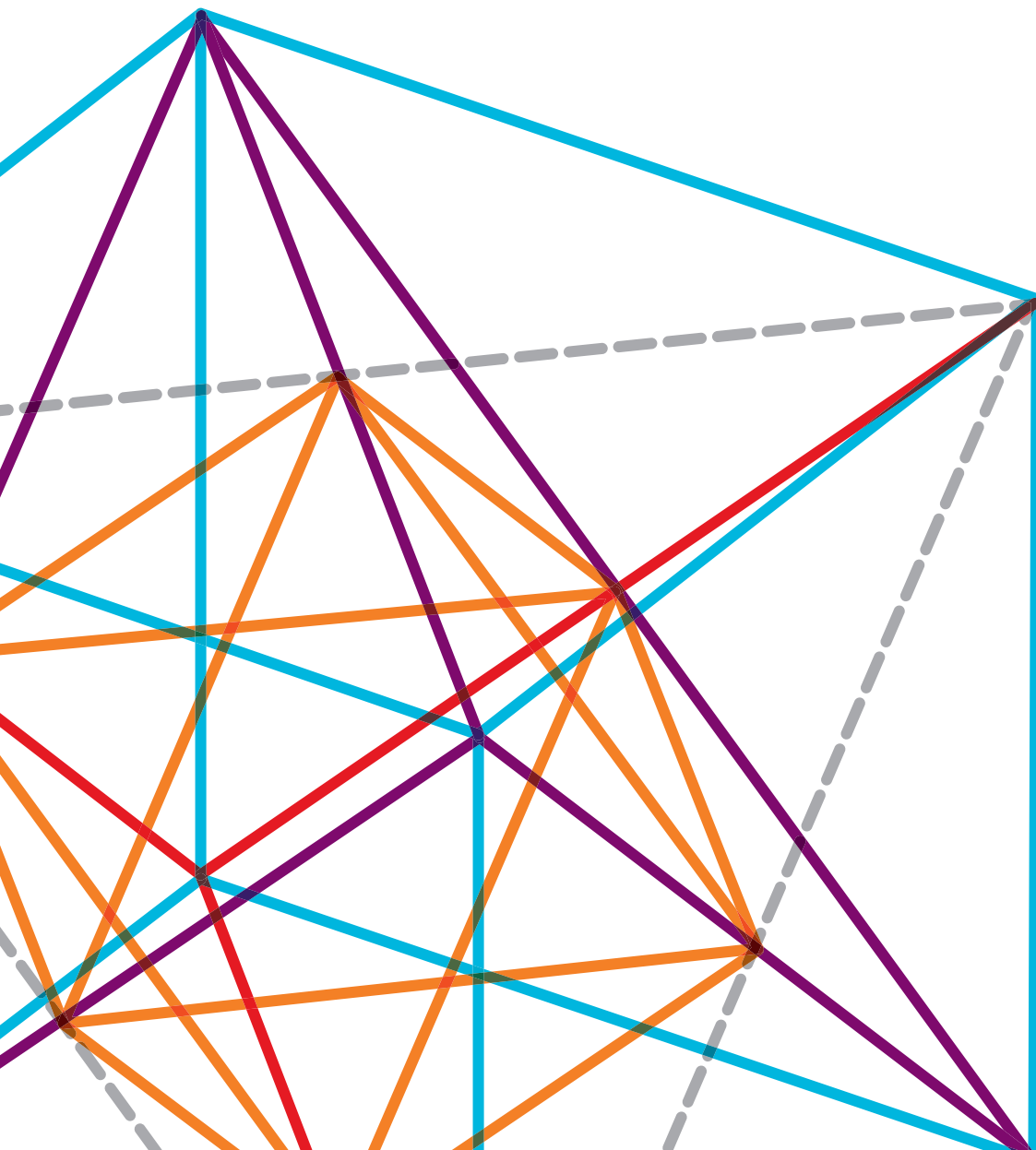


Understanding Technologies for Creating High-Security ID Cards



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ID CARDS AND PRINTERS

Security is an important priority for organizations today more than ever. Having secure access control and identification technologies in place is essential to protecting people and assets.

Tamper-proof ID cards play a critical role in high-security identification processes. This paper introduces different card printing technologies, security features and considerations when creating ID cards.

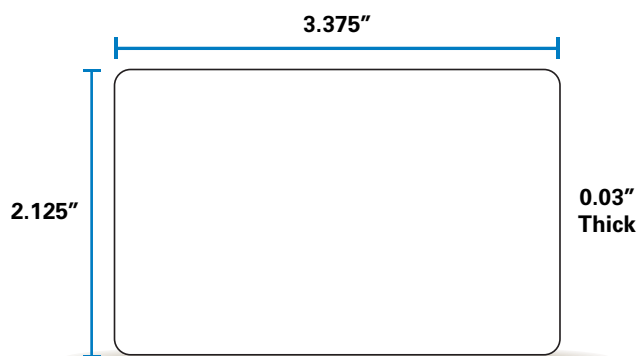
Before you invest in an ID card system, make sure you have identified your specific security and identification needs. Based on these factors, you will be able to choose the right card printer and the right ID card technology for your application:

- The type of card you plan to use
- How many cards you plan to print
- How often you need to print cards
- What printing elements you need to incorporate into your card
- The quality of card images
- Type of encoding required on the card

There are five major factors to consider:

1. Card size

Most plastic cards found in wallets and purses have the same physical dimensions. This is the standard CR-80 card, measuring about 3.375" x 2.125" (85.5 mm x 54 mm). The standard thickness is 30 mil (0.75 mm), but can range from 10 to 60 mil.



2. Printing speeds

Card printers come with a variety of card printing speeds depending on whether you need to print both sides or just one side of the card. In general, the faster the cards are printed, the more expensive the printer. The needs of the printer speed will be determined by the application (e.g., on-premise/on-demand printing, mass duplication printing (same card design printed multiple times) or one-offs).

3. The physical properties of the printer

If you are limited on work space, you will want a printer with a small footprint. If other work must be accomplished while the printer is printing, you will also want to make sure you purchase a printer that is relatively quiet. While the size and loudness of a printer may not be a concern in a factory, it might be important in an application such as a small office, retail store or cruise ship.

4. Ease of use

A card printer should be easy to use right out of the box, especially if the user is not familiar with card printers.

5. The type of printing you want

Thermal, dye sublimation, mass transfer printing, or direct-to-card (DTC) or retransfer printing. These are discussed in detail below.

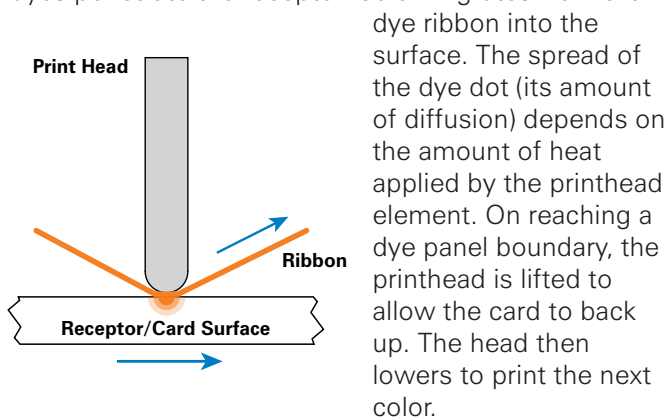
THERMAL PRINTING

Like all other computer-based printers in the office, today's photo ID printers are digital. Resolutions of 300 dots per inch (dpi) or more are common in office printers, so the problem of jagged edges is largely a

thing of the past. Most photo IDs are printed by digital thermal transfer, a process by which color is transferred from a single-use ribbon to various kinds of receptor materials.

DYE SUBLIMATION PRINTING

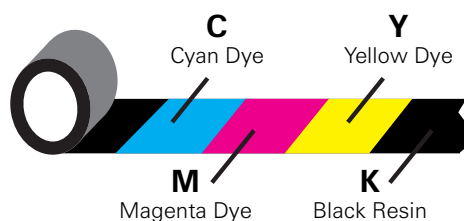
The variable size and density of each color dot is the secret to the photo-quality printing possible with dye sublimation—bright colors and no jagged edges. YMC dyes penetrate the receptor. Color migrates from the



Yellow, magenta and cyan are combined in varying proportions to print photo-quality images. When “fully saturated,” the three colors together print “process

black” text and graphics, which is similar in appearance to “black resin printing” (discussed in the next section) but is not infrared readable.

The illustration below shows the usual pattern for dye sublimation (“dyesub”) printer ribbons. The K panel is not a dye. It is instead a “mass transfer” black resin used for infrared readable bar codes and other data. A second K panel (YMCKK) is sometimes provided to allow black resin printing on both sides of the card. An overlay panel—or O panel—is available to protect the image from abrasions and fading. The number quantity number of images per roll varies based on the type of ribbon—or number of panels—and the manufacturer. .



MASS TRANSFER PRINTING

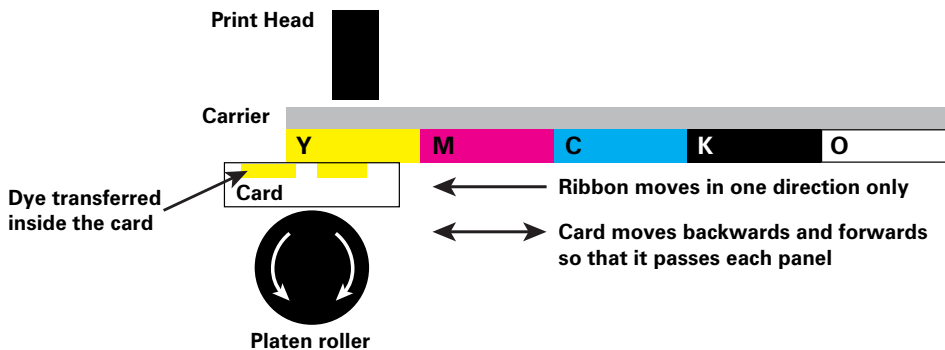
With a mass transfer panel, the printer cannot control either the ink dot's size or density. It is either there or it is not, which is not good for continuous tone images such as photographs. To create the illusion of continuous tone from discrete dots of ink, printers use a process called dithering, exactly the same behind-the-scenes operation your computer performs any time it sends a picture to the office laser printer.

A mass transfer ribbon is a layer of monochrome resin on a thin backing film. The resin is usually black, so this type of printing is also referred to as “black resin printing.” When heated, the resin is stripped from the backing and deposited as a physical layer on the receptor. Mass transfer delivers sharp text and graphics plus infrared readable barcodes. Photo reproduction is adequate for many applications calling for high printing speed and low cost.

DIRECT-TO-CARD PRINT TECHNOLOGY

Using dye sublimation and/or thermal transfer printing methods, heat is used to transfer a digitized image from the ribbon directly to the flat surface of a plastic card. The relatively small number of affordable, durable card materials that accept dyes limits the types of cards used and limits the intensity of colors

that DTC can reproduce. The DTC process depends on uniform, intimate contact between the printhead, the dye ribbon, and the card surface; therefore, uneven card surfaces cannot achieve high color density and uniformity when dye is transferred directly to a card.



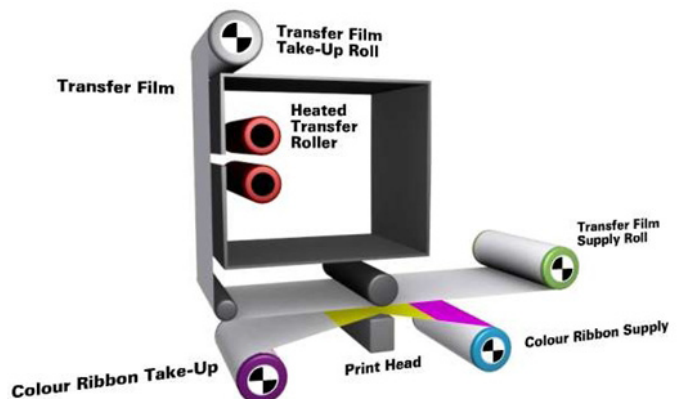
RETRANSFER PRINT TECHNOLOGY

Retransfer printing uses a process called reverse thermal transfer. Unlike traditional dye sublimation card printers—which use a printhead to transfer the image through a dye ribbon directly onto the card surface—retransfer printers use a two-step process:

1. In the first step, the retransfer process prints a high-resolution image in reverse directly onto a clear receiving layer carried by a flexible, intermediate film. The dye sublimation process prints the image to the film, just like in DTC printing.
2. Next, the printer uses heat and pressure to thermally transfer the image and the entire image-receiving intermediate film onto the card surface. During this process, the layer thermally bonds to the card surface, and the printed image resides underneath the clear image-receiving layer.

The benefits of retransfer printing include:

- Superior image quality
- Prints on more types of card
- Improved security and tamper resistance
- Lower printhead costs



HOW PRINTING CAN MAKE ID CARDS MORE SECURE

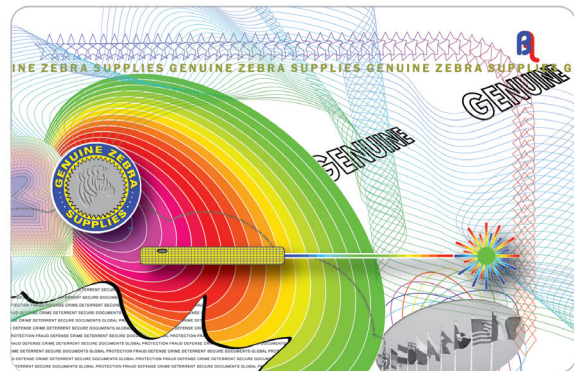
Security comes from a combination of media features, printer capability, database verification, and special security (e.g., unusual, covert and forensic features). Media features include surface quality, durability and built-in security elements. Printer capability encompasses high-resolution graphics and reliable barcodes plus

covert features printed at the time of issue. Database verification consists of a central archive of cardholder data, including a photo, personal statistics, employee number, date, time and place of issue. Special security features are only shared with customers in order to protect their covert qualities.

START WITH HIGH-QUALITY CARDS

First and most important, the card itself has to be tough. In this security-conscious age, governments and other large organizations insist on custom-designed card media of ever-increasing sophistication. This is for two main reasons. First, multiple security features create greater counterfeiting difficulties. Second, guards can quickly and easily validate unique features known only to the organization's security force.

Your card media should offer an array of security features, any or all of which may be incorporated into custom designs. Today's cards must be extremely durable. For example, your card stock should be ten times the flex life of regular PVC cards. It should meet or exceed all international standards for resistance to cracking, permanent adhesion of over-laminate, and durability of image. Choose cards that do not tear easily. Look for unique tear-resistant designs. The lanyard slot in a regular PVC card is often fragile. If the slot tears, an unauthorized user needs only to change the photo to go past a careless inspector.



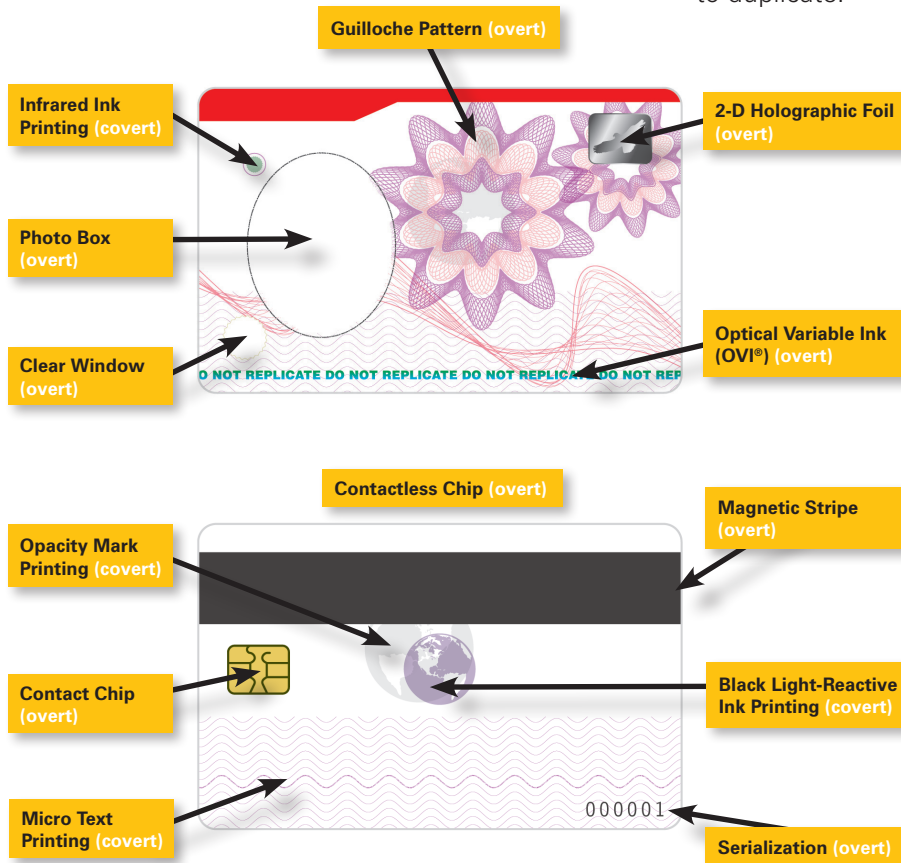
To increase durability, higher capability printers feature fully integrated hot roll laminating stations that apply 0.6 or 1.0 mil laminate patch materials, with or without holograms. Cards with laminates will provide up to seven years of wear. Such lamination is especially recommended for abrasion-intensive applications such as frequent barcode or magnetic stripe reading. Depending on volume and how quickly one needs to print cards, there are printers that laminate one side or both sides at once.

MODERN PRINT FEATURES ARE HARD TO COPY

To prevent counterfeiting, alteration or duplication, there are many techniques that companies can use with digital printers. First of all, they can position multiple security images or holograms. One security image alone increases the difficulty of counterfeiting; two makes it at least twice as hard. The holographic image lamination process also provides a very rich-looking card. Multiple screenings of the same photograph increase integrity. This is the standard for most driver's licenses. Unique graphic identifiers, such as allowing only the red-bordered cardholders to access an area, help differentiate security levels.

You can also purchase card stock with pre-printed security features, including ultraviolet-visible text and graphics that are available in two colors, green and blue. With micro-printing, text can be added to a user's specifications, with deliberate random font changes and misspellings if desired. Character height is five thousandths of an inch (0.125 mm).

Pre-printed serial numbers can also be incorporated into card stock. Laser etching is another option. Fine-line Guilloche patterns with hidden micro-text are aimed at foiling counterfeiters, and micro-printing of text and miniature graphic elements are also difficult to duplicate.



An over-laminate film adds security to the printed ID card. The inner surface of the laminate can be preprinted with OVI ink or UV-visible ink in one, two or three colors. In addition, today's high-tech printers can also laminate with holographic metallization, including embossed micro-text.

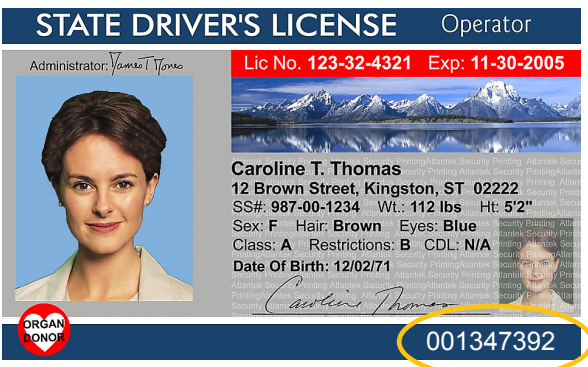
Applications for such security-enhanced cards include driver's licenses; national health, social security and voter registration programs; badging for the armed forces, law enforcement and government agency personnel; and access and identification for educational institutions, industry and transportation.

KEEPING TRACK OF CRITICAL INFORMATION

It is important to keep track of card transactions in the printer's host computer. For example, Zebra's ID/Log records the applicant's personal data, together with other point-of-issue data. This data set can provide a means for security officers to validate the card by comparing a photo ID card with this centrally located data.

Card serialization adds security. Printers with magnetic stripe encoder, proximity encoder or smart card contact options can be set up to function only with serial numbered card stock and also to add serial numbers to the data recorded by ID/Log.

Here's how card serialization works: All cards supplied to an organization using this system are pre-printed on the front or back with a serial number, which is also recorded on the card's credential medium, such as magnetic stripe, proximity chip or smart card integrated circuit (IC). The ID card printer is configured to accept only serial numbered cards and will eject—without printing—any card without the appropriate encoding. If a valid serial number is detected, the card is printed.



The serial number read from the credential medium is recorded in the printer's host computer, where it is linked with the license or employee number and other data such as date, time and location. This data set is available for uploading at any time to the organization's central database. As a result, the security officer can read any ID card that is linked to a serial number in the database on-the-spot and without any special equipment. When transmitted to the central database, the serial number can, in turn, trigger a download to a local terminal. Now, in addition to the usual comparison of photo and subject, it is easy to instantly check the correlation of serial number and credentials.

SUMMARY AND CONCLUSION

Now that you know the basic elements of a high-quality ID card and the fundamentals of the printing process, you are well on your way to choosing the right printing technology to meet your ID card needs and security feature requirements to help you protect your organization's people and assets.

A global leader respected for innovation and reliability, Zebra offers technologies that illuminate organizations' operational events involving their assets, people and transactions, allowing them to see opportunities to create new value. We call it the Visible Value Chain.

Zebra's extensive portfolio of marking and printing technologies, including barcode, RFID, GPS and sensing, turns the physical into the digital to give operational events a virtual voice. This enables organizations to know in real-time the location, condition, timing and accuracy of the events occurring throughout their value chain. Once the events are seen, organizations can create new value from what is already there.

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Corporate Headquarters
+1 800 423 0442
inquiry4@zebra.com

Asia-Pacific Headquarters
+65 6858 0722
apacchannelmarketing@zebra.com

EMEA Headquarters
+44 (0)1628 556000
mseurope@zebra.com

Latin America Headquarters
+1 847 955 2283
inquiry4@zebra.com

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