# CRISTAL STANDARDS FOR BAR CODING AND LABELLING OF AGRO PRODUCTS



## Version 4.1

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# 1   Executive Summary

Meeting farmers' expectations with regard to the supply of the right products, in the right quantity, at the right price and right quality at the right time and place is fundamental to the success of agribusiness participants.  For agribusiness supply chains, success in achieving this goal can be measured in terms of avoidance of wasted effort, low costs, and high levels of customer satisfaction.

Achieving efficiency in the management of the agro business supply chain relies on having fast, accurate and timely information about production, distribution and consumption.  The need for a highly responsive supply chain is driving the development of communication techniques.  Technologies such as automatic data capture (through the use of bar coding or RFID), electronic messaging, and data synchronisation are essential for this communication.  Any company serious about exploiting the concepts and practices of supply chain management must be competent in the use of these technologies. Nothing is more central to the effectiveness of a supply chain than the ability to transmit accurate, relevant, understandable and timely information among its participants.

To this end, the Agro business Industry seeks to adopt supply chain numbering and bar coding standards as defined by GS1. This should be a key objective for all trading partners if they are to effectively meet their company needs and exceed customers' expectations.

# 2 Introduction to Cristal

Three core technologies are required to support electronic commerce:

- Electronic Data Interchange (EDI) to transport the data between organisations;

- identification codes to provide the links to the meaning of the data communicated using EDI;

- bar codes to connect the data communicated with the physical goods transported between parties.

This document defines the standards for the use of bar codes and the labelling of products which will be followed by the manufacturers of agrochemicals participating in Project CRISTAL. The standards are based on those developed by GS1 and have been agreed by members of the CRISTAL Project Team operating under the remit of the European Crop Protection Association (ECPA). The primary purposes of the document are to define:

- the standards for bar coding

- the standards for the labelling of products towards which the manufacturers will work, taking into account the constraints imposed by current manufacturing processes.

These standards are designed to help business partners (manufacturers, carriers, distributors and retailers) to build e-commerce tools business to business oriented.

There are further documents from the project which define the standards for Electronic Data Interchange (EDI) messages, which will be used in conjunction with the standards defined in this document.
http://cristal.ecpa.be/ccom/documents/00003548.htm

The recommended basic standard for electronic data exchange is EDIFACT edited by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT). This organization releases international EDI Electronic Data Interchange standards for electronic trade documents in XML format.
http://www.unece.org/cefact.html
The implantation of EDI trade messages within the agricultural Supply Chain in France is one example of a common approach between all involved parties.
http://www.agroedieurope.fr/en/index.php
Beside there are compatible sub standards in use such as EANCOM or GS1 XML. More information is available in separate documents.
http://www.gs1.org/gsmp/kc/ecom/xml/un_cefact
http://www.gs1.org/ecom; http://www.gs1.org/gsmp/kc/ecom/xml/xml_bms; http://www.gs1-germany.de/gs1-standards/datenaustausch/eancom/edi-anwendungsempfehlung-von-gs1-germany/

## 2.1 The GS1 System

The GS1 System permits organisations of any size to order, track, trace, deliver and pay for goods across the supply chain, anywhere in the world.

As illustrated in Figure 1, GS1 Solutions and Services using the GS1 System include:

GS1 Identification Keys: GS1 Identification Keys are the keys to accessing information about a product (or any physical or non-physical item) on a computer file. The numbers are unique, non-significant and global. They can be allocated to trade items, logistic units, locations, assets, shipments, consignments, documents and service relationships. The main elements of the numbering system are GTIN, SSCC, GLN and the Attribute Data. Please contact GS1 Australia for a full list of a GS1 Identification Keys.

Bar Codes: Within the GS1 System, data carriers (most commonly bar codes) are used to encode the GS1 Identification Keys to facilitate communication, data collection and exchange of information and smooth the flow of information between trading partners.

eMessaging: GS1 EANCOM and GS1 XML are based on the principle of the transfer of structured data, using agreed messaging standards from one computer application to another by electronic means and with a minimum of human intervention. The structure and data content are exchanged by agreed means by trading partners. The electronic exchange of data or eMessaging provides trading partners with an efficient trading tool for the transmission of data.

**Figure 1: The GS1 System**
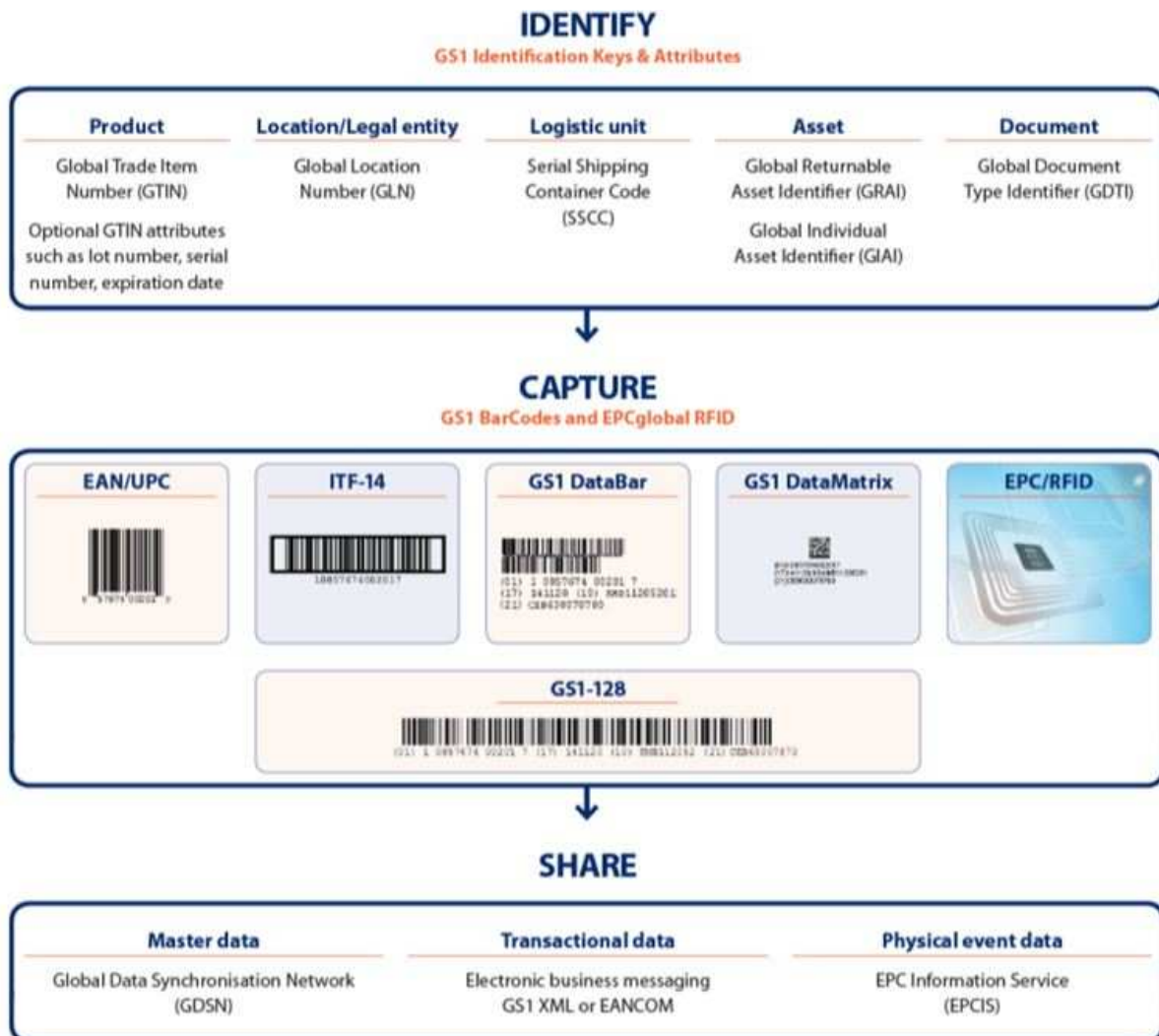


GS1 GDSN: The GS1 Global Data Synchronisation Network (GDSN) is a concept developed by various industry groups, including Global Commerce Initiative (GCI) and GS1 to assist industries streamline their supply chain transactions with the aim of reducing supply chain costs. The GS1 GDSN is an internet based interconnected network of interoperable data posted to a global registry that enables companies around the globe to exchange and synchronise supply chain master data with their trading partners. SA2 World Sync is the GDSN Data Pool run by a subsidiary of GS1 Germany.

EPCglobal: The EPC (Electronic Product Code) Network is an open standards-based system that will make organisations more effective through real and timely visibility of information about items in the supply chain. This new, open global standard combines Radio Frequency Identification technology (RFID), existing communications network infrastructure and the EPC (a number for uniquely identifying

an item) to create cost-efficient, real-time, accurate information about the location of items, the history of items, and the number of items in the supply chain.  It is based on research conducted through the Auto-ID Centre with the support of more than 100 leading companies.

# 3   Benefits of Implementation

Using a standard common approach to the numbering and bar coding of trade items, logistic units, locations, assets, and documents, amongst others, will deliver the benefits of speed, accuracy and labour savings in the handling and distribution of goods throughout the entire agribusiness supply chain.  Companies should consider that the implementation of the GS1 standards is applicable not only to meet customer or trading partner demands but also to improve internal supply chain management.  The benefits listed below are defined generically for users throughout the entire supply chain and not just the end user.

Some of the specific identified benefits are:
- More accurate information
- Real-time information
- Reduced manual entry
- Improved traceability (including for product recalls/withdrawals)
- Common identification across Industry
- Improved stock handling
- Improved stocktaking
- Reduced picking errors
- Reduce customer order errors

# 4 How to Number and Bar Code Trade Items

## 4.1 Definition of Trade Item

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 or ordered or invoiced at any point in any supply chain. This definition covers raw materials through to the end user products and also includes services, all of them having pre-defined characteristics.

A trade item may be a single, non-breakable unit and is identified with a Global Trade Item Number (GTIN); it may also be a standard and stable grouping of a series of single items. Such a unit may be presented in a wide variety of physical forms: a fibreboard carton, a covered or banded pallet, a film-wrapped tray, a crate with bottles, etc. Trade items consisting of single units are also identified with a unique GTIN; standard groupings of identical or different units are identified with separate unique GTINs.

The GTIN can be represented in one of the following ways:
- GTIN-8[1]
- GTIN-12[2]
- GTIN-13
- GTIN-14

A separate GTIN must be assigned to every different variation of a product. Size, style, grade, colour, etc are all considered separate variations and thus require separate GTINs.

Any change to trade items, such as weight, description, etc. may require the allocation of another GTIN. In this event consult www.gs1.org and follow the links to "GTIN Allocation Rules" for guidance on when a change of GTIN is required, or contact your local GS1 organisation for further information.

**Figure 2: Global Trade Item Number GTIN - Formats**

| Data Structures | GTIN *right justified in a 14-digt numeric field* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ | $T_{11}$ | $T_{12}$ | $T_{13}$ | $T_{14}$ |
| **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 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ |

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[1] GTIN-8 may be required if your trade item is too small to carry a GTIN-13. Please contact your local GS1 organisation.
[2] GTIN-12 may be required if your trade item is sold within the USA or Canada.

When allocating GTINs in any of the formats described in the following sections, GS1 recommends that no significance is created within the GTIN itself. Data is linked via a database to the GTIN, thus no level of understanding is required within the number itself.

**Note**: A GTIN allocated to a trade item that has become obsolete must not be re-used for another trade item until at least 48 months (4 years) has elapsed after:

- The expiration date of the last original trade items produced with that GTIN, or
- The last original trade items produced with that GTIN have been supplied to the customer

Companies may choose to extend the period of time before a GTIN is re-used beyond the minimum of four years; this is perfectly acceptable.

Consideration should be given to items which may exist in the marketplace for a longer period. For example, steel beams may be stored for many years before entering the supply chain, and processes should be put in place to ensure that the GTIN is not reallocated for a significant period of time.

In addition, when contemplating the re-use of a GTIN, consideration should be given to the use of data associated with the original GTIN by trading partners for statistical analysis or service records, which may continue long after the original trade item was last supplied.

# 4.2   Difference between Numbering and Bar Coding

The GS1 System makes a clear distinction between numbering and bar coding. Even though they often go together, it is very important to be clear about the difference.

## 4.2.1   Numbering

The GS1 System provides Identification Keys (the 'Numbers') for different applications. The application will determine how the number is to be used. The data structure of the GS1 Identification Keys guarantees worldwide uniqueness within the relevant area of application. There are nine GS1 Identification Keys that support the identification of trade items, logistic units, shipments, consignments, locations, documents, service recipients, individual assets, and returnable assets. Each of the GS1 Identification Keys provides a link between the items and information pertaining to them.

## 4.2.2   Bar Coding

All of the GS1 Identification Keys ('numbers') used in the GS1 System can be represented in data carriers and of these, bar codes are the most commonly used. Bar codes are a means of representing data in machine readable form, and allow automatic data capture at each point where an item leaves or enters premises.

With improvements in the technology and new application requirements, new data carriers such as GS1 DataMatrix and EPC/RFID have been introduced.

Bar codes are usually included in the production process, at the producer site. They may be pre-printed with other information present on the packaging, a label can be affixed to the item at the production line, or they can be printed directly on to the packaging online.

**Figure 3: Differnce between Key and Data Carrier**



GS1 Identification Key „number")
e. g. **GTIN-13**

GS1 Data Carrier („bar code"
e. g. **EAN-13**

3 362130 001232

# 4.3   Fixed Measure Trade Items – Consumer Unit

In general this is the lowest level of packaging as sold at retail level.  It could be a pack, a multi-pack or a twin pack. Any trade item which is intended to be sold to the final consumer through retail Point-of-Sale (POS) is more commonly known as a retail Item or consumer unit.

Consumer units can be identified with a GTIN-13 as described in the following section.

The format of the GTIN-13 is:

**Figure 4: Format of GTIN-13**
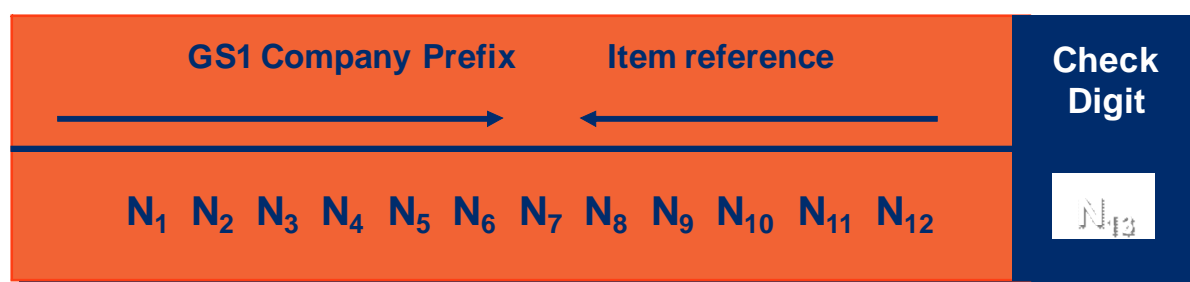


| GS1 Company Prefix: | The GS1 Company Prefix is allocated by GS1 Member Organisations.  In Germany, GS1 Germany allocates seven-, eight- or nine-digit GS1 Company Prefixes. |
|---|---|
| Item Reference: | A unique non-significant number for each individual trade item. Generally issued sequentially, 000, 001, 002 etc for each different variant of a product. |
| Check Digit: | Validates the accuracy of the entire number by mathematical formula. |

A GTIN-13 can be represented in an EAN-13.

**Figure 5: Example of a trade item carrying a GTIN-13 represented in an EAN-13 Bar Code**

# 4.4   Fixed Measure Trade Items – Shipper

## 4.4.1   Definition

This is the lowest grouping of consumer units traded between manufacturers and distributors. Shippers, cartons and cases are typical trade units. It can be either a single item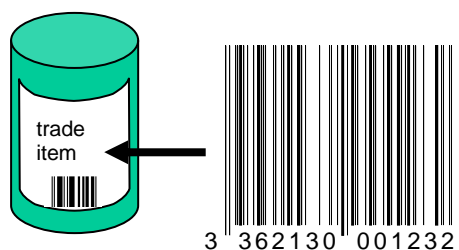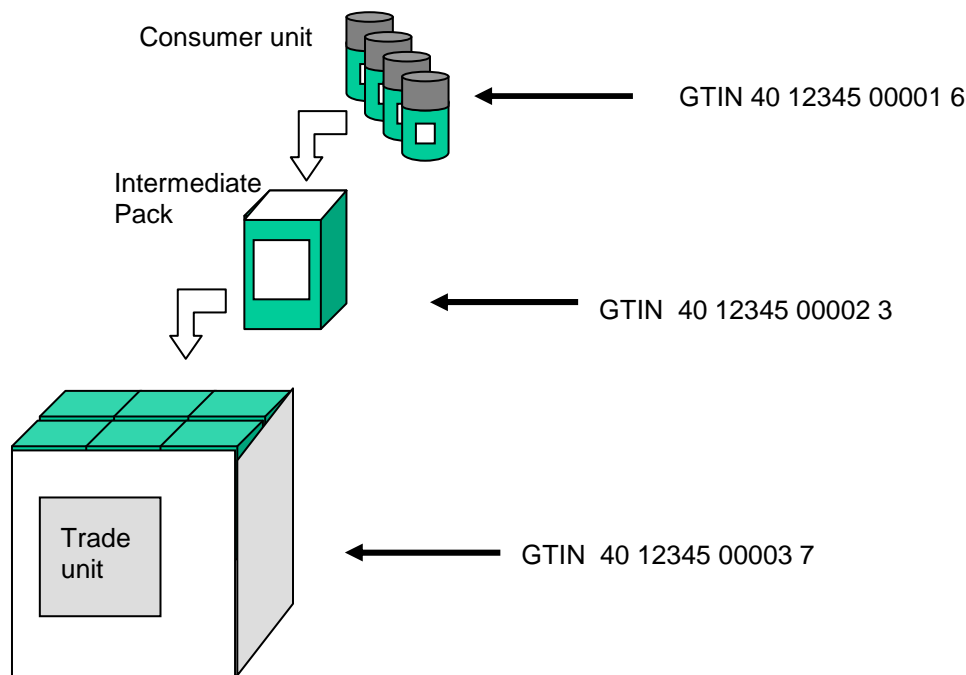s or any standard grouping of items made up to facilitate the operations of handling, storing, order preparation, shipments etc.

It is recognised that beyond the consumer unit, there can be many different levels of packaging of trade items.  The next level of packaging, is often referred to as an inner or intermediate pack.  The last level of packaging (the outer most) is considered to be the highest level; this is up to but not including the pallet.  However, this does not preclude suppliers from issuing GTINs to pallets if they wish to identify the pallet itself as a trade item.

**Note:**   Each individual level of trade item must be uniquely identified with a different GTIN

**Figure 6: Multiple Layers of Units**



Consumer unit — GTIN 40 12345 00001 6

Intermediate Pack — GTIN  40 12345 00002 3

Trade unit — GTIN  40 12345 00003 7

## 4.4.2  Options for Trade Items - Shipper

A trade item **not** sold at retail POS can be numbered and bar coded with:

- GTIN-13  represented in an EAN-13 or GS1 DataMatrix
- GTIN-14 represented in GS1 DataMatrix

### 4.4.2.1   GTIN-13

If desired, a GTIN-13 can be allocated to a trade item. The method used to allocate this number is the same as for allocating a number to a consumer unit.

GTIN-13 can be encoded in a GS1 DataMatrix, provided that a leading zero is added in front of the GTIN-13.

### 4.4.2.2  GTIN-14

This option is only available for homogenous groupings of standard trade items, where all units contained in the group are identical. It involves using an Indicator with the GTIN and recalculating the Check Digit.
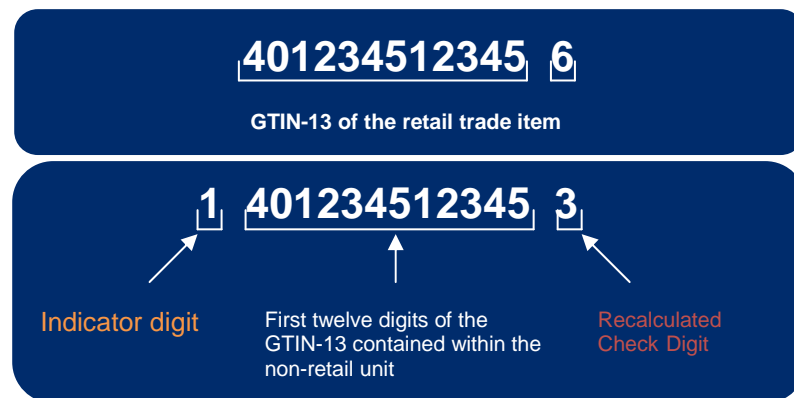
An Indicator can be any number from one to eight. Indicators are used to create up to eight unique GTIN-14s to distinguish between different packaging levels or pack quantities of the same trade item. They are chosen at the discretion of the company allocating the number.

**Note**:   The Indicator 9 is reserved for variable measure trade items

### How to form a GTIN-14 if a Consumer Unit Carries a GTIN-13

Choose the GTIN-13 on the consumer unit that is the lowest level of packaging within the packaging hierarchy. To form the GTIN-14, put an Indicator in front of the first twelve digits of this GTIN-13 then recalculate the Check Digit. A Check Digit Calculator Program is available on the website www.gs1-germany.de.

**Figure 7: Structure of GTIN-14 based on GTIN-13**



| Item | | GTIN | Bar Code |
|---|---|---|---|
| Consumer unit/retail item | | 401234512345 **6** | EAN-13 <br><br> or <br><br> GS1 DataMatrix <br><br> (01)04012345123456 |
| Box of 20 identical consumer units | | **1** 401234512345 **3** | GS1-128 <br><br> *or* <br><br> GS1 DataMatrix <br> (01)14012345123453 |
| Box of 50 identical consumer units | | **2** 401234512345 **0** | GS1-128 <br><br> *or* <br><br> GS1 DataMatrix <br> (01)24012345123450 |

**Note:**   Only allowed with identical products in the trade unit.
GS1 Data Matrix is recommended as future standard, readability at time of passing for press not ensured for all retailers at POS (See page 14).

Dynamic Data of Trade Items

Dynamic data of trade items is any data over and above the item identifier, i.e. the GTIN. Examples of this type of information include batch numbers, serial numbers and variable measure information such as length, weight etc.

Dynamic data is represented by GS1 Application Identifiers (AIs) and these ensure that the dynamic data can be interpreted unambiguously by trading partners throughout the entire supply chain.

***Important for retail Point-of-Sale scanning***

**The GTIN is encoded in an EAN-13 bar code. The dynamic data, such as expiry date, batch number or serial number are encoded in an additional code, e.g. a GS1 Data Matrix code. At the POS there are at the moment not all scanners ready to read 2D matrix codes as well nevertheless the CRISTAL team strongly believes that future scanners will have this option as standard.**

For further information regarding the use of Application Identifiers please contact your local GS1 organisation.

Suppliers, at their discretion, can apply to items, any of the AIs available to them under the GS1 specifications.

***Example:***
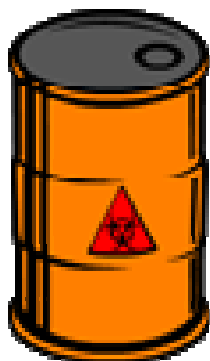
**Figure 8: Dynamic data used for traceability**



3  362130  001027

Brand X

(17)100203(10)AB1234

EXPIRY: 3.2.2010
BATCH/LOT: AB1234

# 4.5   Concatenation of Data Elements

All GS1 bar code symbologies that use GS1 Application Identifiers allow several Element Strings to be encoded in one bar code, a process called concatenation. Concatenation is advantageous because it means that the symbology elements are only needed once, and the space required for the symbol is smaller than when separate bar codes are used to encode each Element String. It also improves scanning accuracy, allowing for single scanning rather than multiple scanning. The various Element Strings can be transmitted from the bar code reader as a single full string.
The various Element Strings, which are transmitted from concatenated bar codes, have to be analyzed and processed. Element Strings that are of variable length and do not appear at the end of the symbol (encoded immediately before the Symbol Check Character) must be delimited to separate them from the Element String that follows. Concatenating Element Strings of variable length involves the use of a Separator Character. The Separator Character used is the Function 1 Symbol Character (FNC1). It is placed immediately after the last symbol character of a variable length data string and is followed by the Application Identifier of the next Element String. If the Element String is the last to be encoded, FNC1 Separator Character is not required.

# 4.6 Electronic Product Code and Radio Frequency Identification

## 4.6.1 Electronic Product Code (EPC)

The EPC terms a system of globally unique identifiers for all kind of objects (i.e. trade items, reusable transport items, assets, documents, service relations, locations, etc., see the following figure).

**Figure 9: Serialized GS1 Identification Numbers**

○ **SGTIN** **S**erialized **G**lobal **T**rade **I**tem **N**umber
(trade items, e.g.)

○ **SSCC** **S**erial **S**hipping **C**ontainer **C**ode
(shipping units, e.g.)

○ **SGLN** **S**erialized **G**lobal **L**ocation **N**umber
(precise shelf locations, read points, etc.)

○ **GRAI** **G**lobal **R**eturnable **A**sset **I**dentifier
(reusable cases, e.g.)

○ **GIAI** **G**lobal **I**ndividual **A**sset **I**dentifier
(specific assets)

○ **GSRN** **G**lobal **S**ervice **R**elation **N**umber
(service relations)

○ **GDTI** **G**lobal **D**ocument **T**ype **I**dentifier
(physical and virtual documents)

In the following the term EPC refers to the serialized GTIN when talking about trade items and to the serial shipping container code when talking about logistic units.

The data carrier for the EPC is not necessarily RFID, although it is often equalized. RFID is just one data carrier beside bar codes.

It is important to comprehend the compatibility of GS1's data carrier portfolio. Thus, it is possible to encode an EPC not only on a RFID tag, but also in a GS1 DataMatrix or a GS1-128. Nevertheless, as an EPC always requires serialization, other bar codes such as EAN-13 are not feasible in order to encode an EPC. The following figure displays GS1's data carrier compatibility using the example of RFID and GS1-128:

**Figure 10: Compatability of Bar Code and EPC/RFID**



| | Indicator Digit | GS1 Company Prefix | Item Reference | Check Digit | Serial Number |
|---|---|---|---|---|---|
| GTIN + Serial number | 0 | 4012345 | 12345 | 6 | 123456789123 |

as GS1-128:

(01)04012345123456(21)123456789123

as EPC (96-bit SGTIN):

| | Header | Filter | Partition | GS1 Company Prefix | Object Class | Serial Number |
|---|---|---|---|---|---|---|
| Lenght | 8 bits | 3 bits | 3 bits | 20-40 bits | 24-4 bits | 38 bits |
| Value | 0011 0000 | 000 | 5 (decimal) | 4012345 (decimal) | 012345 (decimal) | 123456789123 (decimal) |

For redundancy purposes, it is advisable to apply a barcode on objects an EPC/RFID tag has been attached to. Thus, the EPC can be read in case the RFID transponder is not operational anymore. Moreover, this backup information can be used for commissioning a new RFID tag with the identical EPC for the affected object.

## 4.6.2 Radio Frequency Identification (RFID)

RFID is a technology utilizing radio waves to transfer data between a reader and a RFID transponder. It has significant advantages such as (for instance) bulk and non-contact reading.

The following figure displays the general layout of an UHF Gen2 EPC/RFID Tag:

**Figure 11: Layout of an UHF Gen 2 EPC/RFID Tag**

| | | |
|---|---|---|
| **00** | **Reserved** | o "Kill" password (optional)<br>o Access password (optional) |

o Cyclic Redundancy Check-16
o Protocol Control (PC) Bits inkl. **"Hazmats" Bit**
o **Electronic Product Code**

| **01** | **EPC** |
|---|---|

| Header | Filter | Partition | EPC Manager | Object Class | Serial Number |
|---|---|---|---|---|---|

o Extended Protocol Control Bits (XPC)

| | | |
|---|---|---|
| **10** | **TID** | o issued by chip manufacturer<br>o not for product identification purposes<br>o extended TID (**XTID**) offers optional serialization |

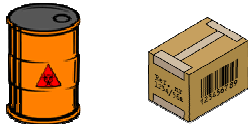| | | |
|---|---|---|
| **11** | **User** | o supplementary information<br>o EPCglobal Tag Data Standards 1.5 (Aug 2010) supports **GS1 Application Identifiers** (AIs) as well as ISO Data Identifiers (DIs) |

For end users, the most relevant memory banks of Gen2 EPC/RFID-Tags are the EPC and User Memory bank as the first one contains the EPC (such as a SGTIN; SSCC, etc.) along with some control information, whereas the second one offers the opportunity to encode all kind of data elements according to GS1's Application Identifier (AI) concept (for instance, "AI 10" for batch/ lot, "AI 11" for production date).

A useful feature in addition to the EPC (see 4.6.1) is the filter value, which enables RFID readers to select or deselect RFID tags corresponding to certain logistic levels (for instance, to make it easier just to read RFID tags identifying a pallet while disregarding all item level tags on those pallets). Please note that the filter value is not part of the EPC. Moreover, in case of the SGTIN EPC, the filter value does not equate to the GTIN indicator as these two concepts have been specified for totally different purposes. Thus, the filter value (i. e., the logistic level) of objects which are supposed to be equipped with a RFID tag has to be maintained as an attribute in the master data.

# 4.7 Numbering, Bar Coding and packaging levels for the Agro Industry

The Agro Industry supports the use of dynamic data in the supply chain. The Cristal Project team recommend the following:

**Guide to choosing the numbering and bar coding options for a particular application**

| | Dynamic Data required | Encoded Data | Application Identifier (AI) | Recommended Symbology to Select From |
|---|---|---|---|---|
| **consumer unit[3]** | mandatory | GTIN | (01) | EAN-13 *or* GS1 DataMatrix |
| | recommen-ded | Production date[4] | (11) | GS1-128 *or* GS1 DataMatrix |
| | | Batch No. | (10) | |
| | optional | Expiry date | (17) | |
| | | Serial No. | (21) | |
| | | | | |
| **Trade unit** | mandatory | GTIN | (01) | GS1-128 *or* GS1 DataMatrix |
| | | Production date[4] | (11) | |
| | | Batch No. | (10) | |
| | optional | Serial No. | (21) | |
| | | Expiry date | (17) | |
| | | SSCC | (00) | |
| **Pallet (logistic unit)** | See chapter 5 | | | |

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[3] If the consumer unit is a trade unit, then the coding standards for trade units apply.
[4] Will be replaced by Release date

# 5 How to Number and Bar Code Logistic Units

## 5.1 Serial Shipping Container Code (SSCC)

A logistic unit is an item of any composition established for transport and/or storage, which needs to be managed through the supply chain.

There are also instances within the European agro industry where the allocation of a GTIN is not feasible because the resulting permutations and combination of product is limitless and is generally governed by the customer's order.

Mixed orders fall into this category; with customers able to pick and choose what is required and hence the allocation of a GTIN for each combination is unrealistic. With the use of scan packing, the solution for the marking of such a logistic unit is with the Serial Shipping Container Code.
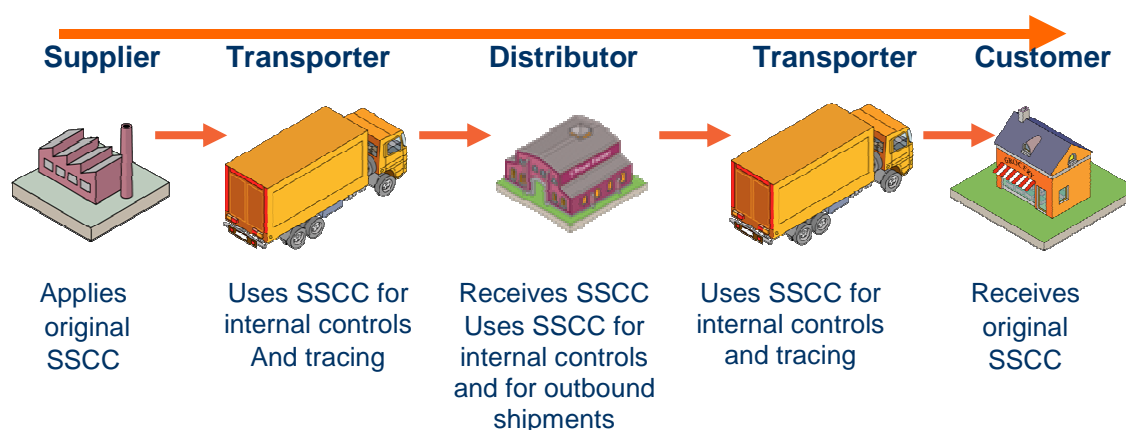
The Serial Shipping Container Code (SSCC) is a reference number or license plate used to uniquely identify logistics units. The SSCC acts as a "reference key" which can be stored in a computer system to which information can be added and shared amongst trading partners as the logistics unit moves throughout the supply chain. This unique "license plate" provides the opportunity to track and trace logistic units in the supply chain.

Scanning the SSCC marked on each logistic unit allows the physical movement of units to be individually tracked and traced by providing an information flow. It also opens up the opportunity to implement a wide range of applications such as cross docking, shipment routing, automated receiving etc.

The SSCC is used to uniquely identify goods on the way from sender to final recipient, and can be used by all participants in the transport and distribution chain. Each shipping container or logistic unit, at the time of its creation, is uniquely identified by the sender with an SSCC. A label encoding the SSCC is applied to the logistic unit using the appropriate AI and the GS1-128 Bar Code or EPC/RFID.

The SSCC uniquely identifies the entity (typically the shipping container or logistic unit to which the SSCC is applied) for the lifetime of that unit.

**Figure 12: The Use of the SSCC throughout the supply chain**



| Supplier | Transporter | Distributor | Transporter | Customer |
|---|---|---|---|---|
| Applies original SSCC | Uses SSCC for internal controls And tracing | Receives SSCC Uses SSCC for internal controls and for outbound shipments | Uses SSCC for internal controls and tracing | Receives original SSCC |

It is essential that the recipient, logistics service provider, distributor or customer of the transport unit with the SSCC attached, receives prior advice about the details of the transport unit and the SSCC. This advice is usually communicated via eMessaging, which is the computer-to-computer exchange of business messages in a standard format.

There may be instances where all parties relevant to a particular shipment are not fully capable of eMessaging and where only some electronic messages are being exchanged. In this situation there may be a requirement to add additional information to the logistics label to facilitate the process of the logistic units through the supply chain. Alternatively the whole supply chain may be fully capable of eMessaging and the whole suites of shipping messages are being exchanged.

# 5.2 How to Allocate the Serial Shipping Container Code (SSCC)

The SSCC should be handled as an eighteen digit non-significant number uniquely identifying the unit to which it is attached. The company responsible for the marking of the logistic unit is responsible for issuing the SSCC.

The format of the Serial Shipping Container Code is as follows:

**Figure 13: structure of the SSCC**
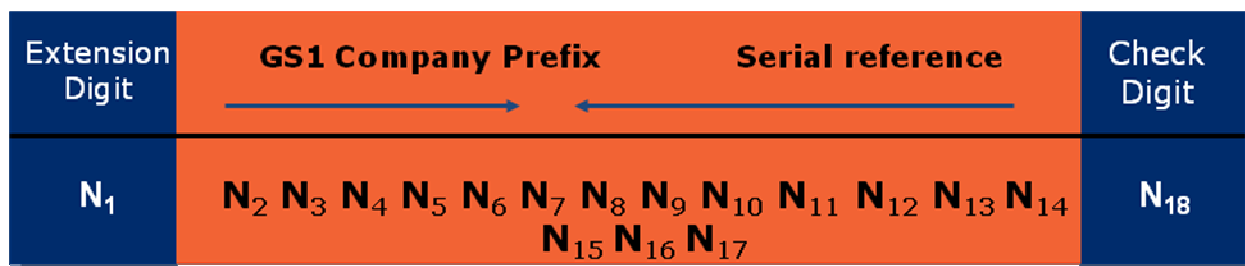


**Table 1: structure of the SSCC**

| Extension Digit | A digit (0-9) used to increase the capacity of the Serial Reference within the SSCC. The company that constructs the SSCC assigns the extension digit to the logistic unit. |
|---|---|
| GS1 Company Prefix | The GS1 Company Prefix is allocated by GS1 Member Organisations. It makes the SSCC unique worldwide but does not identify the country of origin of the unit. |
| Serial Reference | A Serial Reference depends on the length of the GS1 Company Prefix and uniquely identifies each transport package or logistic unit. The method used to allocate a Serial Reference is at the discretion of the company coding the package. |
| Check Digit | Calculated using a mathematical formula. |

# 5.3 The Logistics Label

The various trading partners involved in a distribution channel have different information needs. The information flow, which accompanies the physical flow of goods, is communicated between trading

partners by various means.  Electronic Commerce, or eMessaging, is the way to transmit information along the supply chain.

In practice, however, fully automated communication channels, which make it possible to rely exclusively on electronic files for retrieving information on the movements of goods, are not always available.

For this reason, there is a need to indicate relevant information on the goods themselves, in addition to their identification.  The various fields of information need to be organised in a standardized way in order to facilitate their interpretation and processing by all trading partners in the supply chain.

The purpose of the GS1 Logistics Label is to provide information about the unit to which it is fixed, clearly and concisely.  The core information on the label should be represented both in machine (bar code) and human readable form.  There may be other information, which is represented in human readable form only.

This GS1 Logistics Label can be applied to a single item, or a grouping of several items made up to facilitate the operation of handling, storing and shipping. This can be:
- A carton
- A pallet
- A group of shrink wrapped units
- A tray
- A container
- Or any other similar type of packaging created for the purpose of handling, storing or shipping.

The following information is a reference for the design of logistics labels.  Application Identifiers (AIs) and the GS1-128 Symbology are important components of logistics labels and apply to all of the specifications relating to these labels.

The structure and layout for logistics labels is explained, however, emphasis is given to the basic requirements for practical application in an open trade environment.  The major areas include:
- the unambiguous identification of logistics units
- the efficient presentation of text and machine readable data (bar codes)
- the information requirements of key partners in the supply chain– suppliers, customers and carriers
- technical parameters to ensure systematic and stable interpretation of the labels

This information is applicable to any type of logistic unit marked with a Serial Shipping Container Code (SSCC), which is used in logistic and transport applications where there is a need to track and trace individual units or a grouping of units being a part of the same transport transaction.

## 5.3.1  Components of the GS1 Logistics Label

Information represented on GS1 Logistics Labels has two basic forms:
- Information required to be utilised by people–usually comprising text and graphics, e.g. to and from addresses
- Bar codes (machine readable form) – a secure and efficient method of conveying structured data

The human readable text allows general access to basic information at any point in the supply chain.  However, both methods of information representation provide value to the GS1 Logistics Label and often co-exist on the same label.

The mandatory field for all logistics labels is the Serial Shipping Container Code (SSCC) represented by the Application Identifier (00). The SSCC is a unique identification number assigned to each specific logistic unit.  In principle the SSCC is sufficient for all logistic applications.

In an environment where eMessaging is used to transmit the detailed information pertaining to each logistic unit, or where the information is already within a database, the SSCC acts as the reference point to information.

However, when eMessaging is not available at each point in the supply chain, or when redundancy is desired, certain additional elements of information are desirable. Each of these is also represented through the use of Application Identifiers (AIs).

## 5.3.2    Label Design

The design of the logistics label accounts for the supply chain process by grouping information into three logical sections.  A section is a logical grouping of information that is generally known at a particular time.

- **Supplier section:**
  This section of the label contains information that is generally known at the time of packaging by the supplier.  The SSCC is applied here as the unit identifier, along with the GTIN if used. Other information that may be of interest to the supplier but might also be useful for customers and carriers can be applied. This includes product-related information such as product variant; dates such as production, packaging, expiration, and best-before dates; and batch/lot and serial numbers.

- **Customer section**
  The customer section of the label contains information that is generally known at the time of the order and order processing by the supplier. Typical information includes the ship to location, purchase order number, and customer-specific routing and handling information.

- **Carrier section**
  The carrier section of the label contains information that is generally known at the time of shipment and is typically related to transport.

Each label section may be applied at a different point in time, as the relevant information becomes known.  However should all relevant information be known at the time, the label is to be produced, it can be combined into one label, please refer to examples in Section 5.4.

Within each section bar coded information is separated from text information to facilitate separate processing by automatic data capture and people.  Bar codes are represented in the lower part of each section, while human readable information is shown in the upper part of the section.  This facilitates access to each component as required.


**Figure 14: Label sections represented separately on a logistic unit**
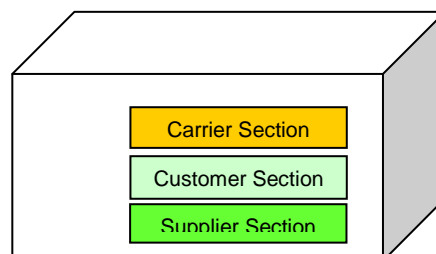
## 5.3.3    Label Dimensions

The physical dimensions of the label are determined by the company applying the label to the logistic unit.  However, the size of the label should be consistent with the information required in all sections of the label.

The business requirements for most users of GS1 Logistic Labels are met by using one of the following:
- A6 format (105mm x 148mm) which is particularly suitable when only the SSCC, or the SSCC and limited additional data is encoded.
- A5 (148 mm x 210 mm)

## 5.3.4    Technical Specifications

The following sections identify specific aspects of the format of the logistics label to assist in the initial processes of development.  Not all technical aspects have been provided within this document and companies should ensure that they contact their local GS1 organisation for further information.

### 5.3.4.1    Bar Codes

The GS1-128 Bar Code shall be used for all information on the GS1 Logistics Label.

The number of GS1-128 Bar Codes may be minimised by using concatenation (stringing data elements together) wherever possible.  When not possible due to constraint of label size, data can be represented in multiple bar codes.  The sequence of the bar coded data elements is irrelevant in terms of interpretation.

**Note:**    The exception is the SSCC, which is the identifier for the logistic unit and the most fundamental element of the label. Due to the larger magnification recommended for the SSCC, concatenation is not feasible on a standard width label.

### 5.3.4.2    Bar Code Orientation and Placement

Bar codes shall be in picket fence orientation on logistic units, i.e. the bars and spaces shall be perpendicular to the base on which the logistic unit stands.  In all cases, the SSCC shall be placed in the lowest portion of the label.

### 5.3.4.3    Text

There are three types of text information, which can appear on a logistics label:
- Plain text - text that is not encoded in the bar code but often required on a label e.g. name and address of the sender and receiver
- Human Readable Interpretation - the information encoded in the bar code that is required to support manual operations and to facilitate key entry.
- Data titles - the standard abbreviated descriptions of data fields used to denote the Human Readable Interpretation of data fields e.g. SERIAL is the data title of serial number.

# 5.4 GS1 Logistics Label Formats for the Agro Industry

As described in Section 5.1 there is the ability to identify logistic units with the use of the Serial Shipping Container Code (SSCC).  Where companies and/or industry sectors are not fully capable of eMessaging there is often a need to identify additional data represented on the GS1 Logistics Label to assist processing of shipments through the supply chain.

The following section describes the minimum data set required on a GS1 Logistics Label for the Agro Industry for use on logistic units of the following configuration:

- **Logistic unit containing the same trade items – Standard pallet, homogenous in product and batch**
  This label format would be used in the instance where the trade items carry the same GTINs within the logistics unit.  Data on this label is only applicable where the GTINs, batch number and expiry dates are all the same on the individual trade items, for example a pallet of 20 cartons of plastic cups. The logistics unit could consist of either a standard grouping of identical trade items or a standard mix of trade items.
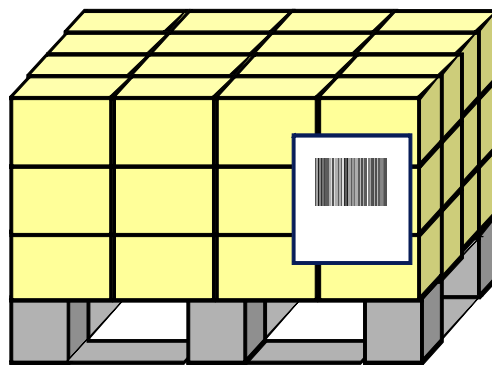


- **Logistic unit containing the same trade items – Standard pallet, homogenous in product, different in batch**
  This label format would be used in the instance where the trade items carry the same GTINs within the logistics unit.  Data on this label is only applicable where the GTINs are all the same on the individual trade items.

- **Logistic unit containing the same trade items – Non-standard pallet**
  This label format would be used in the instance where the trade items carry the same GTINs within the logistic unit.  Data on this label is only applicable where the GTINs are all the same on the individual trade items.
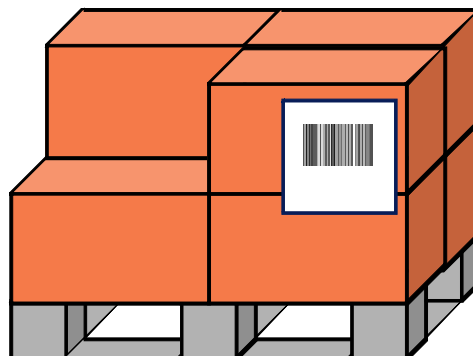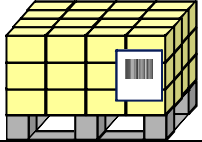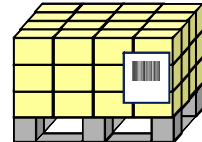
- **Mixed pallet on the logistic unit**
  When an order is picked and packed and is a mix of various trade items then label format can be used. Note full use of eMessaging is required to advise the customer of the information linked to the SSCC.
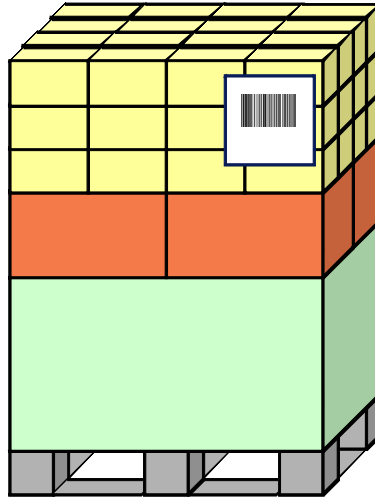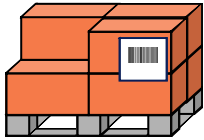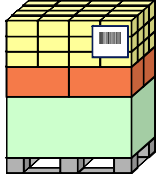
- **Where full eMessaging is applicable**
  In this example full use of eMessaging is applicable between trading partners. Here all the information is linked to the SSCC and this acts as the key to access all information about the logistic unit. This label format can be used on all types of logistic units from, standard groupings to mixed trade items. The only requirement is that eMessaging is fully operational between all trading partners throughout the supply chain.

| Type of logistic unit | Data | Encoded Data | Application Identifier (AI) | Symbology |
|---|---|---|---|---|
| **Standard pallet** **Homogenous in batch and product** | mandatory | SSCC | (00) | **GS1 DataMatrix** **or** **GS1-128** |
| | | GTIN | (01) or (02) + (37) | |
| | | Production date[5] | (11) | |
| | | Batch No. | (10) | |
| | optional | Expiry date | (17) | |
| **Standard pallet** **Homogenous in product, different in batch** | mandatory | SSCC | (00) | **GS1 DataMatrix** **or** **GS1-128** |
| | | GTIN | (01) or (02) + (37) | |
| | optional | Production date[5] | (11) | |
| | | Expiry date | (17) | |
| **Non-standard** | mandatory | SSCC | (00) | |

[5] Will be replaced by Release date

| pallet | | GTIN  Production date[5]  Batch No. | (02) + (37)  (11)  (10) | GS1 DataMatrix or GS1-128 |
|---|---|---|---|---|
| | optional | Expiry date | (17) | |
| | | | | |
| Mixed trade item | mandatory | SSCC | (00) | GS1 DataMatrix or GS1-128 |
| For additional information, all Application Identifiers (AI) described in the current GS1 General Specifications must be used. For further information please contact your local GS1 organisation. | | | | |

**Figure 15: Example of a Logistics Label**



## 5.4.1    Location of Logistic Unit Label

The bar codes on units intended for General Distribution should be upright (i.e. in picket fence orientation) and placed on the sides of the unit. Each item shall have at least one bar code, and two are recommended.

In the event that the product is not a standard carton or pallet of uniform shape all efforts should be made to meet the recommendations.  For shipments with an irregular or unconventional shape common sense should direct the location of any logistics labels to ensure that the label is visible at all times.

**Note:**  If only one label is applied, the side chosen needs to take into consideration the way the pallet will be picked.  In this instance the label should be applied to the "pick side" of the pallet.  Before taking this option, consultation with all trading partners is advised.

## 5.4.2    Cartons and Outer Cases

For cartons and outer cases, logistic labels should be placed so that the lowest edge of the vertical bars of the GS1-128 Bar Code containing the SSCC is 32mm from the base of the unit.  Ensure that no part of the bar code (Including Quiet Zones) is closer than 19mm from any vertical edge.

**Figure 16: Location of the GS1 Logistics Label on a carton or unit**

**less than 1 metre in height**



19mm Minimum

32mm
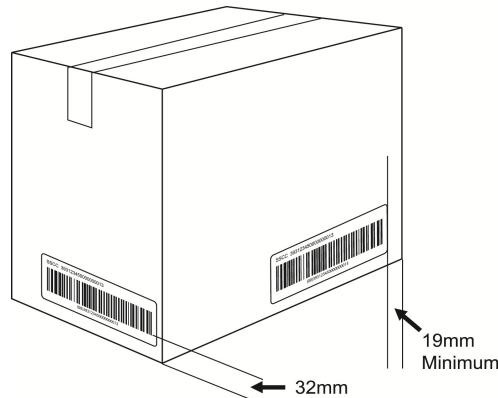
if the unit is already marked with an EAN-13 Bar Code for trade item identification purposes, the label should be placed so as not to obscure the pre-existing bar code. The preferred location of the label in this case is to the side of the pre-existing bar code, so that a consistent horizontal location is maintained.

## 5.4.3 Pallets

For all types of pallets, including full pallets containing individual trade items and singular trade items bar codes should be placed at a height between 400mm and 800mm from the base of the unit. Including Quiet Zones, the bar codes should be no closer than 50mm from any vertical edge to avoid possible damage.

For pallets less than 400mm in height, the bar codes should be placed as high as possible whilst protecting the logistics label.

**Figure 17: Location of the GS1 Logistics Label on pallets**



*h* < 800 mm

*h* > 400 mm

*x* > 50 mm

*x*                    *x*
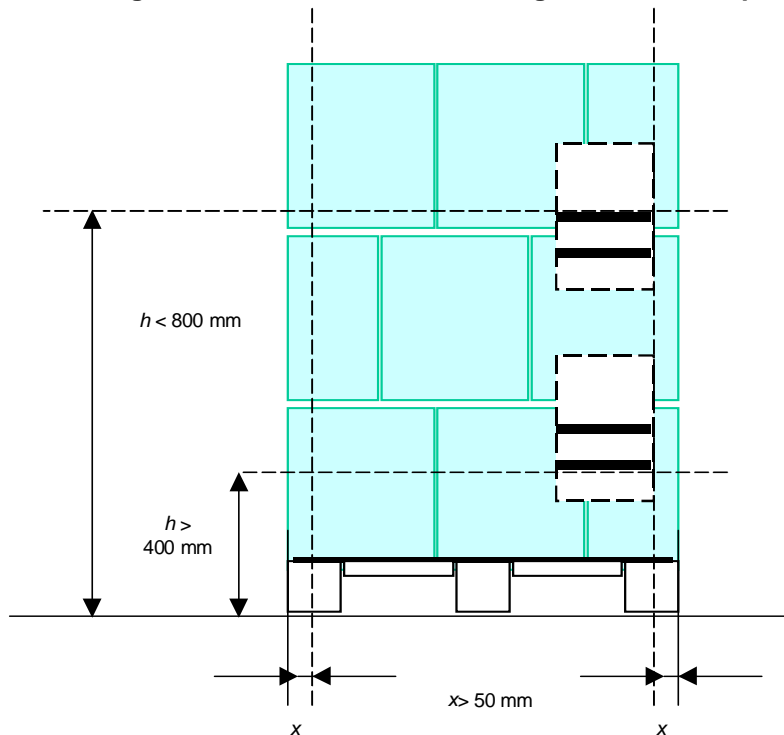
# 6   Asset Numbering

The GS1 System provides a method for the identification of assets.  The object of asset identification is to identify a physical entity as an inventory item.

Asset Identifiers may be used for simple applications, such as the location and use of a given fixed asset (e.g. a personal computer), or for complex applications such as recording the characteristics of a returnable asset (e.g. a reusable beer keg), its movements, its life-cycle history and any relevant data for accounting purposes.

**Figure 18: Structure of the Global Returnable Asset Identifier**



| Application Identifier | Global Returnabel Asset Identifier GRAI | | | |
|---|---|---|---|---|
| | **GS1 Company Prefix** ⟶ | **Asset Type** ⟵ | Check Digit | **Serial Number (optional)** |
| 8003 | 0 $N_1$ $N_2$ $N_3$ $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | | $N_{13}$ | $X_1$   variable   $X_{16}$ |
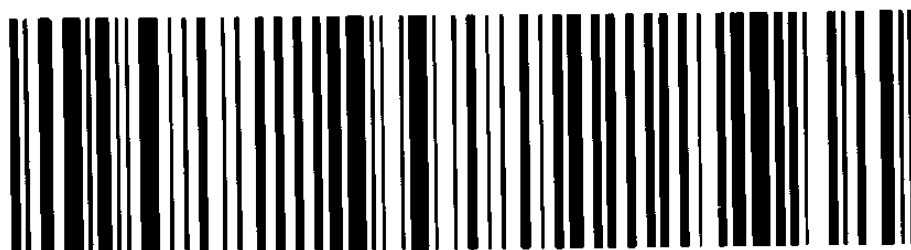


M-plus   8003 0 4026094 05041 3 00004491

# Annex

GS1 Application Identifiers used in the Agro business industry:

| | |
|---|---|
| 00 | Serial Shipping Container Code |
| 01 | Global Trade Item Number |
| 02 | GTIN of contained trade items |
| 10 | Batch/Lot number |
| 11 | Production date[6] |
| 17 | Expiry date |
| 21 | Serial number |
| 37 | Count of Trade items |
| 410 | Ship to - Deliver to Global Location Number |
| 8003 | Global Returnable Asset Identifier |

The typical matrix size for consumer packages is 26 x 26. Smaller matrix sizes are acceptable provided that the data capacity for the encoded data is sufficient. Preferred are quadratic codes. In case that packaging design or printing technology needed rectangular codes they can be used as well.

| Symbol Size Square | Dimension (mm) Consumer Unit | | | Data Capacity | |
|---|---|---|---|---|---|
| Row x Column | Typical $x = 0,35$ | Min $x = 0,25$ | Max $x = 0,615$ | Numeric | Alpha-numeric |
| **26 x 26** | **9,1** | **6,5** | **16,0** | **88** | **64** |
| Symbolism ISO/IEC16022. Error correction according ECC200. Printing quality ISO/IEC 15415/ Minimum grading ANSI D > 0,5. To ensure a correct readability across the supply chain the aspired quality should be at least ANSI C > 1,5. | | | | | |

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[6] Will be replaced by Release date

# Afterword

The new release of CRISTAL Standards provides state of the art technology to reflect changes and requirements in crop protection and seed business globally. Enhancement of these standards allows the implementation of a full supply chain visibility helping to significantly improve product safety and stewardship and providing new services. The CRISTAL standard is a working document which is open to all involved parties. The document is owned by CRISTAL and provided for information purposes only. The standard is subject to revision and changes reflecting the dynamic of the business and the associated supply chain and will be periodically updated. Also for the future development of this standard the expertise and input of all involved parties in supply chain is highly appreciated. Please direct change requests or enhancements to CRISTAL/ European Crop Protection Association ECPA*.

The Cristal Standards have been sponsored by the European Crop Protection Association with involvement of CropLife International.

The Cristal team would particularly thank GS1 Germany for the technical support and consulting in the edition of this standard.

* Contact: ECPA | European Crop Protection Association; Aisbl 6, Avenue E. Van Nieuwenhuyse B-1160 Brussels Belgium; Phone +32 2 663 15 50