food management systems

# INTRODUCTION TO BARCODE TECHNOLOGY

A Bar Code allows data to be collected rapidly and with extreme accuracy. Bar codes provide a simple and easy method of encoding text information in a printed symbol that is easily read by inexpensive electronic readers. A typical bar code consists of a series of parallel, adjacent bars and spaces. Pre-defined sets of bar and space patterns (symbologies) are used to represent individual characters in a printed symbol similar to the way Morse code encodes characters using audible dots and dashes.

There are a variety of different bar code symbologies, each of which were developed to fulfill a specific need. Different symbologies have different capabilities for encoding data. For example the UPC symbology used to identify retail products always contains 12 numeric digits whereas the general purpose Code 39 or Code 128 bar code symbologies can encode variable length alphanumeric data up to about 30 characters in length.

Most commercially available bar code scanners are able to read all of the different linear bar code symbologies therefore you do not need different readers for different types of bar codes.

**How A Bar Code Reader Works**

A bar code scanner decodes a bar code by scanning a light source across the bar code and measuring the intensity of light reflected back. The pattern of reflected light produces an electronic signal that exactly matches the printed bar code. This signal is then decoded into the original data, it does not make any difference if you scan a bar code from right to left or from left to right. Special start and stop patterns are used to indicate which end of the bar code is the beginning and which is the end.

The factors that make a bar code readable are: an adequate print contrast between the light and dark bars and having all bar and space dimensions within the tolerances for the symbology. It is also helpful to have sharp bar edges, few or no spots or voids, a smooth surface and clear margins or quiet zones at either end, and top and bottom of the printed symbol.

Because of the way a bar code reader works, it is extremely important that the widths of all bars and spaces are printed within precise tolerances. If the width of a single bar or space is just slightly off, it can cause a bar code symbol to be unreadable.

**Bar Code Dimensions**

Because of differences in the design of each bar code symbology, there are differences in the way that the dimensions for each symbology are expressed. For most linear bar code symbologies, the two main dimensions used to define the size of most bar codes are the Narrow Bar Width and the overall Bar Height. The Height is generally less important than the

Narrow Bar Width and you can scale the height to any size that you like. For the sake of readability the height should not be less than a quarter of an inch or 15% of the total width of the symbol, whichever is greater.

**How To Produce Readable Bar Codes**

Black bars on a white background yield the best results. If you intend to use colored bar codes or colored paper, you should always test the readability of your bar codes before committing to a color scheme. Another important consideration is that there should always be a small amount of space or Quiet Zones preceding and following the bar code so that the reading device is able to properly determine the true start and end of the bar code symbol. A good rule of thumb is to reserve at least a quarter of an inch or 10 times the width of a single narrow bar (whichever is greater) for blank space at either end of a bar code.

You should try to avoid very small or very large bar codes, both narrow bar widths and overall bar code dimensions. As a precaution you should always test your printed output with whatever bar code reading equipment you eventually intend to use.

**CODE 39 (Normal, Full ASCII and HIBC versions)**

The Normal CODE 39 is a variable length symbology that can encode the following 44 characters: 1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ-. *$/+%. Code 39 is the most popular symbology in the non-retail world and is used extensively in manufacturing, military, and health care applications. Each Code 39 bar code is framed by a start/stop character represented by an asterisk (*). The Asterisk is reserved for this purpose and may not be used in the body of a message. The FULL ASCII version of Code 39 is a modification of the NORMAL (standard) version that can encode the complete 128 ASCII character set (including asterisks). Some bar code readers support a feature of Code 39 that allows for concatenation of two or more bar codes so that you can break long messages into multiple, shorter, symbols.

**UPC-A, UPC-E, and UPC Supplementals**

UPC-A is a 12 digit, numeric symbology used in retail applications. UPC-A symbols consist of 11 data digits and one check digit. The first digit is a number system digit that usually represents the type of product being identified. The following 5 digits are a manufacturers code and the next 5 digits are used to identify a specific product. UPC numbers are assigned to manufacturers by the Uniform Code Council (UCC).

UPC-E is a smaller, six-digit UPC symbology for number system 0. It is often used for small retail items like sweets and cigarettes.

**EAN-8 / EAN-13, and EAN Supplementals**

EAN or European Article Numbering system (also called JAN in Japan) is a European version of UPC. It uses the same size requirements and a similar encoding scheme as UPC codes. EAN-8 encodes 8 numeric digits consisting of two country code digits, five data digits and one check

digit. EAN-13 is the European version of UPC-A. EAN bar code numbers are assigned to specific products and manufacturers by an organization called GS1.

**BookLand**
EAN-13 has been adopted as the standard in the publishing industry for encoding ISBN numbers on books. An ISBN or BookLand bar code is simply an EAN-13 symbol consisting of the first 9 digits of an ISBN number preceded by the digits 978 and terminated with a standard EAN check digit.

**CODE 93**
CODE 93 is a variable length symbology that can encode the complete 128 ASCII character set. Code 93 was developed as an enhancement to the CODE 39 symbology by providing a slightly higher character density than CODE 39.

**CODABAR**
CodaBar is a variable length symbology that allows encoding of the following 20 characters: 0123456789-$:/.+ABCD. CodaBar is commonly used in libraries, blood banks, and the air parcel business.

**INTERLEAVED 2 OF 5 (ITF)**
Interleaved 2 of 5 is a high-density variable length numeric only symbology that encodes digit pairs in an interleaved manner. The odd position digits are encoded in the bars and the even position digits are encoded in the spaces. Because of this, Interleaved 2 of 5 bar codes must consist of an even number of digits.

**CODE 128**
Code 128 is a variable length, high density, alphanumeric symbology. Code 128 has 106 different bar and space patterns and each pattern can have one of three different meanings depending on which of three different character sets is employed.

**EAN/UCC 128**
The EAN/UCC 128 symbology is a variation of the original Code 128 symbology designed primarily for use in product identification applications.

**POSTNET**
POSTNET (Postal Numeric Encoding Technique) is a 5, 9 or 11 digit numeric only bar code symbology used by the US Postal Service to encode ZIP Code information for automatic mail sorting. POSTNET is unlike other bar codes because data is encoded in the height of the bars instead of in the widths of the bars and spaces.

**PDF417**
PDF417 is a high density 2 dimensional bar code symbology that resembles a stacked set of smaller bar codes. The symbology is capable of encoding the entire (256 character) ASCII or ANSI character set. PDF stands for "Portable Data File" because it can encode as many as 2710

data characters in a single bar code.  A PDF417 bar code symbol consists of multiple rows of data encoded in units called code words.  Each symbol can contain from 3 to 90 rows and each row consists of a Start/Stop pattern and from 3 to 32 code words (1 to 30 code words for data and 2 for Right and Left Row Indicators). The smallest element in a PDF417 symbol is called a module.

**Aztec Code**

Aztec Code is a high density 2 dimensional matrix style symbology that can encode up to 3750 characters from the entire 256 byte ASCII character set. The symbol is built on a square grid with a bulls-eye pattern at its centre. Data is encoded in a series of "layers" that circle around the bulls-eye pattern. Each additional layer completely surrounds the previous layer thus causing the symbol to grow in size as more data is encoded. Aztec's primary features include: a wide range of sizes allowing both small and large messages to be encoded.

**Data Matrix**

Data Matrix is a high density 2 dimensional matrix style bar code symbology that can encode up to 3116 characters from the entire 256 byte ASCII character set. The symbol is built on a square grid arranged with a finder pattern around the perimeter of the bar code symbol.

**RFID**

RFID is short for Radio Frequency Identification. It's the technology used in Oyster cards, entry systems in secure buildings and for tags on goods. It uses radio waves transmitted from a small tag which passes data to a computer system without the need to physically scan the item. The two elements of RFID are firstly a tag or card containing a silicon chip and a small radio antenna, and secondly a reader that communicates with the tags to pass the data to a computer.  RFID is likely to replace barcodes eventually. The key difference is that instead of displaying and reading a visual code, RFID tags are chips that can be incredibly small (some are a third of a millimetre wide) that transmit a radio signal when the chip receives a radio enquiry from a reader.

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