A TOTAL GUIDE TO BARCODING

GSM BARCODING

WHY USE BAR CODES?

Studies have shown that bar code solutions are implemented in over 70% of installed Auto ID applications. Bar codes provide virtually error free data collection. Studies have shown that a proficient data operator will make one error for every 300 characters manually entered. Compare this to 1 in 3 million utilising bar code technology.

Almost everybody has seen bar codes on products in the supermarket and experienced the benefit of bar code scanning at the checkout. Imagine the time it would take the operator to manually enter the SKU (stock keeping unit) and price for every item.

Historically the early adopters of bar code technology were the industrial sector followed by retail. Nowadays bar code technology has extended to many sectors of industry and commerce. Example applications include:

Automotive, books, courier services, defence, electronics, food, government, health, insurance, mail order, packaging, postal, printing, rental, transport, and wholesaling.

Bar coding is used in so many areas because it has proved to be an adaptable and successful technology. Virtually all types of industry are using bar codes to replace keyboard data input.

WHY SHOULD YOU USE BAR CODING?

Many companies perceive bar coding to be an additional cost of doing business. In reality bar code investments usually pay for themselves in less than a year. Benefits can include increased productivity, increased invoicing accuracy, faster reaction to problems and a reduction in inventory levels.

Whatever the business system, a bar code solution can be added to:

- Improve service levels
- Improve working environment reducing the frustrations of a manual environment.
- Improve margin.

When considering bar code solutions, they should generally be used to improve the efficiency of an existing paper based system. Do not try to design a bar code solution from scratch. There may be too many problems to solve at once. Think about the following issues:

- What is the problem?
- How could you resolve it?
- Consider a few procedures that can be made more efficient.
- Decide how and where to read bar codes.
- Decide how to print bar codes.

THE TECHNOLOGY UNCOVERED.

Many people misunderstand the technology that is behind the bar codes printed on food labels, packaging labels, documents, envelopes, product serial number labels etc. They all seem to look the same, but they are not. Many industries may have their own bar code standard. By reading through this guide you will learn about:

- Industries and Applications
- Bar code basics
- Bar code symbologies
- Bar code printing
- Bar code quality
- Bar code scanners – fixed
- Bar code scanners – portable

Now lets take the first step and look at some of the common applications that are ideally suited to bar code technology.

APPLICATION EXAMPLES

There are many uses for bar coding solutions. The common applications are associated with the industrial and retail sectors. However, there are many more applications for bar codes. Nearly all industries use keyboard input for data entry. It is conceivable that all these industries have a potential requirement for a bar code solution. Listed below are a few applications that are common in our industry.

- Inventory control
- Receiving (Goods Inward)
- Work in progress
- Despatch
- Point of Sale
- Time and attendance
- Marketing (data collected on portable terminals)
- Package delivery
- Quality control
- Retail Demand (bar code verification)
- Ticketing
- Healthcare

INVENTORY CONTROL

Inventory and warehousing is one of the most common applications for bar code solutions. A warehouse must have the ability to receive products, despatch products and keep accurate inventory. If a mistake is made in the warehouse, it is often compounded. The wrong product is sent to a customer, the inventory is inaccurate, the product can not be sold and the customer is dissatisfied, increased delivery costs are incurred and additional man-hours are needed to fix the problem.

Most companies already have a warehousing system in place. Whilst these are tried and tested paper based systems the accuracy can be improved with the implementation of a bar code solution.

When the stock is received, each item should be labelled with a bar code. The label could be produced using a PC based label design package such as LabelView, or generated direct from the host system. The label could be on any material though paper is the most common. For many applications, a Code 39 bar code symbology is adequate. The part number is usually bar coded and the product description becomes part of the label.

In some industries, raw materials and components arrive at the receiving bay already bar coded. Increasingly these codes conform to an industry standard. These can be scanned to confirm that the correct items have been received.

If the warehouse is relatively small these codes can be scanned with a scanner having either a keyboard wedge or RS232 interface. The items must be physically brought to the scanner. This is the least expensive approach. For larger or busy warehouses, it is not always practical to bring the item to the scanner. Portable Data Terminals act as portable computers and with built in scanning capabilities, record the item at point of receipt. The collected information will be downloaded to the host either in a batch or by radio frequency communication method.

The use of bar codes significantly reduces the effort required to perform a physical inventory whilst at the same time dramatically improves the accuracy.

During the actual inventory process a program on the PDT prompts the operator to scan the bar code label on the product and if appropriate the bar code location label. Usually the operator is prompted for the quantity. The quantity would normally be entered via the keyboard of the terminal. Throughout the process, the program builds a data file of location, part number and quantity. Other information such as operator identification and date/time may also be stored. Suitable validation built into the software ensures the accuracy of collected data.

When the stock take is complete or at regular intervals depending upon the size of the warehouse, the data will be downloaded to the host computer for processing.

The inventory process can be extended to cycle counting. The main difference is that a data file can be downloaded to the portable terminal before the process begins. This data file could contain the location, product number and expected quantity. The display on the terminal will guide the operator to the correct location and prompt which part to check. Once the objects

have been counted the actual quantity can be recorded. If there is a mismatch between actual and expected quantity, the error can be recorded.

RECEIVING (Goods Inward)

Many products received into a warehouse now already contain a bar code supplied by the vendor. The label could contain details such as product code, serial number, build date, revision identification, purchase order number etc. These pre-marked products can be useful if your computer system maintains a list of expected deliveries. Scanning the serial numbers at the receiving bay can quickly update the host computer with completed orders. Even if the host does not have a list of what is expected, bar code reading will still speed the receiving process.

Not all packages received contain bar coded labels. If this is true it is still possible to implement a bar code tracking system. As products are received the details from the despatch note could be entered onto a computer. The computer could assign a unique serial number to each product. Connected to the computer would be a thermal transfer printer which would print a label containing description, product code and serial number. Each label could be manually applied to the product before it is put away.

Equipped with a portable terminal the operator would store the product and the warehouse. The terminal would prompt the operator for location, product code and serial number. When the put-away is complete or at regular intervals depending upon the size of the warehouse, the data will be downloaded to the host computer for processing.

WORK IN PROGRESS

In a manufacturing environment, the company's stock will constitute three components: raw materials, work in progress (WIP) and finished goods. WIP is the hardest to measure. With a suitable WIP system it is possible to monitor the stock values of WIP, which could be 30% of total inventory.

The simplest form of WIP system would be a host computer linked to a network of bar code readers and one bar code printer. At each workstation, an operator would record products as they pass through. The operation could involve scanning the work station identifier, product code and activity performed. The product itself could be bar coded though in many cases a 'build document' follows the actual product. In this instance, the 'build document ' would contain a bar coded works order number and a detailed list of operations. As the operator completes the task the bar code reader is used to enter the works order number, operation code and employee number. On the 'build document' each operation description would have a bar code associated. The data collected would also be time/date stamped. It could be used to provide reports on:

1) Work order status
2) WIP levels
3) Product tracability
4) Product/batch recalls
5) Identify manufacturing bottle-necks

DESPATCH

This area of business can be a complex process. Orders must be sorted, picked, and made ready to be loaded on to delivery vehicles. The correct process used in conjunction with bar coding can provide an accurate and up to date picture of the overall despatch process.

A primary use of bar coding in despatch applications is to meet customers' demands on label requirements. Customers may demand that all products received must contain a bar code label that matches a predefined specification. Industries where this is required include automotive, retail and defence.

A second use is creating an accurate list of items picked. A picking list can be downloaded to a portable terminal. This will prompt the operator for the location, part number and serial number. Verification on the portable terminal ensures that only the required items are picked. The collected data will be uploaded to the host computer. Products would be physically picked and moved to the despatch area.

POINT OF SALE

Bar code POS systems are installed in small gift shops through to large supermarket chain stores. Virtually all supermarkets use counter mounted projection scanners that allow bar code reading regardless of orientation. Smaller stores find that bar coding is practical because of the increased speed at the checkout, timely and accurate stock checking and sound price assurance. These smaller convenience stores tend to use CCD or hand held laser bar code readers.

The POS terminal is usually connected to a network containing a central database. This database is usually on-line so that stock levels are adjusted automatically. When an item is scanned the data from the EAN bar code is used to lookup the price and description. These details are sent back to the POS terminal to record each transaction.

In most supermarkets bar code shelf edge labels are also used. These are often used to provide pricing information to the customer. These labels can be used as part of a random price checking process. The operator would scan the shelf edge label with a Portable Data Terminal and bar code reader. The terminal would have either part or the full database in its memory. When the shelf edge label is scanned the display would show the product description and price. If the price on the shelf edge label does not match that on the terminal display the error can be rectified.

TIME AND ATTENDANCE

With the introduction of government's 48-hour working directive, time & attendance packages are becoming more popular. They provide an easy method of tracking employee's hours.

Most time & attendance systems comprise of a network of wall mount terminals connected to a PC. Software on the terminals record the employee in or out as they swipe an identification card through a reader. The information can be sorted by department and provide detailed attendance records including sick leave and holidays.

MARKETING (Data collected from portable terminals)

Manufacture's are able to record purchasing trends by providing shoppers with a bar code reader. As products are placed in the shopping trolley the purchaser can scan the product bar code using a portable data terminal. When they return home, these details can be downloaded through a modem to the information collation centre.

PACKAGE DELIVERY

Many private delivery companies now benefit from bar coding solutions. Many of them offer a guaranteed overnight delivery service by a fixed time the next day and need the ability to provide accurate information on the whereabouts of a parcel. This is achieved by scanning the parcel code onto the vehicle. The drivers take with them a portable data terminal pre-loaded with a data file containing all delivery details for the route. These details will include delivery address, customer account code and parcels to be delivered. The terminal will prompt the driver through the shortest and most economical route. Upon arrival all products to be delivered will be scanned. If an item is missed the driver will be warned, if an incorrect parcel code is scanned it will be not be unloaded. After completing the delivery the driver will insert the terminal into a vehicle cradle and transmit the data through a suitable media such as GSM. This method allows head office real time information that can help them answer any customer queries.

QUALITY CONTROL

Just as bar code implementation is possible for production systems it can be used in quality control applications. Bar codes can be used as part of an inspection procedure; a different code can be used to identify a fault or rejection.

RETAIL DEMAND (Bar code Verification)

Requirements for the checking and verification of bar codes vary depending on how the barcodes you have printed are going to be used. If you are printing bar codes purely for your own internal use there will not be any requirement for any body outside the company to read the code.

However if you are producing bar codes that will be used by third parties, possibly with a variety of bar code readers there may be a requirement to verify that bar code has been printed within the specification of the symbology in use. Verification is particularly important if you are supplying bar coded products to the retail sector. Here it is critical that the bar code can be read first time at the checkout. Any failure to read the bar code first time will result in a delay at the checkout as the operator manually key enters the bar code number. If this happens (however remote it may seem) there is the possibility that the retailer may say "we cannot read your bar codes with our reader and therefore are returning all your products and imposing a large fine".

Verification allows you to check the quality of your bar code and to guarantee they have been printed within the specification determined for the symbology. It is a little more complex than simply scanning the bar code to check it reads on your scanner. A special bar code verifier is required that is capable of analyzing the compliance of the code in line with the specifications of the symbology. A bar code verifier will provide lots of technical information about a bar code (e.g. measured reflectance density (MRD) contrast rating, wide/narrow bar ratio etc.) Usually the verifier will summarize all these details to inform the user if the bar code is within or outside the acceptable tolerances of the bar code symbology.

TICKETING

The need for computerised ticketing to automate the admissions process is now expanding to medium and small applications. These emerging markets include small office/home office and e-commerce but typically the industry is comprised of niche markets. These focus on tracking customers and the purchase of admittance to a specific attraction. Typical niche markets include:

- Theatre box office
- Cinemas
- Concert events
- Amusement parks
- Ski Areas
- Transportation tickets etc.

HEALTHCARE

The healthcare industry uses bar codes to capture data and help manage critical patient and drug information. From the laboratory to the hospital ward, bar code data can enable real time access to clinical documentation, patient details, drug recognition, insurance data and much more.

OTHER APPLICATIONS

No matter what industry your customer is in, bar code technology can be applied to help automate and improve the efficiency of your data processing requirements.

WHAT IS A BAR CODE?

A bar code is a method of encoding data (numbers and/or letters) in a form that can be read and understood by a machine. The data is encoded in an array of parallel bars and spaces of varying widths. Reading the bar code employs an optical technique because information is scanned using light that reflects from the bars and spaces within the symbol. There are different types of bar codes. These various types are known as symbologies.

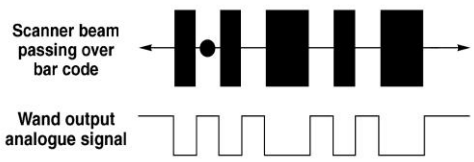
The definition of a symbology is "Any of the standard systems representing data in a bar code form, each having its particular characteristics and rules of composition. The symbology specifies the character set, start and stop codes, length etc". An easy definition is to consider a symbology as a language in bar code technology. Just as we have different languages in different countries, we have different symbologies for different industries. Many of us are familiar with the bar code found on products in our local shops, but there are many standards used in various industries. Retail, healthcare, manufacturing, postal, automotive etc. all have a symbology unique to the industry. Why? Simply because symbologies have evolved to solve different problems.

BETWEEN THE LINES (AND SPACES)

A bar code does not normally contain descriptive data. A bar code normally contains a reference number that is used by a computer to lookup an associated record that contains descriptive data and other important information. *FOR EXAMPLE:*

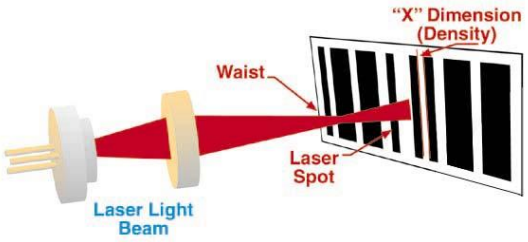
> A bar code found on a tin of beans does not contain the description and price. It contains a 13-digit number. When the cashier scans this bar code, the computer (till) uses the number to look up the associated record. The computer instantly does a "price lookup" and displays the price and product description on the till.

HOW ARE BAR CODES READ



When the bar code is scanned the optical elements in the reader convert the light reflected back into an analogue (i.e. not digital) signal. More light is reflected from the spaces than from the bars. The electrical pattern seen by the reader is interpreted as a series of high / low voltages. A decoder either internal to or external to the reader will convert this analogue signal into its digital representation i.e. data.

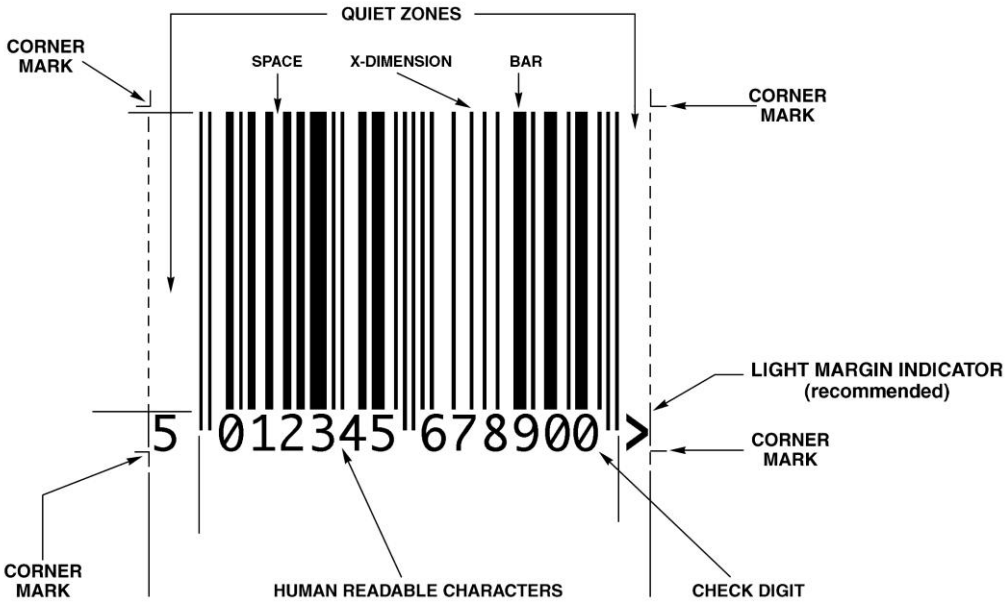
The scanner starts to read the bar code at a white space (quiet zone) before the first bar. The scanner continues past the last bar and the white space that follows it. As a general rule the longer the bar code, the higher the bars will be. This is because the bar code reader cannot read the bar code if the light source (scanner) moves out side of the top and bottom of the bars. The longer the information is to be encoded the longer the bar code. It is useful to remember that the size (magnification) is dependent upon printing conditions. Bar codes will need to be enlarged for poorer quality printing processes.



BAR CODE COLOURS

There are a number of colour combinations that can be used to represent the dark bars and light background of a bar code symbol. The most common colour combination is black bars and white spaces. The picture illustrated shows some other acceptable colour combinations.

The structure of bar codes varies from symbology to symbology but the diagram below represents some of the components in a bar code.



BARCODE SYMBOLOGIES

SYMBOLOGY CONFIGURATIONS

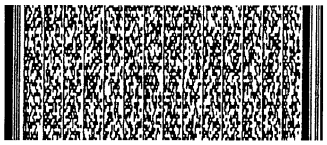
Bar code symbologies can be loosely be sub divided into four different categories.

1) Linear
2) 2-D Stacked
3) 2-D Matrix
4) Composite

LINEAR SYMBOLOGIES

A linear bar code symbology is a single row of bars or spaces. These are the most common forms in use today.

2-D STACKED SYMBOLOGIES



These look like conventional linear bar codes stacked on top of each other. Multiple rows stacked on top of each other have the same length and touch each other.

2-D MATRIX SYMBOLOGIES

Cannot be described as traditional bar codes. They encode data into a two dimensional pattern of data cells. These are usually two different colours (black & white) and the cells maybe squares, dots or polygons.

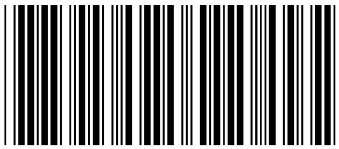
UCC/EAN COMPOSITE SYMBOLOGIES

Based around the PDF417 symbology there are new standards under development for this emerging symbology.

Note: Symbologies shown are not represented at actual size.

BAR CODE SYMBOLOGIES AND APPLICATIONS

Code 39



Code 39 was the first bar code developed to encode alphabetic characters. The character set includes the 26 alphabetic characters, 10 numeric and 8 special characters.

Each Code 39 symbol has the following structure.

1) Leading quiet zone
2) Start Character
3) Data
4) Check Digit (Optional)
5) Stop Character
6) Final quiet zone.

It is known as Code 39 because each character has 9 elements; 5 bars and 4 spaces. Out of these nine elements, three of them are wide. It is a discrete symbology (i.e. there is a space between each character that is not part of the bar code).

Code 39 is relatively easy to print. It is a ratio based symbology having only two widths of elements; wide:narrow. The ratio can range from 2.0:1 to 3.0:1

Code 39 applications

Code 39 is a very popular bar code symbology. Its capability to encode alphanumeric data has resulted in wide acceptance. Many organisations will use it for internal applications. It has a wide use in industrial applications especially in the motor industry.

Interleaved 2 of 5

Interleaved 2 of 5 was developed to improve the low density of the original discrete 2 of 5 symbology. It is a high-density continuous code. Every bar code character actually encodes two digits; one in the bars and one in the spaces. This is a numeric only bar code with data encoded in pairs of digits.

Interleaved 2 of 5 has the following structure.

1) Leading quiet zone
2) Start pattern
3) One or more pairs of data characters
4) Stop character
5) Final quiet zone

It is called Interleaved 2 of 5 because every character has 5 elements, 2 of which are wide. The interleaving is created by the fact that digits are encoded in pairs.

Interleaved 2 of 5 is relatively easy to print. It is a ratio based symbol having only two widths of elements; wide:narrow. The ratio can range from 2.0:1 to 3.0:1

Interleaved 2 of 5 applications

A major application is its use in the EAN system. It is used to identify trade units by a bar code on the outer case carton of bulk packaging. Interleaved 2 of 5 is used here because of its ease of printing on corrugated cardboard. Even pressure when printing is assured by the use of bearer bars surrounding the symbol on all four sides. These bearer bars also ensure no mis-reads occur.

There have been many other traditional applications for this symbology due to its high-density data encoding. You should be aware that this is not the most secure bar code symbology. Unfortunately, a partial scan (i.e. one that does not include both quite zones) has a high probability of decoding as valid, but shorter Interleaved 2 of 5 symbol. For example, 14digit Interleaved 2 of 5 code could be mis-read as a valid 6 digit Interleaved 2 of 5 code. This is because the start and stop patterns can be duplicated within the symbol. Because of this, Interleaved 2 of 5 is best used in fixed length data applications. The reader can be programmed to accept only symbols of the correct length. Any others will be rejected.

UPC-A

The Uniform Product Code (UPC) has been successfully used in the retail industry in the United States and Canada since 1973. This is a coding system as well as a symbology. It is designed to uniquely identify a product and its manufacturer. The UPC-A code is a 12 digit numeric code. The first six digits represent the manufacturer, the next five digits are a unique product identifier and the twelfth is a check digit. The first six digits are allocated by the UCC (Uniform Code Council).

The actual data is encoded as two bars and two spaces within seven modules. The symbology allows omni-directional scanning i.e. presenting the code in any orientation to certain types of scanner.

UPC- A Applications.

UPC-A is normally only used in the retail sector in the United States and Canada.

UPC-E

Is a fixed length, 6 digit numeric code. It is a compressed code ideal for use on small packages. It is also known as the zero suppression version of UPC-A. It allows manufactures to encode a limited number of 12 digit codes in six digits.

The actual data is encoded as two bars and two spaces within seven modules.

The symbology allows omni-directional scanning i.e. presenting the code in any orientation to certain types of scanner.

UPC- E Applications.

UPC-E is normally only used in the retail sector in the United States and Canada.

EAN 8 & 13

The EAN (European Article Numbering) system has two common versions. The EAN-13 and EAN-8 encoding 13 and 8 numeric digits respectively. The EAN symbology was developed for one requirement: to enable grocery products to be scanned at the Point of Sale. The symbol contains numeric data only.

The symbology allows omni-directional scanning i.e. presenting the code in any orientation to certain types of scanner. The most commonly seen symbol in Europe is the EAN-13 symbol. The symbology must not be used without adhering to the rule of the numbering system. Manufactures of products carrying the EAN symbol must register the company and product to a national coding authority. Each country will have a coding authority. The authorities are responsible for assigning a code to each manufacturer and maintaining a manufacturer/code database. In Europe, the International Article Numbering Association is responsible for this task.

On a 13 digit symbol, the first two or three digits are the country of origin, the next four or five represent the manufacturer's code and the remaining digits generally provide the product code. The 13th digit is the check digit.

EAN 8 & 13 Applications.

EAN 8 & 13 is normally only used in the retail sector in Europe.

Code 128

The name Code 128 derives from the fact that you can encode 128 different data characters from the full ASCII set. This is a very high-density alphanumeric bar code symbology. It is variable length and continuous with 4 element widths. Each character has 11 modules, which may be either dark or light. Each character has 3 bars and 3 spaces. Each character begins with a bar and ends with a space.

Of all the linear symbologies Code 128 is the most flexible. It supports numeric and alphanumeric characters and when using character set 'C' has the highest number of characters per inch in a variable length code.

Each character can have one of three meanings, depending upon which of the character sets are used. Three different start characters tell the reader which character set is being used, and three shift codes allow the changing of the character sets within the symbol.

Set A includes numeric, upper case alpha and ASCII control character. Set B includes numeric and both upper and lower case alpha characters. Set C encodes pairs of numeric data into single bar code characters.

For example the same character can be represented as:

Set A CR
Set B m
Set C 77

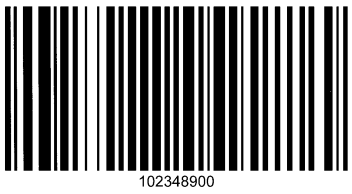
The code 128 has the following structure:

1) Leading quiet zone
2) Start character
3) Data characters
4) Stop character
5) Modular 103 check digit
6) Ending quiet zone

Code 128 Applications

Code 128 is being used in many applications due to its flexibility. Many formats of data can be encoded.

EAN-128



A subset of Code 128, using a special Code 128 character creates the EAN-128. The Function Code 1 (FNC 1) when encoded immediately after the start character has been reserved to indicate that the data follow conforms to the EAN/UPC structure. The ANA, EAN and UCC have reserved its usage.

EAN-128 Applications

This is largely used in retail distribution to allow the tracking of serialized cartons.

Codabar

Codabar is a numeric only symbology. It has 4 different start and stop characters that can be used to identify different types of data. Using a correct combination of these start/stop characters it is possible to read two adjacent bar codes simultaneously

Codabar Applications

Codabar was predominantly used in the blood transfusion industry because of its ability to ensure two bar codes are read simultaneously. Its use in this application is reducing with the acceptance of Code 128 as its successor.

Code 93

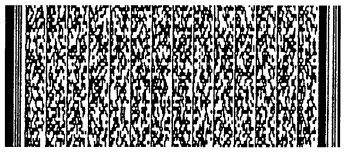
Code 93 was designed to be a high-density variant of Code 39. It can encode the full 128 ASCII characters. Code 93 is a multiple width symbology with two mandatory check digits.

Other linear bar code symbologies

There are many symbologies that you may come across. In most cases those listed previously will be suitable for most applications. There are a number of others that are still in use. Amongst these are:

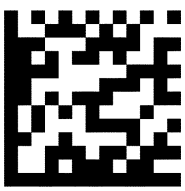
Telepen
MSI Plessey
Code 11
Discrete 2 of 5
Nixdorf code
Post net
State net code

PDF417



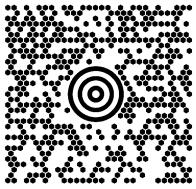
The most common 2-D stacked code today is the PDF417. This is a variable length symbol. Each character consists of 4 bars and 4 spaces in a 17-module length. This is a (17,4) structure- giving rise to the symbology name. There are 929 character values in each of three different sets. A given row uses one character set whilst the two adjacent rows use different sets. Because no row uses the same set as its neighbor the scanner is able to determine when it completes one row. The number of rows and the row length is variable allowing the size to be adjusted to suit the label. Each code consists of 3 to 90 stacked rows surrounded by a quiet zone on all four sides. The PDF417 can exceed over 1000 characters depending upon its content.

DataMatrix



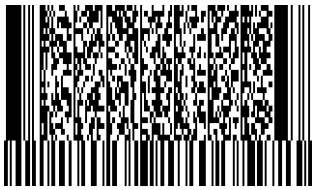
Is a two-dimensional variable length symbology capable of encoding ASCII characters. Each code has a unique perimeter pattern that is used to determine the orientation. Two of the outside rows are solid, forming the letter 'L' and the opposite two sides use alternating black and white patterns which help synchronize the decoding process. Up to 2334 characters can be encoded.

Maxicode



Developed by United Parcel Service for the automatic sortation and tracking of packages. It is a fixed length alphanumeric symbology composed of an array of interlocking hexagons surrounding a circle pattern. 144 characters can be encoded.

UCC/EAN Composite



The UCC/EAN composite symbology is likely to be adopted as a standard for drug identification. It has been designed to offer increased security, safety and control in drug distribution and dispensing. It may also be adopted by other industries including healthcare, electronics and telecommunications. With 3 different subsets the code can contain up to 2361 digits including authorisation number, expiry date and batch number. A scanner that is ideally suited to scanning this symbology is the M2000 Cyclone from Symbol Technologies.

BARCODE SCANNERS

WHICH SCANNER IS RIGHT FOR MY APPLICATION

There are many forms of bar code reading devices ranging from compact lightweight scanners through to fixed mount industrial scanners designed for conveyor belt applications. In selecting an appropriate bar code reader for your needs you should consider:

- The operating environment that the codes will be read.
- The required throughput or volume of codes to be read.
- The distance at which the code should be read.
- Any existing bar code symbologies.
- Hand held or fixed position readers.
- The quality of code to be read.
- The level of training required.

Snapshots of five popular bar code reading technologies are listed here.

CCD (Charged Coupled Device)

This is a common device often used in retail or office automation. The CCD is another form of hand held device but is far more 'aggressive' than the wand. Historically these were considered contact devices and were limited by a short read range. Nowadays this is not a primary concern. Some CCD readers can read a bar code at a distance of up to 170mm. Traditional CCD readers had one definite disadvantage: the aperture of the input device limits its reading capabilities. Typically a CCD will have either a 60mm or 80mm head. Bar codes wider than these dimensions could not be read. A CCD requires less operator training and gives a higher throughput than a wand.

Hand Held Laser Scanner

These are probably the most popular bar code reading device. They are far more aggressive than a CCD, have greater reading distance and can generally read poor quality bar codes. A typical laser scanner can read at a distance of between 6" to 18" whilst long range variants can read at a distance of up to 35ft. Reading on irregular shaped surfaces is achievable with this technology. Instinctively an operator will require little training. With scan speeds at up to 200 scans per second the throughput is high.

In standard laser scanners a laser beam is aimed at oscillating mirrors. Because the scan rate is above 20 per second, the human eye's persistence of vision gives the impression that a continuous line, rather than a moving spot is being projected.

The development of 2-D stacked symbologies has led to the development of hand held raster scanners. The horizontal scan rate is much higher and a vertical scan rate is also employed. The amplitude of the two scan patterns is such that a rectangular area is covered that matches the form of a typical 2-D stacked symbol.

Presentation/Hands Free Scanners

More commonly found in the supermarket, this type of scanner will be either in counter mounted or positioned vertically. In this technology a series of scan lines, typically 20, are projected in a multiple angle arrangement. One or more of them will cross all the symbol's bars and spaces, no matter what the orientation. This setup is ideal for retail outlets because the checkout operator does not have to align the bar code to the laser beam; the scanner projects a very aggressive scan pattern. This scanning method is 'hands free'.

Image Scanners

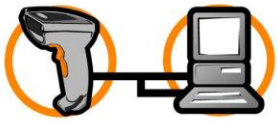
These are special scanners designed to read both stacked and matrix 2-D symbologies in addition to linear codes. In this machine no lasers are used. The technology is similar to that used in home camcorders. When the operator depresses the trigger, an illumination system is momentarily activated and a 'picture' is taken. A digital signal process chip, high-resolution array and software decoding algorithms find and decode the symbol.

ARE SCANNERS COMPATIBLE WITH MY EXISTING APPLICATION?

The data can be sent to the host in many different output formats. Most bar code readers can output the data in any of the main formats. These are USB, keyboard wedge, RS232 or wand emulation.

USB

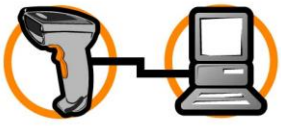
Universal Serial Bus is a plug and play method that allows many peripherals to be connected to a single port. It replaces all kinds of serial and parallel connectors. With USB compliant PC's and scanners you just plug them in and turn them on, USB makes the process automatic.



Scanner Is connected to the PC through the keyboard.

Keyboard wedge – the bar code reader or decoder connects between the keyboard and the base unit of the PC. Data is sent to the PC as though it has come from the keyboard.

RS232 – is an industry standard protocol for data transfer between two peripheral devices. The specification allows for data transfer from one transmitting device to another at relatively slow data rates (up to 38.4K bits/second) and short distances (up to 50ft).



Scanner connects to the PC through the RS232 serial port

Undecoded scanner connects to the PC via a decoder, or connects to PDT

Wand emulation – outputs the data as an analogue signal, which requires decoding before being sent to the host system.

PRINTING

PRINTING

The initial question on printing would be whether to print them in-house or to use an outside agency to print them. The latter would normally be used if you know the data and quantities well in advance or the bar code may form a part of packaging. This method is the least flexible taking the production out of your control. It is often inconvenient and impossible to plan.

Some things to consider include:

1) How much space is available for data or barcodes?
2) What are the required volumes?
3) What is the length of the print run?
4) What is the size of the label?
5) What material is the bar code to be printed on?

There are two printers that will support on-demand printing on-site. These include:

- Thermal Transfer / Direct Thermal

THERMAL TRANSFER / DIRECT THERMAL PRINTING

The benefits of these technologies allow:

- On demand printing giving the precise number of labels needed without any wastage.
- When used with suitable label stock and ribbons the image can be very durable and scratch/smudge/solvent resistant. This is ideal for compliance type labels.
- These printers produce a very high quality bar code.
- Square heating elements giving excellent bar code edge definition.
- High speed – often up to 12" of label can be printed every second.

Thermal and direct thermal printers are available with printheads with dot densities from 152, 203, 300, 305, 400 and 600 dots per inch. These dot sizes dictate the x-dimension that can be printed. To print a 100% EAN-13 digit bar code a density of either 152, 300 or 600 d.p.i. would be required.

Direct thermal / thermal transfer printers generally operate in one of three modes. A convertible path allows configuration for.

1) Straight through – in this mode the stock runs straight through the printer with no attempt to wind the labels or separate them from the backing paper.
2) Peel & Present – in this mode the printed labels are fed out one at a time. The printer internally rewinds the backing paper. In this mode one label at a time is presented to the operator without the backing paper.
3) Internal Rewind – Assuming the printer has an internal rewind the printer spools the printed media internally. The roll of 'pre-printed' labels can then be used on a manual label dispenser.

DIRECT THERMAL PRINTING

These are special printers designed to print bar codes and other data onto labels, tags or continuous media. They can print onto a wide variety of sizes and material types. This generally makes it easy to find a label type that matches your application.

They all use chemically treated paper to create the image. Usually a light coloured paper is impregnated with a clear coating that changes to a dark colour when exposed to heat.

The printer selectively heats areas of the label creating a dark image. The heating is performed by small elements in a printhead. The printhead is in contact with the label as is moves through its paper path. These heaters are normally in the form of rectangular dots that are conducive to the bar patterns in a bar code.

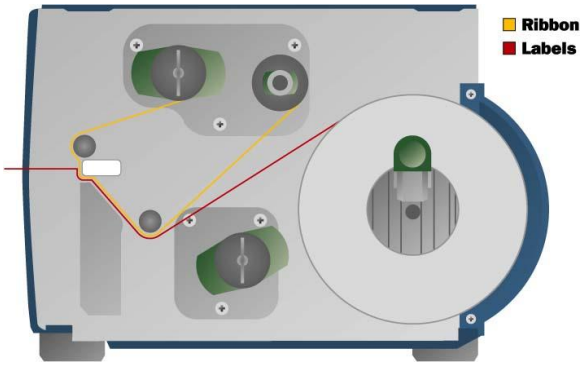
Thermal printers are often rated by the speed at which the labels can be printed. Typical speeds range from 2" to 12" per second.

A disadvantage of this technology is that the chemicals in the paper still remain active when the label is printed. These chemicals can react to heat and ambient light over a period of time and will corrupt the image. Special labels are required which are more abrasive than standard labels which in time wear on the printhead.

The advantages are that it uses no ribbon and the image is smear resistant.

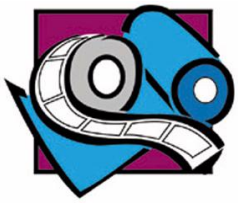
THERMAL TRANSFER PRINTING

The same basic technique is used for thermal transfer printing as is used in direct thermal printing only a plain label is used. This time the printhead is in contact with a special ribbon that releases its ink when heat is applied. The ribbon is in contact with the paper and the ink is transferred to the paper.



The resulting image is stable and unaffected by heat or exposure to light. Thermal transfer printers are just as versatile as direct thermal printers with the additional advantage that plain paper labels can be used. Depending on the combination of labels and ribbon the image is suitable for out door use and the printhead life is longer. The only drawback is the requirement for additional consumables i.e. the ribbon.

RIBBONS AND LABELS



The quality and durability of the printed image is the most important element of the bar code system. Poor quality printed bar codes result in slow first time read rates or on some occasions a mis-read. There are lots of combinations of ribbons and labels. These must be matched to withstand the environment in which the application resides. The bar code must be readable for its entire expected life cycle. This may be from days to years.

Choose the correct face material

There are two broad classifications of face material; paper and synthetics. Paper is the most common and least expensive. It can be coated or uncoated to meet most requirements. Synthetic materials are better suited to applications where the label will be subjected to excessive abrasion, heat, chemicals, rain, snow, or other destructive elements.

Match the ribbon to your face material

Thermal transfer ribbons consist of a protective back coat, a film and ink. The ribbon protects the printhead from abrasion. As heat generates from the printhead, the film provides thermal conductivity for the ink whilst at the same time prevents the ink from smearing. Thermal transfer ribbons can be split into 3 basic categories. The most popular and lowest in comparative cost is **the Wax-Based** ribbon. These are used with paper and some synthetics. A very high quality image is produced but will scratch or smudge if subjected to abrasion or heat. **Resin-based ribbons** produce high quality images on paper and synthetics. The image is resistant to scratching, smearing, abrasion and will be unaffected by many chemicals and other harsh environments. Some combinations of synthetic and resin ribbon can withstand temperatures over 1000^{o}F. **Wax/Resin ribbons** have many of the features of wax and resin ribbons but at a lower cost than resin products.

Choose the adhesive

There are many adhesive types to match your requirements. These range from peelable to permanent, tamper evident and adhesives to enable labels to stick to refrigerated products, concrete and wood.

LABEL DESIGN SOFTWARE

If you need to print labels on Thermal Transfer / Direct Thermal printers a label design package such as LabelView can be used. This supports over 400 different bar code printers and over 300 Windows printers. It will allow you to easily design your label, insert text, bar codes and graphics in minutes.

PDA’S & HANDHELD COMPUTERS

PDA's and Handheld Computers

PDA's and Handheld Computers are used in bar code solutions when it is not practical to bring the computer to the data collection point. Their use generally replaces an existing paper based system. The terminal provides a convenient and efficient way of collecting data whilst away from the computer. When the data is collected and processed the data can be uploaded to the host system. Data can be collected in batch mode or utilise RF (Radio Frequency) for applications demanding real time access with the host computer.

When choosing a PDA/Handheld Computer you should consider the following characteristics.

Keyboard – the keyboard is one of the most prominent feature. The keyboard should be designed to suit the application. The keys should be large enough to be used accurately by the operator. For example, if the PDA/Handheld is to be used by an operator wearing gloves the keyboard should not be so small that incorrect keys may be pressed in error. Many keyboards offer numeric only, 'shifted' alphanumeric and numeric keyboard. In some applications it may be necessary to consider the amount of keyboard input.

Bar code scanner option – When considering the purchase of a unit the operation and handling should be a key decision in the selection process. The size and weight are also particularly important. Many devices are now smaller and lighter and have pistol grips specific to warehouse applications. 1D and 2D scanner options are now integral to most units. The difference is single or dual handed operation i.e. does the user need both hands to operate the bar code scanning equipment. Another consideration is the distance the operator be scanning the bar code

LCD display – This should be large enough to give meaningful prompts to the operator and display adequate data for validation purposes. Displays come in various sizes and most displays have a back light function so that the terminal may be used in poor light conditions.

Touch screen display - The display may also act as an input device. This pen-based interface is useful for form filling or applications that require signature capture. The operator does not rely on traditional push button controls but use a 'pen' stylus to hand write characters on the screen, touch select characters from a virtual keyboard or capture the operator's signature. Devices with touch screen displays are available in many different formats including varying display sizes and methods of input. These units may have a scanner built in, character recognition software and touch entry, ideal if the operator does not have keyboard skills.

The operating system – determines the method of programming, devices generally use a propriety operating system. Proprietary operating systems usually require a propriety programming language. The advantages of propriety operating systems is that they are designed specifically for data collection applications, require little processing power and are efficient when custom data collection applications are needed. Many manufacturers' now supply units with Windows Mobile or Windows CE operating system that will allow a programmer to develop an application in a language that they are familiar with.

Processor – the architecture of PDA/Handheld Computers are designed to suit the bar code data collection environment. The batteries would need to be higher powered, these would not last a full shift, the processor would need to be fan cooled making the unit bigger and hence less portable, more memory would be needed which would affect the price etc.

Batch data communications – once the data has been collected, how is it transferred to another system. This could be a batch process through a direct connect method using the RS232 serial link. Alternatively for remote batch communications data could be transferred over the telephone lines using a modem. The risk of losing data with a batch system is minimalised by frequent data downloads. With most batch systems users generally transfer data once or twice a shift for two reasons (1) to avoid the inefficiency of frequent trips to the office to upload and download the data and (2) transfer the collected data to the host in the unlikely event of a hardware failure.

Radio frequency data communication - is used to transfer data from a PDA/Mobile Computer to a host computer in real time. Real time means the data is captured and downloaded via radio in one instantaneous and seamless process. The devices communicate with the host computer via a base station connected directly or more typically the base station is connected to the Local Area Network.

Memory – The unit must be able to collect enough data to cover at least a single shift. For most applications 256MB of memory is sufficient to store a complete shift of data collection. 256MB is equivalent to over 20,000 EAN 13 digit bar codes. That's a lot of scanning! Nowadays many PDTs have a memory capacity of 512MB or larger. A memory capacity of this stature will only be involved in batch data collection applications where it is deemed necessary to download a large data lookup file to the Unit.

Operating environment – Where will the unit be used? Indoors, outdoors, hazardous environments or in cold stores? Scanners are available that will operate in temperature ranges from -25^{o}C to 50^{o}C.

IP Code

The **IP Code** (or **International Protection Rating**) consists of the letters *IP* followed by two digits and an optional letter. As defined in international standard IEC 60529, it classifies the degrees of protection provided against the intrusion of solid objects (including body parts like hands and fingers), dust, accidental contact, and water in electrical enclosures. The standard aims to provide users more detailed information than vague marketing terms such as *waterproof*.

The digits (characteristic numerals) indicate conformity with the conditions summarized in the tables below. Where there is no protection rating with regard to one of the criteria, the digit is replaced with the letter *X*.

For example, an electrical socket rated IP22 is protected against insertion of fingers and will not be damaged or become unsafe during a specified test in which it is exposed to vertically or nearly vertically dripping water. IP22 or IP2X are typical minimum requirements for the design of electrical accessories for indoor use.

First digit

The first digit indicates the level of protection that the enclosure provides against access to hazardous parts (e.g., electrical conductors, moving parts) and the ingress of solid foreign objects.

Level	Object size protected against	Effective against
0	—	No protection against contact and ingress of objects
1	>50 mm	Any large surface of the body, such as the back of a hand, but no protection against deliberate contact with a body part
2	>12.5 mm	Fingers or similar objects
3	>2.5 mm	Tools, thick wires, etc.
4	>1 mm	Most wires, screws, etc.
5	dust protected	Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment; complete protection against contact
6	dust tight	No ingress of dust; complete protection against contact

Second digit

Protection of the equipment inside the enclosure against harmful ingress of water.

Level	Protected against	Details
0	not protected	—
1	dripping water	Dripping water (vertically falling drops) shall have no harmful effect.
2	dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at an angle up to 15° from its normal position.
3	spraying water	Water falling as a spray at any angle up to 60° from the vertical shall have no harmful effect.
4	splashing water	Water splashing against the enclosure from any direction shall have no harmful effect.
5	water jets	Water projected by a nozzle against enclosure from any direction shall have no harmful effects.
6	powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects.
7	immersion up to 1 m	Ingress of water in harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time (up to 1 m of submersion).
8	immersion beyond 1 m	The equipment is suitable for continuous immersion in water under conditions which shall be specified by the manufacturer. NOTE: Normally, this will mean that the equipment is hermetically sealed. However, with certain types of equipment, it can mean that water can enter but only in such a manner that produces no harmful effects

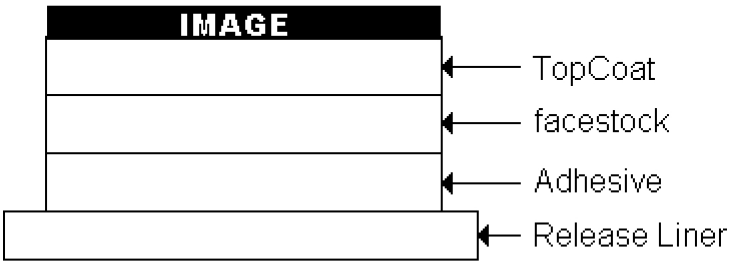
LABELS

Consumables – the key part of any identification system

It is important to remember that consumables are part of a total system, and the entire system needs to be taken into consideration before a selection is made. For example, one needs to consider what will be labeled, when it needs to be labeled and how long the label needs to last. While this may seem like a large task, the benefits that can be attained by understanding the complete solution will pay off in the long run.
Consumables are typically characterized as tags, labels, printing inks and ribbons. Tags and labels differ in that labels have a layer of pressure sensitive adhesive while tags are typically constructed of a facestock and a topcoat and are attached using some form of mechanical fastener.

Label Construction
Pressure sensitive labels typically consist of five components: a release liner, pressure sensitive adhesive, facestock, topcoat and an image, as detailed in Figure 1.

Figure 1: Cross Section of a Pressure Sensitive Label



The release liner is typically a paper or plastic film that is used as a carrier for the labels and also protects the adhesive from picking up dust and debris. The pressure sensitive adhesive is the layer that will ultimately make contact with the surface that needs to be identified.
The facestock can be thought of as the backbone for the label. It provides a surface for both the adhesive and the topcoat. The topcoat is that portion of the label that will provide the background for the image. And finally, there is the image itself.

Label components – adhesives

General considerations

One of the first things to consider when selecting a label stock is the type of pressure sensitive adhesive that is required. There are many issues to address during the selection process. A beginning list of questions is given below:

> To what type of surface will the label be required to adhere - glass, plastic, metal?
> What are the surface characteristics - smooth, rough, flat, curved, clean, or dirty?
> To what type of environment will the label be exposed? Humidity? Sunlight? What are the application and service temperatures?
> Will the labels be exposed to any chemicals?
> Does the label need a permanent, removable or reposition-able adhesive? Will the labels be automatically applied?
> Are there any regulatory requirements for the label - UL, CSA, FDA?
> What type of printing process will be used to image the labels - laser, thermal transfer, impact, ink jet, other?
> Are there any visual requirements for the adhesive?
> Are there any chemicals that are contamination concerns?

While this is not a totally inclusive list of considerations, it should provide a basic understanding of the common considerations necessary in adhesive selection.

Adhesive performance characteristics

Label manufacturers will typically refer to three characteristics about the adhesive: adhesion, tack and drop shear. The adhesion is a measure of how tightly the label adheres to the surface. Adhesion measurements are typically done under the ASTM D1000 test procedure. Test results are reported in lbs./in or oz/inch. The test involves laminating a one inch wide test strip to a panel (usually stainless steel but the exact nature of the test panel may vary for specific applications), allowing the test strip to dwell on the panel for 20 minutes and then reproducibly removing the test strip from the panel while the force required to accomplish this task is recorded. Adhesion values can vary widely depending on the type of surface. It is common to see typical values of 30 - 50 oz/inch for permanent acrylic adhesives on stainless steel test panels. The tack of an adhesive is a measure of how "sticky" the adhesive is. For example, pressing your fingers against the adhesive surface of duct tape and masking tape. Duct tape feels very sticky or tacky to the touch while masking tape does not feel as sticky. Tack values are typically measured in grams, and common values may range from 300 - 1500 grams/cm^2.

The final common measurement is that of drop shear. Again, there are standard industry tests designed to measure this property. This test is designed to measure the cohesive strength of the adhesive. The test involves laminating a small test strip (1/2" x 1") to a stainless steel panel and then applying a shear force to the test strip. This force is applied by physically suspending a 500 gram weight from the test tape. Unlike the adhesion and tack tests, this test does not measure force but rather the time that it takes for the adhesive to separate from the test panel.

Types of adhesives

There are three general classes of pressure sensitive adhesive: rubber, acrylic and silicone. Each class of adhesives can be further divided into permanent, removable and reposition-able adhesives.
Rubber- based adhesives are the oldest type of pressure sensitive adhesives (PSAs). Typical characteristics include good wet out on surfaces, high initial bond strength, limited temperature resistance, poor UV resistance, less solvent resistance than acrylics and low cost. Typical applications that are well serviced by these adhesives are names plates on textured plastics and curved surfaces as well as wire and cable markers.
Acrylic-based adhesives have a large product range and is probably the most widely used due to their broad range of properties. While the adhesive wet out may not be as good as rubber-based adhesives, the aging, weathering, clarity and temperature resistance greatly outperform rubber- based products. Typical applications include industrial tapes, product ID, graphics labels, and many work in process applications. The final class is that of silicone adhesives. Silicone adhesives have excellent solvent/water resistance, high temperature stability (above 350^{o}C), UV resistance and good performance at very low temperatures. However, in addition to these benefits, they are also accompanied by a high price tag. Typical applications are those that involve high temperatures including work in process applications.

Label Components - Release Liners

The release liner can be thought of as a carrier for the pressure sensitive labels and it does not come into contact with the object that the label will identify. Therefore, the general requirements for a liner are slightly different than that of an adhesive. Release liners are commonly paper or plastic films. Within each of these classes there are several sub classes. Typical liners range in thickness from 2 - 5 mils. Paper densities have been modified to provide the end user with products specific for improved die cutting and for automatic application characteristics.
It is critical to consider the interaction between the adhesive and the release liner when selecting a release liner. The label must release smoothly from the liner without tearing or stretching this protective sheet, this is particularly important in label applicator systems where the label is automatically removed from the liner.
The printing technology selected for use with the label will also help to steer the liner selection process. For example, some plastic film liners cannot be used in laser printers due to the fact that the film will melt when it encounters the high temperatures required at the toner fusion roll. Additionally, some paper liners may be unacceptable in specific applications such as clean room environments.
The recent past has seen the introduction of "linerless" labels. No release liner is required with this technology. Here, the label material is self-wound, eliminating the need for a separate release liner. While this eliminates the need for the liner, the technology is not yet capable of supporting many high performance materials.

Label Components – Facestocks

In most applications, the facestock selection is critical. This component of the label can be thought of as the skeletal system of the product and it will determine the tensile properties. A number of factors need to be considered including:

Service temperatures that the label must endure
Chemical resistance, what chemicals at what concentration UV
and humidity stability
Abrasion resistance
Type of printing system that will be used
Surface to which the label will need to adhere (smooth, rough, flat, curved) Tear resistance
Method of dispensing desired
Cost

There is a wide range of facestocks on the market today. In general they can be grouped into paper and film types. In the paper category there are coated and uncoated types, as well as natural and synthetics. Paper's advantages are that it can be easily printed using a variety of inks and is relatively low cost. However, paper has poor tear strength and abrasion resistance. Typical applications for paper-based labels include shipping and some warehouse identification labels.

The film category is much more diverse. They are a number of plastic materials that are available as films such as vinyl (PVC), biaxially-orientated polypropylene (BOPP), polycarbonate (PC), high density polyethylene (HDPE), low density polyethylene(LDPE), polyester (PET), polyethylenenaphthalate (PEN), polyvinylflouride (PVF), polyetherimide (PEI) and polyimide (PI) to name a few. The performance characteristics and cost of these materials is very wide spread. Table 2 contains a comparison of some of the common facestocks available today.

On the lower end of the performance and cost scale there is polyethylene. This film has good tear strength, chemical and abrasion resistance; however, the film stretches easily and can be difficult to die cut. Polyethylene labels are often encountered in packaging applications.

Polyester is towards the middle of the price scale. It has good tear strength and abrasion resistance, long term UV stability, dimensional stability and is available in clear, white and metalized versions. Polyester is a very common facestock in the industrial and medical labeling markets. Typical examples include, component ID, asset ID, and work in process.

Polyimide completes the high end of the price scale. This high performance film has excellent high temperature resistance and can typically be used for applications that require exposure to temperatures up to 600^{o} Fahrenheit. It has good tear strength, chemical resistance and dimensional stability; however, it has an amber color. One of the most common applications for this facestock is in the area of work in process for printed wiring assemblies.

Table 2: Relative comparison of typical facestocks.

Facestock	Tensile Strength	Chemical Resistance	Heat Resistance	Cost
Paper	Poor	Poor	Poor	Low
Polyethylene	Very Good	Very Good	Good	Low
Polypropylene	Excellent	Very Good	Good	Moderate
Vinyl	Poor-Good	Good	Fair	Moderate
Polyester	Excellent	Very Good	Very Good	Moderate
Polyvinylflouride	Excellent	Excellent	Good	High
Polyimide	Excellent	Excellent	Excellent	High

Label components – topcoats

Three components of a label have been discussed, the adhesive, the liner and the facestock. If the discussion were to conclude with these elements, the user would be able to purchase a label that would adhere to the desired surface, withstand the exposure to the environment but it may provide little or no value to the end user. This is due to the fact that many times in order to be useful; the label must be printed with some information. The topcoat is that portion of the label that allows for the information to be added to the label.
Topcoats can range from very thin clear coatings to rather thick-pigmented coatings. In some cases the topcoat may be used to apply a color to the label background; however, in most cases the primary purpose of the topcoat is to provide a receptive surface for the image. Just like the interaction between the adhesive and the release liner is critical, the topcoat and printing technology must be compatible. For example, a thermal transfer topcoat must be relatively smooth so that it can accept the THT ribbon ink, while an ink jet receptive topcoat needs to be porous to allow for controlled ink penetration.

Print Technologies

It may be surprising to learn that the type of print technology that one wishes to use or that is recommended is a key driving force in label selection. One must consider the range of questions that have already been addressed. For example, will the label be exposed to any chemicals that could attack the image? What temperature does the image need to withstand? And how long does the image need to remain legible?

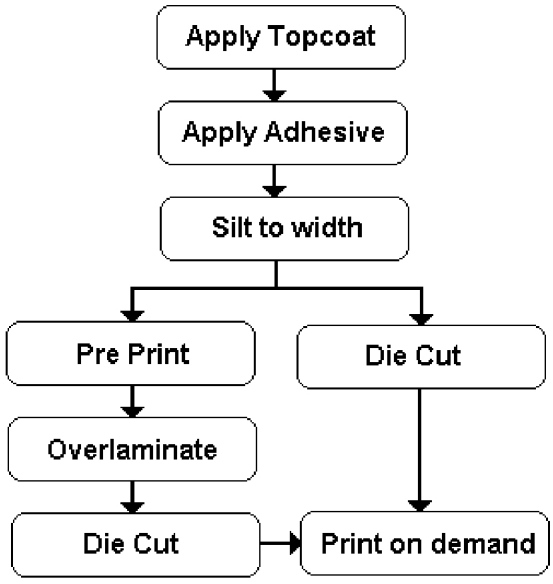
Over laminates

If the imaged label will be exposed to severe chemical or abrasive environments which are outside the scope of the chosen technologies limits, an over laminate can be used to add durability. Over laminates are typically a, clear film with a clear pressure sensitive adhesive. The over laminate can either be applied manually or form part of an automated application system after the image is printed when using in- house label production, alternatively it can be applied after the label has been imaged at the off site converting house.

Label Manufacturing Process

There are several steps in the manufacturing process for labels and the order of these steps may vary from one manufacturer to the next. One of the first steps is to apply the topcoat to the facestock. See Figure Two. Topcoats are typically fluid mixes that can be coated onto the facestock using a variety of coating techniques such as slot die, reverse roll, gravure, or flexographic coating. This coating is dried and cured onto the facestock.
The pressure sensitive adhesive is then applied to the opposite side of the facestock. This may be accomplished with a wet coating process using any of the techniques outlined above. Additionally, many manufacturers may use a process in which a previously dried "transfer adhesive" is laminated to the facestock. Both the topcoat and the adhesive coating processes are usually performed on material that ranges from 24" to 60" in width. Once the adhesive and topcoats are applied, the wide roll form material is slit or cut into smaller width rolls that will fit onto standard converting equipment. Typical widths are 4" to 18" depending on the material and equipment. The process of converting the narrow web roll form material into small labels is called die cutting. These presses can be rotary or flat bed. In this operation, a die is used to cut the labels into the desired dimensions. The labels remain on the release liner while the matrix or waste is removed. Many presses of this type also have the ability to add background color, constant copy, or serialization to the labels.

F**igure Two: Flow chart of the typical label manufacturing process**.

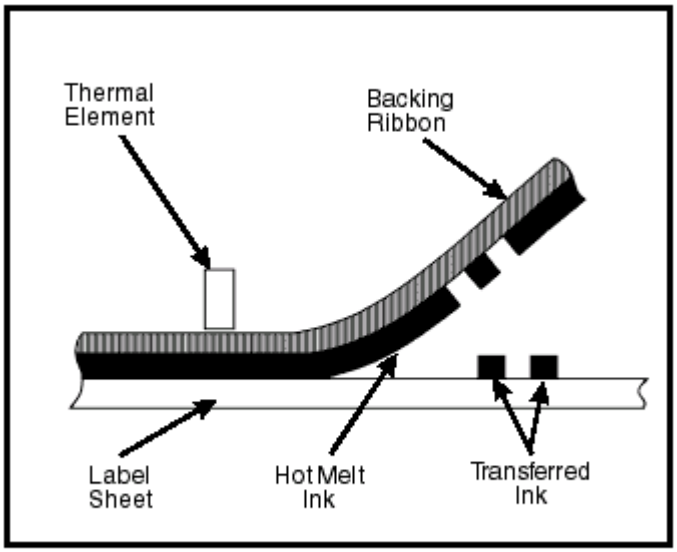


The type of converting process that is used will depend on the end user's application for the label. In some cases, labels may be die cut so as to allow the label to be used more effectively in automatic application equipment. In other cases, the labels made are sheeted so that they can be used in a laser printer. After conversion, the labels are inspected, packaged and shipped to the end user. If the end user is going to be printing labels on demand, the end user will complete the manufacturing process by running the labels through a printer to apply the required identification information.

THERMAL TRANSFER RIBBONS

THERMAL TRANSFER RIBBONS

Thermal transfer ribbons consist of a protective back coat, a film and ink. The ribbon protects the printhead from abrasion. As the heat generates from the printhead, the film provides thermal conductivity for the ink whilst as the same time prevents the ink from smearing.



Thermal Transfer Printing

Thermal transfer ribbons can be spilt into 3 basic categories. The most popular and lowest in comparative cost is the Wax-Based ribbon. These are used with paper and some synthetics. A very high quality image is produced but will scratch or smudge if subjected to abrasion or heat. Resin-based ribbons produce high quality images on paper and synthetics. The image is resistant to scratching, smearing, abrasion and will be unaffected by many chemicals and other harsh environments. Some combinations of synthetic and resin ribbon can withstand temperatures over 1000F. Wax/Resin ribbons have many of the features of wax and resin ribbons but at a lower cost than resin products.

- Wax – Generally used for paper labels only. Does not produce a stable image. Can be easily smudged.
- Wax / Resin – Generally used on paper labels. Produces a stable image and not easily smudged.
- Resin – Generally used for Synthetic labels. Produces a stable image. The ink actually becomes part of the labels.

  Certain brands of resin ribbon also have chemical resistance.

Advantages of Thermal Transfer

- On demand label printing
- Print 1 label at a time
- Designed to print high quality barcodes
- Fast – up to 12” per second
- Prints on many material types
- Can take different combinations of materials to solve problems