



## A Practical Barcode Introduction

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## **About Rugged and Mobile**

### **What do we do?**

Rugged and Mobile develops mobile, data and web solutions, delivering into the rugged, enterprise and consumer mobile markets. Offering end to end solutions our services include:

- Hardware reselling of rugged and mobile devices, selling anything from barcode readers to Windows mobile phones and supporting them.
- Bespoke software consultancy, delivering tailored software and project management into businesses. We deliver both Microsoft and Apple iPhone solutions.
- SOA/SaaS solutions, serving businesses and individual customers with new, exciting and flexible mobile services.

### **Our Culture**

Rugged and Mobile is a newly founded company. We understand how to run a tech company right and how to treat the people within it. We work hard, we play hard and mostly the two are the same thing!

### **Company Vision**

We want to become the leading UK provider of mobile solutions. We intend to do this by keeping at the forefront of mobile and data capture technologies, by providing excellent service to our customers and by employing the right people who can help deliver our vision.



## **Understanding Barcodes Introduction**

Hi there, so this article will be about barcodes. It's a popular subject for us and one that many people have asked me to help them with. Barcodes to Rugged and Mobile are what sandwiches are to the rest of us. We live off them whether it's for brekky, lunch or sometimes tea!

This article is designed to be high level and give the average barcode scanning buyer some good information in order to buy and implement the right barcode system. We'll be leaving all the technical stuff like check bits, parity and the plethora of device settings to another discussion.

Barcodes in a nutshell are about being able to identify something. It could be a product where just the type of product is needed for a price. It could be to track an asset of some kind where identifying a unique piece of equipment is required or it could be for something more generic where fast/convenient entering of data is required. For example I have seen a rudimentary tracking system where a security guard will scan a barcode on various doors to simply confirm he had been there on his watch.

If you have a requirement to quickly ID and track something then a barcode has been and still is a pretty good way of doing it.

## **Why use barcodes?**

Despite barcodes being around for decades and having a shaky technical start to its life, barcodes still remain the most reliable, inexpensive and easy to implement system of identification. When compared to younger more functional auto ID technology such as RFID (see my next article), the hardware acquisition costs alone are still streets apart. A barcode costs well under 1 pence to generate, you can generate it using pretty much any printer on the market and it can be read by cheap equipment. Most mobile Enterprise phones these days can read barcodes simply using the built in camera along with a simple piece of software.

RFID on the other hand, costs a lot more on average putting its fantastic functionality out of reach of many projects for the time being.

## **Barcode labels**

Just a quick mention at this point that you can print your barcodes on almost anything and there are 1000's of types of labelling you can use. There are standard paper labels, labels for normal every day printers, labels for purpose barcode printers like the Zebra QL range for example. You can print on tear proof, water proof, fade proof (Or purpose fading) media to name but a few and there are many companies including Rugged and Mobile who you can get your media from as well as outsource your printing to.

The market is at the stage now where it is very cheap and easy to set up a barcoding solution as long as you know the pitfalls like we do here!

One word of warning is that all barcodes need to follow a strict set of rules regarding their size, contrast and structure. If your barcodes are too light, printed too small or not standards compliant in any way then the chances are you will have great difficulty when scanning them.

Bar code scanning devices don't use magic to scan a barcode, they use technology and as such you need to make sure that your barcodes are printed correctly.

### **The history of the barcode**

Before we go on I wanted to mention briefly the history of barcoding. Barcodes were originally developed and used in the US in the 1960's by the railroad companies to automatically identify their train wagons. However the project ended up a failure and it wasn't until the mid 80's where supermarket pressure to reduce their supply chain costs sanctioned a barcoding project that would change identification forever. It still resembles pretty much what we see today in the shape of the UPC barcode. The first ever barcode scan was performed on a stick of Wrigley's juicy fruit chewing gum in 1974 and ever since then barcodes were slowly but surely adopted by more and more businesses and markets.



It wasn't long before IBM designed various versions of the UPC barcode in order to help it find its feet in different markets and new ones are still being developed today. Let's look at some of the different types of barcode in the market today.

### **Barcode Symbologies**

There are many different type of barcodes used today, approximately 40-50 world-wide, known as barcode symbologies. Some are tightly governed like ISBN or EAN codes used for book reference and others are freely usable open source like Semacode or QR Code and the rest fall into the middle somewhere. Essentially 3 different formats of barcode are used in industry with new versions being added all the time. The most common types are:

#### **1D or linear barcodes**

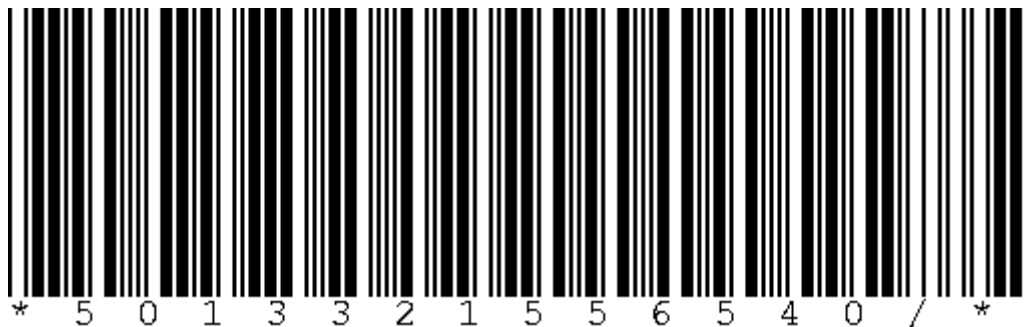
Still by far the most commonly used symbology and you see them everywhere! They're used on most products you buy at the supermarket and come in a variety of sub categories. However they're all essentially black lines of varying thickness and can be read by almost all types of scanner. The main limitation of this symbology is the limit to the amount of data that can be stored inside the barcode and we can see this demonstrated below.



A typical UPC-A barcode storing a unique number.

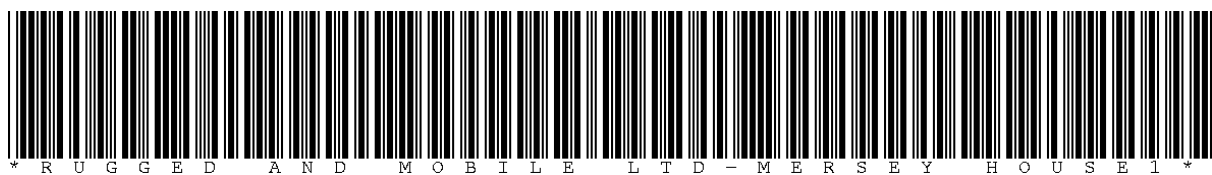
Looks OK doesn't it? However this barcode format only allows us to store numerical data and spaces. Pretty restrictive these days so other standards are launched to provide more functionality.

Code39, for example can store capital letters, digits 0-9 some symbols and space characters. Much better but there's a cost to all this:



The barcode requires more lines to store each character and it grows in size. Already this barcode is pretty unusable in certain applications.

If we were to store information in this barcode such as an address things rapidly become madness!



This has been reduced in size by about 50% and only shows limited address data.

Not particularly usable is it and even using other barcode formats you'll quickly run into the same issue.

So what am I trying to demonstrate here is that 1D barcodes still have a great use in the ID arena where an ID is required on the asset you are tracking. Products still use UPC in some manner and Code 39, 93 128 and others are widely used too.

The parcel delivery world however demonstrates perfectly a limitation to the 1D barcode. What if you need to store more information on the parcel itself? In the case of parcel delivery it is common that a parcel has to go through various delivery companies, all with proprietary and incompatible IT

systems. Scanning a 1D barcode for the ID would make sense for 1 company but would probably make little sense to the others. So to get round this many use 2D barcodes that can store much more data, the address for instance, so that if all else fails each company has a chance at automating delivery in some way.

### **2D “stacked” barcodes**

As the need to store more information in the barcode increased, the 'stacked' barcode became more popular. This barcode looks like a 2D barcode (see next) but it is essentially just a bunch of 1D barcodes “stacked” on top of each other. This meant that for instance a name and address details could be stored in a barcode, where it would have been impossible before. These barcodes can still be read by most laser or CCD based scanners by dragging the scan line down as you scan, depending on the scanner’s software or set-up.



The above actually stores our whole address in it in a 4 column PDF417 2D barcode. You’ll see these barcodes frequently used in the parcel delivery trade where the need to store data with the parcel is required. In fact you usually see a whole range of barcodes on a parcel as different ones are used for the identification process as are used for simply storing more data for the delivery drivers.

The need to store even more information within the same space, along with attempts to secure the data have given rise to the 3<sup>rd</sup> main barcode symbology, the Matrix barcode.

### **2D Matrix barcode**

Again commonly seen and used on parcel delivery labels and adopted by the Japanese in full force, the 2D Matrix barcode can store even more data and are typified by their blocky almost artistic nature! You need a 2D scanner to read these types of barcodes.

The below shows QR Code and Aztec 2D barcodes storing the same full address data:



You can store much more in these types of barcode with efficient increases in size.

### **Postal barcodes**

These are the last barcode type we’ll mention here. They’re now on every letter you receive and are the odd black or bright orange lines you see on the front of your letters.

The below barcode is our postcode translated into Royal Mail 4 state customer code(RM4SCC):



Primarily developed for the mail sorting machines to identify letters better, there are an increasing number of handheld scanners and PDA's that can now read them opening up a whole bunch of new opportunities for letter identification post delivery.

There are more barcode symbologies but they pretty much fall into all the above categories apart from a few such as Microsoft's Tag barcode that uses colour to store a whole new dimension of data depth. However it is the opinion of Rugged and mobile that by the time a lot of these standards could be adopted, RFID and other newer technology could end up killing them off so it'll be interesting watching them but inevitably other technologies will take over.

### **How do barcodes work and how do we scan them?**

So, we have generated lots of barcodes. Stuck them on all our assets but how do we now make use of this newly installed technology? Well we now need to scan them!!

From reading Manufacturers data sheets you would be forgiven for thinking that there are many different types of scanning technologies available. However whilst actual components and specification/sensitivity of components will differ, scanning types largely break down into a few categories.

#### **Laser Technology**

This is probably still the most common scanner type and you will all have seen the typical red laser light that these devices emit when being used. This method uses photodiode technology and the reading device has a light sensing photodiode inside it. The laser light is 'thrown' from the scanner typically using a moving mirror and more powerful light source so that you can scan barcodes from a distance and at an angle and the reflected light is captured on the diode. Where the laser falls on black lines, most of the light will be absorbed by the barcode and not reflected back creating a pattern of absorption on the diode that is represented by a voltage. This is measured and deciphered by the scanning device.

#### **Contact Technology**

Pen readers or scanners that require you to actually touch the barcode to read it, use the same light source and a photodiode to sense where light is absorbed as the laser read above. Whilst essentially the same technology as the laser read above, it is a little bit different because it can use LED or laser light due to the reduced distance from the barcode. Still quite common, you'll see these scanners in libraries, some shops and in conditions where the ambient light is high enough to create problems for scanners that scan over a distance.

#### **CCD or LED Technology**

This type of scanner uses an array of hundreds of tiny light sensors. It's like having 100's of photodiodes all lined up in a row. The difference from the above 2 methods is that CCD readers measure the actual light from the barcode, whereas Laser scanners measure reflected light at a frequency that comes from the scanner.

#### **Camera based technology**

The newest types of scanners use a small video camera to capture an actual image of the barcode and this way more complex 2D barcodes can be captured and read. It's similar technology to that used in CCD/LED however this time there is a 2D array of sensors picking up the image, not just 1 row. Complex image processing algorithms are then used to decipher a large range of barcodes.

The rule of thumb is that contact scanners tend to be the cheapest and then the scanners get more expensive as you go down the above list above. However a CCD or camera based scanner can usually scan everything that a scanner using Laser technology can plus all the ones that it can't.

Because of the nature of camera based technology it allows complicated and new algorithms to be developed to read more and more types of barcodes. We see "fuzzy" logic scanners, the ability to scan from larger distances, close distances and a plethora of post capture encoding processes all designed to be better than before. Whilst this will teach you of the basic technology used today, you still need to talk to an expert to ensure that you are using the most efficient design of scanner available to you.

### **A look to the future**

The future bodes well for barcodes as the technology continues to adapt to new social needs whilst maintaining low costs to implement. We are still seeing new symbologies launched. Postnet is now the staple barcode for postage and in the past 18 months we have seen more and more handheld devices reliably reading it which opens up fantastic new opportunities.

Microsoft and Nokia are using barcode technology, along with your location so that you can scan a poster, say a movie poster, which will take into account your location and then automatically download information to your phone based upon this. In fact we're working with someone right now on this very technology and i've tested it and it's pretty cool to be able to scan a barcode on a poster and quickly get information on the product as well as the nearest retailers and a coupon for my troubles!!

Barcodes look set to stay for the near future at least!

### **Wrapping up**

So.....That was barcodes in a nutshell. Hopefully you should now have a good idea at what you can do with a barcode and what you need to scan it and hopefully those manufacturer spec sheets should make a little bit more sense to you now!

The technology is ever expanding which means there is always something new to learn. As always Rugged and Mobile is here to help so if you're looking for help on barcodes why not post the question in our forum, or comment on our blogs or if you're in the process of buying or renewing your technology then give us an email or a call and we'll make sure you get the right advice.

Bye for now!