies such as PDF bar codes and smart chip cards are now capturing part of the magnetic stripe market since they can hold more information.

Magnetic Stripe Plastic Card

Magnetic stripe encoding terms:

Coercivity

A technical term used to designate how strong a magnetic field must be to affect data encoded on a magnetic stripe. Coercivity is measured in Oersteds (Oe). Coercivity is the measure of how difficult it is to encode information in a magnetic stripe.

Hi-Co

Abbreviation for High Coercivity. Hi-Co magnetic stripes provide the highest level of immunity to damage by stray magnetic fields. They are more difficult to encode than Lo-Co magnetic stripes because the encoding requires more power. Hi-Co magnetic stripe cards are slightly more expensive for this reason.

Lo-Co

Abbreviation for Low Coercivity. Easier to encode and slightly less expensive than Hi-Co magnetic stripe cards. Selecting which type of magnetic stripe to adopt depends on how the card is to be used. Will the magnetic stripe be used daily, once a month, or just a couple of times a year? The chart below shows some of the applications where magnetic stripes are used and which stripe is common for that application.

Typical Magnetic Stripe Card Applications, Types and Usage

APPLICATIONS	HI-CO	LO-CO	USAGE
Access Control		●	Daily
Retail Customer Loyalty Cards	●		Weekly
Membership Cards	●		Weekly / Monthly
Time and Attendance		●	Daily
Debit/Credit	International	United States	Weekly / Monthly
Drivers License		●	Occasional, but Hi-Co required by most states.

The easiest way to determine visually if a stripe on a card is Hi-Co or Lo-Co is by the colour. Hi-Co stripes are black and Lo-Co stripes are a lighter brown. Magnetic stripe readers are “blind” as to whether a stripe is Hi-Co or Lo-Co and are designed to read both.

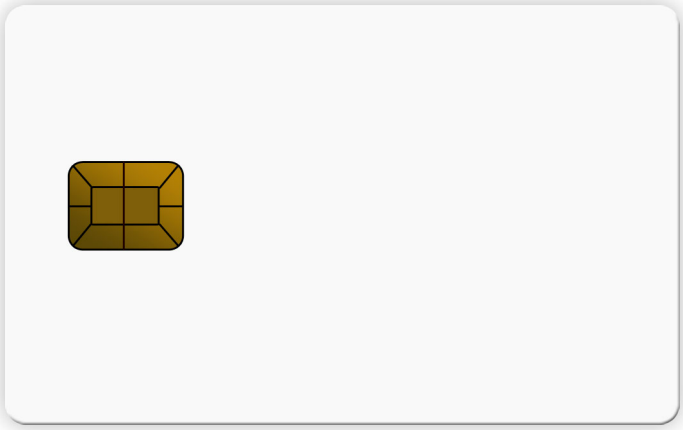
Another term often used is Stripe-up and Stripe-down. Stripe-up means the magnetic stripe is on the front of the card and Stripe-down means the magnetic stripe is on the back of the card. This information is important when ordering a printer since the magnetic encoder must be installed differently for Stripe-up and Stripe-down models at the factory. The most common is Stripe-down.

All encoders follow the ISO standard for encoding, but can be changed via the Windows driver to enable proprietary encoding. Proprietary encoding offers greater security and most readers can also be easily reprogrammed to read custom encoding.

Smart Cards

There are a wide variety of contact and contactless smart cards currently in use. The Terms “Smart Chip Card, IC Card, and Smart Card” all refer to the same type of card. Smart cards have a chip embedded in them which can be programmed. Smart cards can store over 100 times more information than a magnetic stripe and they can be reprogrammed to add, delete or rearrange data.

Smart cards were invented in Europe in the 1970s and were in wide use in Western Europe by the early 80s. Smart cards are an easy, inexpensive way for European businesses to do off-line transaction verification. The reason for off-line verification is preferred is the high cost of telecommunications throughout Europe. The United States has been slow to implement smart cards because it would require replacing the widely installed magnetic stripe card reading equipment with smart card readers. The cost of having the current magnetic stripe readers "on-line" via telecommunications is relatively inexpensive in the U.S. compared to the rest of the world.



Microprocessor Smart Card

The second type of smart card contains both a microprocessor as well as memory. These cards can store massive amounts of information, plus the micro-processor enables the card to make its own decisions regarding the information stored.

Both types of chips can be addressed by plastic card printers since they all offer an optional smart card contact station. The printer brings the card into the contact station and then passes programming signals from an external programmer to encode the smart chip.

Contactless smart cards utilize various RFID technologies to write and read. Many card printers print on these kinds of smart cards. Encoding or programming the electronic devices on these cards is typically accomplished by an external encoding or programming device, but contactless smart card encoders integrated into the card printer are becoming increasingly available.

Proximity Cards

Proximity cards are primarily used for access control applications. They are similar to contactless smart cards, but are passive, read only devices. Proximity cards contain embedded RFID antenna and can nominally be read from distances up to 10".

Card Durability and Security

Various types of materials are used to protect plastic cards from abrasion, wear, fading. Alternation and duplications. Overlay varnishes and laminate patches are the most common materials used to enhance card durability and security.

Card durability has to do with how well the card withstands various forms of environmental stress. They include resistance to abrasion, such as passing the card through a magnetic stripe or bar code reader, protection from image fading when exposed to sunlight, and resistance to damage when immersed in water or exposed to chemicals.

Another important factor in applications such as drivers licensing is resistance to tampering, alteration, and/or replication. With the use of protective materials such as laminate patches with holograms, cards can be constructed to eliminate the potential of tampering and alteration.

Card security means that the card can be verified for authenticity. Techniques include the application of overlay varnish or over-laminate materials with hologram images. Use of these materials in constructing cards makes replication by anyone without access to the custom hologram image materials virtually impossible.

Card Protection Materials

MATERIAL	CARD LIFE	DURABILITY	SECURITY
Overlay Varnish	Up to 2 years	Minimal	
Overlay Varnish with Hologram	Up to 2 years	Minimal	Visual
Clear Laminate Patch	Up to 5 years	High	
Laminate Patch with Hologram	Up to 5 years	High	Visual

Overlay varnishes provide card protection, but have a much shorter life span that laminate patches - and offer very little security (with the exception of some hologram varnishes). Varnishes are not a solid covering and have multiple tiny holes in the surface, which allows the dyes to be drawn away from the card. This will cause the image on the card to blur and fade due to UV light, shift in colour, or just wear away. The life expectancy of a plain plastic card is up to 2 years.

Laminate patches offer better protection than plain varnish, for both security and life expectancy. A patch laminate is, as its name implies, a polyester patch that is applied to the surface of the card after printing. Laminate patches, most often either .6 or 1.0 mil thick are applied via a hot roll laminating station. The life expectancy of a plastic card with a laminate patch is up to seven years.

Glossary of Card Printing Terms

Access Control Cards
Plastic cards used to gain access to premises, usually associated with magnetic stripe and proximity cards.

Bar Code
An array of machine-readable rectangular bars and spaces arranged in a specific way defined in international standards to represent letters, numbers, and other human-readable symbols.

Digital Imaging
Scanning or otherwise capturing images which may be subsequently edited, filed, displayed or printed on a plastic card.

Dye Sublimation
An imaging method for transferring controlled quantities of printer ribbon dye onto a plastic card. Because of the print head resolution (300 dpi), near photographic quality results.

Encoding
The process of electronically “writing” information on magnetic stripes or smart card chips.

Font
A character set (alphabet and numerals) of a specified design and size.

Hologram
A unique photographic printing that provides a three-dimensional effect on a flat surface. Holograms cannot be easily copied and are used for security and aesthetic purposes on cards.

Image Capture System
A hardware and software system used to obtain and save personal data and cardholder photographic images.

Lamination
The process of combining lamination material and core material using time, heat and pressure. Laminate patches used in card printers come on rolls, with and without carriers/liners.

Machine-Readable
A code or characters that can be read by machines.

Magnetic Stripe
Magnetic material, applied as a strip in the surface of a card, used to encode cardholder information.

Memory Card
A type of smart card. Also known as a synchronous card, it features 256 bit or 32 byte memory
and us suitable for use as a token card or identification card.

Microprocessor Card

A type of smart card, also known as an asynchronous card. Features 1 kilobyte to 64 Kbytes of memory and is suitable for portable or confidential files, identification, tokens, electronic purse or any combination of uses.

Overlay Varnish

A thin transparent layer applied (using the print head) to cards to resist scratching and fading from exposure to UV radiation.

Resolution

Dimension of the smallest element of an image that can be printed. Usually stated as dots-per inch (dpi).

Prox Card

Short for Proximity card; a form of contactless smart card used for access control applications. Embedded in the card is a metallic antenna coil, which allows it to communicate with an external antenna. Because the cards require only close “proximity” to a RF antenna to be read, they are also referred to as contactless cards.

PVC

Polyvinyl Chloride. The primary material used for typical plastic cards.

Smart Card/Contact Smart Card

Also called a “chip” card or IC card. A plastic card with an embedded microchip, which may be used to store information about the cardholder or record card transactions as they occur.

Thermal Printing

The process of creating an image on a plastic card using a heated print head.

Thermal Print Head

An electronic device which uses heat to transfer a digitized image from a special ribbon to the flat surface of a plastic card.

YMC

Yellow, Magenta, and Cyan are the primary print colours for cards. The three colours are combined in varying degrees to make a full spectrum of colours. YMCKO is the same as YMC plus Black (K) and clear protective overcoat (O).

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