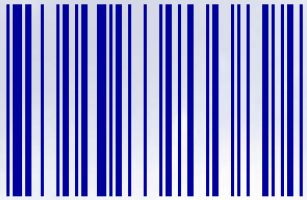
Bar Code Scanning



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Bar Code Scanning

Firstly,

What is a bar code?

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Bar Code Scanning

Firstly,

What is a bar code?

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By definition, a bar code is a machine-readable representation of information (usually in dark ink on a light background, to create high and low reflectance) which when read is converted in to a series of one's and zero's, (i.e., data).

Originally, barcodes only stored data according to the width and spacing of a series of parallel printed lines, but today they also come in patterns of dots, concentric circles, and text codes hidden within images

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Barcodes can be read by optical scanners called barcode readers using laser light, or scanned from an image taken by what is basically a camera, and then read by special software.

Barcodes are widely used to implement Auto ID Data Capture (AIDC) systems that improve the speed and accuracy of computer data entry.

Essentially, providing that the bar code is coded in the first place with the correct data, when being read, due to the maths employed in producing and then reading the bar code, it is almost impossible that the data will not be read correctly.

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The first patent for a bar code type product (US Patent #2,612,994) was issued to the inventors Joseph Woodland and Bernard Silver.

As the patent was issued on October 7, 1952 it is now widely felt that bar coding is a mature technology.

The implementation was made possible through the work of Raymond Alexander and Frank Stietz, two engineers with a company called Sylvania (who were also granted a patent), as a result of their work on a system to identify American railway carriages.

It was not until 1966 that barcodes were put to commercial use although they were not commercially successful until the 1980s

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Traditionally barcode coding schemes only used numbers.

Newer barcode symbologies add new characters, including uppercase letters, or even the complete ASCII character set.

The drive to encode more information in combination with the space requirements of simple barcodes led to the development of matrix codes (a type of 2D barcode), which do not consist of bars but rather a grid of square cells.

Stacked barcodes are a compromise between true 2D barcodes and linear codes (also known as 1D barcodes), and are formed by taking a traditional linear bar code and placing it in an 'envelope' that allows multiple rows of linear bar codes.

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Since their invention in the 20th century, barcodes — especially the UPC bar code, have slowly become an essential part of modern civilisation.

Their use is widespread, and the technology behind barcodes is constantly improving.

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Bar Code Scanning

Practically every item purchased from a grocery store, department store, and mass merchandiser has a barcode on it.

Document Management tools often allow for barcoded sheets to facilitate the separation and indexing of documents

Item movement, including rental cars, airline luggage, nuclear waste, mail and parcels.

Tickets now have barcodes that need to be validated before allowing the holder to enter sports arenas, cinemas, theatres, fairgrounds, transportation etc.

Used on vehicles, they can be located anywhere, front or rear, on many parts of the vehicle.

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The best-known and most widespread use of barcodes has been on consumer products.

The UPC symbol is a response to a business need first identified by the US grocery industry in the early 1970's.

The first agreed version of a 'standard' barcode was the Universal Product Code and the U.P.C. barcode symbol on April 1, 1973.

IBM also designed five versions of the UPC symbology for future industry requirements — UPC-A, B, C, D, and E.

The U.P.C. bar code made its first commercial appearance at the Marsh Supermarket in Troy, Ohio in June 1974.

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Economic studies conducted for the grocery industry committee projected over $40 million in savings to the industry from scanning by the mid-1970's.

Unfortunately, the reality was that due to the cost of the device(s) to actually read the barcode, the uptake did not happen, and the projected costs were merely that……

For the time being.

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The mapping between messages and barcodes is called a symbology.

The specification of a symbology includes the encoding of the single digits and characters of the message as well as the start and stop markers into bars and spaces.

The specification also includes the size of the quiet zone required to be present both before and after the barcode as well as the computation of a 'checksum'.

The checksum is a calculated figure that proves to the scanning equipment that all of the bar code has been read.

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Bar Code Scanning

Linear symbologies are optimized to be read by a laser scanner, which sweeps a beam of light across the barcode in a straight line, reading a **slice** of the bar code light-dark patterns.

In the 1990s development of CCD imagers to read bar codes was pioneered by Welch Allyn (later to become Hand Held Products, now part of Honeywell Imaging.

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Bar Code Scanning

Imaging does not require moving parts, like a laser scanner does.

In 2007, linear imaging was declared to have surpassed laser scanning as the preferred scan engine due to its performance and durability.

Stacked symbologies are also optimized for laser scanning, with the laser making multiple passes across the barcode.

2-D symbologies cannot be read by a laser as there is typically no sweep pattern that can encompass the entire symbol.

They must be scanned by a camera capture device.

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Bar Code Scanning

Bar Code Verification(Pika inspection)

Barcode verifiers are primarily used by businesses that print barcodes.
Any business in the supply chain should test its barcode quality.

It is important to "grade" a barcode to ensure that *any* scanner used in the supply chain can read the barcode.

Retailers use the bar code for Point Of Sales (POS) activity.

This means that the bar codes used to identify products MUST be the best quality that can be produced.

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Bar Code Scanning

Barcode verifiers work in a way similar to a scanner but instead of simply decoding a barcode, a verifier performs a series of eight tests.

Each test is given a grade from 0.0 to 4.0 (F to A) and the lowest result of any of the tests is the scan grade.

For most applications a 2.5 (C) grade is the minimum acceptable grade.

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Bar Code Scanning

In point-of-sale management, the use of barcodes can provide detailed up-to-date information on key aspects of the business, enabling decisions to be made much more quickly and with more confidence.

For example:

Fast-selling items can be identified quickly and automatically.

They can be reordered 'on the fly' to meet consumer demand.

Slow-selling items can be identified, preventing a build-up of unwanted stock,
The effects of repositioning a given product within a store can be monitored, allowing fast-moving more profitable items to occupy the best space,

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Historical data can be collated. It can then be used to predict seasonal fluctuations very accurately.

Items can be re-priced whilst on the shelf to reflect both sale prices and price increases – and decreases!

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Besides sales and inventory tracking, barcodes are very useful in shipping, receiving, and item tracking.

When a manufacturer produces an item, a Unique Identifying Number (UID) can be assigned to the item or the packaging.

A relational database can be created to relate the UID to relevant information about the box; such as order number, items packed, qty packed, final destination, etc…

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The information can be transmitted through a communication system such as Electronic Data Interchange (EDI) so the retailer has the information about a shipment before it arrives.

Tracking, when shipments are sent to a Distribution Center (DC) before being forwarded to the final destination.

Finally, when the shipment gets to the final destination, the UID gets scanned, the recipient knows who and where the order came from, what is inside the box, and most importantly –

How much to pay you, the manufacturer of the goods.

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Bar Code Scanning

The reason that bar codes are business friendly is that bar code scanners are, compared to the 1970's, relatively low cost.

Most importantly, they are extremely accurate –

Only about 1 in 100,000 entries will be wrong.

This equates to a figure of 0.001%

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Bar Code Scanning

Code 39 (also known as "Code 3 of 9")
Is a barcode symbology that can encode uppercase letters (A to Z), digits (0 to 9) and a handful of special characters like the American $ sign.

The barcode itself does not contain a check digit (in contrast to the Code 128), but it is considered self-checking on the grounds that a single erroneously interpreted bar cannot generate another valid character.

The most serious drawback of Code 39 is its low data density:
It requires more space to encode data in Code 39 than, for example, in Code 128.
This means that very small goods cannot be labeled with a Code 39 based barcode. However, Code 39 is still widely used and *can* be decoded with virtually any barcode reader.

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Bar Code Scanning

Code 128

- is a very high-density barcode symbology, used extensively world wide in shipping and packaging industries.

- It is used for alphanumeric or numeric-only barcodes.

- It can encode all 128 characters of ASCII coding and is also capable of encoding two numbers into one character width, called double density.

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- This feature is evidence of it being designed to reduce the amount of space the bar code occupies, to address the ever-increasing needs of item catalogs.

- Each printed character can have one of three different meanings, depending on which of three different character sets are employed.

- Code 128 is the major component of the labeling standard for GS1-128 (formerly known as UCC/EAN-128), used as product identification for container and pallet levels of retail markets.

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Interleaved 2 of 5
Is a continuous two-width barcode symbology encoding digits.

I2/5 encodes pairs of digits; the first digit is encoded in the five bars (the "black lines"), while the second digit is encoded in the five spaces interleaved with them (the "white lines").

Before the actual pairs there is a start code consisting of 4 narrow lines, and after all symbols there is the stop code consisting of 1 wide line followed by 3 narrow lines.

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As only an even number of digits can be encoded, a 0 is added as first digit. Sometimes an odd number of digits is encoded by putting five narrow spaces in the last pair.

A checksum can be added as last digit, which is calculated in the same way as UPC checksums.

There are very specific constraints on the height and width of the bars and the width of the "quiet areas", the blank areas before the start and after the stop symbol.

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Bar Code Scanning

PDF417 is a stacked linear bar code symbol used in a variety of applications, primarily transport, identification cards, and inventory management.

PDF stands for Portable Data File.

The PDF417 format was developed by Symbol Technologies, now part of the Motorola group.

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Bar Code Scanning

A **Data Matrix** code is a two-dimensional matrix barcode consisting of black and white square modules arranged in either a square or rectangular pattern.

The information to be encoded can be text or raw data. Usual data size is from a few bytes up to 2 kilobytes.

The length of the encoded data depends on the symbol dimension used.

Error correction codes are added to increase symbol strength: **even if they are partially damaged, they can still typically be read.**

A Data Matrix symbol can store up to 2,335 alpha - numeric characters.

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Bar Code Scanning

The most popular application for Data Matrix is marking small items, due to the code's ability to encode fifty characters in a symbol that is readable at a size of 2 or 3 mm^2 and the fact that the code can be read with only a 20% contrast ratio.

The Electronic Industries Alliance (EIA) recommends using Data Matrix for labeling small electronic components.

Data Matrix codes are part of a new traceability drive in many industries, particularly the aerospace industry where quality control is tight and a black market exists for counterfeit or non-serviceable parts.

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Data Matrix codes (and the accompanying alpha-numeric data) identify details of the component, including manufacturer ID, part number and a unique serial number.

The United States Department of Defense aims to have all components of every new aircraft identified by Data Matrix codes.

Data Matrix forms the basis of the Direct Part Marking (DPM) projects currently under way by parts manufacturers, etc.

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Bar Code Scanning

Direct Part Marking (**DPM**)
Is a process to permanently mark parts with a barcode.

It is done to allow the tracking of parts through their full life cycle.

But, the interpretation of 'permanent' often depends on the context the part is used.

In the aerospace industry an aircraft part may be in service for over 30 years. Within telecom and computer industries the life cycle may only last a few years.

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DPM is often used by automotive, aerospace, and electronic manufacturers to facilitate a reliable identification of their parts.

This can assist in data logging for safety, for warranty issues and to satisfy regulatory requirements.

Also the United States Department of Defense demands a physical mark on tangible assets in conjunction with the Item Unique Identification.

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Methods to produce a permanent mark on parts are:

Casting or moulding into the material
Dot peen
Laser-Shot peening
Abrasive blasting
Electro-chemical etching
Engraving/milling
Laser marking

Adhesive dispensing
Stencil (mechanical cut, photo process, laser cut)
Embroidery

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- Non-intrusive marking methods are recommended for parts used in safety critical applications.

- It is more difficult to place a Data Matrix on a curved surface than it is on a flat surface.

- Highly polished metal surfaces should be textured to reduce glare prior to marking. The textured area should extend one symbol width beyond the borders of marking.

- When a 2D Symbol is used, the size of the part is not a relevant factor as the available marking area is reduced to below 1/4 inch square

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- The operating environment should be controlled, the marking method should survive in its intended environment and remain readable for the life cycle of the part.

- A rough surface is not suitable for a 2D barcode as the data elements can be recognized appropriately. The surface roughness levels should be limited to 8 micro-inches.

- Surface thickness must be taken into account when applying intrusive markings to prevent deformation or excessive weakening of the part. In most applications the marking depth should not exceed 1/10 the thickness of the part.

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Bar Code Scanning

So,

How do we actually do this?

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- Barcode Scanners and image based data capture devices (inc DPM & UV).

Typically, these will be connected by BT (Bluetooth) nowadays, to a base station, or by a direct cable to the controlling PC.

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Bar Code Scanning

Rugged mobile computers.

Again, these will use a BT connection or a cable connection.

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Bar Code Scanning

Production line scanning:

Because of the design of the hardware, these will typically use a cabled connection to the host serving the scanner.

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Bar Code Scanning

Mobile / Hand Held Data Terminals.

Whereas here, the device has the scanning ability built in, and it also has the network connectivity to send the data to the host device.

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Bar Code Scanning

And how do we get the items labelled?

Basically, it depends finally on what the application /device / product that is required to be labelled.

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If the product is smooth, flat, clean, dry, etc, then a self adhesive label can be applied.

This can be paper based, it can be paper based using thermal paper, it can be manufactured on plastic, it can even be produced using foam 'tape'.

It can also be printed onto a plastic tag and then affixed to the product, using a cable (zip) tie if the product is to be shipped as a bundle of the product.

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Depending on the technology to be used for the actual label, the printing media may also be in use already ……

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Bar Code Scanning

For any information on Bar Code Scanning, Scanning Applications, or Labelling, please call Spirit Data Capture Ltd:

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Fax:	0870 762 2824

Spirit Data Capture can also supply the hardware required for you to Bar Code your products.

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