

# BARCODES

## Barcodes generally

A barcode is an optical machine-readable representation of data, which shows certain data on certain products. Barcodes can be read by optical scanners called barcode readers, or scanned from an image by special software. Barcodes are an essential part of the broader automatic identification and data capture (AIDC) concept.

## Barcode history

1949 Bernard Silver, a graduate of Drexel Institute of Technology, heard the president of a local food chain ask for a system that automatically read product information upon checkout. Bernard told his friend Norman Woodland and they decided to try to store information using the dots and lines of Morse code. The dots were too small to be read so they ended up stretching the dots to thin and the lines to thick bars. They made a barcode reader from a 500 watt lamp. Barcodes started to spread on products in the 70's, when the first barcode readers started to enter the market. It was at the same time as the UPC-code was presented for standard product marking. EAN was presented 1977 and was made to match the UPC.

## Barcodes today

The most common use of barcodes is EAN codes for trade products. Barcodes are however used broadly in the entire supply chain. Barcodes have also become more common in other sectors. New generations of barcodes opens possibilities for new applications. For example, Data Matrix allows a large amount of information to be stored in a small space. This is for example used in the healthcare sector. Barcodes are currently the best known and most widely used automatic identification technology.

## Barcodes in the future

Barcode technology is constantly developed. GS1 DataBar and Data Matrix symbols are a good example of this. New applications for the barcodes are also invented. For example the healthcare sector has just started to utilize barcodes in their supply chains. Other technologies are also developed to improve AIDC. An example of this is RFID. Some think that RFID will eventually replace barcodes and some think that they will coexist and complement each other in the future. In practice this would mean that in the same supply chains some partners can utilize RFID and others barcode but still they can all work with the same products. Currently GS1 develops combined use of Electronic Product Code (EPC) and barcodes. Both technologies share same priority, AIDC.

### EAN/UPC

- Are specified for retail Point-of-Sale (POS) because they are designed for the high volume scanning environment.
- Used at POS and in logistics must be printed larger than the "target" size to accommodate logistics scanning.
- Limited to carrying GS1 Keys and special identifiers for restricted applications like variable measure trade items and internal numbering.



- EAN-13**
- 13 numeric
  - GTIN-13
  - Omnidirectional (for Point-of-Sale)



- EAN-8**
- 8 numeric
  - GTIN-8
  - Omnidirectional (for Point-of-Sale)



- UPC-A**
- 12 numeric
  - GTIN-12
  - Omnidirectional (for Point-of-Sale)



- UPC-E**
- 8 numeric
  - GTIN-8
  - Omnidirectional (for Point-of-Sale)

### GS1 DataBar

- A family of symbols that can be scanned at retail point-of-sale (POS), are smaller than EAN/UPC and can carry additional information such as GS1 keys, serial numbers, lot numbers and expiry dates.
- A subset of GS1 DataBar barcodes designed for use at POS are considered to deploy in the future.
- GS1 DataBar symbols are already approved for global use on healthcare items that do not cross POS.



- GS1 DataBar Omnidirectional**
- 14 numeric
  - GTIN-8,-12,-13,-14
  - Omnidirectional



- GS1 DataBar Stacked Omnidirectional**
- 14 numeric
  - GTIN-8,-12,-13,-14
  - Not omnidirectional



- GS1 DataBar Limited**
- 14 numeric
  - GTIN-8,-12,-13,-14
  - Lead digit 0 or 1
  - Not omnidirectional



- GS1 DataBar Stacked**
- 14 numeric
  - GTIN-8,-12,-13,-14
  - Not omnidirectional



- GS1 DataBar Expanded Stacked**
- Max. 74 numeric / 41 alphanumeric
  - All GS1 keys and Application Identifiers
  - Omnidirectional



- GS1 DataBar Expanded**
- Max. 74 numeric / 41 alphanumeric
  - All GS1 keys and Application Identifiers
  - Omnidirectional



- GS1 DataBar Truncated**
- 14 numeric
  - GTIN-8,-12,-13,-14
  - Not omnidirectional

### GS1-128

- GS1-128 (UCC/EAN-128) barcodes can carry all GS1 Keys and attributes.
- Mainly used in logistics.
- Cannot be used to identify items crossing POS.



- GS1-128 code
- 48 Alphanumeric capacity
- Carries Application Identifiers
- Unique GS1 Identifier
- Not omnidirectional

### ITF-14

- ITF-14 barcodes can only carry GTINs.
- Can be printed directly on corrugated cartons.
- Cannot be used to identify items crossing POS.



- Interleaved 2 of 5 code
- 14 numeric
- GTIN - 12, -13, -14
- Not omnidirectional

### GS1 DataMatrix

- GS1 DataMatrix is the only "2D Matrix" symbol specified by GS1 and e.g. is becoming increasingly utilized in healthcare sector.
- Because GS1 DataMatrix requires camera based scanners it is currently specified for healthcare items not crossing POS and direct part marking.



- GS1 DataMatrix code (version ECC 200)
- 3116 numeric capacity
- 2335 alphanumeric capacity
- Carries Application Identifiers
- Unique GS1 identifier
- Camer-based (imaging) scanners only

## GS1 Barcodes

Originally, barcodes represented data in the widths (lines) and the spacings of parallel lines, and may be referred to as linear or 1D (1 dimensional) barcodes or symbologies. Now days barcodes also come in patterns of squares, dots, hexagons and other geometric patterns within images termed 2D (2 dimensional) matrix codes or symbologies. From these different barcode techniques GS1 has developed and standardized its own, more defined barcode structures, especially suitable for supply chain management. GS1 standardized barcodes can be used worldwide. They differ from other barcodes, so that the information inside the barcode is also standardized. The GS1 System provides several types of barcodes for GS1 members use. Depending on the application different barcode types have different strengths and weaknesses. GS1 members select the barcode that fits the best for the application.

## AI (Application Identifiers)

GS1 Application Identifiers are 2-4 digit codes that indicate the related information and determine its length and form. Application Identifiers provide the opportunity for additional information. The following information may be alphanumeric max 30 characters. They are used in GS1 barcodes: GS1-128, GS1 DataMatrix and GS1 DataBar.

1948 Bernard Silver hears a local merchant dream of a system that automatically read product information upon checkout.



1967 One of the first scanning systems at a Kroger store on Cincinnati is installed by RCA. The product codes are presented in the "bull's eye" barcodes. They aren't pre-printed on packages, but labels are placed on the items by store employees.

1977 European Article Numbering Association (EAN) is established.

1980 First handheld laser scanner is developed.



1987 First 2D barcodes is developed.



1994 The QR Code is created by the Japanese corporation Denso-Wave.



2006 GS1 Databar is introduced for small items to be scanned at POS.



1950

1960

1970

1980

1990

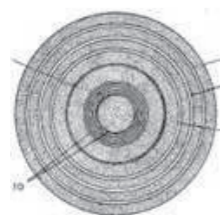
2000

2010

1949 Woodland and Silver fill a patent application for their invention.

1950

Woodland's and Silver's barcode is described as a "bull's eye" symbol, made up of a series of concentric circles.



1970

The Universal Product Code (UPC) is developed in the summer of 1970.



1974

The first UPC scanner is made by the National Cash Register Co and the first product with a UPC barcode is scanned at a check-out counter.



1988

The UCC in coordination with EAN International endorses Code 128 to encode supplementary information on dispatch units.

1998

The UCC and EAN International jointly announce specifications for a new class of symbology for space constrained products (GS1 Data Matrix).



2005

GS1 launches worldwide. GS1 is the new name of EAN International and the Uniform Code Council (UCC).



2010

Barcodes are widely used in industry and logistics. Barcode use is also growing in the healthcare and public sector. New applications and GS1 standards are developed.