



## 2D symbols in distribution and logistics

### Two new position papers – September 2015

Two-dimensional (2D) symbols are becoming increasingly popular. Besides mobile scanning applications for consumers also more and more business applications are emerging. GS1 offers two 2D symbologies: GS1 DataMatrix and GS1 QR Code.

In **retail** GS1 has initiated various projects to address the questions and requirements related to the adoption of 2D symbologies. These initiatives are focusing primarily on the impact on the identification of consumer products at the retail POS including the transition to image-based scanning, and the mobile scanning requirements of consumers.

In **healthcare** GS1 DataMatrix has been adopted as the preferred data carrier for Regulated Healthcare Trade Items.

In the two attached position papers the adoption in **distribution and logistics** processes is addressed.

- Using 2D Symbols on Logistic Units (e.g. pallet labels)
- Using 2D Symbols on Trade Item Groupings (e.g. outer cases)

In both applications the introduction of 2D symbols and ubiquitous mobile scanning capabilities is expected to have a major impact. And although there are similarities between these two applications, there are also significant differences:

	Trade item groupings	Logistic units
scanned at/by	production / packaging lines, warehouses, stores	production / packaging lines, warehouses, stores, carriers, end-customers (parcels)
primary key	GTIN	SSCC
additional data attributes	Batch/Lot, Expiry date, Net weight (variable measure items)	For carrier: postal code, ship to GLN, routing code, GINC, GSIN For customer: store GLN, order number For customer and supplier: GTIN + attributes (batch/lot, expiry date, ...)
currently supported symbologies	ITF-14, EAN/UPC, GS1-128, GS1 DataBar	GS1-128

For this reason the GS1 position on these applications is presented in two separate papers.

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GS1 Position Paper – 24-August-2015

# Using 2D Symbols on Trade Item Groupings

## Current state and future direction

### 1 Introduction

Trade item groupings are distribution units that contain a constant pre-defined number of consumer units, for example outer cases. GS1 recommends to treat such units as independent trade items, identified and marked with their own GTIN.

1D barcodes are used to physically mark the GTIN on the product label or directly on the packaging material. The traditionally used symbols, EAN/UPC and ITF-14, can only carry the GTIN. There is presently a shift towards the use of GS1-128 barcodes, since these allow additional attributes to be encoded. This is driven by the need for more precise product information in distribution processes, for example to address product and consumer safety requirements.

With the emergence of two-dimensional (2D) symbologies more compact representations of the GTIN and attributes have become possible.

### 2 Background

Trade item groupings such as outer cases are used in distribution and warehousing processes, and in deliveries to stores. Trade item groupings are traded between companies and usually not sold directly to consumers.

GS1 recommends to treat such groupings as independent trade items, identified and marked with their own GTIN. The GTIN enables efficient distribution processes such as storage, picking and packing and inspection. It also supports a seamless link with the ordering and invoicing process, helping companies to establish a 3-way match between what was ordered, received and invoiced.

#### 2.1 Need for additional attributes beyond the GTIN

Stricter requirements around product and consumer safety, warehouse efficiency and product information are creating a need for more precise identification of trade item groupings. In addition to the GTIN it must be possible to automatically capture other data attributes such as batch/lot number, expiry date, weight (for variable measure trade items), etc. Such attributes were often already included as text on the label, but now are making their way to the barcode.

#### 2.2 Barcodes

One-dimensional (1D) barcode symbols consist of a pattern of bars and spaces. GS1 offers 4 types of 1D symbologies:

- Two symbologies, EAN/UPC and ITF-14, can only carry the GTIN and no additional data attributes.
- The two other symbologies, GS1-128 and GS1 DataBar can represent the GTIN plus additional data attributes.

2D barcodes are symbols composed of patterns such as square modules arranged in a matrix. GS1 offers two types of 2D symbologies:

- GS1 QR Code and GS1 DataMatrix.

Depending on the length of the additional attributes to be included the 1D symbols can become large, making them more difficult to produce, fit on the label, and scan. For GS1-128 it is allowed to include multiple separate symbols to alleviate size concerns. The 2D symbologies are more space efficient. Normally the data required for a trade item grouping will fit into one 2D symbol without a significant impact on the required label space.

## 2.3 Scanning characteristics

Two main types of barcode scanners exist:

- The traditional scanners apply line or laser scanning technology and are capable of reading 1D symbols.
- Camera based imaging scanners or vision systems are able to scan both 1D symbols as well as 2D symbols.

In logistics and distribution environments symbols may need to be scanned from a greater distance than typical hand held scanning applications. Often fixed mount scanning systems are used in these applications, for example to scan the labels on shipping cases or pallets moving on a conveyor belt. ITF-14 and GS1-128 have proven to be very suitable for such processes.

It is important to note that eCommerce developments are causing the traditional distinction between distribution and retail store environments to blur. Due to fulfilment models such as home deliveries warehouses and logistic service providers are more and more handling consumer units as well as distribution units.

## 2.4 Printing and packaging characteristics

An important aspect of using dynamic attributes in barcodes is they cannot be printed as pre-printed artwork on the packaging. This means that this information must be printed either "inline" on the package (a.k.a. "print & apply" labels) or that pre-printed labels / packaging material needs to be matched with the produced trade item groupings. It is likely that inline printed labels will be the dominant method.

Production of good quality GS1-128 barcodes under such circumstances has proven to be very well achievable, when proper care is given to printer maintenance, setup and education. It is expected that production of 2D symbols will not be significantly more complex or easy. However, GS1 2D symbols may be printed faster and with greater tolerance for printing defects given the nature of the symbol design and error-correction features. 2D symbols may also be more suitable than GS1-128 symbols when printed directly on corrugated packaging material.

## 3 Conclusion

GS1 does not expect an immediate switch from 1D to 2D data carrier use on trade item groupings, but expects 2D data carriers will start appearing on some products depending on the product category and local market regulations.

GS1 recommends companies that need to replace printing or scanning equipment to consider investing in equipment capable of scanning 2D symbols as well as 1D symbols. Such scanning equipment will be more expensive than traditional laser based equipment, but will provide greater flexibility in dealing with the variety of legacy and trending symbols that need to be processed in a distribution and logistics environment.

GS1 will investigate whether changes to the standards are needed in order to facilitate the use of 2D symbols in a distribution and logistics environment.

## 4 References

- GS1 General Specifications





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GS1 Position Paper – 24-August-2015

## Using 2D Symbols on Logistic Units

### Current state and future direction

#### 1 Introduction

Logistic Units are identified with a Serial Shipping Container Code (SSCC). The GS1-128 barcode is used to physically mark the SSCC and additional attributes on a logistics label.

Usually the SSCC is represented in a GS1-128 barcode symbol at the bottom of the label, and additional attributes are included in one or more additional GS1-128 symbols above the symbol holding the SSCC.

With the emergence of two-dimensional (2D) symbologies more compact combined representations of the SSCC and attributes have become possible.

#### 2 Background

Over the years various GS1 sectors have invested heavily in programs to optimize the shipping and receiving processes, with the GS1 logistics label and SSCC as key components. In most implementations there was a need for additional barcoded and textual attributes beyond the SSCC, leading to various layout variations depending on the type of information needed, i.e. transport, customer and / or supplier / product information.

##### 2.1 Need for additional attributes beyond the SSCC

In order to identify and track the logistic unit only the barcode carrying the SSCC needs to be scanned.

All other attributes are specific to a particular business need or process. For example, the ship to location (GLN) may be included to support the transport process, whereas the GTIN + batch / lot number + expiry date may be included (for homogeneous units) to support the receiving process and traceability requirements. This means that not all attribute data will be needed and scanned by all parties.

Furthermore, the data may become available at different times during the production, packing and shipping stages. For example: After production the batch number and expiration date will be known where the ship-to location may become available only at a later stage, such as during the picking-packing process.

##### 2.2 Barcodes

The GS1-128 barcode is a one-dimensional (1D) symbology consisting of a pattern of bars and spaces.

2D barcodes are symbols composed of patterns such as square modules arranged in a matrix. GS1 has endorsed the use of two 2D symbologies: GS1 QR Code and GS1 DataMatrix

Depending on the amount of encoded data GS1-128 symbols can become rather large, making them more difficult to produce, fit on the label and scan. It is allowed to divide the data across multiple separate GS1-128 symbols. Besides accommodating situations where data become available at different times (see above) this also helps to alleviate size concerns.

2D symbologies are more space-efficient than 1D symbologies. Normally the data required for a logistics label will fit into one 2D symbol without a significant impact on the required label space. This makes 2D symbols better suited for 'single-scan' operations.

## 2.3 Scanning characteristics

Two main types of barcode scanners exist:

- The traditional scanners apply line or laser scanning technology and are capable of reading 1D symbols.
- Camera based imaging scanners or vision systems are able to scan 1D symbols as well as 2D symbols.

In logistics and distribution environments symbols may need to be scanned from a greater distance than typical hand held scanning applications. Often fixed mount scanning systems are used in these applications, for example to scan the labels on shipping cases or pallets moving on a conveyor belt. GS1-128 has proven to be very suitable for such processes.

Scanning of logistics labels using mobile devices such as smartphones is expected to grow. It is a relatively low-cost way to provide employees such as truck drivers and other personnel in the field with basic scanning and recording capabilities. Such mobile devices are camera-based, supporting a wide variety of symbols, and typically used at a short distance.

## 2.4 Printing and packaging characteristics

Typically logistics labels are printed inline during production, packaging or shipping, using locally installed printers. Production of good quality GS1-128 barcodes under such circumstances has proven to be very well achievable, when proper care is given to printer maintenance, setup and education.

It is expected that production of 2D symbols will not be significantly more complex or easy than 1D symbols. An advantage is that GS1 2D symbols may be printed faster and with greater tolerance for printing defects given the nature of the symbol design and error-correction features.

## 3 Conclusion

GS1 expects 2D symbols to start appearing on logistics labels as additional symbols next to the GS1-128 symbol: for example, a GS1-128 symbol with SSCC in combination with a 2D symbol with transport information.

GS1 recommends companies that need to replace printing or scanning equipment to consider investing in equipment capable of producing and scanning 2D symbols as well as 1D symbols. GS1 also recommends to take the capabilities of multi-purpose mobile devices such as smartphones into account when evaluating logistics label scanning options.

GS1 will investigate whether changes to the standards are needed in order to facilitate the use of 2D symbols in a distribution and logistics environment.

## 4 References

- GS1 General Specifications

