GS1 Ireland

# The GS1 Ireland Introductory Guide to Bar Coding for the FMCG Sector

(Version 2.0)

www.gs1ie.org

The Global Language of Business

## Foreword

The objective of this introductory guide is to provide new **FMCG members** of GS1 Ireland and companies considering implementing the GS1 System with a simple, user-friendly introduction to the subject.

This guide is not exhaustive and does not replace the **GS1 General Specifications**. If you would like a copy of the full technical specifications which are produced annually please download a copy from our website www.gs1ie.org

## Release History

| Release | Reason for Change | Date |
|---|---|---|
| Version 1.0 | Initial version | 2002 |
| Version 2.0 | Updated to General Specifications 2008 and inclusion of GS1 DataBar | 2008 |

### The Four Pillars of GS1

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# Section 1

In this section you will be introduced to GS1 and GS1 Ireland

## 1.1 Introduction to GS1

In 1977, European Article Numbering (EAN) was established in Brussels by retailers and manufacturers from 12 European countries to launch a similar and compatible system in Europe to UCC System in the United States. EAN quickly included countries from outside Europe and was renamed EAN International. In the following decades the use of EAN bar codes spread across the world.

Global Standards 1 (GS1) was launched as the new name for EAN International in February 2005. The formation came about following the decision by the US and Canada, UCC and ECCC organisations, to become Member Organisations of EAN International in November 2002. Having joined forces and changed its name, GS1 is now a single, global body responsible for promoting the GS1 System.

Today GS1 has offices in over 108 countries world-wide with its headquarters in Brussels, Belgium. In total, over 1.3 million member companies use GS1 standards as part of their daily business communications in over 150 countries. The GS1 Standards are not confined just to the Fast Moving Consumer Goods, FMCG, sector any more, but are now used in many other sectors from Defence to Healthcare.

By providing a common global language for trade, the GS1 Standards enable companies worldwide in many different sectors to execute trade transactions in a universally understandable and "standard" way, facilitating faster, more accurate and more efficient processes. Over 5 billion transactions occur daily based on GS1 Standards.

## 1.2 An introduction to GS1 Ireland

GS1 Ireland, formerly the Article Number Association of Ireland (ANAI) and EAN Ireland, was founded as a **neutral, not for profit** organisation in 1980 by the leading grocery suppliers and retailers of the day. GS1 Ireland's role is to support the GS1 Standards and promote their development and use in Ireland.

Since its foundation, the membership of GS1 Ireland has grown steadily and now totals almost 3,000 members. In common with the global foundation, the use of the GS1 Standards has spread beyond their original retail point-of-sale applications and are now utilised throughout the supply chain from retail and warehousing to logistics and distribution. Other sectors such as Healthcare and Hardware/DIY are also leveraging the benefits of GS1 Standards. New and advance applications based on the GS1 Standards such as Global Data Synchronisation (Datapool), Electronic Product Codes, RFID and "Track and Trace" are being implemented.

The GS1 Ireland Office participates in many of GS1's global activities to ensure that Irish users and their business needs are considered in the future developments of the GS1 System.

## 1.3 Structure and Organisation of GS1 Ireland

GS1 Ireland is governed by a Supervisory Board drawn from its membership base and includes participants from many industry sectors. The Supervisory Board of GS1 Ireland is responsible for determining the overall strategic direction and objectives of the organisation in Ireland.

The work of the Supervisory Board is supported by several committees and the GS1 Executive Team. Committees are formed to address the needs of specific sectors or business applications. Each committee participant is a representative of a member company or key industry organisation and brings a wide range of experience and knowledge to the meetings. Currently there are committees dedicated to the development of the GS1 Standards in FMCG, Healthcare, eCommerce, Data Pools, Hardware/DIY, RFID and Food Traceability. Working groups are also active in the areas of

Data Synchronisation and EDI implementation in the Hardware/DIY sector.

The GS1 Executive Team looks after the day to day administration of the organisation. The team is available to answer queries any member may have regarding the GS1 Standards. A telephone helpdesk (01 2080660) is available in addition to our online helpdesk and advisory services. GS1 regularly organises training, workshops and seminars to assist members with their understanding of the standards and how to apply them.

GS1 Ireland offers a number of possible solutions to address all training needs. Please visit our website www.gs1ie.org for details.

*Disclaimer*

***Please note:*** *the illustrations and diagrams used in this guide are only examples and are not intended to be scanned or used as references.*

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*In addition no warranty or representation is made that the standards will not require modification due to additions to the system and developments in technology.*

*For advice please contact the help desk at 01-2080660 or email info@gs1ie*

A visit to **www.gs1ie.org** will provide you with a wealth of information about bar coding, eCommerce messaging, data synchronisation and RFID. Details of forthcoming training courses and events are listed in addition to numerous helpful documents which visitors can download.

# Section 2

In this section you will be introduced to the GS1 System: standards for identification, data carriers, electronic messages, data synchronisation and RFID.

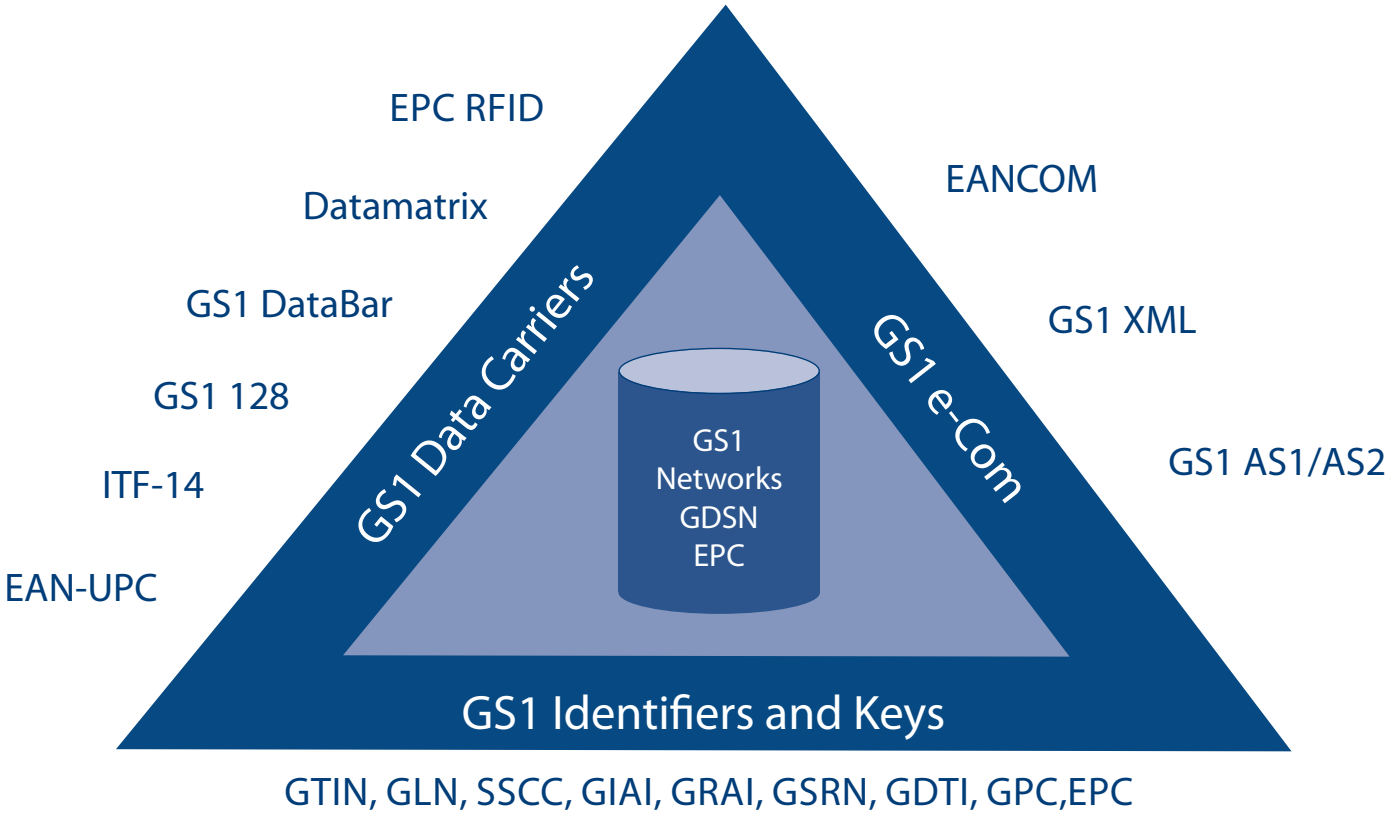
## 2.1 Why Numbers?

The GS1 "system" relies on the use of numbers to securely identify products, people and places. Before going any further into how to use numbers for identification purposes, it is important to answer the question; "Why use numbers?" People differ in how they identify products so an alternative method of identification is needed - numbers. There are several reasons why numbers (particularly GS1 number banks) make better identifiers than names, including:

- Numbers are easily processed by computers.
- Numbers are not language dependant. Regardless of the language or script used numbers are recognised all over the world making them a globally recognised language.
- GS1 numbers are unique to each product, person or place, i.e. a number that is assigned to a product will identify it anywhere in the world.
- GS1 numbers eliminate misunderstandings surrounding product descriptions.
- GS1 numbers are secure, i.e. there is no other information contained in the number other than the number itself.

## 2.2 Areas of Application for the GS1 System

The GS1 System is open to use by anyone who wishes to trade and communicate in a globally acceptable and understandable way. It is currently used by over 25 different industry sectors around the globe including, grocery and general merchandise retail, clothing & textiles, transport and logistics, healthcare, food traceability and defence. The GS1 System contains a powerful set of standard tools to enable a wide variety of applications in an open standards environment.




*The GS1 System*

## 2.3 The GS1 System

The GS1 System is the complete set of global standards that include keys for the identification of objects, standards for data carriers (bar codes, RFID tags) and standards for exchanging electronic messages (e-Com).

The GS1 Standards are an integrated solution that facilitates trade by combining the unique identification keys with data carriers and electronic commerce processes resulting in efficient, accurate and timely business communications.

The application of GS1 Standards can result in significant improvements in logistics operations, a reduction in paperwork costs, shorter order and delivery lead times, increased invoice accuracy and better management of the whole supply chain. Enormous cost savings are realised daily by user companies who have adopted the GS1 Standards because they apply the same solution for communicating with all their trading partners.

### 2.3.1 The Components of the GS1 System

The GS1 System consists of the following distinct components:

- **GS1 Bar Codes** comprising of
  - GS1 Identifiers
  - Data Carriers
- **GS1 eCom**:
  - EANCOM
  - XML Electronic Messages
  - AS1/AS2 Protocols
- **GS1 GPC**: Global Product Classification
- **GS1 GDSN**: Data Pooling and Synchronisation
- **GS1 EPCglobal**: Electronic Product Codes and the EPC Network

## 2.4 GS1 Bar codes

GS1 Bar codes are made up of two distinct sub-components:

- GS1 Identifiers
- Data carriers.

### 2.4.1 The GS1 Identifiers

The GS1 System relies on globally unique identifiers or keys. These identifiers enable the unique identification of products, services, assets, documents, locations and transactions.

The unique identifiers (or keys) are used for accessing information about an item (a product, service or any physical or non-physical item) on a computer database.

The structure of the GS1 System ensures that the identifiers are globally unique, contain no significance or meaning, are secure and are globally understood. The identifiers can be allocated to consumer or retail items, traded goods, logistics units, locations and many others items such as assets, services and documents.

The following GS1 identifiers are commonly used in retail and supply chain applications:

- The Global Trade Item Number (GTIN)
- The Serial Shipping Container Code (SSCC)
- The Global Location Number (GLN)

In addition to the above, the GS1 identifiers below may be used by any company that adopts the GS1 Schema for more advanced applications.

- The Global Individual Asset Identifier (GIAI)
- The Global Returnable Asset Identifier (GRAI)
- The Global Service Relationship Number (GSRN)
- The Global Document Type Identifier (GDTI)
- The Electronic Product Code (EPC)

***These identifiers are beyond the scope of this guideline. Please contact GS1 for further information.***

**The Global Trade Item Number (GTIN)**

The GTIN is a number used to uniquely identify trade items worldwide.

**Note:** *A trade item is any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, ordered or invoiced for trade between participants at any point in any supply chain.*

The GTIN is most commonly used to identify consumer products and outer cases containing consumer products. The use of the GTIN enables the following:

- retail point-of-sale scanning
- electronic ordering
- goods inwards
- goods inwards management and control
- sales analysis
- data alignment and
- a wide range of other business applications.

**The Serial Shipping Container Code (SSCC)**

The SSCC is a number used for the unique identification of logistic units such as cases, pallets and containers.

*Note: A Logistic Unit is an item of any composition established for transport and/or storage which needs to be managed throughout the supply chain.*

The SSCC is typically used: -

- to facilitate logistical track and trace applications
- to improve supply chain efficiency through faster handling at goods inwards
- in warehouse management systems

**The Global Location Number (GLN)**

The Global Location Number (GLN) is a number used to identify individual organisational entities.

GLN's are used as unique reference numbers for:-

- e-Commerce to identify the sender and receiver of an electronic message
- Data alignment to identify the data suppliers and receivers
- To identify logistics organisations responsible for shipping, delivery and warehouse management

By following the principles of the GS1 Identifiers, users can design applications to process data automatically with the guarantee that the identifiers used are globally unique and will not conflict. The most obvious example of this is scanning at the point of sale where a single GS1 Identifier in a bar code can be scanned in any country worldwide and will not conflict with any other item.

### 2.4.2 GS1 Data Carriers

The GS1 identification numbers (and other standard data) can be translated into a machine-readable form, better known as a bar code. Physically the GS1 identifier assigned to an object can travel with that object forming a link between the physical flow of goods and the associated information flow. A scanner is used to read the identification number and transmit it to a computer.

There are different types of data carriers (or bar code symbols) and their use depends upon a number of factors including:

- the environment in which the code will be scanned
- the item to be identified and bar coded

For point of sale applications, the following GS1 BarCodes may be used: -

- EAN-13
- EAN-8 for very small items
- UPC-A
- UPC-E for very small items

The symbols can be read omni-directionally.


*Note: : Please note that a new type of symbol GS1 DataBar will be added to the above list after 2010.*

For Trade Items and Logistics Units not intended for the point of sale. The following GS1 BarCodes may be used: -

- EAN-13
- UPC-A
- ITF-14
- GS1-128

*For guidance on selecting a suitable data carrier see Section 5.3*

## 2.5 GS1 eCOM, Standard Electronic Messages

The GS1 identification numbers are also used in e-Commerce (i.e. electronic data interchange (EDI) messages) to improve the speed and accuracy of data communicated between trading partners.

GS1 has two suites of standards for electronic messages EANCOM and GS1 XML. In addition, a secure protocol has been prepared for Internet based communications called GS1 AS1/AS2.

The most commonly used e-COM standard in Ireland is Harmised EDI, H-EDI which is based on EANCOM and includes the specific business and legal requirements agreed by Irish users. The H-EDI Guidelines are available for download from the GS1 Ireland website or may be ordered from GS1 Ireland Membership Services.

## 2.6 GS1 Global Product Classification

**Global Product Classification (GPC)** is an internationally agreed standard for product classification and is a key enabler for the Global Data Synchronisation Network (GDSN) and category management.

***Note: The GPC Schema is aligned with the United Nations Standard Product and Services Classification (UNSPSC).***

## 2.7 GS1 GDSN, Standards for Data Synchronisation and the GS1 Ireland Data Pool Service

The next component of the GS1 System is a suite of standards developed to facilitate the exchange of product and company information via a network of linked data pools across the globe called the **Global Data Synchronisation Service (GDSN)**. The **GS1 Ireland Data Pool Service,** linked with the GDSN, will enable Irish companies to publish and to receive product information.

GS1 Ireland in conjunction with the Irish FMCG community has identified the data synchronisation requirements for Ireland.

## 2.8 EPCglobal, Standards for Radio Frequency Identification (RFID) applications

The fourth component of the GS1 System is a set of standards for RFID applications packaged under the brand name EPCglobal. EPC stands for Electronic Product Code which is a unique identification key stored in an RFID tag which can then be applied to products to identify them and monitor their location and movement throughout the supply chain. In very simple terms, EPC acts like an electronic bar code. The EPC Code combined with the EPCIS (EPC Information Service) will enable real-time supply chain visibility and more effective track and trace.

***Note:***
***If you would like further information on any of the components listed above, please contact the GS1 Ireland Help Desk at:***


*Tel:* *(01)-2080660*
*E-mail:* *info@gs1ie.org*
*Web:* *www.gs1ie.org*

# Section 3

In this section you will be introduced to GS1 Ireland, the Company Prefix Number and guided through the process of issuing GTIN numbers for use in bar codes. The requirements for good record keeping and the re-use of old numbers are also covered.

## 3.1 Introduction

Most companies start using the GS1 System following a request from a trading partner asking them to "implement barcodes" on their products. But who is really responsible for implementing bar codes?

The brand owner, the organisation that owns the specifications of the product, regardless of where and by whom it is manufactured, is normally responsible for implementing bar coding. Examples of Brand Ownership include:-

- **The manufacturer or supplier:** If a company manufactures the product itself or has it manufactured in any other country and sells it under a brand name that belongs to the manufacturer or supplier.

- **The importer or wholesaler:** If the importer or wholesaler has the product manufactured in any country and sells it under a brand name that belongs to the company. If the importer or wholesaler changes the product, for example, by modifying the packaging of the article.

- **The retailer:** If the retailer has the product manufactured in any country and sells it under a brand name that belongs to the retailer.

As outlined in Section 2 of this guide there is much more to the GS1 System and "implementing bar codes" than the simple symbol printed on your product packaging. It is therefore worthwhile to get to know the standards and to ensure your company can maximise the benefits of GS1System. GS1 Ireland is here to help you to realise these benefits.

## 3.2 Getting Started

The first step is to become a member of GS1 Ireland. But to help us there is some data that you need to gather first. For example:

- How many products are to be identified and bar coded?
- Of these products that you have to identify, are there different stock keeping units (e.g. different flavours, colours) that need to be distinguished?
- Are inners, cases and pallets to be identified and bar coded also?
- Do you need to be able to identify specific locations?
- Are there any particular legal/legislative/customer requirements such as traceability or shelf-life requirements to be considered?

GS1 Ireland needs the above information in order to help you select the type of membership you need and how best you can implement the GS1 Standards.

You can apply for membership of GS1 Ireland in several ways:

1. Log on to our website www.gs1ie.org and complete the online application form.

2. Email info@gs1ie.org to request a copy of an application form

3. Call our Helpdesk for assistance.

Depending upon your requirements you will be allocated a prefix number from which you can generate your identification numbers. The technical name for the prefix number is a GS1Global Company Prefix or GS1 GCP. The GS1 Membership Services Team will be able to advise you on the GCP you require to meet your business needs.

## 3.3 Global Company Prefixes (GCPs)

The GS1 Global Company Prefix is exclusive to your company. Numbers generated from this prefix must not be sold, given or leased, in whole or in part, for use by another company or business.

**The Global Company Prefix is exclusively licenced to your company. The licence is renewed annually on paying the appropriate annual fee.**

The GS1 Global Company Prefix is the starting point for creating the following GS1 Identifiers: -

- The Global Trade Item Number (GTIN)

- The Serial Shipping Container Code (SSCC)
- The Global Location Number (GLN)
- The Global Individual Asset Identifier (GIAI)
- The Global Returnable Asset Identifier (GRAI)
- The Global Service Relationship Number (GSRN)
- The Global Document Type Identifier (GDTI)
- The Electronic Product Code (EPC)

## 3.4 Global Trade Item Numbers (GTINs)

A trade item is defined as any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, ordered or invoiced at any point in the supply chain.

The fundamental concept underpinning the GS1 System is a number which uniquely identifies a trade item. The correct name for this identification number is a Global Trade Item Number or GTIN, the number which is encoded in the barcode symbol.

Thus a consumer item scanned at the checkout is a trade item. A case containing that item is another trade item. Although it contains a multiple of the consumer unit, it is a different trade item.

This definition covers all products from raw materials through to finished products and services. A trade item may be a standard, fixed weight product or a product whose weight varies.

In Ireland, there are various GS1 GCP lengths depending on the number of trade items you need to identify. The suggested GCP prefix types are outlined in the table below:

| Title | Prefix | Number of products |
|---|---|---|
| GCP 11 | 539NNNNNNNNPC | Less than 4 products |
| GCP 9 | 539NNNNNNPPPC | Less than 500 products |
| GCP 7 | 539NNNNNPPPPPC | Less than 50000 products |

*Note: The number of products is only a guideline and is not a definitive*

Where-

- 539 is the number identifying GS1 Ireland as the issuing office,
- N---N is the company reference assigned by GS1 Ireland,
- P-P is the product reference assigned by your company
- C is the check digit calculated using a standard algorithm

**The combination of the 539 and the 'N' digits is your GPC.**

**Note:**
*The GS1 Global Company Prefix cannot be used to identify consumer products which are sold by weight or to identify money-off vouchers or coupons. A separate prefix number will be allocated to your company by GS1 Ireland if you wish to identify either of these*

Please refer to Section 3.5 for further information on variable measure products and to Section 3.7 for information on coupons.

Once assigned to a trade item, a GTIN identifies it unambiguously and can be used for trade world-wide. Whatever country an item is manufactured or sold in, the GTIN will remain valid. It is independent of prices and methods of supply. The GTIN is the key to accessing additional information about the item which is stored in a database. It is a non-significant number, which means that the individual digits in the number do not relate to any classification or convey any specific information.

The GTIN can be used in bar codes, electronic and printed catalogues, on product sheets, price lists, documents or messages exchanged for transactions such as data alignment (bilateral or within datapools), purchase orders, delivery notes or invoices.

### 3.4.1 GTIN Allocation Rules

**Health Warning**

**It is absolutely critical to the success of the supply chain that your GTINs are correctly managed. Once GTINs are assigned to products they become the key interface between the physical flow of goods and the associated information flow. Your trading partners depend on the accuracy of your GTINs to ensure accurate pricing at the point sale, sales analysis, order processing, logistic management and commercial settlements of invoices. Other applications such as electronic messaging, traceability and anti-counterfeiting measures depend on it. Failure to manage the GTINs properly will sour commercial relationships and could result in the delisting of products.**

The following are general rules apply when you allocate a GTIN to a trade item: -

1. Each company is responsible for ensuring that one and only one GTIN is allocated to each trade item from their range of GTIN's. You cannot use a number outside your range of numbers as it may have already being assigned to another member.

2. The general rule is that a separate GTIN will be required

for every different trade item. If a product is packed in different sizes or quantities a separate GTIN must be allocated to each. Similarly, a different GTIN will be allocated to the outer case of a product as distinct from the consumer unit. It is critical that once a GTIN is assigned to a trade item, it is not used for another trade item, even if the supply channels are different. For example, different GTIN's would be allocated to each of the following:

- A can of paint
- A box of six cans of paint
- A case containing 24 boxes of one kilo of lawn fertiliser
- A multipack consisting of one shampoo and one conditioner

3. It is strongly recommended that GTIN's are allocated sequentially. Adding meaning to blocks of numbers within the allocated range is not recommended.

4. Having assigned GTIN's to your product and its packaging units, ideally those GTIN's remain unchanged over the life of the product. There are some products that have had GTIN's assigned 25 years ago and are still valid today. However for a variety of reasons - commercial, regulatory, packaging, branding, pricing, etc. it is necessary to distinguish the difference between the "old" and the "new".

   The number allocated to a consumer unit (an item that could be sold at a retail point of sale) must be changed when: -

   - the declared weight is different
   - extra product is provided free, for example "10% extra free"
   - the name of the product changes, for example from Marathon™ to Snickers™
   - a free gift is attached to the item
   - different prices are pre-printed on the packaging

   Numbers allocated to consumer units should remain unaltered when:

   - a free gift is included inside the item
   - a promotional offer is being advertised
   - the undeclared weight changes by an amount that does not affect its handling within any supply chain
   - a minor packaging change, for example a different type of similar packaging material is now being used

   Different numbers are required on outer cases (traded units or trade items that do not cross a retail point of sale) when:

   - they contain different quantities of the same consumer unit
   - the products inside the outer case have a new item number
   - a promotion needs to be distinguished for ordering and invoicing purposes
   - the packaging of the consumer units changes significantly, for example when a glass container replaces a plastic container

   Changes of number are required when the outer case needs to be distinguished from any other outer case. Changes in packaging material may affect the gross weight of the item even though all other aspects are unaltered. This weight change may affect the logistics processes involved in the product's handling, so a different number is required.

5. Some companies produce the same product in different countries or at several manufacturing facilities. In this case the number should be allocated and managed centrally or by just one of the companies or plants and communicated to the other plants.

6. A record has to be kept of all GTIN allocations. **GS1 Ireland does not keep a record of the GTIN's that you have allocated**. It is your responsibility to keep the record and to maintain it over the full life cycle of the product and for four years after the product has been deleted. Records may be kept on paper on a product specification or electronically. A simple record can be maintained on a spreadsheet – however a properly structured database (implemented as part of company wide IT infrastructure) is more appropriate if you are dealing with a lot of GTIN's. This record should be part of the information that you share with your trading partners when you are listing the product for the very first time. The detail of the record to be kept is very much dependent on the company and the type of products.

**It is strongly recommended that a company who starts to use the GS1 System appoints a senior person within the organisation with the responsibility of managing the GS1 System. This person should be trained in all aspects of the system. They should be identified to GS1 Ireland so that all communication relating to GS1 activities and developments are communicated in a timely manner.**

### 3.4.2 How does one "bar code" a Retail Fixed Measure Product?

Generally, when people refer to "barcoding" their products what they are actually doing is representing a GTIN in a

barcode symbol. Based on the allocation rules above the steps 1 to 5 below should be completed for fixed measure trade items.

*A fixed measure product is any product that is sold as a discrete item and is not sold by a variable measure such as weight, volume, length etc. Variable measure items are dealt with in Section 3.5*

### *Step 1 – Review the Product Hierarchy*

The product hierarchy relates to how you supply and package products for distribution through the supply chain to the consumer.

First, you need to determine the item that will be sold at point of sale. You then need to decide how it is grouped into traded units for supply chain purposes.

In most situations you will have at least:- -

- A point of sale item (consumer unit/retail unit)
- A case containing a fixed quantity of consumer items

In some circumstances you will have:

- An inner pack contained within the case and/or prepared as shelf ready package
- Cases with different case quantities
- A pallet containing cases of the same quantities (homogenous pallets)

It is recommended that each discrete packaging unit from the point of sale item up to and including the pallet should be identified with a **separate** GTIN.

### *Step 2 – Assigning the GTIN to Retail items*

All point of sale items are marked with a 13-digit GTIN.

The starting point for assigning a GTIN for bar coding is your GCP.

Using the GCP issued to your company you add additional numbers called item reference numbers to make the number up to 12 digits. The final called a check digit is calculated based on a mathematical algorithm to complete the 13th digit of the number

**GCP-11**

If you have been allocated a GCP consisting of 11 digits, you have a capacity to allocate a total of 10 numbers.

You may allocate

from 539NNNNNNNN0C
to 539NNNNNNNN9C

e.g. 539123456780C to 539123456789C

The item reference number is one digit long if you have an 11-digit GCP prefix.

**GCP-9**

If you have been allocated a GCP consisting of 9 digits, you have a capacity to allocate a total of 1,000 numbers.

from 539NNNNNN000C
to 539NNNNNN999C

e.g. 539654321000C to 539654321999C

The item reference number is three digits long if you have a 9-digit GCP prefix.

**GCP-7**

If you have been allocated a GCP consisting of 7 digits, you have a capacity to allocate a total of 100,000 numbers.

from 539NNNN00000C
to 539NNNN99999C

e.g. 539432100000C to 539432199999C

The item reference number is 5 digits long if you have a 7 digit GCP prefix.

'N' identifies the numbers as assigned by GS1 Ireland and 'C' is the check digit as calculated using the GS1 Mathematical Algorithm – see below.

The GTIN must be treated as a whole number and no data processing should be based on part of the number.

### *Step 3 – The Check Digit*

The next and final step in completing your full GTIN is to calculate the Check Digit. The Check Digit is the final digit at the right side of the number and is based on a mathematical algorithm called the Modulo 10.

To ensure that the check digit is properly calculated we recommend that you use the calculator on the GS1 Ireland website **www.gs1ie.org.**

The check digit is a key control in the accuracy of the GTIN. It is a computer check to make sure the bar code is calculated correctly. When a scanner reads a bar code symbol, it will

perform the same calculation and verify that the two results match. In this way the scanner knows it has read all the digits of the number correctly.

It is also used to ensure that manually entered GTIN's are inputted correctly. It is strongly recommended where operators manually enter a GTIN, that the check digit algorithm is embedded in the IT application to ensure that data keying errors are eliminated.

***For more information see www.gs1ie.org***

***Step 4 – Each different hierarchical unit requires a different GTIN***

A **Traded Unit** is the term used to define a product or case of product exchanged between two trading partners. Traded units are commonly known as "outer cases" or "shippers". For historical and legacy reasons some organisations refer to the GTIN applied to a case as an ITF-14 number or TUC meaning Traded Unit Code

Having assigned the GTIN to the retail unit,

- a separate GTIN will be used for the case,
- another GTIN for a case with a different case quantity,
- another GTIN for an inner and
- another for each different homogenous pallet depending on how the item is packaged for the supply chain.

Non-retail fixed measure goods refer to the traded units between manufacturer/distributor and the retailer. The most common examples are "outer cases", but could include "inner units", "shelf ready units" or pallets.

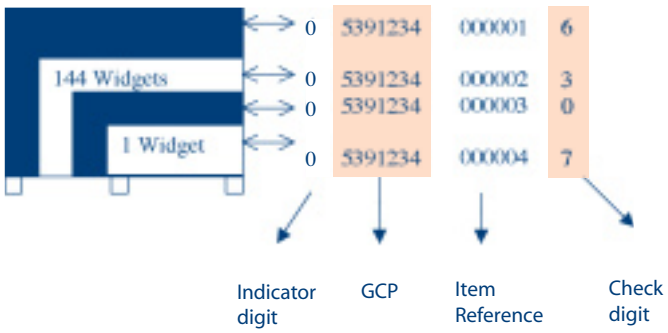
Fixed Measure Traded Units are identified using a 14 digit GTIN called a GTIN-14. The procedure for allocating the number is the same as the procedure for allocating standard GTIN's with the exception of point 2 below.

1. Using your GCP assign the next in sequence item reference making a 12 digit number.

2. Place a prefix "0"(zero) in front of the first digit making a 13 digit number

3. Calculate the check digit using the online calculator and place the result in the 14th digit place on the right hand side.

The assignment of GTIN's is completed when all items in the product hierarchy have been assigned their respective GTIN's.




The previous diagram indicates how GTIN's are assigned for a hierarchical structured fixed measure item.

**Note**

**When designing databases to record GTIN data, it is critical that the field size should be 14 digits. Although only thirteen are presently used – future applications will extend to 14 digits at the point of sale.**

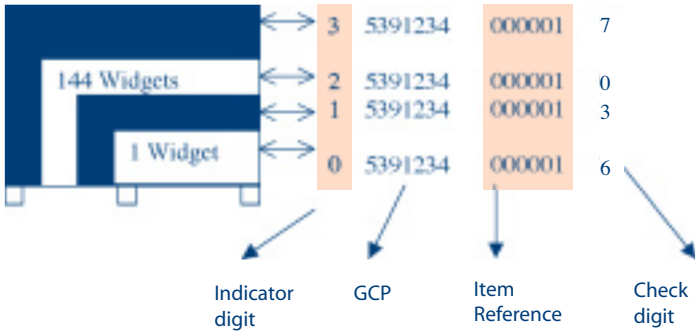
**Step 5 – Notify your Trading Partners**

Having assigned the GTIN's to your products, it is imperative to inform all your trading partners. Most retailers will request this data on product data sheets. This data will include the GTIN for on the point sale item and other GTIN's assigned to higher packing levels up to and including the pallet.

The GTIN's are also the key identifiers used by the GS1 Ireland Data Pool. Data Pool which will provide product data to your trading partners.

### 3.4.3 Alternate Method for GTIN Assignment for Non-Retail fixed Measure Trade Units

In the United States and Canada as well some other countries, an alternate method to identify Trade Units may be used.



The indicator digit can be used as a packaging hierarchy flag, enabling the stem (GCP + Item Reference) to remain the same. The check digit will change because the indicator value changes.

The indicator value "9" is retained for Variable Measure Traded Units see Section 3.5.2 below.

### 3.5 GTINs on Very Small Fixed Measure Retail Items

The allocation of the special GTIN-8 Number is restricted to items that, because of their small size, cannot accommodate a GTIN-13. The GTIN-8 is assigned by GS1 Ireland to retail items only on request and approval. Again, the numbers commence with the digits 539, indicating that the number was issued by GS1 Ireland. The next four digits uniquely identify the product and the final digit is the check digit.

When making an application to GS1 Ireland for a GTIN-8, details about the product such as name, size of product and label size are required.

A GTIN-8 may be issued under the following conditions:

- If the GTIN-13 Bar Code Symbol, in the size required as a result of print quality studies, exceeds either 25% of the largest side of the printed label area or 12.5% of the total printable area.
- If either the largest side of the printed label is less than 4cm or the total printable area is less than 8 $cm^2$.
- On cylindrical products with diameter less than 3cm.

**GTIN's on Very Small Fixed Measure Non-Retail Items**

GTIN-8's are not issued for Traded Units. GTIN-8 items contained in non-retail fixed measure traded units are managed as per the procedures above for a standard fixed measure item.

As per GS1 recommendations proper records need to be maintained of all GTIN-8 numbers assigned to you by GS1 Ireland. Should you cancel or delete a product, GS1 Ireland should be notified that the GTIN-8 Numbers are no longer required. If you reassign the GTIN-8 Numbers (four years after the deletion of the product) you should notify GS1 Ireland of the reassignment.

**GS1 are introducing a new style of bar code called a GS1 DataBar. With this style of bar code it will be possible to encode the full GTIN-13 in a reduced size symbol for small items. Please refer to Section 5.4 for an introduction to GS1 DataBar**

### 3.6 Variable Measure Trade Items

The term Variable Measure Trade Item is used to describe products which are sold, ordered or produced in quantities which can vary continuously, such as fruit and vegetables, meat, cheese, rope, chain, fabric, carpets on a roll etc.

#### 3.6.1 Variable Measure Retail Trade Items

In Ireland, for retail items only, the Variable Measure Trade Item identification is based on a specifically reserved number bank allocated by GS1 Ireland. This reserved number includes a company identification, product identification and price. In addition, there are verifiers and check digits included in the number. The number can only be used in the Republic of Ireland.

The first step is to contact GS1 Ireland and request a "Branded Variable Weight" number.

GS1 Ireland will issue you with a number that has the following structure:

20 XXX NN V PPPP C

Where:

| | |
|---|---|
| 20 | a prefix that indicates that the item is a variable measure trade item |
| XXX | the identifier assigned to the company by GS1 Ireland |
| NN | the item number assigned by company |
| V | the price verifier number |
| PPPP | the price of the product in Euro and Cent (EECC) |
| C | the check digit |

The value NN allows you to detail up to one hundred different variable measure items.

The price verifier "V" algorithm is calculated using a 4-digit price verifier algorithm based on the values in the PPPP fields of the number. This calculation will be made by the software incorporated into digital scales equipment. If you require further details on the price verifier please contact GS1 Ireland.

The check digit "C" is calculated after the price verifier is calculated and is the same as the standard GTIN algorithm.

The same rules apply to the maintenance of this number as applies to the fixed measure items. As the price field continuously varies in the number, for the purposes of recording the number in a database the price field should be zero filled.

GS1 Ireland is introducing a new style of bar code called a GS1 DataBar. With this style of bar code it is possible to encode

the full GTIN-13 and also to include the price, currency and/or weight as part of the symbol. The GS1 DataBar can also hold additional information such as traceability data and expiry dates enhancing compliance with food traceability legislation.

**Please refer to section 5.4 for an introduction to GS1 DataBar**

### 3.6.2 Non-Retail Variable Measure Items or Traded Units

Non-retail Variable Measure Trade Items refer to the traded units between manufacturer/distributor and the retailer. These items are variable measure either because the production processes do not guarantee consistency in weight, size or length (e.g. carcasses of meat, whole cheeses etc.) or the items are created to meet a special order which states a specific quantity (e.g. textiles ordered by the metre, glass ordered by the square metre).

Variable Measure Traded units are identified using a GTIN-14. The procedure for allocating the number is basically the same as the procedure for allocating fixed measure GTIN's with the exception of point 2.

1. Using your GCP assign the next in sequence item reference making a 12 digit number.
2. Place a prefix "9" in the first digit making a 13 digit number
3. Calculate the check digit using the online calculator and place the result in the fourteenth digit place.

The value "9" used for the first digit of the GTIN acts as a special flag to indicate to the scanning application that an additional piece of data needs to be scanned to quantify the traded unit. This additional piece of data is normally the weight of the item.

Variable Measure Trade Item identification requires two data attributes to fully identify and quantify the item identification and the value of the measure used, i.e. to complete the identification of a variable measure trade item the presence of the specific measure of the item is mandatory.

**Note**: *Trade items which are sold in discrete and pre-defined bands (e.g. as a nominal weight) are treated as fixed measure trade items*

## 3.7 Exporting to the United States and Canada

A separate numbering system used in the United States and Canada, called the Universal Product Code or UPC (now renamed GTIN-12) is administered by GS1 US. If you are exporting to either of the above countries you may need to apply to GS1 Ireland for a UPC-A Prefix (GTIN-12), with which you can number your products.

The number structures and bar code symbols for North America look very similar to those used for GTIN-13. The crucial difference however is that the numbers are 12 digits including the check digit. Currently many databases in the U.S. together with the software for scanning bar codes at a retail point of sale are configured to read a maximum of 12 digits. However, outside North America UPC codes (GTIN-12) will be scanned and read without any problem including Ireland and Europe.

A GTIN-13 will only be accepted by some retailers in North America for point of sale. A project is currently underway to migrate all U.S. systems to a 14-digit data field.

**If you are exporting to North America you should check if your customers can scan a full GTIN-13 at the point of sale. If not you will require a UPC code.**

A similar procedure applies for very small items exported to the United States and Canada.

GTIN-14 used for non-retail items is widely in use in the United States.

## 3.8 Money Off Vouchers or Coupons (Euro Zone only)

A common GTIN structure has been developed for money off vouchers or coupons for Euro zone countries. If you wish to bar code a coupon you will need a special Company Prefix Number starting with the digits 981 or 982. As with variable weight retail units, these GTIN's encode the value of the coupon. The structure of a Euro Coupon Prefix is as follows:

981 XXXX NNVVV C (for coupons €10.0 to €99.9)
982 XXXX NNVVV C (for coupons €0.01 to €9.99)

Where

981XXXX or 982XXXX is called the Coupon Issuer Number. These seven digits identify your company as the unique holder of this coupon number.

NN is the Coupon Reference Number. These two digits enable your company to allocate unique numbers to each coupon promotion. The first promotion can be numbered 00, the second 01 and so on to 99. Each promotion has a unique reference number.

VVV is the monetary value. These three digits are the redemption value of the coupon. Redemption values from 1c to €9.99 should be represented with the prefix 982 and by three value digits from 001 to 999. For example, if the coupon redemption value is 50 cent VVV= 050. For values greater than €10 use the prefix 981 and the value is in 10 cent blocks from

10.0 to 99.9. Coupons for free goods should have a zero value (VVV = 000).

C is the Check Digit. This digit is calculated according to the standard formula.

As per GS1 recommendations proper records need to be maintained of all coupons issued.

### 3.9 Books & Serial Publications

Books and Serial publications are identified by two numbers. They are not managed by GS1 but have a similar construction as a GTIN-13

**ISBN**: The International Standard Book Number (ISBN) is a 13-digit number that uniquely identifies a specific edition of a book. National centres throughout the world, acting on behalf of the International ISBN Agency, assign ISBNs to new books shortly before publication. The ISBN Agency for the UK and the Republic of Ireland issues ISBNs for books published in Ireland.

**ISSN**: The International Standard Serial Number (ISSN) is an 8-digit number that uniquely identifies a serial publication. If you are the publisher or editor of a periodical then we strongly recommend that you apply to have an ISSN assigned to your publication. This can be done retrospectively, even if the periodical was first published many years ago. The Irish National ISSN centre is in the National Library of Ireland.

**If you require further information, please contact the National Library of Ireland.**

### 3.10 Overall Representation of GTINs in the GS1 Standards

In cases where there are less than 14 numbers in a data structure e.g. GTIN-8, the numbers must be right-justified in a 14-digit field and the left most positions are prefixed with zeros to make the number up to 14-digits. See the diagram below

### 3.11 A Special Word on Promotions

Some promotions require a temporary change to a trade item that visibly modifies the presentation of the product. The promotional product usually co-exists with the standard product.

- Promotional variants of trade items, which affect the size or the weight of the product, must be allocated a separate GTIN. Examples would include an extra percentage of a product free or if a free gift is attached.
- Promotional variants of trade items, where a price reduction is explicitly specified on the pack (flash packs) must be allocated a separate GTIN. An example would be a package advertising that there are 10 cents off the purchase price.
- Seasonal promotions of a trade item, e.g. chocolate specially over-wrapped for Easter or Christmas should be allocated a separate GTIN.
- Other promotional variants should not be allocated a separate GTIN. Examples: Money off coupon, free gift inside, "send for" offer or competition offer.

However, if the promotion is based purely on price and does not affect the packaging and supply of the product then the GTIN need not be changed.

If the retail GTIN changes all higher packaging GTIN's linked to that item must also change.

### 3.12 Need to Know Items

#### 3.12.1 What if the retail item and the traded unit are the same?

If the packaging unit is the same as the consumer unit and is sold at the retail POS e.g. a sack of potatoes then the GTIN remains the same.

#### 3.12.2 Re-using deleted GTIN's

If a product is discontinued, the GTIN may be re-assigned to another product if the product is no longer within the supply chain and a period of no less than four years has lapsed since the product was discontinued.

| Data structures | Global Trade Item Number (GTIN) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ | $T_{11}$ | $T_{12}$ | $T_{13}$ | $T_{14}$ |
| GTIN-14 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ | $N_{14}$ |
| GTIN-13 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ |
| GTIN-12 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ |
| GTIN-8 | 0 | 0 | 0 | 0 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ |

# Section 4

In this Section you will be shown how to use the GS1 System to add value to other Supply Chain Processes.

## 4.1 Adding Value Using the GS1 System

### 4.1.1 The Serial Shipping Container Code

The Serial Shipping Container Code (SSCC) is a globally unique reference number that may be applied to a mixed or homogenous shipper or pallet to uniquely identify that container in the supply chain. It is in effect a globally unique license plate.

The SSCC is printed in a bar code symbol on a shipping label which is then applied to the shipper or pallet. This can then be scanned at any point in the supply chain and data can be stored, processed and retrieved about the shipment provided it has been sent in advance.

See Pallet Label in Section 6

**Generating an SSCC**

The Global Company Prefix as assigned to your company is used to generate the SSCC. The SSCC is generated as follows:

**Step 1**
Using your GCP as assigned by GS1 an extension digit "3" is added as a prefix to the GCP number.

**Step 2**
Using the number in step 1(depending on your GCP) 5 to 9 extra digits are added to make up a total of seventeen digits. These extra digits are generated on demand for each shipper or pallet to be labelled.

If you have a:

- GCP-11 the capacity is 100,000 shippers/pallets.
- GCP-9 the capacity is 10,000,000 shippers/pallets.
- GCP-7 the capacity is 1,000,000,000 shippers/pallets.

**Step 3**
The final step is to generate the check digit using the standard GS1 algorithm (see www.gs1ie.org).

SSCC's may be reused after a period of 2 years.

### 4.1.2 Global Location Numbers

**GLN:**

Global Location Numbers (GLN) are used to identify places within an organisation. The use of GLN's can be divided into two categories; external and internal.

#### 4.1.2.1 External Usage

Externally GLN's are used in eCommerce to enable trading partners communicate with each other through Electronic Data Interchange (EDI). The GLN used in EDI acts as a secure mailbox through which information can be exchanged. Through the use of GLN's, trading partners can ensure that sensitive information such as purchase orders and invoices can be securely sent to the GLN of the intended recipient only.

These Global Location Numbers can only be obtained directly from GS1 Ireland (they cannot be assigned from the bank of numbers that are allocated to an organisation). Further information on these GLN's can be obtained from GS1 Ireland.

#### 4.1.2.2 Internal Usage

Internally GLN's are used to identify specific entities within organisations. These numbers are assigned by companies from the GCP that has been allocated to them by GS1 Ireland. These numbers can be used to identify:

| Serial Shipping Container Code | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Extension digit | GCP Serial Reference | | | | | | | | | | | | | | | Check Digit |
| | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ | $N_{14}$ | $N_{15}$ | $N_{16}$ | $N_{17}$ | $N_{18}$ |
| GCP-11 | 3 | 5 | 3 | 9 | N | N | N | N | N | N | N | N | S | S | S | S | S | $N_{18}$ |
| GCP-9 | 3 | 5 | 3 | 9 | N | N | N | N | N | N | S | S | S | S | S | S | S | $N_{18}$ |
| GCP-7 | 3 | 5 | 3 | 9 | N | N | N | N | S | S | S | S | S | S | S | S | S | $N_{18}$ |

- Warehouses
- Rooms
- Areas within Warehouses/Rooms
- Vehicles
- Racks
- Etc.

In fact internal GLN's can be used to give an identification to any level of location that is required, from an entire factory/warehouse to a desk within a warehouse.

A Global Location Number (GLN) can be used in an electronic message, a bar code or in a radio frequency tag.

For example, if some areas of your business operate in different locations (e.g. retail outlets or warehouse) each of the locations can be assigned a different GLN. Another example might be to assign a GLN to different departments within your organisation.

Electronic messages and bar codes can include GLN's that can be scanned/read and then link the scanned item to a location e.g. a delivery location or an invoice department.

#### 4.1.2.3 How does one assign a GLN?

GLN's can be assigned in the same way as a GTIN. You may use your company prefix to reserve a portion of the number range for GLN purposes. Then allocate them in sequence as you would a GTIN and calculate the respective check digits using the same algorithm as the GTIN algorithm.

Please refer to the GLN allocation rules on our website www.gs1ie.org

# Section 5

In this section you will be introduced to the various different types of bar code symbol which can be used to print GTIN's and the other identifiers in a machine readable format.

### Translating the GTIN into a bar code.

Now that you have been allocated the GCP and have generated the identification number it is time to translate those digits into a machine readable form, i.e., a bar code.

Bar codes work on the principle of contrast between light and dark areas. When a bar code scanner interrogates a bar code, it detects the contrast between the light areas and the dark areas and then interprets the number, i.e., GTIN and other data from the scan. The ideal bar code is one that represents the correct data and is scannable when printed within the allowable ranges. There a number of important parameters to be considered for all types of bar codes to ensure a successful data capture each time the bar code is scanned.

### X-Dimension

The size of the symbol is determined by a parameter called the x-dimension. The x-dimension refers to the individual width of a single bar (narrowest) or module. The width of the other bars and spaces is two, three or four times the x-dimension. For the different symbols there is a nominal dimension which will guarantee the performance of the symbol. However, the X-dimension can be varied between a maximum and a minimum value.

### Quiet Zones (Light Margins)

The clear spaces to the left and right of each bar code are very important as they are used by the scanner to determine where the bar code starts and finishes. These light margins or quiet zones must be the same background colour as the rest of the bar code and nothing must be printed in these areas except for the symbol's light margin indicators. The minimum Quiet Zone width required by the main bar code symbol is based on at least 7 times the x-dimension.

It is optional, but recommended, that an extra 2mm is added to the left and right light margins to ensure that adequate light margins are maintained.

Light margin indicators are optional, but they are strongly recommended to help safeguard the light margins.

### Symbol Heights

Symbol heights are related to the X Dimension. For EAN/UPC symbols the height includes the human readable data. For ITF-14 and GS1-128 the symbol height refers to the actual bar height only.

## 5.1 Types of Bar Codes

Just as there were different GTIN formats for different applications, there are different bar code formats or "symbologies".

### 5.1.1 EAN-13

### EAN-13 Specifications

The EAN-13 symbol is used for the 13-digit retail GTIN numbers assigned directly by your company for use on fixed weight consumer products. It is also the symbology used for encoding the variable weight numbers commencing with the prefixes 20 and 02. Finally, the EAN-13 format is used if you wish to print a bar code commencing with the 981 or 982 prefixes for use on a money off voucher or coupon.


| | X dimension | Width | Height | Left Quite Zone(11x) | Right Quite Zone(7X) |
|---|---|---|---|---|---|
| Nominal | 0.33mm | 37.29mm | 26mm | 3.63mm | 2.31mm |
| Maximum | 0.66mm | 74.58mm | 52mm | 7.26mm | 4.62mm |
| Minimum | 0.264mm | 29.83mm | 21mm | 2.904mm | 1.848mm |

***Note: Bar code height has been rounded***

If an EAN-13 symbol is used for a Traded Unit then the target X dimension is 0.495 mm and the minimum height is 32mm.

### 5.1.2 EAN-8

#### EAN-8 Specifications

The EAN-8 symbol is used for retail GTIN numbers assigned directly by GS1 Ireland for small retail products.


| | X dimension | Width | Height | Left Quite Zone(7x) | Right Quite Zone(7X) |
|---|---|---|---|---|---|
| Nominal | 0.33mm | 26.73mm | 21mm | 2.31mm | 2.31mm |
| Maximum | 0.66mm | 53.46mm | 43 mm | 4.62mm | 4.62mm |
| Minimum | 0.264mm | 21.38mm | 17mm | 1.848mm | 1.848mm |

***Note: Bar code height has been rounded***

### 5.1.3 UPC-A & UPC-E

#### UPC-A and UPC-E Specifications

The UPC-A symbol is used for the 12-digit retail GTIN numbers assigned for use on fixed weight consumer products intended for sale in North America. The UPC-E symbol is used for small retail products intended for sale in North America which cannot accommodate a UPC-A symbol.

**UPC-A**


| | X dimension | Width | Height | Left Quite Zone(9x) | Right Quite Zone(9X) |
|---|---|---|---|---|---|
| Nominal | 0.33mm | 37.29mm | 26mm | 2.97mm | 2.97mm |
| Maximum | 0.66mm | 74.58mm | 52mm | 5.94mm | 5.94mm |
| Minimum | 0.264mm | 29.83mm | 21mm | 2.376mm | 2.376mm |

***Note: Bar code height has been rounded***

If an UPC-A symbol is used for a Traded Unit then the target X dimension is 0.495 mm and the minimum height is 32mm.

**UPC-E**


| | X dimension | Width | Height | Left Quite Zone(9x) | Right Quite Zone(7X) |
|---|---|---|---|---|---|
| Nominal | 0.33mm | 22.11mm | 26mm | 2.97mm | 2.31mm |
| Maximum | 0.66mm | 44.22mm | 52mm | 5.94mm | 4.62mm |
| Minimum | 0.264mm | 17.69mm | 21mm | 2.376mm | 1.848mm |

***Note: Bar code height has been rounded***

### 5.1.4 ITF-14

The ITF-14 symbol is used for trade items not passing the point of sale and is ideal for use where the symbol is to be printed onto corrugated fibreboard. If you have to provide extra information you will have to use the GS1-128 Symbol (see below)

| | X dimension | Width | Height | Left Quite Zone(10x) | Right Quite Zone(10X) |
|---|---|---|---|---|---|
| Nominal | 1.016mm | 142.75mm | 32.00mm | 10.2mm | 10.2mm |
| Maximum | 1.016mm | 142.75mm | 32.00mm | 10.2mm | 10.2mm |
| Minimum | 0.495mm | 71 .4mm | 32.00mm | 4.95mm | 4.95mm |

Only use an ITF-14 symbol with an X-dimension of less than 0.635mm when printing onto labels or high quality substrates.

The bar codes must be upright, in picket fence orientation, so that the bars are vertical.

The heavy outer bearer bar should always be printed when printing on fibreboard. If printing onto a label, it is only necessary to print the upper and lower bars to a width of 1mm.

## 5.2 GS1-128

The GS1-128 is a symbol which enables users to encode supplementary information about a product in addition to its GTIN (Global Trade Identification Number). GS1-128 is structured using Application Identifiers (AI's) i.e. prefixes which indicate the type of information included in the bar code. This additional information may typically include batch numbers, sell by dates, serial numbers, measurements and quantities or where the order is to be delivered using GLNs.

GS1-128 may only be used on traded unit items. Retail POS systems are currently not capable of reading a GS1-128 symbol. It is also not recommended to use GS1-128 symbol when printing directly onto corrugated fibreboard (an ITF-14 symbol is more suitable but does not have the data capabilities).

### 5.2.1 Where did GS1-128 come from?

The GS1-128 was formerly known as the UCC\EAN 128 and its use is exclusively licensed to GS1. The GS1-128 symbology is a pure sub-set of another bar code called Code-128. Code-128 is a symbol which can encode all 128 ASCII alpha-numeric and special characters. Code-128 is not used in open trade as it does not follow a defined data structure. Therefore, it is only suitable for in-house or closed system applications.

However, GS1-128 can be used in open trade as it has a defined structure which has been agreed between GS1 and the Automatic Identification Manufacturers Inc. (AIM). A unique character called the Function One (FNC 1) character, found at the start of the bar code symbol, distinguishes GS1-128 from Code-128 symbol.

These bar codes, together with the Application Identifier standards, enable companies to provide additional information about a product alongside the GTIN. GS1-128 symbols are recommended when it is necessary to be able to scan:-

- Use by and best before dates
- Measurements for variable measure products
- Batch/Lot numbers
- Serial numbers

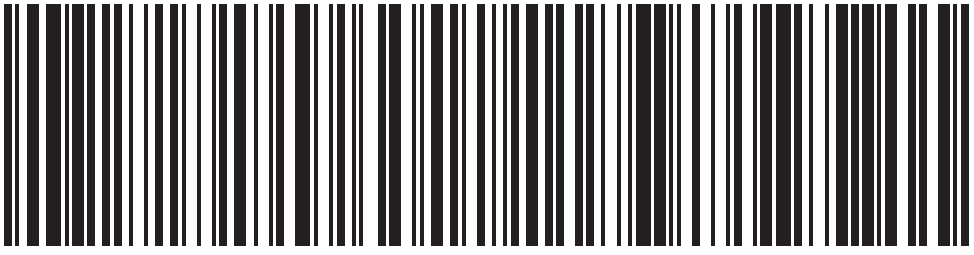
The different types of data are specified by the application identifiers (AI's). These AI's are encoded in the barcode symbol. The AI's appear enclosed in brackets in the human readable data of the symbol before each data field. The brackets are not encoded into the symbol itself.

Bearer bars are not mandatory but are strongly recommended to highlight bar code printing problems. When GS1-128 bar codes are printed on demand, in picket fence orientation, any missing print head elements will show up as white gaps in the bearer bars at the top of the symbol. The use of bearer bars will help ensure accurate production of these symbols.

Light margin indicators are not mandatory but are strongly recommended. Users must be confident that sufficient light margins are provided at each side of the symbol.

**It is important to remember that GS1-128 and Code-128 are not the same.**

| | X dimension | Width | Height | Left Quite Zone(10x) | Right Quite Zone(10X) |
|---|---|---|---|---|---|
| Nominal | 1.016mm | 165mm | 32.00mm | 10.2mm | 10.2mm |
| Maximum | 1.016mm | 165mm | 32.00mm | 10.2mm | 10.2mm |
| Minimum | 0.495mm | 165mm | 32.00mm | 4.95mm | 4.95mm |



(01)05391234987652(17)081231(10)AB1023

*This barcode is printed at 50% of nominal size*

The maximum number of characters that can be encoded in a single GS1-128 symbol is 48. If the number of characters is than less than 48 then the maximum width is reduced accordingly.

Specific recommendations are detailed in the General Specifications which explain how the data elements can be implemented in the GS1-128 symbol. In addition, for applications in healthcare where the scanning environment is significantly different the dimensional tolerances may be further reduced.

### 5.2.2 Application Identifiers

#### 5.2.2.1 What is an Application Identifier (AI)?

GS1-128 has a defined structure i.e. sets of rules which define the nature, format and structure of each piece of data. An Application Identifier or AI is a prefix or tag which precedes a piece of data and indicates the nature, format and content of that data string which follows it.

Application Identifiers may be 2 – 4 digits in length and will determine if the subsequent piece of data takes numeric or alphanumeric data and is fixed or variable in length. The AIs are represented in the human readable characters surrounded by brackets. For example the Application Identifier (01) means "GTIN" or Article Number. Application Identifiers are set globally by GS1 and are the keys to the successful interpretation of a GS1-128 symbol.

#### 5.2.2.2 What AIs are available?

There is a whole range of AIs to cover many different business requirements. These include, among others:

- Item Identification
- Traceability Numbers
- Dates
- Trade Quantities and Measures
- References & Locations

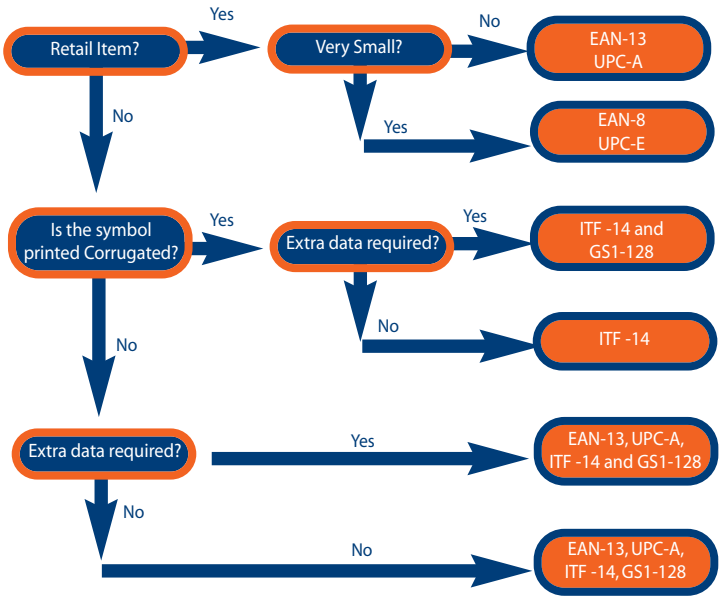
Some of the most commonly used Application Identifiers are:

00 for the SSCC
01 for the GTIN
02 for the GTIN of the item contained
10 for batch or lot number
11 Production Date
15 Best Before Date
17 Use By/Expiry Date
21 Serial Number
240 Additional Manufacturer's ID
3102 Net Weight KG (two decimal places)
37 is the quantity of the 02 GTIN
400 Customers P.O. No.
410 Ship To GLN
91 - 98 Internal Applications

A full list of all Application Identifiers, together with their specification, may be downloaded from the GS1 Ireland website www.gs1ie.org if required.

### 5.3 Which Symbol Should I Use?

The diagram below will assist in the selection of the correct type of symbol.




***Note: : A GS1-128 Symbol will have quality issues when printed directly onto corrugated. The GS1-128 Symbol can encode additional data as well as the GTIN itself***

## 5.4 GS1 DataBar

The GS1 DataBar family of bar code symbols (formerly know as RSS - Reduced Space Symbology) is one of latest additions to the GS1 suite of barcode symbols. GS1 DataBar symbols can be used to identify small items and can carry more information than the current GS1 linear retail symbols. The importance of these symbols is their small size.

GS1 DataBar can be used for hard to mark products such as fresh foods, jewellery and DIY products. They can also carry additional data such as serial numbers, lot numbers, and expiration dates using the same Application Identifiers as in the GS1-128 barcode symbol. This creates the opportunity for solutions supporting product authentication and traceability, product quality and effectiveness and variable measure product identification. They can provide additional value also for GS1 coupons by including authentication capabilities not currently available in the present coupons.

There are a number of international implementation programmes addressing Coupons (United States) and Fresh Produce (Europe). In Ireland, retailers are being encouraged to get ready for Data Bar and to review particular applications where the benefits of the GS1 Data Bar can be realised.

GS1 recommends that all retailing scanning applications should be able to scan GS1 DataBar after 1st January 2010.

### 5.4.1 The GS1 DataBar Family

The following symbols are contained within the GS1 DataBar family.

- GS1 DataBar
- GS1 DataBar Truncated
- GS1 DataBar Stacked Omnidirectional
- GS1 DataBar Limited
- GS1 DataBar Expanded
- GS1 DataBar Expanded Stacked

The first four symbols only contain the GTIN. The next two can contain additional data such as expiry and batch information.

**GS1 DataBar**


*Actual Size*

The GS1 DataBar-14 Bar Code Symbol is designed to be read by an omnidirectional scanner, such as a retail slot scanner. Its dimensions are 96X wide, starting with a 1X space and ending with a 1X bar, by 33X high (where X is the width of a module). For example, an GS1 DataBar-14 Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 24 millimetre (0.96 inch) wide and 8.25 millimetre (0.33 inch) high.

**GS1 DataBar Truncated**


*Actual Size*

The GS1 DataBar-14 Truncated Bar Code Symbol is a reduced height version of the GS1 DataBar-14 Bar Code Symbol that is designed for small items that will not need to be read by omnidirectional scanners. Its dimensions are 96X wide by 13X high (where X is the width of a module). For example, an GS1 DataBar-14 Truncated Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 24 millimetres (0.96 inch) wide by 3.25 millimetres (0.13 inch) high.

**GS1 DataBar Stacked**


*Actual Size*

The GS1 DataBar-14 Stacked Bar Code Symbol is a reduced height two-row version of the GS1 DataBar-14 Bar Code Symbol that is designed for small items that will not need to be read by omnidirectional scanners. Its dimensions are 50X wide by 13X high (where X is the width of a module). For example, an GS1 DataBar-14 Stacked Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 12.5 millimetres (0.50 inch) wide by 3.25 millimetres (0.13 inch) high. Its structure includes a 1X high separator pattern between the two rows.

**GS1DataBar Stacked Omnidirectional**


*Actual Size*

The GS1 DataBar-14 Stacked Omnidirectional Bar Code Symbol is a full height, two-row version of the GS1 DataBar-14 Bar Code Symbol that is designed to be read by an omnidirectional scanner, such as a retail slot scanner. Its dimensions are 50X wide by 69X high (where X is the width of a module). For example, an GS1 DataBar-14 Stacked Omnidirectional Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 12.5 millimetres (0.50 inch) wide by 17.25 millimetres (0.69 inch) high. The height of 69X includes a 3X high separator pattern between two rows of 33X each.

### GS1 DataBar Limited


*Actual Size*

The GS1 DataBar Limited Bar Code Symbol encodes the Element String AI (01). This Element String is based on the GTIN-12, GTIN-8, GTIN-13, or GTIN-14 Data Structures. However, when using the GTIN-14 Data Structure, only the indicator value 1 is allowed. The GS1 DataBar-14 family must be used for GTIN-14 Data Structures with an Indicator value greater than 1.

The GS1 DataBar Limited Bar Code Symbol is designed for small items that will not need to be read by omnidirectional Point-of-Sale (POS) scanners. Its dimensions are 74X wide, starting with a 1X space and ending with a 1X bar, by 10X high (where X is the width of a module). For example, an GS1 DataBar Limited Bar Code Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 18.5 millimetres (0.74 inches) wide by 2.5 millimetres (0.10 inch) high.

### GS1 DataBar Expanded Versions

GS1 DataBar Expanded is a variable length linear symbology capable of encoding up to 74 numeric or 41 alphabetic characters of AI Element String data. GS1 DataBar Expanded is designed to encode primary and supplementary data in items for Point-of-Sale (POS) and other applications. It has the same capabilities as a GS1-128 Symbol except that it is also designed to be scanned by omnidirectional slot scanners. It is designed for variable weight products, perishable products, traceable retail products, and coupons.

### GS1 DataBar Expanded


*Actual Size*

The GS1 DataBar Expanded Bar Code Symbol has a variable width (from 4 to 22 symbol characters, or a minimum of 102X wide and a maximum of 534X wide) and is 34X high (where X is the width of a module). The symbol starts with a 1X space and ends with either a 1X bar or space. For example, the GS1 DataBar Expanded Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 37.75 millimetres (1.51 inches) wide by 8.5 millimetres (0.34 inch) high.

### GS1 DataBar Expanded Stacked


*Actual Size*

The GS1 DataBar Expanded Stacked Bar Code Symbol is a multi-row stacked version of GS1 DataBar Expanded. It can be printed in widths of 2 to 20 segments and can have from 2 to 11 rows. Its structure includes a 3X high separator pattern between rows. It is designed to be read by an omnidirectional scanner such as a retail slot scanner. The GS1 DataBar Expanded Stacked Symbol with an X-dimension of 0.25 millimetre (0.010 inch) would be 25.5 millimetres (1.02 inches) wide by 17.75 millimetres (0.71 inch) high.

## 5.4.2 Coming Developments

GS1 Ireland is working with the retailing community to identify the most appropriate applications for the introduction of GS1 DataBar in Ireland.

## 5.5 GS1 Data Matrix

GS1 Data Matrix barcode is a high-density and very efficient, two-dimensional (2D) barcode Symbology that uses a small area of square modules with a unique perimeter pattern, which helps the barcode scanner determine cell locations and decode the symbol. The Symbology is made up of square modules arranged in either a square or rectangular format.

*Actual Size, 100%*

*Enlarged to 200% for better viewing*

The GS1 System has adopted this symbol because it can encode the full GS1 128 data structures in a much smaller space than a linear bar code. While these symbols cannot be scanned by current POS scanners (they require image and vision based scanners} because of their technical capabilities they are finding many new applications.

The symbols: -

- can be printed in a very small area;
- can be printed on many different substrates;
- can use many advanced printing techniques;
- have very good error correction capabilities; and
- encode an enormous amount of data (the greater the number of characters the greater the size (The square symbol format can encode up to 3116 digits and the rectangle can encode up to 98 digits).

GS1 Ireland is currently working on a number of non retail projects using the above symbols and they are offering exciting opportunities particular in healthcare and upstream track and trace applications including direct part marking.

# Section 6

In this section you will be introduced to the Pallet Logistics Label – an industry wide agreed standard for a label that can be applied to Logistical Units illustrating how human readable data and bar code symbols should be used.

## 6.1 Pallet Logistical Label

Pallets and other transport units may be labelled with a GS1 logistics label and an example of one is given opposite. The x-dimension for the GS1-128 bar codes shown here is 0.495 mm, and this is both the minimum and target size that should be used.

The GS1 General Specifications stipulate that GS1-128 bar codes must be used on these labels to represent the GS1 defined data. The most common label size is close to A5 which is 148 mm wide and 210 mm tall. If less information is required, some companies will choose to use a label size close to A6 which is 105 mm wide and 148 mm tall. The actual size of the label will depend on the requirements of the particular value chain, and any size of label may be used.

The label uses GS1-128 bar codes and provides information that will be useful to all the participants in the transport and distribution chain.

Each shipping container, transport unit or pallet is identified with a unique tracking number called a serial shipping container code or SSCC. See Section 4

- The SSCC is an 18 digit number that is unique for each unit
- The SSCC is specified by the AI 00
- The bar code containing the SSCC must always be the lowest bar code on the label

In addition to the SSCC most users will provide details of the contents of the pallet.

- Use AI 02 to give the GTIN of the cases on the pallet together with AI 37 to provide a count of the cases
- Only use AI 01 to give a GTIN for the pallet, if the pallet has a pre-defined configuration, and it is a traded unit. AI 01 must not be used together with AIs 02 and 37
- Use whichever extra AIs you need to provide additional information for yourself or your trading partners, for example AI 10 for batch number
- The height of the bars of all the bar codes must be a minimum of 32 mm
- Bearer bars should be used to give an indication of print head failure

# THE COMPANY LIMITED

## ANY ADDITIONAL INFORMATION

**SSCC**

050123450001234563

**Content**

15012345678907

**Count**

110

**Use by**

25.12.07

**Batch No.**

1234AB

# Section 7

This section will deal with the placement, printing and quality of bar codes symbols. An introduction to the Verification of bar code symbols is also included

## 7.1 Bar Code Placement

**Symbol placement guidelines**
Productivity and scanning accuracy improve considerably when the bar code location is predictable. Consistency in the location of the bar code achieves maximum productivity in any scanning environment.

**Symbol placement guidelines for retail items**
The preferred placement for a bar code is on the lower right quadrant on the back of the product, respecting the proper Quiet Zone areas around the bar code symbol and the edge rule. The alternative is on the lower quadrant of another side of the container.

**The Edge Rule:** the bar code symbol must not be closer than 8 mm from any edge or seam of the package / container.

The bar code, including the human readable digits underneath (identification number) must be visible and free of any obstacles preventing it from scanning.

Never allow two bar codes encoding different GTIN's to be visible on a package. This is particularly relevant to multi-packs, especially those with clear wrapping. Multi-packs must carry a separate GTIN, with all internal bar codes obscured.

If the item is **random wrapped**, the same bar code can be printed more than once on the wrapping. This ensures that one complete bar code is always visible.

Scanning is most successful when the bar code is printed on a reasonably **smooth matt** finish. Avoid printing around corners or on folds, creases, seams and any other uneven packaging area. Sometimes the **irregular shape** of packaging prevents the bar code from flat (parallel) contact with the scanning surface of slot scanners. This applies in particular to carded, blister-packed, or concave items.

The bar codes on consumer units must not be visible through the outer packaging

For small cylindrical products, the bar code must be positioned vertically (ladder orientation) to the curve, subject to the printing process and or the direction of print

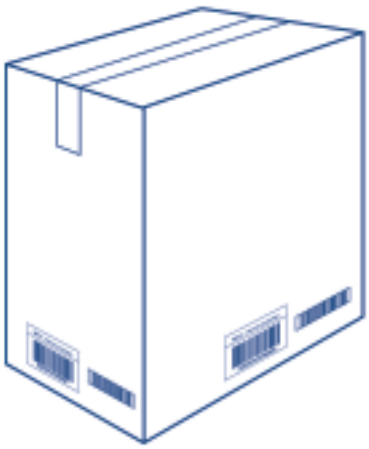
When determining which orientation to print the bar code, take into account the print process involved. For example, when using a flexographic process, it is essential to print the bar code in the print direction because of the ink "spread" associated with this printing process. When using a lithography process, spread is usually insignificant. Consult with your printer in all cases. On cylindrical products, where the printing direction allows, it is generally desirable that the bars are horizontal (ladder style) when you stand the item 'on its end'. This caters for the problems associated with curves on items such as cans and bottles. The ladder orientation is imperative for curved surfaces with a small radius.


**Symbol placement guidelines on non-retail items**

Two labels (or printed symbols) should be fixed to adjacent sides; a short side and the long side to the right (in warehouse applications this enables consistent turning to ensure a label is visible). The minimum is of course one label on any side, but not on the base.

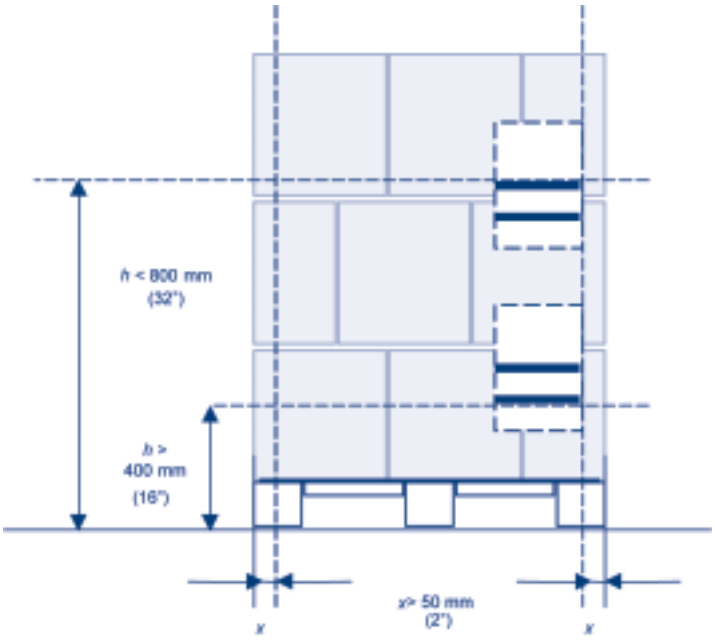
**(a) On cases less than 1 metre in height**

The lower edge of bar should be located 32 mm from the lower edge of the base of the case. Including Quiet Zones, the symbol should be at least 19 mm from the vertical edges. When using an ITF-14 Bar Code, the outer edges of the bar code's left or right bearer bar should be a minimum of 19 mm from the vertical edges of the side of the case.



**(b) On pallets and cases greater than 1 metre in height**

For pallets and other units greater than 1 metre in height, labels should be placed so that all the bar code symbols are at a height of between 400 mm and 800 mm from the base of the unit and no closer than 50 mm from the vertical edge.




## 7.2 Bar Code Print and Quality

### Getting bar codes printed

There are several ways to apply bar codes to your products. You can decide to incorporate the bar code into the product's printed packaging design or apply it to the product on an adhesive label either prepared in your office or by a print company. Alternatively depending upon your manufacturing process you can also consider in-line printing, where labels are applied to products during the manufacturing process.

Whatever method you choose to apply, a number of things must be considered, the size, bar height, quiet zones, colour, quality and placement.

### Sizes

See recommendations in Section 5.0

Bar codes can be printed in various sizes. The size to be selected, besides the scanning environment, depends also on the printing conditions. A small bar code can be used if good quality printing is coupled with a good quality substrate. It is not possible to select an arbitrary symbol size to fit a predetermined space on the package.

For each type of bar code, the size may vary between a minimum size and a maximum size. For direct printing, it is determined by testing the symbol according to established standards – See Section 7.3.

Another factor is the environment in which the symbol is to be scanned. Symbols intended for retail applications may be as small as the print quality permits, whereas the bar codes for use in a warehouse should be as large as is necessary to allow scanning from a considerable distance, i.e. by the operator of a Fork Lift truck.

### Truncation

Truncation, (reducing the height of the symbol) removes the omni-directional capability. Truncation should be used only as a last resort and is not recommended.

*The pictures below show symbols shortened in height.*

### Quiet Zones

All types of bar codes require Quiet Zones (i.e. an empty space), before the first bar and after the last bar. This Quiet Zone (aka Light Zone) is extremely important and must be respected. The size of the Quiet Zone area varies depending on the symbol size and type of the bar code. Any print within Quiet Zones can prevent the bar code symbol from being read.

*The diagram below illustrates symbols with insufficient light zones.*

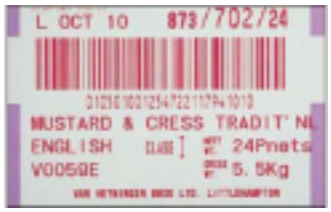
### Colour and contrast

Scanners work by measuring reflectance. There must be sufficient contrast between dark bars and light spaces and sufficient density of ink in the bars so as not to create voids.

Scanners use a beam of red light. A contrast that seems to be satisfactory to the human eye may not be sufficient for scanners. Bar codes can be printed using various colours. A general guideline is that light colours including red and orange are suitable for the spaces and quiet zones. Dark colours including black, blue, and green are suitable for the bars.

Composite colours are not adequate to print bar codes. It is best to use solid colours.

Choosing incorrect colour combinations, e.g. orange or red bars on a pale background, will not scan. Reversed out images, where the bars are white against a coloured background, are again not scannable.
Please refer to the colour chart reference on the rear cover of this document


High-gloss substrates may change the reflectance and checks must be made before printing. Transparent over-wraps may also reduce contrast and checks on the completed package should be made if over-wrapping is to be used.

## More Examples of Poor Bar Code Quality



Missing bars or horizontal white lines crossing the bar code because of faulty print heads used for on demand printing.

Using transparent or semi-transparent substrates, such as glass or plastic, and hoping that the contents will provide a suitable background colour either for the bars or the spaces.


Printing bar codes that are either too large or too small.



Incorrect adjustment for ink spread (the bar width reduction). The printed bars are out of specification, either being too narrow or too wide.



Placing labels too close to vertical corners or wrapping them around corners so that the bar codes are too close to the edge.


Show through of the bar codes on consumer units through the outer packaging.

Printing bar codes onto film which is distorted as it is used as shrink wrap.



Obscuring the bar codes.


Bar code printed vertically.


Bar code printed too close to edge of label.

**Problems with GS1 128 Symbols**

1. Printing Code 128 symbols instead of GS1-128 symbols because the mandatory Function 1 character is not included.

2. Encoding the brackets around the application identifiers as data within a GS1-128 bar code. These brackets are only used around the application identifiers in the human readable characters printed below the bar code.

3. Printing a GS1-128 symbol wider than 165 mm. This dimension includes the light margins which are not explicitly indicated, so special attention must be given.

4. Not showing the application identifiers in brackets below a GS1-128 bar code.

5. Not including the application identifiers required to define the data in a GS1-128 bar code.

## 7.3 Bar Code Verification

The accurate printing of bar codes is fundamental for effective value chain management as the rapid and accurate scanning of GS1 data provides the basis for all the electronic business transactions that follow.

Bar code scanning provides no indication of bar code quality as it gives no information about the symbol other than whether it can be scanned or not by that particular scanner. Scanners look for sufficient contrast between the bars and spaces, measure, and decode the different widths of bars and spaces into data that is sent to the software system.

The GS1 General Specifications provide a process for the production of bar codes that should result in scannable symbols, but a verification procedure needs to be followed to provide more information about symbol quality.

Staff need to be trained in the use of verification equipment, and must always check symbols visually before using a verifier that meets the requirements of ISO/IEC 15426-1 to provide detailed information. Each symbol must be checked to see that the bars are the correct height, and that no horizontal lines or spaces cut through the symbol. Any marks crossing the bars and spaces of a symbol will reduce its effective height and make it very difficult to scan.

The position of the bar code on the packaging will need to be checked to see that it meets the GS1 General Specifications. Any final labelling or wrapping should also be examined to ensure that the bar codes remain visible and scannable.

When checking symbol quality, you should attempt to simulate the final, filled product or package. If for example a white background is printed on to a clear substrate, check the colour of the contents of the item. If it is not possible to simulate the contents, verify the bar code twice, once over a black background and next over a white background. The worse of the two grades will provide information about the worst possibility.

Having checked that the bar codes are in the correct position and are not shortened in height (truncated), you can use verification equipment to obtain an overall grade for each symbol.

Verifiers that meet the international requirements will make measurements of and grade the following seven parameters of the code:

- The symbol contrast (a measure of the contrast difference between the dark bars and the paler background)
- The minimum reflectance (a check that the bars appear dark enough in relation to the spaces)
- The minimum edge contrast (a measure of the least difference in contrast between an adjacent bar and space). This will be a low grade if the bar code is unlikely to be read when it is scanned
- Modulation (a ratio of the minimum edge contrast to the symbol contrast). This grade will be low if positive

bar gain has increased the width of the bars causing a narrowing of the spaces between them
- Defects (which may be light voids within dark bars or dark spots in the spaces between the bars)
- Decode (an indication that the symbol will decode successfully if it conforms to the specifications, notably in respect of character encodation, check digits and light margins)
- Decodability (an indication of the accuracy of widths and positions of the bars and spaces)

All of these criteria are measured separately and the grade given to the bar code is the lowest score for any one of these measurements.

All of these characteristics can be measured by verification equipment which meets the requirements of ISO/IEC 15426-1, which incorporates the CEN (Comité Européen de Normalisation, the European Standards Committee) standards. These standards are compatible with those from ANSI (the American National Standards Institute) and the table below shows how they compare.

| Numeric Range (CEN) | Alphabetic Grade ANSI |
|---|---|
| 3.5 to 4.0 | A |
| 2.5 to 3.5 | B |
| 1.5 to 2.5 | C |
| 0.5 to 1.5 | D |
| 0.5 or below | F |

This standard applies to all the bar codes used by the GS1 System, and provides a basis for agreeing the quality of symbols acceptable with trading partners. The grade given by a verifier is only an indication of the quality of a symbol. The verifier should ideally be used to check each symbol ten times, using different paths through the symbol. Higher grades mean that the bar code in question is closer to the ideal than lower scoring symbols, but there may still be some faults that will prevent it from being decoded successfully by all scanners.

The aim is to produce bar codes with grades 4 or A, although this will be difficult with some printing processes and materials.

All bar codes must be grade 1.5 or C or above, except for ITF-14 symbols printed on to fibreboard, when grade 0.5 or D is acceptable.

In general, higher quality bar codes can be expected to scan more easily and quickly than lower quality bar codes of the same size. Bar codes of similar sizes, with no reduction in height (truncation), and high print quality contribute to fast, effortless scanning.

**Traditional verification**

The traditional approach to testing print quality, PCS or Print Contrast Signal, is not formally recommended by the GS1 General Specifications but it is still a useful means of obtaining information about the bar code. Most verification equipment will be able to report these parameters:

- The width, magnification or x-dimension of the bar code
- Dimensional bar width deviations, in particular a figure for average bar growth
- Dimensions of the light margins at each side of the code
- Print contrast signal. This compares the amount of light reflected from the bars to the amount of light reflected by the spaces and measures it as a percentage of the light from the spaces. It is a different measure from symbol contrast

# Section 8

In this section you will find details on sources of help, answers to some of the questions we are most frequently asked and an explanation of some of the technical terms you may come across or hear when dealing with bar coding.

## 8.1 Sources of Further Information and Help

### GS1 Ireland Membership Services

The staff of the GS1 Ireland Membership Services Team are available from 9.00 a.m. – 5.30 p.m. Monday to Friday (excluding Bank Holidays) to assist you with any queries you may have about the GS1 System.

Our comprehensive and interactive website contains much useful information about membership, generating bar code numbers and also contains an online facility for calculating check digits. There are other helpful leaflets you can download, together with details of training workshops you may wish to attend.

GS1 Ireland
The Nutley Building
Merrion Road
Dublin 4

Telephone: 01 208 0660

Facsimile: 01 208 0670

Email: info@gs1ie.org
Website: www.gs1ie.org

GS1 Global Office
Blue Tower
Avenue Louise 326 – Bte 10
1050 Brussels
Belgium
Website: www.gs1.org

## 8.2 Appendix One

### Checklist

- ✓ Re-check the GTIN and check this and other encoded data in any artwork
- ✓ Ensure that the check digit is correct.
- ✓ Ensure that the correct symbol is used for the relevant product, application and scanning environment.
- ✓ Check the size of the symbol, both the magnification and the bar height.
- ✓ Check the position of the symbol on the final, made-up product.
- ✓ Ensure that there are adequate light margins and that any optional light margin indicators are correctly placed.
- ✓ Check that the contrast between the bars and the background is adequate and that the colours chosen will scan. Make sure that the colour of the contents of the packaging will not unduly affect the contrast between the bars and spaces.
- ✓ Check the print quality regularly throughout the print run by verifying symbol quality.
- ✓ Check that the bar code will remain readable in the environment in which the product will be stored, handled and distributed.
- ✓ Ensure that no shrink-wrap, tape or other printing will obscure the bar code on the finished product.
- ✓ Ensure that no other bar code will show through from the inside of the pack.
- ✓ Carry out routine verification at all levels of packaging to ensure that the bar code complies with the required quality standard, and to identify any potential problems.
- ✓ Keep records of verification for the shelf life of the product.
- ✓ Notify trading partners of the GTINs and the products they identify in good time.

## 8.3 Appendix Two

### Summary of Best Practice Recommendations

| | EAN-8,EAN-13 UPC-E, UPC-A | ITF-14 printed on a label | ITF-14 pre-printed on board | GS1-128 |
|---|---|---|---|---|
| Consumer unit | 3 | X | X | X |
| Traded unit | 3 (except EAN-8 and UPC-E) | 3 | 3 | 3 |
| Traded unit with Shelf Life and/or Batch Number | N/A | N/A | N/A | 3 |
| Number of bar codes on a Consumer Unit | 1 | N/A | N/A | N/A |
| Number of bar codes on a Traded Unit | 2[1] | 1 | 2 | 1 |
| X-Dimension Range | 0.264 mm to 0.66 mm[2] | 0.495 mm to 1.016 mm | 0.635 mm to 1.016 mm | 0.495 mm to 1.016 mm |
| Target X-Dimension for Consumer Units | 0.33 mm | N/A | N/A | N/A |
| Target X-Dimension for Traded Units | 0.495 mm | 0.495 mm | 1.016 mm | 0.495 mm |
| Target Height Consumer Units at Nominal | 26mm except EAN-8 21mm | N/A | N/A | N/A |
| Target Height Traded Units at Nominal X-Dimensions X-Dimensions | 32 mm | 32 mm | 32 mm | 32 mm |
| Bearer bar | NO | YES - upper and lower sides | YES - All sides | Recommended-upper |
| Light margin indicators | Recommended | Recommended | Recommended | Recommended |
| Minimum Verifier Grade | C | C | D | C |

*Note 1: A minimum of one EAN/UPC symbol is required when the traded unit is also a consumer unit.*
*Note 2: A minimum x-dimension of 0.25mm is allowed for on demand bar code production*

**Key Points**

1. Ensure EAN-13, UPC-A, EAN-8 or UPC-E bar codes are used on any product that might be sold at a retail point of sale

2. If a traded unit might also be sold at a retail point of sale, it must be bar coded with a EAN-13 or UPC-A barcode with an x-dimension of at least 0.495 mm.

3. Traded units can be bar coded with any of these symbols– EAN-13, UPC-A, ITF-14 and EAN-128.

4. Remember that the light margins of any of the barcodes vary in proportion when you increase or decrease their size. Ensure that the light margins you provide at each side of the bar code will be adequate, and it is good practice to allow at least 1 or 2 mm extra on each side to allow for any variation in the printing.

5. When printing any of the GS1bar codes on demand, incorporate horizontal bearer bars that will allow you to see easily whether any print head elements are failing.

6. Make sure it is not possible to scan any of the bar codes on individual items when they are inside any outer packaging. The areas needed for the bar codes at their target sizes are as follows:

| Symbol Type | Nominal X–Dimension | Approx. Light Margin* | Space required for the symbol |
|---|---|---|---|
| EAN-13 | 0.33 mm | 6 mm (left), 4.5 mm (right) | 42 mm x 26 mm |
| UPC-A | 0.33 mm | 5 mm | 42 mm x 26 mm |
| EAN-8 | 0.33 mm | 4.5 mm | 31 mm x 22 mm |
| UPC-E | 0.33 mm | 5 mm (left), 4.5 mm (right) | 27 mm x 26 mm |
| ITF-14 on label | 0.495 mm | 7 mm | 75 mm x 49 mm |
| ITF-14 on board | 1.016 mm | 12 mm | 160 mm x 49 mm |
| GS1-128 showing GTIN and a date on a label | 0.495 mm | 7 mm | 103 mm x 40 mm |
| GS1-128 showing GTIN and a net weight and a date on a label | 0.495 mm | 7 mm | 131 mm x 40 mm |

**These dimensions include an extra 2 mm to the minimum required on each side of the bar code to ensure that adequate light margins are provided.*

## 8.4 Appendix Three

### Frequently Asked Questions

These are answers to the most frequently asked questions. They are intended to clear up some long-standing misconceptions about bar coding.

***Will the American bar codes (UPC-A and UPC-E) scan outside the USA?***

Yes. The GS1 System was designed around the American U.P.C. System, so the American symbols work perfectly in all GS1 Systems.

***Will GTIN-13 Symbols scan in the USA?***

Yes, in most instances. There are still some companies in North America who cannot currently accommodate 13 or 14 digits in their files.

***Do the first digits in the bar code indicate the country of origin of the product?***

No. The first digits refer to the GS1 or UCC office which issued the number. The products themselves may have been produced anywhere in the world. For example, numbers beginning with 539 have been allocated by GS1 Ireland, but members may not necessarily have manufactured the product in Ireland.

***Are the description and price of the item included in the bar code?***

In general this is not true. The bar code represents the number shown below it, which in turn simply identifies the item uniquely. All the information about a product is held on a computer database. The only exceptions are the numbers for retail Variable Measure Trade Items and coupon numbers, which include the price of the item or value of the coupon. GS1-128 bar codes may also be exempt from this rule.

***Are the first seven digits of a GTIN the manufacturer's identity number?***

No. GS1 Member Organisations allocate Company Prefixes that vary in length between six and ten digits, depending upon a company's needs.

***Are the bar codes on outer cases part of a different system?***

No. The GS1 System allows for three different bar code symbologies – GS1/UPC, ITF-14 and GS1-128 to be used. The numbering system is designed to be used for all packaging configurations and the different symbols are used according to information requirements, scanning environment and the printing materials being used.

***Will my in-house coding system fit into the Item Reference part of the article number?***

No, it is not meant to. The GS1 System is designed especially for open trade and will often be used alongside an internal system.

***Do bar codes have to be printed in black on a white background?***

No. It is important that the bars appear dark against a light background when lit by the red light which bar code scanners use. Cold colours such as blue, green or black can be used against backgrounds in warm colours like red, orange and yellow, as well as white. It is important to have sufficient contrast between the bars and spaces, so it is vital to check colour combinations with your printer.

***Are GS1 Bar Codes only really suitable for the retail point-of-sale?***

No. The GS1 System is a totally neutral system that can be used to identify anything that is traded between companies. Goods are scanned as they leave manufacturers, as they are handled by distributors, at goods inwards at warehouses and depots, for stock counts, order picking and so on. The system is used by companies operating in all trade and industry sectors.

***Are all bar codes the same?***

No, GS1, U.P.C., ITF-14 and GS1-128 bar codes have a standardised data content, which means they can be used by any company with a GS1 based system and not be confused with any other symbology. Other bar codes do not have a multi-industry standardised approach to the data they contain and so are only really suitable for use in closed systems.

## 8.5 Appendix Four

### Glossary of Terms

| | |
|---|---|
| AI | Abbreviation for Application Identifier. |
| AIDC Automatic Identification and Capture | a technology used to automatically capture data. AIDC technologies include bar code symbols, smart cards, biometrics and RFID |
| Application Identifier | The field of two or more characters at the beginning of an Element String encoded in a GS1-128 Symbol, which defines uniquely its format and meaning. |
| Bearer Bars | Bars surrounding a bar code to prevent misreads or to improve print quality of the bar code symbol. |
| Brand owner | The party that is responsible for allocating GS1 numbering and bar coding on a given trade item. The administrator of an GS1 Company Prefix. |
| Check Digit | A digit calculated from the other digits of an Element String, used to check that the data has been correctly composed. (See GS1 Check Digit Calculation.) |
| Company Number | A component of the GS1 Company Prefix. GS1 assign GS1 Company Prefixes to entities that administer the allocation of GS1 identification numbers. These entities may be commercial companies, not for profit organisations, governmental agencies, business units within organisations, etc. Criteria to qualify for the assignment of a GS1 Company Prefix are set by the GS1 Member Organisations. |

| | |
|---|---|
| Data carrier | A means to represent data in a machine readable form, used to enable automatic reading of the Element Strings. Elements Stings, e.g., a bar code or RFID tag |
| Data Pool | a database of accurate product information that is maintained by the data publisher (e.g. manufacturer) and is available to all users (i.e. subscribers such as distributors or retailers) who wish to use that data in their respective IT applications. |
| GS1 | Global Standards 1 |
| GS1 Global Office | GS1 Global, based in Brussels, Belgium, is an organisation of GS1 Member Organisations that manages the GS1 System. GS1 Global Standards One. |
| GTIN-8 Bar Code Symbol | A bar code symbol of the GS1 Symbology that encodes GTIN-8 Identification Numbers. |
| GTIN-13 Bar Code Symbol | A bar code symbol of the GS1 Symbology that encodes GTIN-13 Identification Numbers. |
| GS1 Check Digit Calculation | GS1 algorithm for the calculation of a Check Digit to verify accuracy of data decoded from a bar code symbol. |
| Global Company Prefix (GCP) | Part of the international GS1 Data Structures consisting of a GS1 Prefix and a Company Number both of which are allocated by a GS1 Global Member Organisation. |
| GS1 Prefix | A number with two or more digits, administered by GS1 Global, denoting the format and meaning of a particular Element String. |
| GS1 System | The specifications, standards, and guidelines administered by GS1 Global. |
| GTIN-8 | The eight-digit GS1 Data Structure composed of a Prefix, Item Reference and Check Digit used to identify small trade items. |
| GTIN-13 | The 13-digit GS1 Data Structure composed of a GS1 Company Prefix, Item Reference and Check Digit to identify trade items, locations and special applications (e.g. coupons). |
| GTIN 14 | The GS1 Identification Number comprising 14 digits used to identify trade items. |
| GS1/UPC Symbology | A family of bar code symbols including GTIN-8, GTIN-13, UPC-A and UPC-E versions. |
| EDI | Electronic Data Interchange. |
| Electronic Commerce | The conduct of business communications and management through electronic methods, such as electronic data interchange and automated data collection systems. |
| Fixed Measure Trade Item | An item always produced in the same pre-defined version (type, size, weight, contents, design, etc.) that may be sold at any point in the supply chain. |
| GLN | Shorthand term for the GS1 Global Location Number using the GTIN-13 Data Structure to identify physical, functional, or legal entities. |
| GTIN | Shorthand term for the GS1 Global Trade Item Number. A GTIN may use the GTIN-8, GTIN-13 or GTIN 14 Data Structure. |

| | |
|---|---|
| Item Reference | The part of the data structure allocated by the user to identify a trade item for a given GS1 Company Prefix. |
| ITF-14 Symbol | An ITF Symbol used by the GS1 System to carry GTIN 14 Identification Numbers. |
| Magnification | Different sizes of bar codes based on a nominal size and a fixed aspect ratio; stated as a percent or decimal equivalent of a nominal size. |
| Quiet Zone | A clear space containing no machine readable marks, which precedes the start character of a bar code symbol and follows the stop character. Also referred to as a Light Margin. |
| Quiet Zone Indicator | A 'greater than' (>) or 'less than' (<) character, also known as a chevron, which is printed in the human readable field of the bar code symbol, with the tip aligned with the outer edge of the Quiet Zone to preserve the space allocated to it. |
| Symbol Contrast | An ISO 15416 parameter that measures the difference between the largest and smallest reflectance values in a scan reflectance profile. |
| Trade item | Any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced or ordered or invoiced at any point in any supply chain. |
| Traded Unit | Any item that is traded between retailer and supplier. |
| Traded Unit Code | It is a GTIN assigned to a Unit traded by a manufacturer. |
| Truncation | Printing a symbol shorter than the symbology specification's minimum height recommendations. Truncation can make the symbol difficult for an operator to scan. |
| UCC Company Prefix | Part of the UCC-12 Data Structure consisting of a UCC Prefix and a Company Number allocated by the UCC. |
| GS1-128 Bar Code Symbol | A subset of the Code-128 Bar Code Symbol that is utilised exclusively for GS1 defined data structures. |
| UCC-12 Data Structure | The 12-digit UCC Data Structure composed of a UCC Company Prefix, Item Reference and Check Digit. |
| Uniform Code Council, Inc. | The Uniform Code Council, Inc. (UCC) based in the United States is GS1 US a member organisation of GS1 Global . |
| UPC-A Bar Code Symbol | A bar code symbol of the GS1/UPC Symbology that encodes UCC-12 Identification Numbers. |
| UPC-E Bar Code Symbol | A bar code symbol of the GS1/UPC Symbology representing a UCC-12 Identification Number in six explicitly encoded digits using zero suppression techniques. |
| Variable Measure Trade Item | An item always produced in the same pre-defined version (type, design, packaging, etc.) that may be sold at any point in the supply chain, which either may vary in weight/size by its nature or which may be traded without a pre-defined weight/size/length. |
| X-dimension | The specified width of the narrow element in a bar code symbol. |

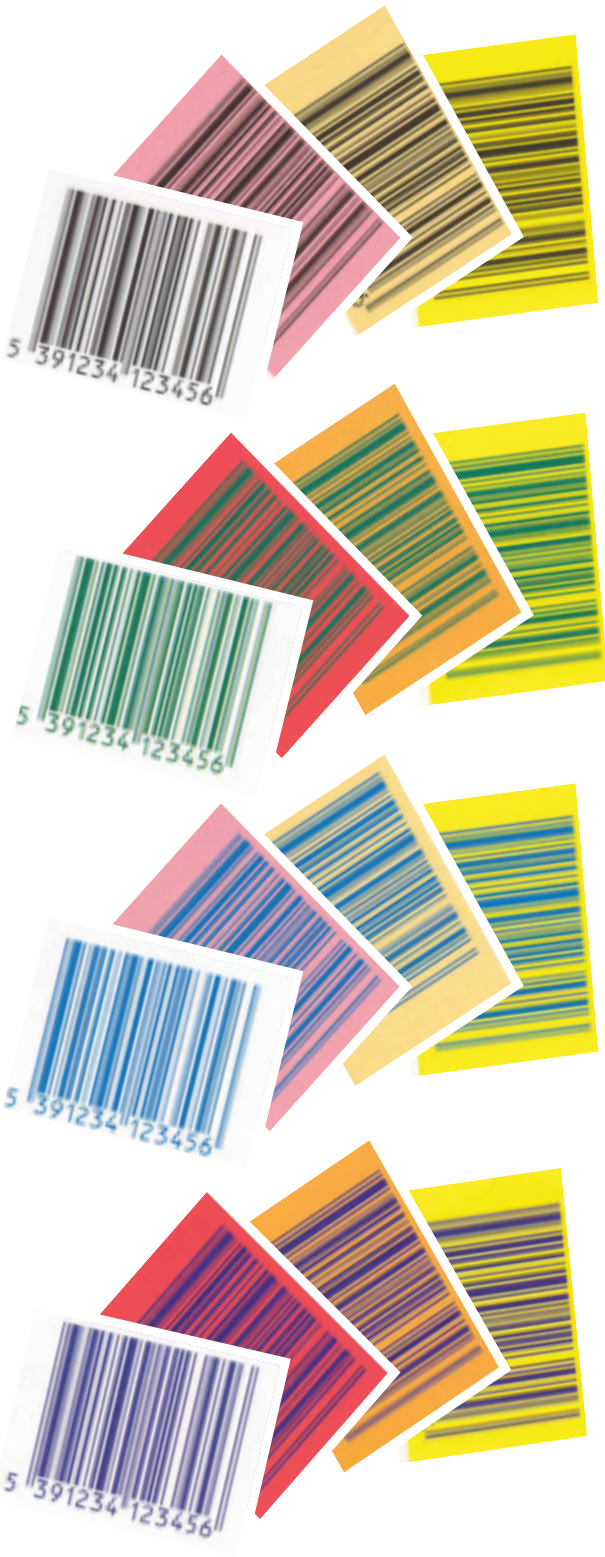
## 8.6 Appendix Five

### List of GS1 Prefixes

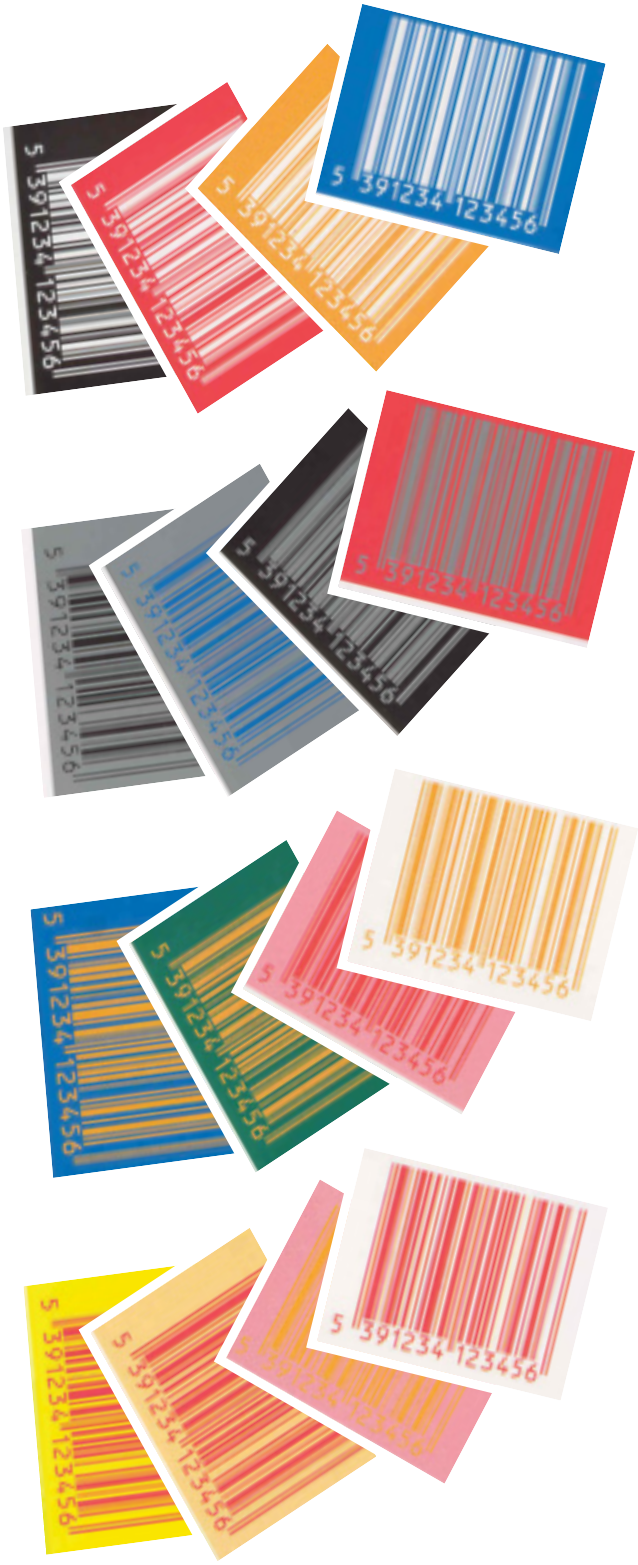
| | |
|---|---|
| 000 - 139 | GS1 US & GS1 Canada |
| 200 - 299 | In-store numbers |
| 300 - 379 | GS1 France |
| 380 | GS1 Bulgaria |
| 383 | GS1 Slovenia |
| 385 | GS1 Croatia |
| 387 | GS1 Bosnia-Herzegovina |
| 400 - 440 | GS1 Germany |
| 450 - 459 & 490 - 499 | GS1 Japan |
| 460 - 469 | GS1 Russia |
| 470 | GS1 Kyrgyzstan |
| 471 | GS1 Taiwan |
| 474 | GS1 Estonia |
| 475 | GS1 Latvia |
| 476 | GS1 Azerbaijan |
| 477 | GS1 Lithuania |
| 478 | GS1 Uzbekistan |
| 479 | GS1 Sri Lanka |
| 480 | GS1 Philippines |
| 481 | GS1 Belarus |
| 482 | GS1 Ukraine |
| 484 | GS1 Moldova |
| 485 | GS1 Armenia |
| 486 | GS1 Georgia |
| 487 | GS1 Kazakstan |
| 489 | GS1 Hong Kong |
| 500 - 509 | GS1 UK |
| 520 | GS1 Greece |
| 528 | GS1 Lebanon |
| 529 | GS1 Cyprus |
| 531 | GS1 Macedonia |
| 535 | GS1 Malta |
| 539 | GS1 Ireland |
| 540 - 549 | GS1Belgium - Luxembourg |
| 560 | GS1 Portugal |
| 569 | GS1 Iceland |
| 570 - 579 | GS1 Denmark |
| 590 | GS1 Poland |
| 594 | GS1 Romania |
| 599 | GS1 Hungary |
| 600 - 601 | GS1 South Africa |
| 608 | GS1 Bahrain |
| 609 | GS1 Mauritius |
| 611 | GS1 Morocco |
| 613 | GS1 Algeria |
| 616 | GS1 Kenya |
| 619 | GS1 Tunisia |
| 621 | GS1 Syria |
| 622 | GS1 Egypt |
| 624 | GS1 Libya |
| 625 | GS1 Jordan |
| 626 | GS1 Iran |
| 627 | GS1 Kuwait |
| 628 | GS1 Saudi Arabia |
| 629 | GS1 Emirates |
| 640 - 649 | GS1 Finland |
| 690 - 695 | GS1 China |
| 700 - 709 | GS1 Norway |
| 729 | GS1 Israel |
| 730 - 739 | GS1 Sweden |
| 740 | GS1 Guatemala |
| 741 | GS1 El Salvador |
| 742 | GS1 Honduras |
| 743 | GS1 Nicaragua |
| 744 | GS1 Costa Rica |
| 745 | GS1 Panama |
| 746 | GS1 República Dominicana |
| 750 | GS1 Mexico |
| 759 | GS1 Venezuela |
| 760 - 769 | GS1 Switzerland |
| 770 | GS1 Colombia |
| 773 | GS1 Uruguay |
| 775 | GS1 Peru |
| 777 | GS1 Bolivia |
| 779 | GS1 Argentina |
| 780 | GS1 Chile |
| 784 | GS1 Paraguay |
| 786 | GS1 Ecuador |
| 789 - 790 | GS1 Brasil |
| 800 - 839 | GS1 Italy |
| 840 - 849 | GS1 Spain |
| 850 | GS1 Cuba |
| 858 | GS1 Slovakia |
| 859 | GS1 Czech Republic |
| 860 | GS1 Yugoslavia |
| 867 | GS1 North Korea |
| 869 | GS1 Turkey |
| 870 - 879 | GS1 Netherlands |
| 880 | GS1 South Korea |
| 885 | GS1 Thailand |
| 888 | GS1 Singapore |
| 890 | GS1 India |
| 893 | GS1 Vietnam |
| 899 | GS1 Indonesia |
| 900 - 919 | GS1 Austria |
| 930 - 939 | GS1 Australia |
| 940 - 949 | GS1 New Zealand |
| 955 | GS1 Malaysia |
| 958 | GS1 Macau |
| 977 | ISSN - Serial publications |
| 978 | ISBN - Books & Paperbacks |
| 979 | ISBN & ISMN (Books & Printed Sheet Music) |
| 980 | Refund receipts |
| 981 - 982 | Euro Currency Coupons |
| 990 - 999 | Coupons |

Note: Prefixes not yet assigned are reserved for future use.

## SCANNABLE



## NON SCANNABLE



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