PRINTING TECHNOLOGIES GUIDE

There are many printing processes available to print bar codes.

PRINT RESOLUTION

One of the key elements in bar code printing is the print resolution of the printer. This is typically measured in dots per inch (DPI). The size of bars within the bar code is dependent upon the resolution. Printers utilizing 300 DPI print in units of .00333 inch. Therefore, bars printed with a printer having 300 DPI resolution can only be printed in whole increments of .00333 inch. For example, a 10 mil (narrow bar) bar code with a 3.0 ratio would be printed at 9.99 mil (.00999)…3.0 ratio times .00333 inch. A bar code requirement other than a 300 DPI multiple, must be printed on another printer.

STATIC PRINTING

Conventional offset or flexography printing is utilized in the printing of UPC retail and other static bar codes. Mechanical numbering machines can be utilized for discrete bar code symbologies (Code 39), but with few exceptions, no continuous or 2D codes.

PHOTOCOMPOSITION

Photocomposition can be used to print extremely small bar codes. It utilizes photo typesetting to create the bar code, number, and text. This process has a resolution of 2000 DPI providing the highest level of quality and also the highest cost. This production process utilizes photographic paper and can include a coating or laminate over the printed image to provide scuff protection. The former is recommended since the latter tends to delaminate.

However, for more complicated bar code applications such as consecutive numbering, random numbering, or data storage, computerized non-impact printing technologies are recommended.

LASER

This printing technology utilizes 300-600 DPI resolution resulting in consistently high quality bar codes. While contrast ratios are extremely good, toner scatter can create scanning errors. Toner scuff can be a problem. Since most laser printers are sheet fed, it is difficult (and expensive) to provide laser labels with protective coatings or laminates. Therefore, a clear protective label or tape must be placed over the label to insure it will withstand normal handling and use.

Laser printing can be low to high speed, batch or on-demand production. The key is to make sure the proper software is in place to produce bar codes correctly. While laser printers can produce a terrific looking bar code, if the proper software is not in place, the ratio between bar sizes can be printed

incorrectly resulting in beautiful but non-scannable bar codes. If the document needs any static printing, it must be preprocessed on a conventional printing press.

Laser printers are limited to paper and tag stocks as well as expensive laser compatible polyester and/or vinyl stocks useable in a heat fusing printer.

Since most laser printers are sheet fed, preprocessed labels of standard fixed sizes must be used (i.e. preprinted and pre die cut sheets typically 8.5" x 11" or 8.5" by 14"). Another consideration is the special, more expensive adhesives and liners that must be used to insure lay flat characteristics and non-ooze characteristics for the laser printer.

ION DEPOSITION

Labels are both manufactured and printed in the same process. Ion Deposition typically utilizes 240-600 DPI resolution. Labels can be provided with protective coating or over laminates. This is the preferred method for medium to high quantity production.

DIRECT THERMAL/THERMAL TRANSFER

There are over two million thermal/thermal transfer printers installed in the United States. This technology is quiet, very simple and highly reliable. This is the preferred method for on demand printing requirements, given its relative low cost and reliable process. Print heads are solid state and are designed to operate in warehousing and manufacturing environments. Direct thermal and thermal transfer are the slowest of non-impact technologies. Printer speeds vary from two to twelve inches per second (frequently there are speed versus DPI tradeoffs).

Both direct thermal and thermal transfer printing technologies use heat to create an image. The printers employed in both technologies use the same type print head, with the media used determining the process employed. In fact, most thermal transfer printers can be converted to direct thermal printers by disabling the ribbon mechanism. The print head is stationary and the media advances past it. There are from 200 to 400 elements (hot spots or dots) per inch arrayed across the face of the print head. The number of elements in a print head determines print resolution (DPI), with most being 203, 304, and 400 DPI. The elements in the print head are square, resulting in a straight edge. This allows these printers to print higher density bar codes. Though they have similar DPI resolution, direct thermal and thermal transfer technology provides higher quality bar codes than laser or ion deposition technologies. Direct thermal and thermal transfer technology incorporates square dots resulting in straighter edges while laser and ion deposition technologies that utilize round dots.

As the media passes under the print head, the heated elements are turned on and off by impulses from the computer. In thermal transfer applications, the contact of those elements melts the colorant off the ribbon onto the media. In direct thermal applications, the contact of those elements on the surface of the thermal media activates the thermal coating to create the image.

Direct thermal and thermal transfer differ in a number of ways:

- Thermal transfer must use a ribbon to form an image.
- Direct thermal uses media with a pre-applied heat sensitive coating.
- Thermal transfer can print in a variety of colors via colored ribbons.
- Direct thermal is largely limited to black imaging.

- Thermal transfer images are more resistant to light and chemical than direct thermal images.
- Thermal transfer media is less expensive than direct thermal media, however thermal transfer requires the use of ribbons

Direct thermal: In direct thermal printing, the print head comes in direct contact with the face of the media. Thermal media has a heat sensitive coating that reacts to the heated elements in the print head resulting in an image. Print quality is very good, but dependent upon the quality of the coating sensitivity on the media being imaged and the heat setting of the print head. Some older infra-red scanners cannot read standard direct thermal media consistently and therefore require special infra-red or near infra-red thermal media which are more expensive.

Direct thermal applications are best suited for indoor applications where temperatures are below 140 degrees F. Because the image is heat sensitive, prolonged exposure to sunlight or UV light may cause the image to fade.

Thermal transfer: This technology utilizes a ribbon image transfer process. The ribbon is coated on one side with a black or colored heat sensitive coating. This side of the ribbon is against the surface of the print media. The other side of the ribbon is flush against the print head. The heated elements of the print head come in contact with the uncoated side of the ribbon, melting the coating off the other side of the ribbon onto the surface of the media. The key is to have the ribbon as close as possible to the surface of the media. In order to accomplish this, the media must be as smooth as possible. While this may sound extreme, print quality is completely dependent upon it. As such, media with level surfaces are a virtual requirement to ensure good print quality. Usually, but not always, media with smooth and/or coated surfaces create this smoothness. There are three primary types of ribbons available for thermal transfer printers, the use of which is dependent upon the type of media being used: 1) wax ribbons, 2) wax/resin combination ribbons, and 3) resin ribbons. Each ribbon type is best suited for particular handling environments.

DOT MATRIX

This technology utilizes the lowest resolution printing via low-density impact printing of round pins with a fabric ribbon to create an image. Because of the low density and round pins used to create the image, the print head must create many dots with overstrikes to achieve an acceptable straight bar edge. This creates considerable print head wear. Bar code printing is slow because these printers do not process bit map commands quickly.

Furthermore, consistent image quality is difficult to maintain due to ribbon performance. New, ink laden ribbons produce bars which "bloom" or "bleed" resulting in smearing and/or bars with inaccurate ratios. Old ribbons produce gray bars with poor contrast ratio.