# GENERAL EAN.UCC SPECIFICATIONS

~~JULY~~ JANUARY 200~~4~~5 – VERSION ~~5.1~~6.0



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# GENERAL EAN.UCC SPECIFICATIONS
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## 0.1 Introduction

This document is the concise definition and explanation of the use of the EAN.UCC System standards within Automatic Data Capture (ADC) technologies, and supersedes all previous ADC technical documents provided and/or published by either EAN International, the Uniform Code Council, Inc.® (UCC™), or other national bodies. The document takes immediate effect as the agreed technical basis for the standards. Every organisation using EAN.UCC System standards is requested to conform fully to the *General EAN.UCC Specifications*.

These specifications were jointly developed by EAN International and the UCC and emphasise the commitment of both organisations to global standards. All future development of the EAN.UCC System will be incorporated by updates to this document.

## 0.2 Disclaimer

Whilst every effort has been made to ensure that the EAN.UCC System standards contained in the document are correct, EAN International, the Uniform Code Council, Inc.® (UCC™), and any other party involved in the creation of the document hereby state that the document is provided without warranty, either expressed or implied, of accuracy or fitness for purpose, and hereby disclaim any liability, direct or indirect, for damages or loss relating to the use of the document. The document may be modified from time to time, subject to developments in technology, changes to the standards, or new legal requirements.

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## 0.3 Overview

### 0.3.1 Who Should Read These Specifications

Technical experts working with the EAN.UCC System should read these specifications. They provide a global reference document covering all technical aspects of the EAN.UCC System. Their primary objective is to define the international standard upon which individual EAN Member Organisations and the Uniform Code Council (UCC™) can develop user documentation.

### 0.3.2 Electronic Data Interchange

The use of Electronic Data Interchange (EDI) is an integral part of the EAN.UCC System philosophy. Full details on the EDI standards are contained in EANCOM®. EANCOM is an implementation guideline of the EDIFACT standards (Electronic Data Interchange For Administration, Commerce and Transport) developed under the auspices of the United Nations.

### 0.3.3 Future Updates

The EAN.UCC System embodies an open architecture approach. It has been carefully designed for modular expansion with minimal disruption to existing applications. Enterprise Resource Planning (ERP) and other supply chain application software drive implementation of the system. New, user driven, applications can be expected, and this document will be updated accordingly.

The maintenance of these specifications will be the joint responsibility of EAN International and the Uniform Code Council (UCC™) and will incorporate the four principles of the EAN.UCC System:

1. Open Standards: The goal is a single, open, business led, integrated system of identification and information transfer technology standards that enables effective supply chain management in any company, in any industry, anywhere in the world.

2. Differentiation: The system is founded on rules-based standards that, when followed, ensure globally unique and discrete identification of such things as products, handling units, assets, and locations. The system includes standard ways to transfer EAN.UCC System identification numbers as well as relevant data related to these numbers.

3. Transparency: EAN.UCC System identification numbers must be relevant and applicable to any supply chain, independent of who assigns, receives, and processes the standards. This should enable only one way to perform any given function. New features should only be introduced to the standard if they enable new applications or better ways to perform existing functions.

4. Non-Significance: Global uniqueness of EAN.UCC System identification is guaranteed only when the standard number is taken as a whole and processed in its entirety. Fixed attributes of an item or service should be looked up from a computer or other data source by entering the item or service's EAN.UCC System identification number as a reference.



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### 0.3.4 Navigator

These specifications have been developed as a reference document aimed primarily at EAN Member Organisations and the Uniform Code Council (UCC™) (who also produce local language user manuals) and system engineers developing software based upon EAN.UCC System standards. All aspects of the EAN.UCC System are summarised in Section 1.0, which is recommended for those wishing to become familiar with the EAN.UCC System logic and terminology.

The sub-sections of Section 2.0 provide detailed rules for implementing the EAN.UCC System in business applications. These rules represent the requirements that must be met by trading partners to meet the international standards.

Each application section mandates the use of system features defined elsewhere in this document, such as Check Digits, Element Strings, data carriers, and bar code symbol placement.

The sections of these General EAN.UCC Specifications are:

Section 1, Basics and Principles of the EAN.UCC System
This section provides an introduction to the core components of the EAN.UCC System.

Section 2.1, Trade Items
This section defines the international standard for the identification of trade items, which are 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.

Section 2.2, Logistic Units
This section defines the international standard for the identification of logistic units, which are items of any composition established for transport and/or storage that need to be managed through the supply chain.

Section 2.3, Assets
This section defines the international standard for the identification of Returnable Assets and Individual Assets.

Section 2.4, Locations
This section defines the international standard for using EAN.UCC Global Location Numbers (GLNs) in bar code applications.

Section 2.5, Service Relationships
This section defines the international standard for the identification of service relationships.

Section 2.6, Special Applications
This section defines the international standard for identification of, for example, coupons, Refund Receipts, internal applications, and other special applications.

Section 2.7, Very Small Healthcare Items
This section defines the international standard for identification of, for example, vials, ampoules, very small bottles, and blister packs intended for use in healthcare service environments (e.g., hospital bedside).



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Section 3, Definitions of the Element Strings
This section introduces the concept of an Element String "*A piece of data defined in structure and meaning, comprising an identification part (prefix or Application Identifier) and a data part, represented in an EAN.UCC System endorsed data carrie*r." Each element string, or the data content of a bar code, is unambiguously defined in this section. A single page is dedicated to each 'element string' and the rules associated with its definition, structure, approved data carrier and any system considerations are given. This section should be viewed as a 'data dictionary'. It allows the reader to reference the exact meaning of each data element that is defined within the EAN.UCC System.

Section 4, Association of Element Strings to Form Valid Messages
This section provides the rules that allow the unambiguous processing of multiple Element Strings.

Section 5, Data Carriers
This section provides a detailed description of the data carriers that are endorsed by EAN International as well as the related bar code production and quality assessment required to achieve excellent scan rates.

Section 6, Symbol Placement Guidelines
This section provides guidance on symbol placement and packaging measurement methodology.

Section 7, System Processing in EDP Applications
This section provides guidelines and hints on developing systems capable of processing EAN.UCC data correctly.

Section 8, Glossary of Terms
A standard vocabulary used throughout the EAN.UCC System.



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# Section 1.0:
# Basics and Principles of the EAN.UCC System

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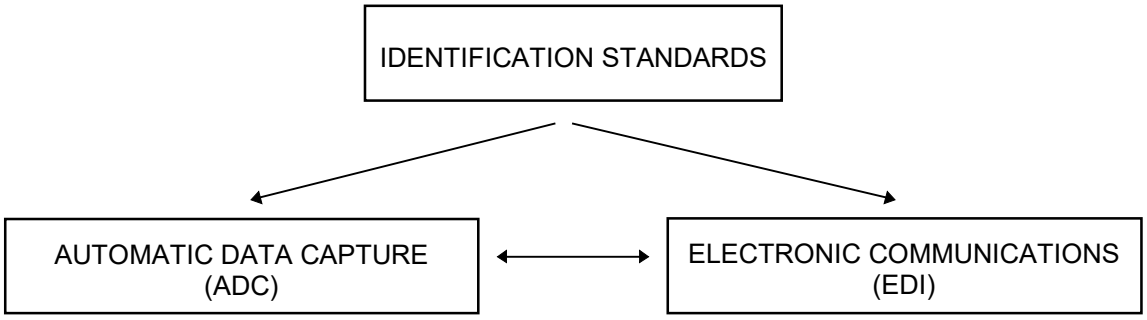
## 1.1 Introduction

The EAN.UCC System originated in the United States and was established in 1973 by the Uniform Product Code Council, now known as the Uniform Code Council, Inc.® (UCC™). The UCC adopted a 12-digit identification number, and the first ID numbers and bar code symbols in open trade were being scanned in 1974. Following the success of this U.P.C. System, the European Article Numbering Association, now known as EAN International, was established in 1977 to develop a compatible system for use outside North America. The EAN System was designed as a superset of the UCC System and principally uses 13-digit numbers. As a consequence of using certain bar code symbols and data structures, the EAN.UCC System has expanded. Today full global compatibility is achieved through the use of the GTIN Format, a 14-digit reference field in computer files that can store data structures to ensure a trade item identification number is unique worldwide.




The EAN.UCC System provides for the use of unambiguous numbers to identify goods, services, assets, and locations worldwide. These numbers can be represented in bar code symbols to enable their electronic reading wherever required in business processes. The system is designed to overcome the limitations of using company, organisation, or sector specific coding systems, and to make trading much more efficient and responsive to customers.

These identification numbers are also used in Electronic Data Interchange (EDI). This document only provides information about the EAN.UCC System's Automatic Data Capture (ADC) standards. For information about EDI, please refer to the EANCOM® manual, the EAN.UCC XML standards or the appropriate national standard.

In addition to providing unique identification numbers, the EAN.UCC System provides for supplementary information, such as best before dates, serial numbers, and batch numbers, which can appear in bar code symbol form. Currently, bar code symbols are used as the data carriers, but other technologies, such as radio frequency tags, might be added in the future. Changes take place only after wide consultation and are subject to a significant migration period.

By following the principles and design of the EAN.UCC System, users can design applications to process EAN.UCC System data automatically. The system logic guarantees that data captured from EAN.UCC endorsed bar code symbols produces unambiguous electronic messages, and processing can be fully pre-programmed.

The EAN.UCC System is designed for use in any industry or trade sector, and any changes to the system are introduced so as not to negatively affect current users.



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## 1.2 EAN.UCC Company Prefix

The EAN.UCC Company Prefix is the part of the EAN International and Uniform Code Council (UCC™) data structures. It consists of an EAN.UCC Prefix, which is co-administered by EAN International and the UCC, and a Company Number, which is assigned by an EAN Member Organisation or the UCC.

An EAN.UCC Company Prefix gives access to all the applications using EAN.UCC System identification standards (e.g., identification of traded items or services, locations, logistic units, returnable containers). The EAN.UCC Company Prefix is a component of each data structure described in Section 2.0 except for EAN/UCC-8.

The normal requirements on the re-use of EAN.UCC Identification numbers apply to all organisations at all times. The following additional guidelines apply w~~W~~hen a company changes legal status as a result of an acquisition, merger, partial purchase, split, or "spin-off"~~ the following guidelines apply~~. EAN Member Organisation or UCC may adapt the following guidelines if the law of the country makes it absolutely necessary. Companies should notify their EAN Member Organisation or UCC of any legal status change, within one year, to facilitate a smooth transition.~~Adaptation to the following guidelines could be done by the EAN Member Organisation or UCC if the law of the country makes it absolutely necessary. Companies should notify their EAN Member Organisation or the UCC to facilitate a smooth transition.~~

### 1.2.1 Acquisitions and Mergers

For the company being acquired, existing stocks on hand which are numbered before the acquisition or merger, keep the same Global Trade Item Numbers™ (GTIN's™). Products that are produced after the acquisition or merger may keep the GTIN allocated before the acquisition if the acquiring company maintains the EAN Member Organisation membership.

A merger implies that someone has taken over a company and has assumed responsibility for the company's EAN.UCC Company Prefix, as well as, their assets and locations. Products that the acquired company produced under its EAN.UCC Company Prefix can still be produced using the same prefix after the merger, since the acquiring company has control of the acquired company's EAN.UCC Company Prefix. If it so desires, the acquiring company can label all acquired products using their existing EAN.UCC Company Prefix. The importance of ensuring trading partners are informed of any changes, in a timely manner, cannot be overemphasised. ~~If a company changes legal status as the result of an acquisition or merger, its EAN Member Organisation must be notified within one year. If a company purchases a division of a company whose EAN.UCC Company Prefix is used in divisions not purchased, then the acquiring company must change the GTINs for the purchased division within one year.~~

~~Existing stocks on hand which are numbered before acquisitions or mergers, keep the same Global Trade Item Numbers™ (GTINs™). Products that are produced after the acquisition or merger may keep the GTIN allocated before the acquisition or merger.~~

A company should be careful when centralising the allocation of all numbers under one EAN.UCC Company Prefix, thus changing the GTIN of the existing products, which are otherwise unchanged. Centralising the allocation of all numbers under a single EAN.UCC Company Prefix should be an exception, as it results in additional work and data file maintenance for customers.

### 1.2.2 Partial Purchase

If a company purchases a division of a company whose EAN.UCC Company Prefix is used in divisions not purchased, then the acquiring company must change the GTIN's for products in the purchased division, as well as any related GLNs, within one year.

~~When a company buys a division, a brand name, or a range of items from another company, it may keep the numbers previously allocated by the selling company.~~ The rules concerning the use of the



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seller's Global Trade Item Numbers™ (GTINs™), and other EAN.UCC Identification Keys, should be taken into consideration when drawing up the purchase contract.

~~However, at~~At the earliest opportunity, the buyer should phase in new numbers, from its own range of numbers, for items whose brand name it has acquired. The buyer will be able to do this, for example, when packaging is redesigned or reprinted~~, even if the normal rule would be to keep the old number. Trading partners must be notified in advance if an identification number changes~~.

If a company sells an asset to another company then the asset identifier should ideally be replaced by another GIAI or GRAI within one year or be removed from the physical item.

During a company sale, and for four years following, the selling company must not reallocate the original numbers to other items.



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### 1.2.3 Split or Spin-Off

When a company splits into two or more separate companies it is necessary for each EAN.UCC Company Prefix assigned to the original company to be transferred to only one of the new companies. Any company left without an EAN.UCC Company Prefix will need to apply to an EAN Member Organisation or the Uniform Code Council (UCC™) to obtain one. The decision about which of the new companies should take the original EAN.UCC Company Prefixes should be made in such a way as to minimise the number of additional Global Trade Item Numbers™ (GTINs™) required. The decision should be part of the legal arrangements of the new companies.

It is not necessary for existing stocks of items to be renumbered. However, when any of the split or spin-off companies has trade items that are numbered with an EAN.UCC Company Prefix that it no longer holds, the company should renumber those items using its own EAN.UCC Company Prefix when new labelling or packaging is produced. Customers should be notified well in advance of the changes.

Split or spin-off companies that retain an EAN.UCC Company Prefix must keep a record of the GTINs created that have been allocated to items they no longer own. They must not re-use these GTINs for a period of at least four years after the company that split away owning those items last supplied goods identified by those GTINs. Therefore, the company that did not retain the EAN.UCC Company Prefix has to keep the company that now maintains it informed of the dates on which goods were last supplied using that EAN.UCC Company Prefix or to guarantee a date by which the number change will be made.



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## 1.3 The Data Structures

The EAN.UCC System provides data structures for different applications. The application will determine how the number is to be used, but regardless of application, each number must be used in its entirety and not broken into constituent parts. The data structure guarantees worldwide uniqueness within the relevant area of application.

### 1.3.1 Global Trade Item Number (GTIN™)

The Global Trade Item Number™ (GTIN™) is used for the unique identification of trade items worldwide.

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 includes individual items as well as all their different configurations in different types of packaging.

These data structures provide unique identification when they are right-justified in a 14-digit reference field, called the GTIN Format (see Figure 1.3.1 – 5).

Figure 1.3.1 – 1

**EAN/UCC-14 Data Structure**

| Indicator | GTIN™ of the Items Contained (Without Check Digit) | Check Digit |
|---|---|---|
| $N_1$ | $N_2$ $N_3$ $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ $N_{13}$ | $N_{14}$ |

Figure 1.3.1 – 2

**EAN/UCC-13 Data Structure**

| EAN.UCC Company Prefix → | ← Item Reference | Check Digit |
|---|---|---|
| $N_1$ $N_2$ $N_3$ $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | | $N_{13}$ |

Figure 1.3.1 – 3

**UCC-12 Data Structure**

| UCC Company Prefix → | ← Item Reference | Check Digit |
|---|---|---|
| $N_1$ $N_2$ $N_3$ $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ | | $N_{12}$ |

Figure 1.3.1 – 4

**EAN/UCC-8 Data Structure**

| EAN.UCC-8 Prefix → | ← Item Reference | Check Digit |
|---|---|---|
| $N_1$ $N_2$ $N_3$ $N_4$ $N_5$ $N_6$ $N_7$ | | $N_8$ |



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Figure 1.3.1 - 5

| **Data Structures** | **GTIN Format*** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ | $T_{11}$ | $T_{12}$ | $T_{13}$ | $T_{14}$ |
| EAN/UCC-14 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ | $N_{14}$ |
| EAN/UCC-13 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ |
| UCC-12 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ |
| EAN/UCC-8 | 0 | 0 | 0 | 0 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ |

*T represents the position of each individual digit in a computer file format, N represents the position of each individual digit in a given data structure, and 0 represents a filler digit.

Note: This format is used in business transactions, especially for Electronic Data Interchange (e.g., orders, invoices, price catalogues).



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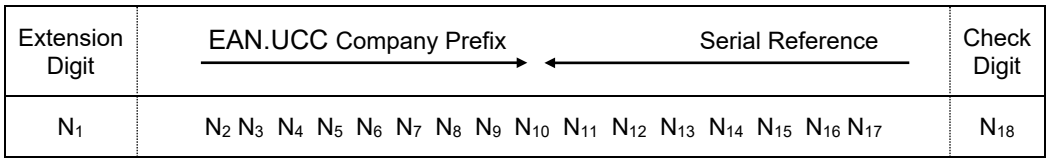
## 1.3.2 SSCC (Serial Shipping Container Code)

The SSCC is used for the unique identification of logistic units.

Figure 1.3.2 - 1

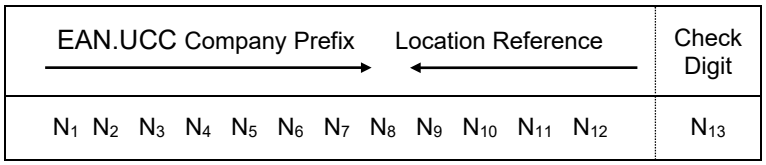



$N_i$' represents a digit

## 1.3.3 EAN.UCC Global Location Number (GLN)

The EAN.UCC Global Location Number (GLN) is used to uniquely identify a physical, functional, or legal entity.

Figure 1.3.3 – 1




$N_i$' represents a digit

Note: The GLN uses the same structure as EAN/UCC-13 Identification Numbers for Trade Items, but must be treated as a separate series of numbers.



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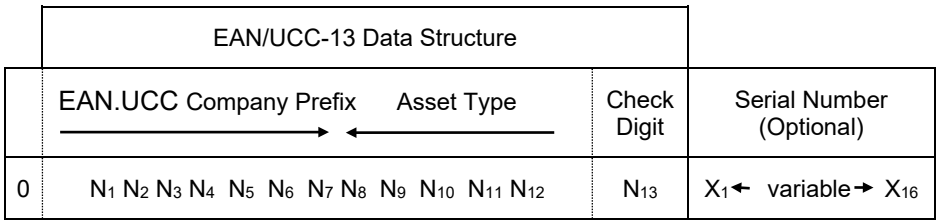
### 1.3.4 EAN.UCC Global Returnable Asset Identifier (GRAI)

The GRAI is used to identify a reusable entity that is normally used for transport and storage of goods.

Figure 1.3.4 – 1

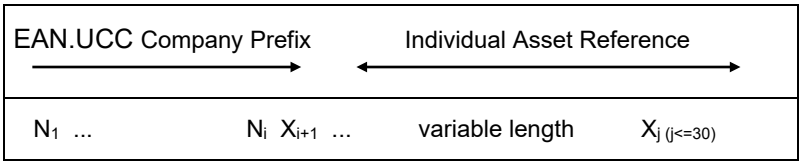



$N_i$' represents a digit and '$X_i$' represents any character contained in Figure 3.A.3 – 1.

### 1.3.5 EAN.UCC Global Individual Asset Identifier (GIAI)

The GIAI is used to identify uniquely an entity that is part of the inventory of a given company.

Figure 1.3.5 – 1

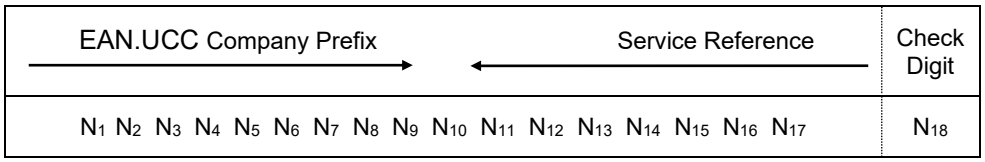



$N_i$' represents a digit and '$X_i$' represents any character contained in Figure 3.A.3 – 1.

### 1.3.6 EAN.UCC Global Service Relation Number (GSRN)

The GSRN is used to identify the recipient of services in the context of a service relationship.

Figure 1.3.6 – 1




$N_i$' represents a digit



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## 1.3.7 Components of the Data Structures

The EAN.UCC Prefix is a number with two or more digits, co-administered by EAN International and the Uniform Code Council (UCC™) that denotes the format and meaning of a particular Element String. The main purpose of the EAN.UCC Prefix is to allow decentralisation of the administration of identification numbers.

EAN.UCC Prefixes are shown in Figures 1.3.7 – 1 and 1.3.7 – 2

Figure 1.3.7 – 1

| **Synopsis of EAN.UCC Prefixes** | |
|---|---|
| **EAN.UCC Prefixes** | **Significance** |
| 000 - 019 | UCC™ data structure* |
| 02 | EAN.UCC Variable Measure Trade Item identification for restricted distribution |
| 030 - 039 | UCC data structure |
| 04 | EAN.UCC item numbering for restricted distribution within a company |
| 05 | UCC coupon identification |
| 060 - 099 | UCC data structure |
| 100 - 139 | EAN.UCC data using EAN/UCC-13 Data Structure |
| 140 - 199 | Reserve |
| 20 - 29 | EAN.UCC numbering for restricted distribution within a geographic region |
| 300 - 969 | EAN.UCC data structure |
| 970 - 976 | Reserve |
| 977 | ISSN standard numbering (serial publications) |
| 978 | ISBN standard numbering (books) |
| 979 | ISBN or ISMN standard numbering |
| 980 | EAN.UCC identification of Refund Receipts |
| 981-982 | EAN.UCC coupon identification for common currency areas |
| 983 - 989 | Reserved for further EAN coupon identification |
| 99 | EAN.UCC coupon identification |

* Starting from EAN.UCC Company Prefix 00 00100 to avoid collision with EAN/UCC-8 Identification Numbers. Note: EAN.UCC Company Prefixes 00 00000 and 00 01000 to 00 07999 have specific application for Locally Assigned Codes (LACs) or Retailer Zero-Suppressed Codes (RZSCs).For details, see Section 3.A.2.

Note: These prefixes all assume an EAN/UCC-13 Data Structure. When UCC identification numbers are carried by UCC-12 (UPC) Bar Code Symbols, the prefixes 00 to 09 will appear as the single figures 0 to 9.

1.3.7 – 2

| **Synopsis of EAN.UCC-8 Prefixes** | |
|---|---|
| **EAN.UCC-8 Prefixes** | **Significance** |
| 0 | Velocity Codes |
| 100 - 139 | EAN.UCC data structure |
| 140 - 199 | Reserve |
| 2 | EAN.UCC numbering for use within a company |
| 300 - 969 | EAN data structure |



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| | |
|---|---|
| 97 - 99 | Reserve |

The EAN.UCC Prefix and the Company Number jointly form the EAN.UCC Company Prefix, which is assigned to each system user by an EAN Member Organisation or the UCC.

EAN.UCC Company Prefixes are assigned to entities that administer the allocation of the EAN.UCC System identification numbers. These entities may be, for example, commercial companies, non-profit organisations, governmental agencies, and business units within organisations. The criteria to qualify for the assignment of an EAN.UCC Company Prefix are established by the EAN Member Organisations and the UCC.

The Item Reference, Serial Reference, Location Reference, Individual Asset Reference, Service Reference, and Asset Type are assigned by system users. Rules for their allocation depend on the particular application. EAN/UCC-8 Identification Numbers are available from EAN Member Organisations or the UCC.

The Indicator in an EAN/UCC-14 Identification Number allows each user to increase the numbering capacity when identifying similar trade units in different packaging configurations.

The Extension digit is used to increase the capacity of the SSCC. It has the value 0 to 9 and has no meaning.

The Check Digit is calculated as explained in Section 3.A.1. It is used to verify that the identification number is correctly composed.

Note: The data structures guarantee unique identification within a particular area of application. Although, for example, trade items may use the same number as locations, each system user must be able to control how data is used according to the EAN.UCC rules.



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## 1.4 The Data Carriers

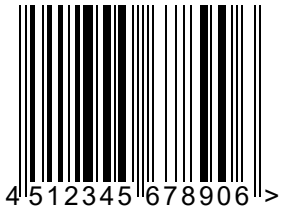
Bar code symbols are the data carriers used in the EAN.UCC System. Other data carriers may be introduced in the future.

The data that comprises each identification number and any extra information that can be provided using the EAN.UCC System Application Identifiers can be regarded as an Element String, and they can all be represented in the bar code symbols endorsed by EAN International and the Uniform Code Council (UCC™). The EAN.UCC System uses the bar code symbologies described below.

The EAN/UPC Symbology (which includes the UPC-A, UPC-E, EAN-13, and EAN-8 Bar Code Symbols as well as the two- and five-digit Add-On Symbols) is a bar code symbology family that can be read omnidirectionally. It must be used for all items that are scanned at the Point-of-Sale and may be used on other trade items.

Figure 1.4 – 1

EAN-13



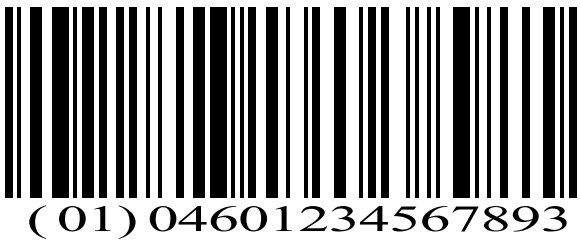

UPC-A

The ITF-14 Bar Code Symbol (Interleaved 2-of-5) is restricted to use on trade items not passing through the Point-of-Sale. This symbology is better suited for direct printing on corrugated fibreboard.

Figure 1.4 – 2

UCC/EAN-128 is a variant of Code 128. Its use is exclusively licensed by EAN International and the UCC™. This extremely flexible symbology is used for the representation of Element Strings using EAN.UCC System Application Identifiers. It is not intended to be read on items passing through the Point-of-Sale.

Figure 1.4 – 3



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## 1.5 The Data Standard

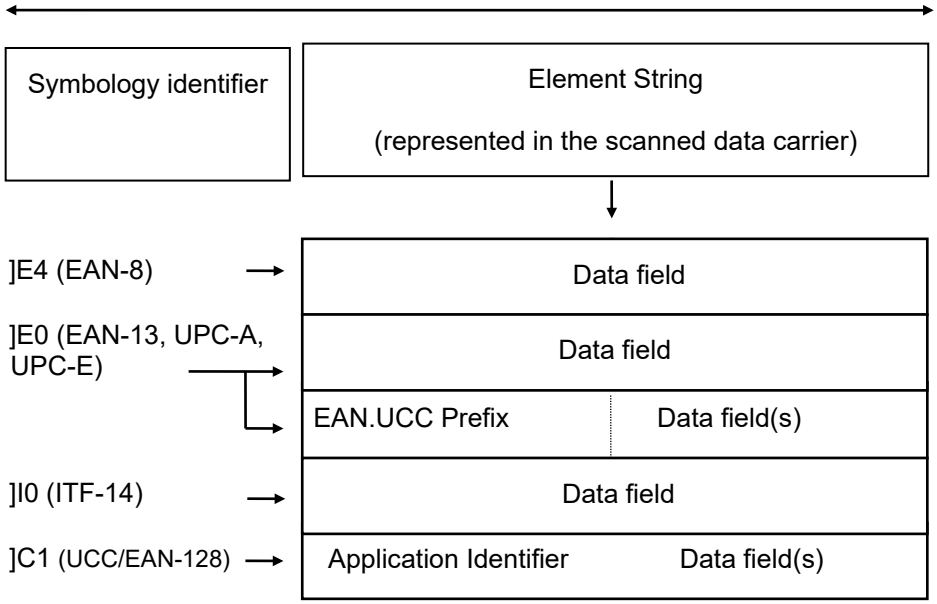
The EAN.UCC System provides various types of standardised data in the form of Element Strings. An Element String is data of a particular structure and meaning that is represented in an EAN.UCC System endorsed data carrier. It may be:

- An EAN/UCC-8, UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number
- An EAN.UCC Prefix and data field(s) for special use with the EAN-13 or UPC-A Bar Code Symbol in a particular environment
- An Application Identifier and data field(s)

A full string consists of the symbology identifier (see Section 5.0.3) followed by one or more Element Strings. The symbology identifier is generated by the reading device and transmitted together with the Element String(s). The symbology identifier ensures that systems distinguish between EAN.UCC System data structures and other non-EAN/UCC System data structures. Figure 1.5 – 1 shows how Element Strings are incorporated in the full string transmitted from a bar code reader to the appropriate software.

Figure 1.5 – 1

Transmitted Full String




Note: The full string may contain several Element Strings.



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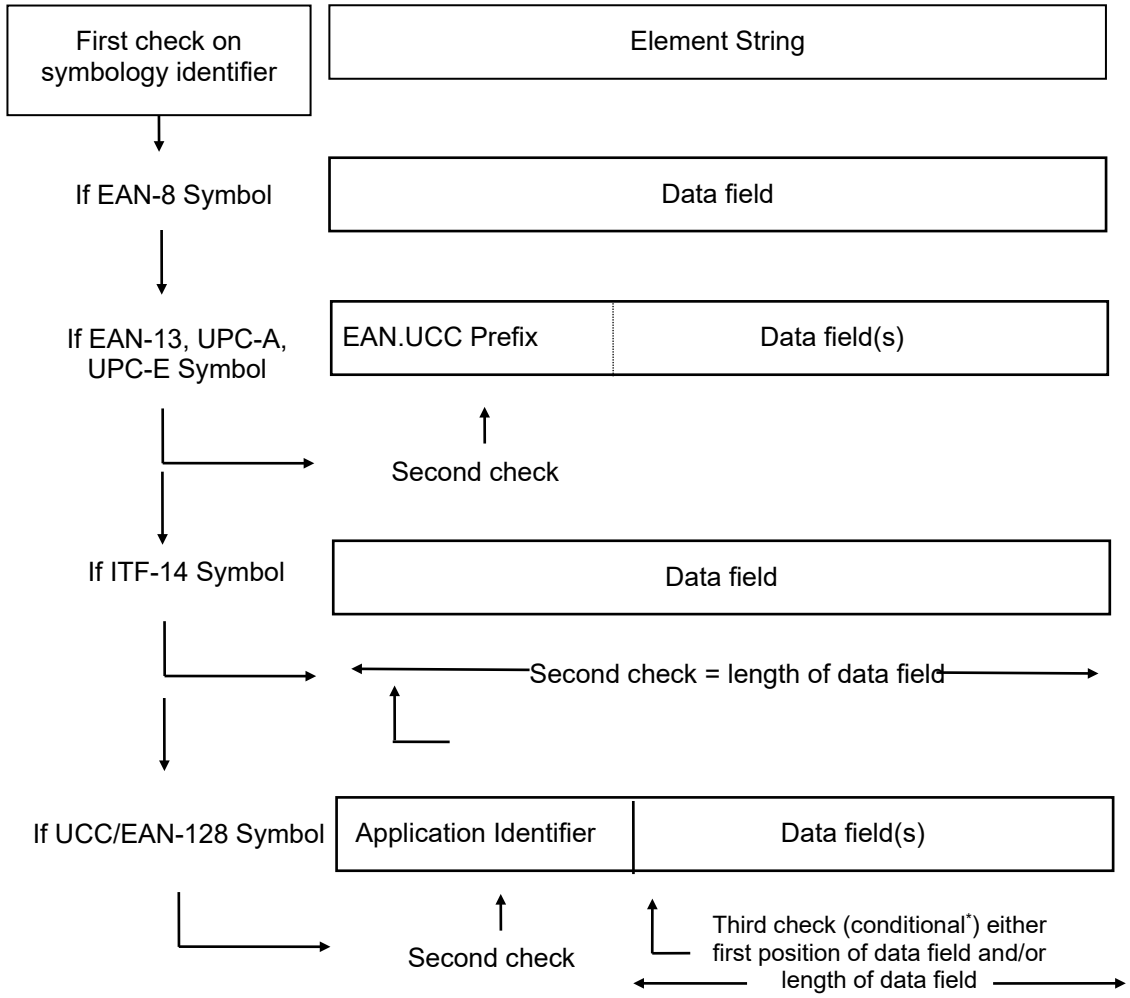
Each Element String, whether consisting of one or several data fields, will have unique meaning, because it is unambiguous and does not depend on other read or stored data, or human intervention. Element Strings must not be used for purposes other than those assigned to them, or this uniqueness will be lost.

The Element Strings of the EAN.UCC System will be used mainly for recording transactions in goods handling and business applications. Some Element Strings will be applied for administrative purposes in specific environments (e.g., hospitals). The use of specific Element Strings in system applications is subject to standards and recommendations. Their logical association is described in Sections 4.0 and 7.0.

The Element Strings are composed of an Application Identifier and one or more data fields. The Application Identifier denotes the content and structure of the respective data fields. Full details are contained in Section 3.0. The meaning of the Element Strings is determined by a sequence of checks carried out on the information in the transmitted full string (see Figure 1.5 – 2). See Section 5.0 for details on symbology identifiers.

Figure 1.5 – 2

**Analysis of the Significance of an Element String Represented in a Data Carrier**




*For Application Identifiers (01) and (02), the digit 9 in the first position indicates a Variable Measure Trade Item (see Section 2.1).



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EAN.UCC Prefixes are shown in Figures 1.5 – 3 and 1.5 - 4.

Figure 1.5 – 3

| Synopsis of EAN.UCC Prefixes | |
|---|---|
| **EAN.UCC Prefixes** | **Significance** |
| 000 - 019 | UCC™ data structure* |
| 02 | UCC Variable Measure Trade Item identification for restricted distribution |
| 030 - 039 | UCC data structure |
| 04 | UCC item numbering for restricted distribution within a company |
| 05 | UCC coupon identification |
| 060 - 099 | UCC data structure |
| 100 - 139 | UCC data using EAN/UCC-13 Data Structure |
| 140 - 199 | Reserve |
| 20 - 29 | EAN numbering for restricted distribution within a geographic region |
| 300 - 969 | EAN data structure |
| 970 - 976 | Reserve |
| 977 | ISSN standard numbering (serial publications) |
| 978 | ISBN standard numbering (books) |
| 979 | ISBN or ISMN standard numbering |
| 980 | EAN identification of Refund Receipts |
| 981-982 | EAN coupon identification for common currency areas |
| 983 - 989 | Reserved for further EAN coupon identification |
| 99 | EAN coupon identification |

* Starting from EAN.UCC Company Prefix 00 00100 to avoid collision with EAN/UCC-8 Identification Numbers.

Note: These prefixes all assume an EAN/UCC-13 Data Structure. When UCC identification numbers are carried by UCC-12 (UPC) Bar Code Symbols, the prefixes 00 to 09 will appear as the single figures 0 to 9.

Figure 1.5 – 4

| Synopsis of EAN/UCC-8 Prefixes | |
|---|---|
| **EAN/UCC-8 Prefixes** | **Significance** |
| 0 | Velocity Codes |
| 10 - 13 | UCC data structure |
| 140 - 199 | Reserve |
| 2 | EAN.UCC numbering for use within a company |
| 300 - 969 | EAN data structure |
| 97 - 99 | Reserve |


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## 1.6 The Areas of System Application

To ensure that Element Strings are used and interpreted correctly together, they must only be used in the appropriate areas of application. In this way, each Element String will always have the same meaning, enabling automatic processing.

Element Strings containing identification numbers provide unique identification within a particular area of application. Each area of application must be distinguished within a database using qualifiers, different fields, or even different files.

### 1.6.1 Area 1: Identification of Trade Items

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 (see Section 2.1). This definition covers services and products, from raw materials through to end user products, all of which have pre-defined characteristics.

EAN/UCC-8, UCC-12, EAN/UCC-13, and EAN/UCC-14 Identification Numbers are all used to identify trade items. These data structures provide unique identification when they are right-justified in a 14-digit reference field, called the GTIN Format (see Figure 1.3.1 – 5). If the item is of variable measure, its identity will need to be completed by measure information, or in some instances, price information. Other variable information about trade items (e.g., production, packaging, expiration dates, lot numbers, serial numbers) is also available as standardised Element Strings.

Each trade item is allocated a unique identification number, which remains the same as long as it is being traded. The same identification number is used for all of these same items. The numbers must be used in their entirety within computer systems and must not be used in parts.

### 1.6.2 Area 2: Identification of Logistic Units

Logistic units are units which store or transport any combination of trade items and which need to be identified and managed through the supply chain (see Section 2.2). Each individual unit is allocated a unique serial number, the SSCC (Serial Shipping Container Code), which must be different for every logistic unit. Even if the logistic units contain identical trade items, they still require different SSCCs.

Attributes relating to logistic units (e.g., gross weight, outside dimensions) are also standardised Element Strings. Standardised Element Strings are available to identify the contents of logistic units that contain a single type of trade item.



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### 1.6.3 Area 3: Identification of Assets

The EAN.UCC Global Returnable Asset Identifier (GRAI) or EAN.UCC Global Individual Asset Identifier (GIAI) can be used to identify specific assets or types of assets within an asset register (see Section 2.3).

### 1.6.4 Area 4: Identification of locations

The EAN/UCC-13 Data Structure is used to identify locations, and each location is given a unique EAN.UCC Global Location Number (GLN) (see Section 2.4).

The identification of physical, functional, or legal entities is required:

- For EDI messages
- When providing transport information on logistic units
- To enable bar code symbol identification of actual locations (e.g., goods inward, warehouse shelving)

### 1.6.5 Area 5: Identification of Service Relationships

The EAN.UCC Global Service Relation Number (GSRN) is used to uniquely identify a receiver of agreed upon services from a particular service provider (See Section 2.5). The GSRN can identify the user as a participant (or member) in a programme or scheme. However, it never constitutes a person's personal identification number because it is always related to a given service arrangement.

### 1.6.6 Area 6: Special System Applications

Special system applications are standardised Element Strings that may be used for company internal and special applications that are not covered by the main application areas (see Section 2.6).



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## 1.7 Automatic Processing of Decoded Data

The purpose of entering data from a bar code scanner into a system is to record a transaction. Transaction data are electronic messages that will be processed according to the meaning of the data transferred. This is possible without any manual intervention.

Although each Element String has only one meaning, correct interpretation of the electronic message depends on the type of transaction. This implies that the transaction type, although not part of the EAN.UCC System standards, should be considered an integral part of EAN.UCC System data processing. Consequently, the electronic message will be derived from:

- The transaction type
- The identification of the bar code symbol
- The data decoded from a bar code symbol, including the Application Identifier(s) or other data identifier(s)

An Electronic Data Interchange (EDI) message has clearly defined components to enable automatic processing, and in the same way, data from a bar code scanner forms a message with a pre-defined structure. Such messages may simply identify an item, but some will also contain data that supplements the identification.

In order to provide unambiguous and complete messages, it is necessary to define which Element Strings are required to form a valid electronic message. Valid electronic messages are determined by the systems components and by business practices (system user applications), which together generate the system's logic. System users assembling these electronic messages need an unambiguous way of characterising the Element Strings, which do not have explicit Application Identifiers.

The EAN.UCC System provides standardised data, which, when carried by EAN.UCC System bar code symbols, can be captured, correctly analysed, and processed automatically. The steps in this procedure are:

- The bar code reader reads the bar code symbol and transmits the full string of data to the front-end processing program.
- The front-end program breaks the full string into Element Strings and transmits them to the analysing program.
- The analysing program assembles the Element Strings from one or more full strings, any manually entered data, and the transaction information collected from the operator or inferred, then validates the correctness of the set and transmits the set of data to the application for processing.
- The application uses the transaction information, the Element Strings, and a database to process the information correctly.

The above steps will be repeated as needed at each point in the supply chain.



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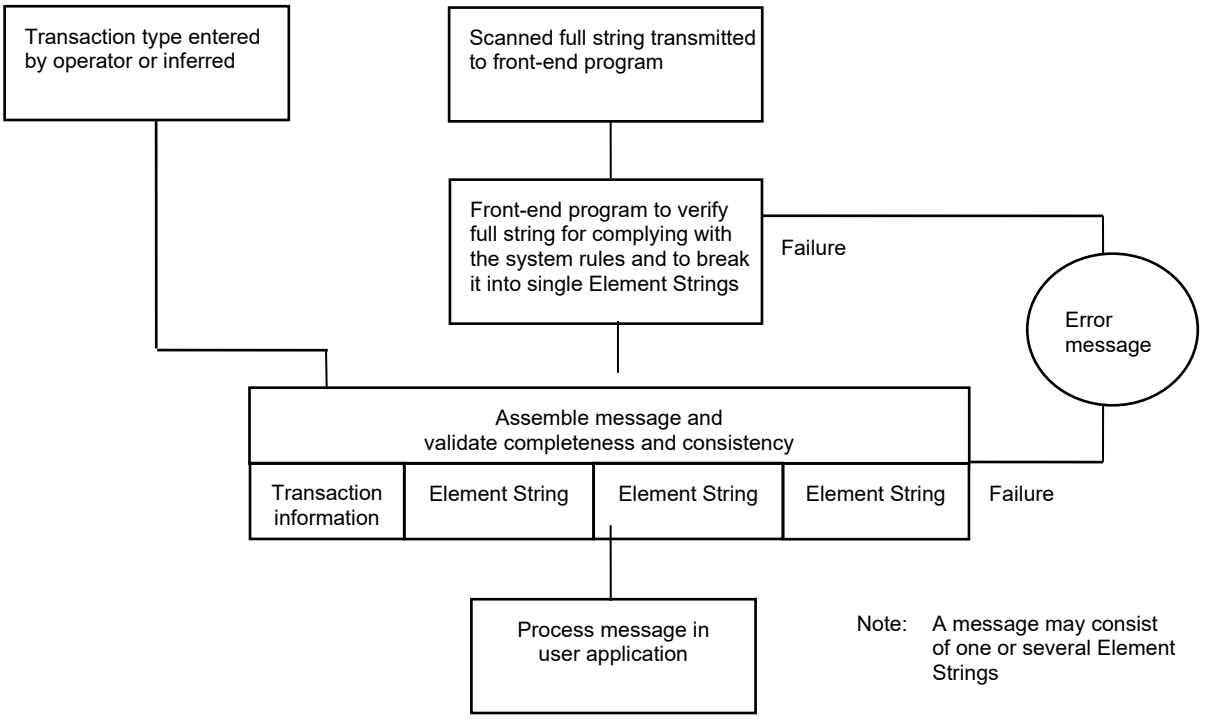
This process is represented in Figure 1.7 – 1.

Figure 1.7 – 1




Note: In principle, all Element Strings provide their information independent of context. When the Element Strings are shown in a bar code symbol applied to an item, the information in the Element Strings is about the item itself. In this way, transactions about items can be recorded as the items are scanned. When printed in a document (e.g., in a product catalogue), the information enables the automatic entry of data for a business transaction, such as an order. For example, the Element String AI (01) will be shown in the same bar code symbol whether physically marked on an item or printed in a catalogue.



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# Section 2.0:

# Areas of System Application

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## 2.0.1 Seven Areas of System Application

The EAN.UCC System is a method of identification comprising a standard numbering system and standardised identification data for unambiguous worldwide use. Represented in data carriers (currently bar code symbols), the identification system is used for Automatic Data Capture and electronic data processing of such things as goods, documents, and physical locations.

The rules and regulations for proper use of the numbering system and its Element Strings apply to seven areas of system application, which are outlined in Figure 2.0.1 – 1. These rules and regulations must be observed by all system users to ensure the integrity of the EAN.UCC System.

System users are continually developing real business applications for the EAN.UCC System. It is neither possible nor desirable to outline all the real world solutions that are based upon the use of EAN.UCC System standards. However, all elements of the EAN.UCC System have been developed to meet user requests while keeping in mind the EAN International and Uniform Code Council, Inc.® (UCC™) objective to improve the efficiency of integrated logistics and contribute added value to partners and consumers.

Unique and unambiguous identification is guaranteed only within each area of application. The six areas of application supported by these standards should only be applied in instances that fit the application as defined. In the future, when new requirements arise, system application areas will be developed to meet those requirements.



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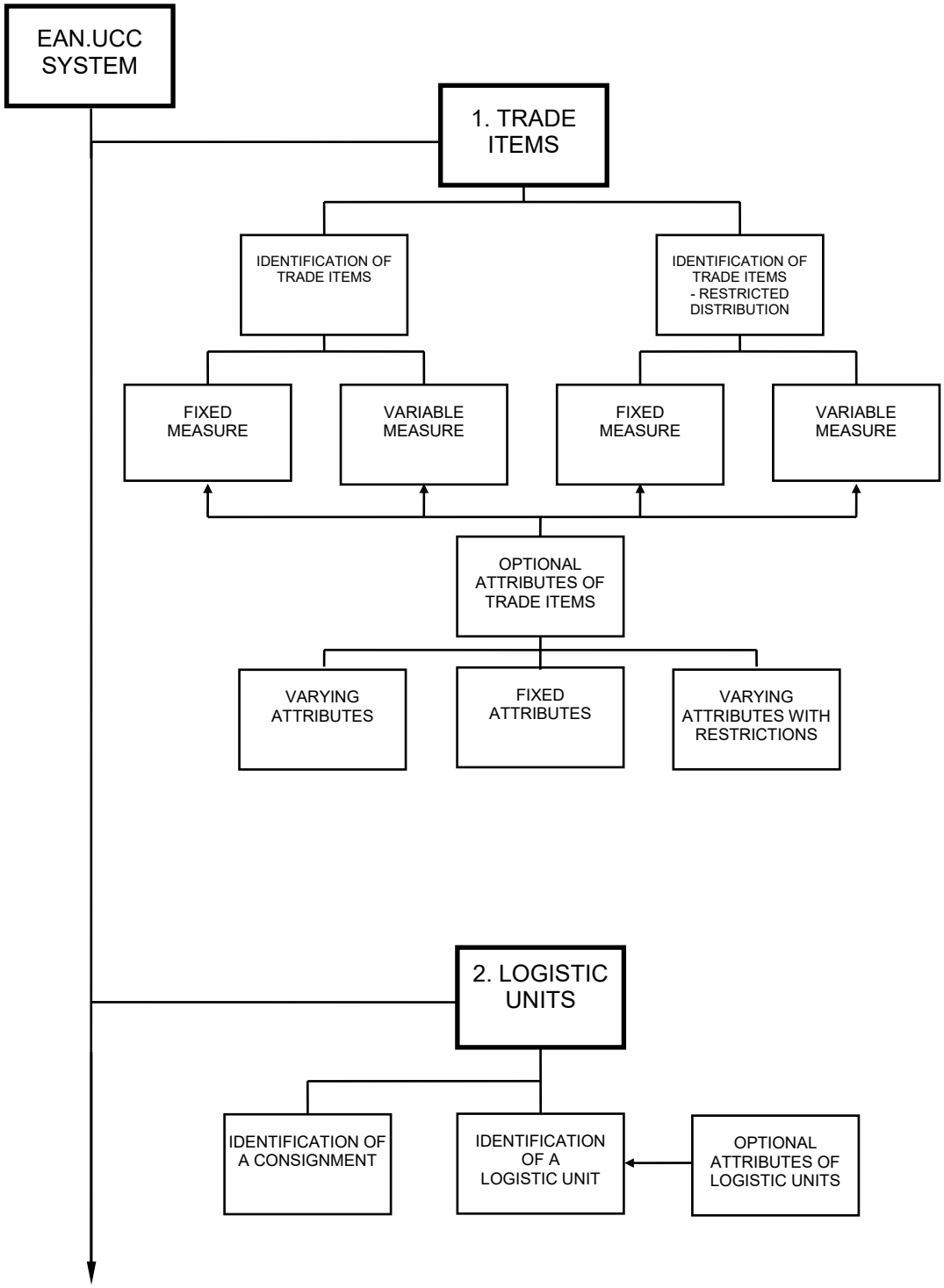
Figure 2.0.1 – 1

**Areas of System Application**



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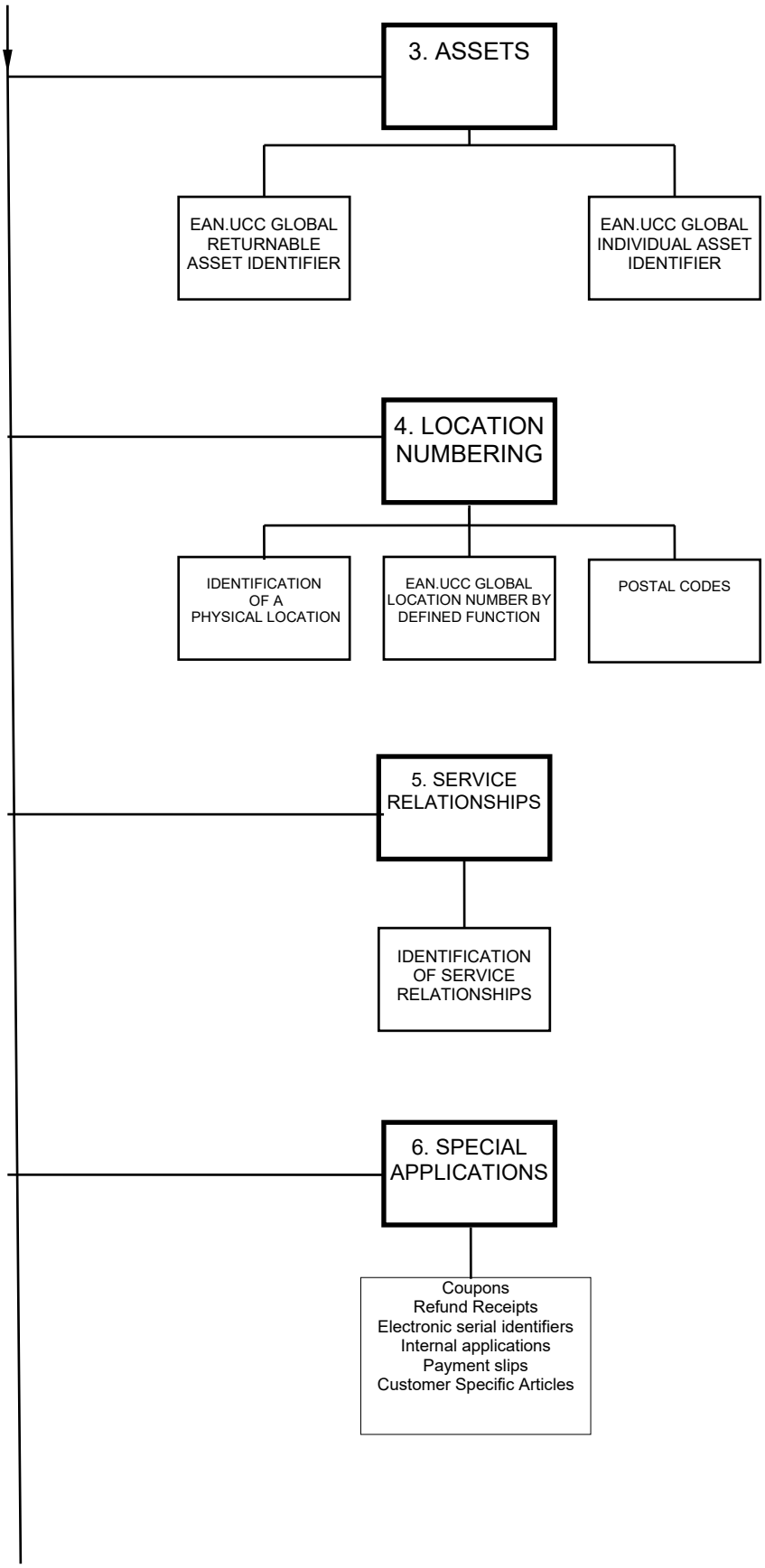




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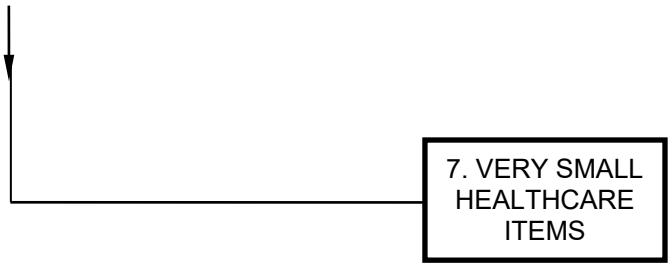



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# Section 2.1:

# Numbering and Symbol Marking of Trade Items

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## 2.1.1 Introduction

### 2.1.1.1 Definitions and Principles

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 services and products, from raw materials through to end user products, all of which may have pre-defined characteristics.

The identification and bar code symbol marking of trade items enables the automation of the Point-of-Sale (through Price Look Up (PLU) files), of goods receiving, inventory management, automatic re-ordering, sales analysis, and a wide range of other business applications.

The EAN/UCC-8, UCC-12, EAN/UCC-13, and EAN/UCC-14 Identification Numbers are used to identify trade items. Each can be considered a Global Trade Item Number™ (GTIN™) when stored in the GTIN Format, a 14-digit reference field.

Figure 2.1.1.1 – 1

| **Data Structures** | **Storage in the GTIN Format** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ | $T_{11}$ | $T_{12}$ | $T_{13}$ | $T_{14}$ |
| EAN/UCC-14 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ | $N_{14}$ |
| EAN/UCC-13 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ |
| UCC-12 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ |
| EAN/UCC-8 | 0 | 0 | 0 | 0 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ |

If the item is of variable measure, the respective measure or price information will often be of critical importance to business applications. Attributes relating to trade items (e.g., dates, lot number) are also available as standardised Element Strings.

Each trade item that is different from another in design and/or content is allocated a unique identification number, which remains the same as long as it is traded. The same identification number is given to all trade items sharing key characteristics. Such numbers must be treated in their entirety throughout the supply chain.

Basic principles for the identification of trade items include:

- Each trade item that is different from another must be allocated a separate, unique GTIN.
- The GTIN does not carry any information related to the trade item. The brand owner responsible for assigning the GTIN must communicate this information by Electronic Data Interchange (EDI) or other means to all business partners.
- An assigned GTIN must never be changed as long as the item is not modified so that it needs to be discriminated from the initial trade item for ordering, stocking, or billing. Exceptions to this rule may occur only when regulatory or legal requirements mandate a change.
- The serialised identification of trade items, which enables total connectivity of information and communication systems, is achieved through the use of AI (01) GTIN and AI (21) Serial Number (See Section 3.6 for full details).



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### 2.1.1.2 Types of Trade Items

Trade items cover a broad variety of things that may carry a bar code symbol and a GTIN™. Different standard solutions apply depending on the nature of the item and the scope of the users' applications. The following sections determine the identification and symbol marking rules applicable to a particular trade item.

#### 2.1.1.2.1 Physical or Non-Physical Trade Items

Non-physical trade items are usually called services. Services may be identified with standard numbers for open trade applications or in restricted distribution environments.

#### 2.1.1.2.2 Open or Restricted Distribution

The main benefit of the EAN.UCC System for trade items is that it provides a unique and unambiguous identification number for every trade item, which is applicable worldwide in open environments. In addition, the system provides for other number series that may be exclusively used for restricted distribution (e.g., national use, company internal use). Restricted distribution identification numbers are available to EAN Member Organisations and Uniform Code Council, Inc.® (UCC™) members to help them develop solutions applicable within their territory.

#### 2.1.1.2.3 Fixed or Variable Measure

Fixed Measure Trade Items are those that are always produced in the same version and composition (e.g., type, size, weight, contents, design). Like a Fixed Measure Trade Item, a Variable Measure Trade Item is an entity with pre-defined characteristics, such as the nature of the product or its contents. Unlike a Fixed Measure Trade Item, a Variable Measure Trade Item has at least one characteristic that varies whilst other characteristics of the trade item remain the same. The variable characteristic may be weight, dimension, number of items contained, or volume information. The complete identification of a Variable Measure Trade Item consists of both an identification number and information about the variable data.

#### 2.1.1.2.4 Retail or Non-Retail

Scanning at the Point-of-Sale is a major application of the EAN.UCC System, and trade items that are intended to cross a Point-of-Sale are subject to specific rules.

#### 2.1.1.2.5 Books and Serial Publications

Published material (newspapers, magazines, and books) requires special consideration due to the following factors:

- A solution for published material should address the requirement to process returns (sorting and counting) to wholesalers and publishers. This implies the reading of a supplementary number that is not required for item identification.
- The international systems, ISSN and ISBN, already handle the numbering of publications and books.
- Because of the large number of titles involved and the problems of creating and updating Price Look Up (PLU) files, price may be encoded within the Global Trade Item Number™ (GTIN™).

#### 2.1.1.2.6 Single Item or Grouping of Items

A trade item may be a single, non-breakable unit or a standard and stable grouping of a series of single items. Such groupings of items may be present in a wide variety of physical forms, such as a fibreboard case, a covered or banded pallet, a film wrapped tray, or a crate with bottles. Trade items consisting of a single unit are identified with a Global Trade Item Number™ (GTIN™). Standard groupings of identical or different units, each identified with a GTIN, are identified with a separate GTIN.



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### 2.1.1.2.7 Single Trade Items Composed of Several Physical Parts

Because of its physical nature, a trade item may be packed in separate physical parcels. For example, furniture equipment may be composed of several pieces (e.g., a sofa and two armchairs, which cannot be ordered or sold separately). A specific standard solution is available to identify and symbol mark each component of a trade item composed of several physical parts.

### 2.1.1.2.8 Quality of Substrate

The choice of the data carrier (bar code symbology) used to symbol mark a trade item depends on the nature of the item and on the environment in which the bar code symbol will be scanned. It also depends on the quality of the substrate on which the bar code symbol will be marked.

### 2.1.1.2.9 Size of the Package

The space available on a package to symbol mark a trade item may be limited. Standard solutions that emphasise strictly defined rules are available to handle these situations.



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## 2.1.2 Identification of Trade Items

### 2.1.2.1 Fixed Measure Trade Items

#### 2.1.2.1.1 General Numbering and Symbol Marking Rules

Fixed Measure Trade Items are those that are always produced in the same version and composition (e.g., type, size, weight, contents, design). The identification number identifies the item unambiguously. Every trade item that is different from another in any respect is assigned a separate Global Trade Item Number™ (GTIN™). The EAN.UCC Prefixes 000 to 019, 030 to 039, 060 to 099, 100 to 139, 300 to 969, and 977 to 979 are used for all GTINs described in this section.

Figure 2.1.2.1.1 – 1 shows the options available when numbering and symbol marking Fixed Measure Trade Items.

Figure 2.1.2.1.1 – 1

| Data Structure | Bar Code Symbol | Reference to Element Strings in Section 3.0 | Comments |
|---|---|---|---|
| EAN/UCC-8 | EAN-8 | Section 3.3.1 | Only for small items |
| UCC-12 | UPC-E | Section 3.2.1 | Only for small items |
| UCC-12 | UPC-A | Section 3.2.1 | For all items |
| EAN/UCC-13 | EAN-13 | Section 3.2.1 | For all items |
| UCC-12 | ITF-14 | Section 3.5.1 | Not for Point-of-Sale |
| EAN/UCC-13 | ITF-14 | Section 3.5.1 | Not for Point-of-Sale |
| EAN/UCC-14 | ITF-14 | Section 3.5.2 | Not for Point-of-Sale |
| UCC-12 | UCC/EAN-128 (AI 01) | Section 3.6.2 | Not for Point-of-Sale |
| EAN/UCC-13 | UCC/EAN-128 (AI 01) | Section 3.6.2 | Not for Point-of-Sale |
| EAN/UCC-14 | UCC/EAN-128 (AI 01) | Section 3.6.2 | Not for Point-of-Sale |

Any bar code symbol that is intended for General Distribution Scanning (including unattended, fixed mount scanning environments, where items are scanned automatically as they pass by on a conveyor) should be a minimum of 32 mm (1.25 in.) in height and be printed at the higher end of the permissible X-dimension range.

#### 2.1.2.1.2 Trade Items Scanned at the Point-of-Sale

A trade item that is intended to cross the Point-of-Sale in a retail outlet must carry a bar code symbol of the EAN/UPC Symbology family. Therefore, these trade items support only EAN/UCC-8, UCC-12, or EAN/UCC-13 Identification Numbers.

Some Point-of-Sale scanning systems may be able to handle symbologies other than the EAN/UPC Symbology. However in an open environment, it is not possible to predict the type of scanner that will be used. Therefore, items intended for scanning at a Point-of-Sale in a retail outlet must be marked with a bar code symbol of the EAN/UPC Symbology family.



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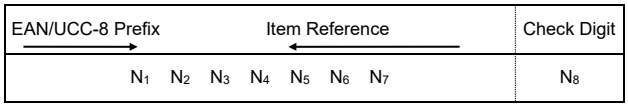
Although a sunrise date of January, 2005, has been set for the global use of the EAN/UCC-13 Identification Number, a UCC-12 (UPC) Identification Number carried by a UPC-A or UPC-E Bar Code Symbol is normally required for items sold at the Point-of-Sale in the United States and Canada. This is because many North American users cannot yet accommodate EAN/UCC-13 Identification Numbers in their [12-digit] database files.

### 2.1.2.1.3 When is an EAN/UCC-8 Identification Number Appropriate?

The EAN/UCC-8 Identification Number is available for items whose packaging does not include enough available space to permit the use an EAN-13 or UPC-A Symbol. EAN/UCC-8 Identification Numbers are individually assigned by EAN Member Organisations and the Uniform Code Council (UCC) on request (see Figure 2.1.2.1.3 – 1).

Figure 2.1.2.1.3 – 1

**EAN/UCC-8 Data Structure**




The following guidelines should be observed:

Before deciding to use an EAN/UCC-8 Identification Number as opposed to an EAN/UCC-13 ID Number or UCC-12 ID Number, companies, working jointly with their printer, should consider options such as:

- Whether the bar code can be reduced in size (e.g., printed at a lower X-dimension, taking into account the minimum bar code symbol print quality requirements (See Section 5.4))

- Whether the label or artwork can reasonably be changed to enable the printer's recommended size of a EAN-13 or UPC-A Bar Code Symbol to be included (e.g., redesigning the label increasing the label size, especially when the existing label is small in comparison with the pack area, or using an additional label). The label includes the total printed design surface, whether or not it is separately affixed.

- Whether a truncated bar code symbol can be used. A truncated bar code symbol (normal length, but reduced in height) may only be used if there is absolutely no possibility of printing a full size bar code symbol. Truncation removes the omni-directional scanning capability. A bar code symbol with excessive truncation will not be of any practical use. Users considering this option should consult their customers to see if an acceptable compromise can be reached.

Pack size constraints allow several possible options:

- The use of an EAN/UCC-8 Identification Number is authorised when the EAN-13 or UPC-A Bar Code Symbol in the size required as a result of print quality studies exceeds either 25% of the printed label area or 12.5% of the total printable area.

- The use of an EAN/UCC-8 Identification Number is authorised when either the largest side of the printed label is less than 40 cm² or the total printable area is less than 80 cm².

- The use of an EAN/UCC-8 Identification Number is authorised on cylindrical products with a diameter less than 3 cm.



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### 2.1.2.1.4 When is a UPC-E Bar Code Symbol Appropriate?

Only UCC Company Prefixes beginning with zero can be used to construct UPC-E Bar Code Symbols. Distribution of UCC Company Prefixes in this range is restricted to proven need only (e.g., for items whose packaging does not include enough available space to permit the use of any other bar code symbol). Companies with these prefixes are encouraged to manage their finite resource carefully.

Technical details for the UPC-E Bar Code Symbol and UCC-12 Identification Numbers are described in Section 3.A.2.

### 2.1.2.1.5 Books, Paperbacks, Serials, and Printed Sheet Music

#### 2.1.2.1.5.1 General Principles Adopted in the Solutions Provided

When identifying books, paperbacks, serials, and printed sheet music, companies can choose between an existing international numbering system, such as ISBN, ISMN, or ISSN, and the EAN/UCC-13 Data Structure (or UCC-12 Data Structure in the United States and Canada). EAN International makes available, through these specifications, a general framework of solutions for books, paperbacks, serials, and printed sheet music, which should be considered by EAN Member Organisations working in liaison with publishers and trade associations.

The numbering and symbol marking rules for books, paperbacks, serials, and printed sheet music sold in the United States and Canada are available from the Uniform Code Council, Inc.® (UCC).

#### 2.1.2.1.5.2 Identification of Books, Paperbacks, and Printed Sheet Music

When identifying books, paperbacks, and printed sheet music, a company should first attempt to identify them in the same manner as any other trade item: by use of the EAN/UCC-13 or UCC-12 Data Structure.

The second option is to use the ISBN or ISMN numbering systems. The EAN.UCC Prefix 978 is used to encode the ISBN number assigned to a particular item without its Check Digit. The EAN.UCC Prefix 979 is used for encoding either the ISBN or the ISMN of a particular item without its Check Digit.

Figure 2.1.2.1.5.2 – 1

| EAN.UCC Prefix | ISBN (Without its Check Digit) | Check Digit |
|---|---|---|
| 9 7 8 | $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | $N_{13}$ |

| EAN.UCC Prefix | ISBN or ISMN (Without its Check Digit) | Check Digit |
|---|---|---|
| 9 7 9 | $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | $N_{13}$ |

Note: For ISMN the $N_4$ (which is represented by "M" in the ISMN) takes the value 0 (zero). $N_5$ to $N_{12}$ are the first eight digits of the ISMN number.



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#### 2.1.2.1.5.3 Symbol Marking of Books, Paperbacks, and Printed Sheet Music

Books, paperbacks, and printed sheet music should be marked with an EAN-13, UPC-A, or UPC-E Bar Code Symbol that complies with the print quality specifications applicable to all EAN.UCC System bar code symbols. In addition, the main bar code symbols on books, paperbacks, and printed sheet music are subject to the following constraints:

- They must not be reduced in height.
- They must appear on the outside cover of the book (to facilitate payment) and inside the cover for books that are subject to return.

#### 2.1.2.1.5.4 Supplementary Information for Books, Paperbacks, and Printed Sheet Music

Some publishers may wish to communicate additional information in a bar code symbol in order to meet their internal requirements. For example, publishers may wish to include an edition variant (e.g., unchanged reprint, price increase), which is not distinguished by the ISBN, ISMN, EAN/UCC-13 ID Number, or UCC-12 ID Number. The EAN.UCC System provides an additional two- or five-digit symbol, called an Add-On Symbol, can be included on the item just to the right of the main bar code symbol.

Add-On Symbols involve the following constraints:

- They should not contain information that must appear in the item's EAN/UCC-13 ID Number (or UCC-12 ID Number).
- The reading of the Add-On Symbol by the retailer's Point-of-Sale system is optional.
- The use of the Add-On Symbol is the responsibility of each publisher.

#### 2.1.2.1.5.5 Identification of Serial Publications

When identifying serial publications, companies should first attempt to identify them in the same manner as any other trade item: using the EAN/UCC-13 or UCC-12 Data Structure.

The second option involves using a special EAN.UCC Company Prefix (assigned by an EAN Member Organisation within its territory), the publication number, and the price of the publication (provided that the national legislation allows this). With this option, the price is placed in clearly defined positions and is directly usable in the country of publication. However, as soon as the item leaves the country, the price has no direct significance and the GTIN must be interpreted in a general way, without being broken down internally.

The third option is to make use of the ISSN numbering system. The EAN.UCC Prefix 977 is used for encoding the ISSN number assigned to a particular item without its Check Digit.

Figure 2.1.2.1.5.5 – 1

| EAN.UCC Prefix | ISSN (Without its Check Digit) | | | | | | | Variant | | Check Digit |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 7 7 | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ |

The variant digits, $N_{11}$ and $N_{12}$ may be used to express variants of the same title for issues with a different price or to identify different issues of a daily within one week. Normal title takes value 00



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**2.1.2.1.5.6 Two-Digit Add-On Symbol**

Serial publications are identified using one of the three solutions previously described. A two-digit serial number encoded in a two-digit Add-On Symbol is also available. The system for assigning the serial number is at the discretion of each EAN Member Organisation or the Uniform Code Council, Inc.® (UCC™).

EAN International and the UCC recommend the use of the following number assignment:

- Dailies (or more generally publications with several issues a week): The publications of each day of the week are considered separate trade items that must be identified with a separate identification number represented in an Add-On Symbol. The two-digit serial number should only be used to represent the applicable week, which, together with the EAN/UCC-13 or UCC-12 ID Number, establishes the day within the year.
- Weeklies: Number of the week (01 – 53)
- Bi-weeklies: Number of the first week of the respective period (01 – 53)
- Monthlies: Number of the month (01 – 12)
- Bi-monthlies: Number of the first month of the respective period (01 – 12)
- Quarterlies: Number of the first month of the respective period (01 – 12)
- Seasonal period: First digit = last digit of the year; second digit = 1 spring, 2 summer, 3 autumn, 4 winter
- Bi-annual period: First digit = last digit of the year; second digit = number of the first season of the respective period
- Annuals: First digit = last digit of the year; second digit = 5
- Special intervals: Consecutively numbered from 01 to 99

The serial number is carried by a two-digit Add-On Symbol that is placed to the right of the symbol and parallel to it. The Add-On Symbol must comply with the print quality specifications applicable to all EAN.UCC System bar code symbols. For example, the X-dimension applied to the main bar code symbol must also be applied to the Add-On Symbol.

**2.1.2.1.5.7 Five-Digit Serial Number**

Serial publications can also use a five-digit serial number carried by a five-digit Add-On Symbol. The reading of the Add-On Symbol at a Point-of-Sale is optional. The Add-On Symbol must not be used to encode information that should be contained within the Global Trade Item Number™ (GTIN™). The Add-On Symbol provides additional information about a particular publication of a printed item, and it is the publisher's responsibility to define the numbering scheme. When using a five-digit Add-On Symbol, a two-digit Add-On Symbol cannot also be used.

Information that can be encoded in the five-digit Add-On Symbol includes the actual date of issue, in order to differentiate between successive issues.

The five-digit Add-On Symbol is placed to the right of the main bar code symbol and parallel to it. The Add-On Symbol must comply with the print quality specifications applicable to all EAN.UCC System bar code symbols. For example, the X-dimension applied to the main symbol also must be applied to the Add-On Symbol.



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## 2.1.2.1.6 Groupings of Trade Items Not Crossing a Point-of-Sale

### 2.1.2.1.6.1 General Identification Rules for Groupings of Trade Items

Every trade item that is different from another in any respect is assigned a unique Global Trade Item Number™ (GTIN™). This includes groupings of trade items, which are also considered a single trade item.

For example each of the packaging types in Figure 2.1.2.1.6.1 – 1, if traded, is assigned a separate GTIN.

Figure 2.1.2.1.6.1 – 1

| Trade Item | Numbering Option to Construct a GTIN | | | |
|---|---|---|---|---|
| | **EAN/UCC-8** | **UCC-12** | **EAN/UCC-13** | **EAN/UCC-14** |
| Single Product A | X | X | X | |
| 50 x Product A (standard case) | | X | X | X |
| 50 x Product A (display case) | | X | X | X |
| 100 x Product A (standard case) | | X | X | X |
| Single Product B | X | X | X | |
| 50 x Product A 50 x Product B | | X | X | |

### 2.1.2.1.6.2 Identification of Uniform Groupings of Trade Items

A uniform grouping of trade items is a standard and stable grouping of a series of identical units identified by an EAN/UCC-8, UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number. If the grouping is itself a trade item, it must be identified with a UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number.

### 2.1.2.1.6.3 Identification of Mixed Groupings of Trade Items

A mixed grouping of trade items is a standard and stable grouping of a series of different units identified by different Global Trade Item Numbers™ (GTINs™). If this mixed grouping is itself a trade item, it must be identified with either a UCC-12 or an EAN/UCC-13 Identification Number.

The EAN/UCC-14 Identification Number is valid for mixed groupings only when the mix is identified with a unique GTIN such as an EAN-8, UCC-12, or EAN-13 Identification Number that is subsequently put into a packaging configuration.

For example:

- GTIN A, GTIN B, and GTIN C (a mixed grouping) are identified by GTIN D.
- GTIN D could then be used to construct an EAN/UCC-14 Identification Number for a traded unit made up of a grouping of trade items identified by GTIN D.



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**2.1.2.1.6.4 Symbol Marking Groupings of Trade Items**

Symbols from the EAN/UPC Symbology family (UPC-A, UPC-E, and EAN-13 Bar Code Symbols) may be used to encode the UCC-12 or EAN/UCC-13 Identification Number of the trade item grouping.

ITF-14 Symbols may be used on groupings of trade items where printing conditions require the application of a less demanding symbology. ITF-14 Symbols can encode the UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number of the item.

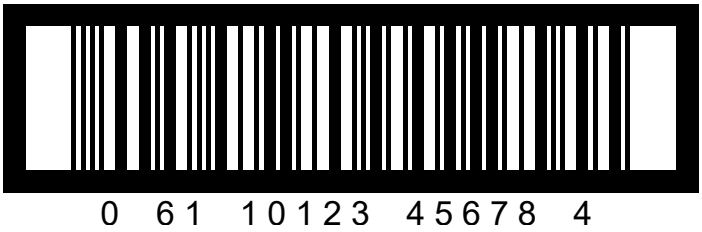
The UCC/EAN-128 Symbology with Application Identifier (01) may be used to encode a UCC-12, EAN/UCC-13, or EAN/UCC-14 Identification Number that identifies the trade item if the printing conditions allow. The choice of this symbology is particularly relevant if there is a need to encode attribute information in addition to the identification number.

Figure 2.1.2.1.6.4 – 1

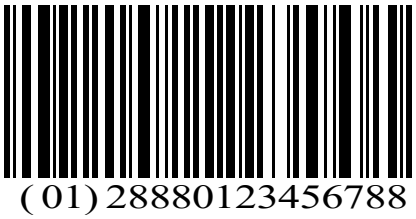
EAN-13

UPC-A

ITF-14




UCC/EAN-128 - AI (01)



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### 2.1.2.1.7 Identification of a Trade Item Composed of Several Parts

The EAN.UCC System provides for an Element String using Application Identifier (8006) (described in Section 3.6.52) to identify a trade item that does not cross a Point-of-Sale and which, due to its nature, is packed in several physical units. Each individual component is marked with a UCC/EAN-128 Bar Code Symbol carrying the Element String, which consists of the Global Trade Item Number™ (GTIN™) of the trade item, the sequence number of the particular component, and the total number of components of the trade item. If an attribute appears on more than one component, its value must be the same.

The use of the Element String AI (8006) to identify a trade item excludes the application of the Element String AI (01) on the same unit.

This solution is not applicable for trade items crossing a Point-of-Sale using slot scanners.



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### 2.1.2.2 Variable Measure Trade Items Not Crossing a Point-of-Sale

#### 2.1.2.2.1 General Numbering and Symbol Marking Rules

This section concerns trade items not intended to be scanned at the Point-of-Sale.

Trade items may be of variable measure either because the production process does not guarantee consistency in weight, size, or length (e.g., carcasses of meat, whole cheeses) or because the items are created to meet a special order that states a quantity (e.g., textiles ordered by the metre, glass ordered by the square metre).

Only trade items that are sold, ordered, or produced in quantities, which can vary continuously, are covered by the rules outlined in this section. Trade items that are sold in discrete and pre-defined bands (e.g., as a nominal weight) are treated as Fixed Measure Trade Items.

A trade item must be considered to be variable measure if its measure is variable at any point in the supply chain. For example, a supplier may sell and invoice chickens in standardised cases of 15 kg each; therefore the quantity of contained chickens will vary. The customer, a retailer in this example, may need to know the exact number of chickens contained in each case in order to organise the distribution to his stores. In this example, the supplier should source mark the trade item by using a variable measure Global Trade Item Number™ (GTIN™) (see Figure 2.1.2.2.1 – 1) and the variable count Element String (see Section 3.6.20).

The options shown in Figure 2.1.2.2.1 – 1 are available to number and symbol mark Variable Measure Trade Items.

Figure 2.1.2.2.1 – 1

| Data Structure | Bar Code Symbol | Reference to Element Strings in Section 3.0 | Comments |
|---|---|---|---|
| EAN/UCC-14 | ITF-14 | Section 3.5.3 | Not for Point-of-Sale |
| EAN/UCC-14 | UCC/EAN-128 - AI (01) | Section 3.6.3 | Not for Point-of-Sale |

The EAN/UCC-14 Identification Number with the Indicator 9 is used to identify a Variable Measure Trade Item. The presence of the variable measure information is mandatory for the complete identification of a particular Variable Measure Trade Item. The digit 9 in the first position is an integral part of the GTIN.

#### 2.1.2.2.2 Trade Measures Required to Complete the Identification of Variable Measure Trade Items

The EAN/UCC-14 Identification Number identifies a Variable Measure Trade Item with respect to its fixed attributes or characteristics. To complete the identification of a Variable Measure Trade Item, the presence of an Element String representing a trade measure is mandatory. Applicable trade measures depend on the nature of the product. They may be a quantity, a weight, or any dimension.

For details on Element Strings for trade measures, see Sections 3.6.20 and 3.6.21.



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#### 2.1.2.2.2.1 Variable Count: AI (30)

This Element String is used if the variable measure of the trade item is the number of items contained. In order to generate a short bar code symbol, always enter an even number of digits in the data field count of items by inserting a leading zero. Concatenation of this Element String with the EAN/UCC-14 Identification Number of the item enhances the accuracy of the application.

Note: This Element String should never be used to indicate the quantity contained in a Fixed Measure Trade Item. However, if it appears on a Fixed Measure Trade Item, it should not invalidate the trade item identification.

#### 2.1.2.2.2.2 Trade Measures: AI (31nn), (32nn), (35nn), (36nn)

These Element Strings are used if the variable measure of the respective trade item is weight, dimension, area, or volume. Only one Element String of a given unit of measure may be applied on a particular item. Several Element Strings containing trade measures are possible on a particular item if the item is available in either unit of measure and if the applicable unit of measure is not distinguished for ordering and billing. This might apply if weight must be expressed in kilograms and pounds.

Note: The fourth (and last) digit of the AI indicates the implied decimal point position. The value 0 means that the measurement is expressed in the basic unit of measure associated with the AI (e.g., kilograms). A value of 1 decreases the measurement by a factor of 10, a value of 2 by a factor of 100, and so on. For example, this enables metric weights to be represented from 999 kilograms to 1/1000 of a milligram.

#### 2.1.2.2.2.3 Roll Products - Width, Length, Core Diameter, Direction, Splices: AI (8001)

The EAN/UCC-14 Identification Number can denote a basic roll product. The Element String AI (8001) contains the pre-defined variable fields of a roll product. It may be used for those variable roll products where the standard trade measures (AI (31nn), (32nn), (35nn), (36nn)) are not sufficient.

This Element String must never be used together with other Element Strings representing standard trade measures.



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### 2.1.2.2.3 Types of Variable Measure Items

Any trade item of a given composition where the quantity/measure information cannot be pre-determined for any reason is a Variable Measure Trade Item. The most frequent types are shown in Figure 2.1.2.2.3 – 1.

Figure 2.1.2.2.3 – 1

| Type | Item Description |
|---|---|
| A | Items traded in bulk, neither portioned nor pre-packed for retail sale, ordered in any quantity, and that are delivered as non-standardised trade items (e.g., fish, fruit, vegetables, cables, carpets, timber, fabrics)<br>The identification number denotes the item as a trade entity containing any quantity of the given product and, if applicable, the form of packaging. Weight or dimensions complete the identification of the individual unit. |
| B | Trade items ordered and delivered by piece (wrapped or unwrapped) and invoiced by weight or measure because weight or measure varies due to the nature of the product or due to the manufacturing process (e.g., whole cheese, sides of bacon, beef carcasses, fish, sausages, ham, chicken, cauliflower, motion picture films)<br>The identification number denotes the item as a particular pre-defined entity and, if applicable, denotes the form of packaging. Price or weight or dimensions complete the identification of the individual item. |
| C | Portioned trade items, pre-packed for sale by weight to the consumer, not standardised in quantity. (e.g., meat, cheese, vegetables, fruit, fillets of fish, sliced poultry, cold cuts)<br>The identification number denotes the item type according to business practice and the form in which it is packed. Price or weight completes the identification of the individual unit. |
| D | Standardised trade items with selectable dimensions where EAN.UCC System standard numbering does not make sense to cover the multiplicity of all variations (e.g., wooden planks, carpeting)<br>The identification number denotes the pre-defined basic trade item. The applicable dimension(s) completes the identification of the individual unit. |
| E | Standardised composition of a fixed number of trade items that are Type B or Type C (e.g., a trade item containing 10 chickens (Type B)<br>The identification number denotes the standardised trade item as an entity and, if applicable, its form of packaging. The total weight of all items contained completes the identification of the particular trade item. |

### 2.1.2.2.4 Examples of Numbering and Symbol Marking of Variable Measure Trade Items

In the examples in the subsections that follow, the following factors apply:

- In order to be illustrative, all examples show the same presentation (e.g., price list, order, delivery, invoice, and recording in a data file).
- UCC/EAN-128 Bar Code Symbols are used.
- The examples are given to demonstrate the correct use of a given Application Identifier when used. When AI (02) is not used, information about the shipment must be received using Electronic Data Interchange (EDI) or other means prior to its physical receipt.



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#### 2.1.2.2.4.1 Example 1: Traded by Piece

The following example shows the order and delivery of an item traded by piece and invoiced by weight.

- The supplier's catalogue contains one entry: one salami weighing ~ 500 g
- The order for 100 units is delivered in three boxes. Each box is marked with an SSCC and, optionally, with information on the content of the box, expressed as follows:

  - AI (02) indicates the variable measure Global Trade Item Number™ (GTIN™) of the units contained within the box.
  - AI (3101) indicates the total weight of the items contained within the box.
  - AI (37) indicates the count of items contained within the box
- The three boxes may be stored on a pallet that may itself be marked with an SSCC and, optionally, with information on the contents of the pallet, expressed as follows:

  - AI (02) indicates the variable measure GTIN of the units contained within the pallet.
  - AI (3101) indicates the total weight of the items contained within the pallet.
  - AI (37) indicates the count of items contained within the pallet

The invoice refers to the GTIN and quantity delivered and shows the total weight and the price per kilogram. The GTIN and quantity of the invoice match the GTIN and quantity of the order.

Figure 2.1.2.2.4.1 – 1

| Process | Description | Element Strings Used / Symbol Marking of the Items |
|---|---|---|
| Supplier's catalogue | one Salami ~ 500 g | GTIN 97612345000018 |
| Order | 100 salamis | 100 x 97612345000018 |
| Delivery | three logistic units<br>Unit 1 = 33 salamis, 16.7 kg<br>Unit 2 = 33 salamis, 16.9 kg<br>Unit 3 = 34 salamis, 17.1 kg | Unit 1: 00 376123450000010008<br>02 97612345000018 3101 000167 37 33<br>Unit 2: 00 376123450000010015<br>02 97612345000018 3101 000169 37 33<br>Unit 3: 00 376123450000010022<br>02 97612345000018 3101 000171 37 34 |
| | If delivery is made on a pallet | Pallet: 00 376123450000010039<br>02 97612345000018 3101 000507 37 0100 |
| Invoice | GTIN of items and the total weight (50.7 kg) + the price per kg | 100 x 97612345000018; 50.7 kg x price per kg |

| Data File Logistic Units | Identification of Logistic Unit (SSCC) | GTIN of Contained Trade Items | Total Trade Weight of Content (grams.) | Number of Units Contained |
|---|---|---|---|---|
| Either pallet | 376123450000010039 | 97612345000018 | 50700 | 100 |
| or individual units | 376123450000010008 | 97612345000018 | 16700 | 33 |
| | 376123450000010015 | 97612345000018 | 16900 | 33 |
| | 376123450000010022 | 97612345000018 | 17100 | 34 |

| Data File Trade Items | GTIN of Trade Item | Total Trade Weight (grams) | Number of Trade Items |
|---|---|---|---|
| One record per identification number | 97612345000018 | 50700 | 100 |



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#### 2.1.2.2.4.2 Example 2: Traded by Standard Grouping

The following example shows the order and delivery of an item traded by standard grouping and invoiced by weight.

- The supplier's catalogue contains one entry: one case of 20 steaks weighing ~ 200 g each.
- The order is for three cases. Each case delivered is marked with the Global Trade Item Number™ (GTIN™) of a single case followed by the actual weight of the items contained.
- The three cases may be stored on a pallet that may itself be marked with an SSCC and, optionally, with information on the contents of the pallet, expressed as follows:
  - AI (02) indicates the variable measure GTIN of the units contained within the pallet.
  - AI (3102) indicates the total weight of the items contained within the pallet.
  - AI (37) indicates the count of cases contained within the pallet
- The invoice refers to the GTIN and quantity delivered and shows the total weight and the price per kilogram. The GTIN and quantity of the invoice match the GTIN and quantity of the order.

Figure 2.1.2.2.4.2 – 1

| Process | Description | Element Strings Used / Symbol Marking of the Items |
|---|---|---|
| Supplier's catalogue | One case of 20 steaks ~ 200 g, vacuum packed | GTIN 97612345000117 |
| Order | Three cases | 3 x 97612345000117 |
| Delivery | Three trade items<br>Unit 1: weight = 4.150 kg<br>Unit 2: weight = 4.070 kg<br>Unit 3: weight = 3.980 kg | <br>Unit 1: 01 97612345000117 3102 000415<br>Unit 2: 01 97612345000117 3102 000407<br>Unit 3: 01 97612345000117 3102 000398 |
| | If delivery is made on a pallet | Pallet: 00 376123450000010091<br>02 97612345000117 3102 001220 37 03 |
| Invoice | GTIN of items and the total weight (12.20 kg) + the price per kg | 3 x 97612345000117; 12.2 kg x price per kg |

| **Data File Logistic Units** | Identification of Logistic Unit (SSCC) | GTIN of Contained Trade Items | Total Trade Weight of Content (grams.) | Number of Units Contained |
|---|---|---|---|---|
| Pallet | 376123450000010091 | 97612345000117 | 12200 | 3 |

| **Data File Trade Items** | GTIN of Trade Item | Total Trade Weight | Number of Trade Items |
|---|---|---|---|
| One Record | 97612345000018 | 12200 | 3 |



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#### 2.1.2.2.4.3 Example 3: Traded in Bulk

The following example shows an order and delivery of an item traded in bulk.

- The supplier's catalogue contains one entry: cabbage unwrapped sold in bulk by kilogram.
- The order is for 100 kg. It is delivered in two cases. Each case is marked with the Global Trade Item Number™ (GTIN™) of the cabbage followed by the actual weight of the items contained.
- The two cases may be stored on a pallet that may itself be marked with an SSCC.
- The invoice refers to the GTIN as ordered and shows the total weight and the price per kilogram. The delivered weight may be verified as being close to the ordered quantity.

Figure 2.1.2.2.4.3 – 1

| Process | Description | Element Strings Used / Symbol Marking of the Items |
|---|---|---|
| Supplier's catalogue | Cabbage unwrapped sold in bulk by kilogram | GTIN 97612345000049 |
| Order | 100 kg of cabbage | 100 kg x 97612345000049 |
| Delivery | Two trade items<br>Unit 1: weight = 42.7 kg<br>Unit 2: weight = 57.6 kg | <br>Unit 1: 01 97612345000049 3101 000427<br>Unit 2: 01 97612345000049 3101 000576 |
| | If delivery is made on a pallet | Pallet: 00 376123450000010107 |
| Invoice | GTIN of item and the total weight (100.3 kg) + the price per kg | 97612345000049 100.3 kg x price per kg |

| **Data File Logistic Units** | Identification of Logistic Unit (SSCC) | GTIN of Contained Trade Items | Total Trade Weight of Content (grams) | Number of Units Contained |
|---|---|---|---|---|
| Pallet | 376123450000010107 | 97612345000049 | 42700 | 1 |
| | | 97612345000049 | 57600 | 1 |

| **Data File Trade Items** | GTIN of Trade Item | Total Trade Weight (grams) | Number of Trade Items |
|---|---|---|---|
| One record per trade item | 97612345000049 | 42700 | 1 |
| | 97612345000049 | 57600 | 1 |



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#### 2.1.2.2.4.4 Example 4: Traded by Standard Grouping

The following example shows an order of standardised Variable Measure Trade Items by case that are invoiced by the number of pieces delivered.

- The supplier's catalogue contains one entry: one case of ~ 10 cabbages sold by piece.
- The order is for two cases. Each case delivered is marked with the Global Trade Item Number™ (GTIN™) of a single case followed by the actual count of the items contained.
- The two cases may be stored on a pallet that may itself be marked with an SSCC and, optionally, with information on the contents of the pallet, expressed as follows:

  AI (02) indicates the variable measure GTIN of the units contained within the pallet.
  AI (30) indicates the total count of the items contained within the pallet.
  AI (37) indicates the count of cases contained within the pallet
- The invoice refers to the GTIN as ordered and delivered and the total count of items.

Figure 2.1.2.2.4.4 – 1

| Process | Description | Element Strings Used / Symbol Marking of the Items |
|---|---|---|
| Supplier's catalogue | Case containing ~10 cabbages sold by pieces | GTIN 97612345000285 |
| Order | Two cases | 2 x 97612345000285 |
| Delivery | Unit 1: 11 pieces<br>Unit 2: 12 pieces | Unit 1: 01 97612345000285 30 11<br>Unit 2: 01 97612345000285 30 12 |
| | If delivery is made on a pallet | Pallet: 00 376123450000010138<br>02 97612345000285 30 23 37 02 |
| Invoice | GTIN of the trade item and the total quantity | 2 x 97612345000285 23 pieces x price per piece |

| **Data File Logistic Units** | Identification of Logistic Unit (SSCC) | GTIN of Contained Trade Items | Total Number of Pieces Contained in the Trade Item | Number of Units Contained |
|---|---|---|---|---|
| Pallet | 376123450000010138 | 97612345000285 | 23 | 2 |

| **Data File Trade Items** | GTIN of Trade Item | Total Number of Pieces | Number of Trade Items |
|---|---|---|---|
| One Record | 97612345000285 | 23 | 2 |



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#### 2.1.2.2.4.5 Example 5: Traded in Bulk

The following example shows a product that can be purchased from a supplier or sold to a customer by any length in metres.

- The supplier's catalogue contains one entry: cable T49 sold in metres.
- The order is for one length of cable of 150 metres. The delivered package is marked with the Global Trade Item Number™ (GTIN™) of the cable followed by the actual length of cable contained.
- The invoice refers to the GTIN as ordered and delivered and the total length.

Figure 2.1.2.2.4.5 – 1

| Process | Description | Element Strings Used / Symbol Marking of the Items |
|---|---|---|
| Supplier's catalogue | Cable T49 sold in any length in metres | GTIN 97612345000063 |
| Order | One trade item of 150 metres | 97612345000063 x 150 metres |
| Delivery | One trade item, 150 metres | 01 97612345000063 3110 000150 |
| Invoice | GTIN of the trade item and the total quantity | 1 x 97612345000063 150 x price per metre |

| Data File Trade Items | GTIN of Trade Item | Total Trade Length (meters) |
|---|---|---|
| One record | 97612345000063 | 150 |



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### 2.1.2.3 Fixed Measure Trade Items - Restricted Distribution

#### 2.1.2.3.1 Definition

This section describes applications where the item identification is defined only in a closed environment. Therefore, the distribution of trade items marked in this way is restricted to a given geographic region or for use within a company. However, within their closed environment these items may be processed along with trade items identified with Global Trade Item Numbers™ (GTINs™) defined for open trade.

Some regulations established by EAN Member Organisations for their country or assigned area should be observed for the allocation of identification numbers for restricted distribution.

When assigned to company internal use, the structure and management of the numbers represented in the Element Strings of this section are the responsibility of the user. Number changes and re-use of expired numbers must be managed by the user based on his requirements.

When centrally administrated within a geographic area, the relevant administration body determines the structure and manages number allocation based on user requirements.

#### 2.1.2.3.2 Company Internal Numbering – EAN.UCC-8 Prefix 0 or 2

This Element String, described in Section 3.3.2, uses an EAN.UCC-8 Prefix of 0 or 2. It provides two million identification numbers, which can be assigned for internal use in a company. When the EAN/UCC-8 Prefix is 0, the Element String is sometimes called a Velocity Code because it is quicker to key enter.

Note 1: In addition to trade item identification, this Element String may be used for any purpose that is supported by the company's equipment supplier (see Section 2.6.4).

Note 2: In some environments where numbers may have to be key entered, the EAN-8 Bar Code Symbol carrying EAN/UCC-8 Identification Numbers (and the EAN.UCC-8 Prefix 0) may be confused with the numbers carried by a UPC-E Bar Code Symbol. If such a risk exists, it is preferable to use the EAN.UCC-8 Prefix 2 capacity for internal use.

#### 2.1.2.3.3 Numbering in a Geographic Area Defined by the EAN Member Organisation – EAN.UCC Prefixes 20 to 29

The EAN.UCC Prefixes 20 to 29 are reserved for identification purposes within a restricted geographic area. Each EAN Member Organisation or UCC is entitled to assign the prefixes to be used for these Element Strings in its country or assigned area (see Section 3.2.2):

- For the central administration of the identification of Fixed Measure Trade Items within the country or assigned area of the EAN Member Organisation or UCC.
- For internal numbering of Fixed Measure Trade Items by a particular company within the country or assigned area of the EAN Member Organisation or UCC.

Note 1: Under the control of an individual EAN Member Organisation or the UCC, EAN.UCC Prefixes 20 to 29 may also be used for the identification of Variable Measure Trade Items for restricted geographic distribution and for any other company internal purpose.

Note 2: In addition to trade item identification, a company may use this data element for any other internal purpose (see Section 2.6.4).

Note 3: Suppliers manufacturing their own label products for several different customers should use unique EAN.UCC System numbering to distinguish their customers. If this is not done, the supplier will not be able to use Electronic Data Interchange (EDI) or electronic catalogues.



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### 2.1.2.3.4 Company Internal Numbering - EAN.UCC Prefix 04

Any company in the world may use this Element String for company internal trade item numbering. If the EAN.UCC Prefix 04 is being applied, the user company may structure the trade item number.

Note: In addition to trade item identification, a company may use this data element for any other internal purpose (see Section 2.6.4).

### 2.1.2.3.5 Company Internal Numbering - EAN.UCC Prefix 00 (LAC and RZSC)

The EAN.UCC Prefix 00 provides for company internal numbering, using Locally Assigned Codes (LACs) or Retailer Zero-Suppressed Codes (RZSCs), which are carried by a UPC-E Bar Code Symbol. EAN.UCC Company Prefixes 00 00000 and 00 01000 to 00 07999 are used in this feature. For details, see Section 3.A.2.



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## 2.1.2.4 Variable Measure Trade Items - Restricted Circulation

### 2.1.2.4.1 Definition

Variable Measure Trade Items are those sold in random quantity against a fixed price per unit quantity and intended to cross a Point-of-Sale (e.g., apples sold at a fixed price per kilogram).

These items are either marked in the store by the retailer or are marked at the source by the supplier. National solutions are available for this purpose.

EAN.UCC Prefixes 02 and 20 to 29 are available to EAN Member Organisations and UCC to devise rules for the marking of Variable Measure Trade Items in their territory. EAN Member Organisations should make part of this capacity available to user companies for company internal applications.

The data fields available after the relevant EAN.UCC Prefix (defined by the EAN Member Organisation or UCC for their territory) can be structured in a variety of ways to represent the product type, net weight, calculated price, or number of units. Equipment is commercially available for automatically weighing items, calculating an item price from the unit price, and printing the information as a bar code label. The scanning equipment can then be programmed to use the prefix as an instruction to decode the ensuing data fields according to the particular structure adopted.

### 2.1.2.4.2 Identification of Variable Measure Trade Items

EAN Member Organisations should assign one or several of the EAN.UCC Prefixes 02 and 20 through 29 for the identification of Variable Measure Trade Items.

Although each EAN Member Organisation and/or user is perfectly free to develop its solution for numbering Variable Measure Trade Items, the EAN.UCC System provides recommended structures aiming at some degree of equipment standardisation. These formats may include an Item Reference, the retail price of the item, and a price verifier-digit. The recommended structures are shown in Figure 2.1.2.4.2 – 1.

Figure 2.1.2.4.2 – 1

| EAN.UCC Prefix* | Recommended Data Structures (Exact Structure Determined by EAN Member Organisation) | Check Digit |
|---|---|---|
| 0 2 | I I I I I V P P P P | C |
| or | I I I I V P P P P P | C |
| 2 0 - 29 | I I I I I I P P P P | C |
| | I I I I I P P P P P | C |

* The EAN.UCC Prefix is co-administered by EAN International and the UCC and denotes the format and meaning of a particular Element String.

Where: I..I = Item Reference
V = Price verifier-digit calculated according to the algorithm specified in Section 3.A.1
P..P = Price in local currency
C = Check Digit calculated according to the standard algorithm in Section 3.A.1

Note: The price field may contain 0, 1, or 2 implied decimal places depending on the monetary unit used. The decimal point, which is not included in the bar code symbol, must nevertheless be taken into account by the marking equipment when printing the Human Readable Interpretation on the label.



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EAN Member Organisations may choose to implement a national solution for Variable Measure Trade Items branded by the supplier for retail. Any national branded variable measure solution requires EAN Member Organisations to manage the allocation of the item number at a national level.

### 2.1.3 Attributes of Trade Items

### 2.1.3.1 General Considerations

#### 2.1.3.1.1 Types of Trade Item Attributes

Trade item attributes are classified into three categories:

- Varying attributes, the use of which is determined by business practices
- Fixed attributes or characteristics of trade items are generally communicated between trading partners by Electronic Data Interchange (EDI) or other means and should thus not be marked on the goods. However, some fixed attributes have been made available for transitional use in order to provide temporary help for particular business applications.
- Varying attributes with restrictions have been established to fulfil special functions in particular applications. Their use makes sense for the issuing company or a within a specific user sector.

#### 2.1.3.1.2 Symbol Marking of Trade Item Attributes

Attributes of trade items shall be symbol marked using a UCC/EAN-128 Bar Code Symbol. The only exceptions are the two- and five-digit Add-On Symbols, which are supplementary to the primary symbol.

### 2.1.3.2 Varying Trade Item Attributes

#### 2.1.3.2.1 Batch or Lot Number: AI (10)

This Element String provides the batch or lot number of the trade item on which the Element String is applied. The Element String is used for tracking trade items with particular manufacturing characteristics wherever required. Complete tracking of the trade item must include the Global Trade Item Number™ (GTIN™).

Note: This Element String must not be used to express characteristics of a trade item that should be included in the GTIN. Use non-significant (shorter) data for batch or lot numbers leading to shorter Element Strings.



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### 2.1.3.2.2 Dates

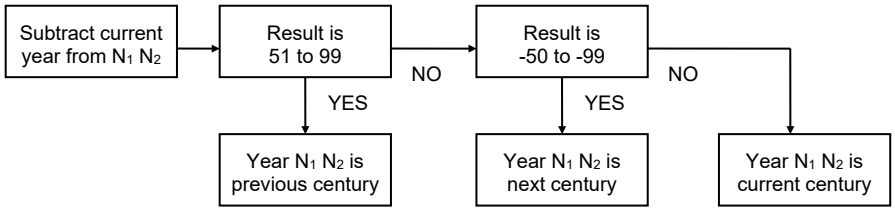
These Element Strings are used to differentiate identical trade items by date information where this is required for business practices. The following types of dates are available:

- Production date - AI (11)
- Packaging date - AI (13)
- Best Before Date - AI (15)
- Expiration Date - AI (17)
- Date and time of production - AI (8008)

It is left to the discretion of the user to interpret a particular date type most useful for his business practices. Such interpretation may change according to the product range for which a date is being applied

Since the data field year consists of two positions, the century is established by the procedure shown in Figure 2.1.3.2.2 – 1.

Figure 2.1.3.2.2 – 1




Note: The Element String can only specify a date in the range from 49 years in the past to 50 years in the future of the current year.

### 2.1.3.2.3 Serial Number: AI (21)

This Element String represents the serial number of a trade item. It is used for tracking a trade item with a particular serial number. Proper tracking must include the Global Trade Item Number™ (GTIN™).

### 2.1.3.2.4 Secondary Data for Specific Health Industry Products: AI (22)

This Element String is mainly used in the United States. It contains a special arrangement of supplementary data required for health industry products. AI (22) should not be taken as substitute for AI (21) Serial Number. For details, see Section 7.8.



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### 2.1.3.2.5 Secondary Serial Number: AI (250)

This Element String is used for tracking a particular component contained in a trade item and when used, Element String AI (21) must also appear on the trade item. The secondary serial number may refer to any of the components contained. It is an attribute of the Global Trade Item Number™ (GTIN™). For example, the secondary serial number may be placed on the chassis of a television set to mark its serial number. The company using this Element String should make clear to all business partners which component of a given trade item a secondary serial number relates.

### 2.1.3.2.6 Reference to Source Entity: AI (251)

Reference to source entity is an attribute of a trade item that refers back to the original item from which the trade item was derived. The issuer of the trade item must indicate through other means the source entity to which the data refers.

### 2.1.3.2.7 Logistic Measures for Variable Measure Trade Items: AI (33nn), (34nn), (35nn), (36nn)

Logistic measures for Fixed Measure Trade Items remain unchanged for each item. Consequently, they are considered as fixed characteristics and should not be symbol marked on the trade item. Logistic measures for Variable Measure Trade Items, however, can change according to the varying size or weight of the items. This Element String may be used to represent the logistic measure of a particular Variable Measure Trade Item.

### 2.1.3.2.8 Kilograms Per Square Metre: AI (337n)

This Element String is used to differentiate identical trade items by the effective weight per square metre. It is a varying attribute of the trade item and it is not a variable measure of the trade item concerned.

For example, depending upon the production conditions, the actual weight of standard paper expressed in grams per square metre may vary slightly. The Global Trade Item Number™ (GTIN™) remains unchanged, but it may be useful to mark the actual weight per square metre on the trade item.

### 2.1.3.2.9 Country of Origin of a Trade Item: AI (422)

This Element String may be used on a physical unit to denote the country of origin of the trade item, the identification number of which is represented in either AI (01) or AI (02).

### 2.1.3.2.10 Country of Initial Processing: AI (423)

This Element String may be used on a physical unit to denote the country of initial processing of the trade item, the identification number of which is represented in either AI (01) or AI (02).

### 2.1.3.2.11 Country of Processing: AI (424)

This Element String may be used on a physical unit to denote the country of processing of the trade item, the identification number of which is represented in either AI (01) or AI (02).

### 2.1.3.2.12 Country of Disassembly: AI (425)

This Element String may be used on a physical unit to denote the country of disassembly of the trade item, the identification number of which is represented in either AI (01) or AI (02).

### 2.1.3.2.13 Country Covering Full Process Chain: AI (426)

This Element String may be used on a physical unit to denote the country covering full process chain of the trade item, the identification number of which is represented in either AI (01) or AI (02).



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### 2.1.3.2.14 Approval Number of Processor: AI (703s)

In some countries, some products are required by law to be marked with an approval number allocated by a national authority. Where required the Application Identifiers in the series 703(s) are used to give the identification of approved location in supply chain. This identification could be an EAN.UCC Global Location Number (GLN) or another scheme endorsed by the national authority. This Element String may be used on a physical unit to denote the country and approval number of a trade item, the identification number of which is represented by a Global Trade Item Number™ (GTIN™).

As multiple approval numbers may be required, the fourth digit of the AI(s) indicates the sequence of the processors. An example from a meat supply chain would be:

> A bovine animal has been slaughtered in a German slaughterhouse (approval number GLN: 4012345000009), and the deboning was done by a Dutch deboning hall (approval number EGNL410).

The country and approval number for slaughtering is shown in Figure 2.1.3.2.14 – 1.

Figure 2.1.3.2.14 – 1

| AI | ISO Country Code for Germany | Approval Number |
|---|---|---|
| 7030 | 276 | 4012345000009 |

The country and approval number of the first processor (Dutch deboning hall) is shown in Figure 2.1.3.2.14 – 2.

Figure 2.1.3.2.14 – 2

| AI | ISO Country Code for the Netherlands | Approval Number |
|---|---|---|
| 7031 | 528 | EGNL410 |



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### 2.1.3.3 Fixed Trade Item Attributes

#### 2.1.3.3.1 Additional Product Identification Assigned by the Manufacturer: AI (240)

This Element String has been created to represent a company's existing (non-EAN.UCC System) trade item identification number.

The ID number may be marked on the same item together with the EAN.UCC Identification Number (AI (01)) in order to facilitate migration to the EAN.UCC System. There must be a one-to-one relationship between the contents of AI (240) and AI (01).

Note: The use of this Element String must be based on an agreement between the users concerned for a limited period. In no way should a company supply internal item identification of any other kind via AI (240), which would violate the EAN.UCC System's principles. It is not a substitute for the Global Trade Item Number™ (GTIN™).

#### 2.1.3.3.2 Customer Part Number: AI (241)

This Element String has been created to facilitate the conversion from the business use of a customer assigned part number to a manufacturer's Global Trade Item Number™ (GTIN™).



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### 2.1.3.4 Varying Trade Item Attributes with Restrictions

#### 2.1.3.4.1 Serial Number for Serial Publications - Two-Digit Add-On Symbol

The two-digit Add-On Symbol identifies each title of a serial publication. This bar code symbol, used to provide supplementary identification on serial publications, is not designed to be scanned at the Point-of-Sale. The Global Trade Item Number™ (GTIN™) provides the necessary data for correct price capture.

This bar code symbol is applied for the processing of returns of serial publications requiring additional identification beyond the level provided by the item identification number. When the two-digit Add-On Symbol is scanned, it is always processed together with the GTIN.

#### 2.1.3.4.2 Supplementary Information for Books, Paperbacks, and Printed Sheet Music - Two-Digit and Five-Digit Add-On Symbol

The two-digit and five-digit Add-On Symbols can identify a title of a book or paperback. These bar code symbols are used to track a particular edition of a book, but not to carry information otherwise included in the Global Trade Item Number™ (GTIN™).

Note: The two-digit and five-digit Add-On Symbols must not be used to represent the price of the book for several reasons. First, the bar code symbol does not ensure the reading reliability needed for price capture. Secondly, there is no currency indicator available to prohibit price misinterpretation for imported or exported books. Thirdly, the system logic does not provide a means to distinguish whether the five-digit Add-On Symbol represents the price or the supplementary information of the particular book.

#### 2.1.3.4.3 Product Variant: AI (20)

EAN.UCC System application rules clearly state that each trade item that is different from another must be assigned a unique Global Trade Item Number™ (GTIN™). However, there are cases where a difference is not significant outside the manufacturing company and, therefore, no separate identification number is required.

Element String AI (20) is a means to handle variations of trade items that are significant only for the producer of the item.

#### 2.1.3.4.4 Price Per Unit of Measure: AI (8005)

This Element String is used to discriminate groupings of price marked Variable Measure Trade Items and to inform about the price per unit of measure marked on the individual units contained in the trade item. It should in no way be used for price marked Fixed Measure Trade Items, in which groupings of trade items not to be scanned at the Point-of-Sale require a unique EAN.UCC System identification number for each separate price or a product variant (AI (20)).



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## 2.1.4 Allocating the Numbers

### 2.1.4.1 General rule

A Global Trade Item Number™ (GTIN™) is used to identify any item (trade item 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. A separate unique GTIN is required whenever any of the pre-defined characteristics of an item are different in any way that is relevant to the trading process. The guiding principle is if the consumer is expected to distinguish a new trade item from an old trade item and purchase accordingly, a new GTIN should be assigned to the new trade item (product package and shelf edge label declarations should appear the same to the consumer). However, any law or regulation that contradicts these rules shall supercede these rules.

Specific rules that apply to prevalent industry practices have been endorsed by the Global Commerce Initiative Board, for the Fast Moving Consumer Goods (FMCG) industry. These rules covering many common business cases can be found in Appendix 2.1.A. While all EAN.UCC standards are voluntary, the rules are intended to drive normative practice within the FMCG sector

### 2.1.4.2 Responsibility

#### 2.1.4.2.1 Branded items

The Brand Owner, the organisation that owns the specifications of the trade item regardless of where and by whom it is manufactured, is normally responsible for the allocation of the Global Trade Item Number™ (GTIN™). On joining an EAN Member Organisation or the UCC the Brand Owner receives an EAN.UCC Company Prefix which is for the sole use of the company to which it is assigned. The company prefix may not be sold, leased or given, in whole or in part, for use by any other company.

The Brand Owner is the organisation that owns the trade item specifications and may be:

**The manufacturer or supplier -** the company manufactures the trade item or has it manufactured, in any country, and sells it under its own brand name

**The importer or wholesaler** - the importer or wholesaler has the trade item manufactured, in any country, and sells it under its own brand name or the importer or wholesaler changes the trade item (for example by modifying the packaging of the trade item).

**The retailer** - the retailer has the trade item manufactured, in any country, and sells it under its own brand.

#### 2.1.4.2.2 Exceptions and non branded items

There are some exceptions as follows:

**Non-Branded Items** - Items without a brand name and generic items – not private labels – are still assigned Global Trade Item Numbers™ (GTIN™) by their manufacturer. As different manufacturers may supply items that appear identical to the consumer, it is possible that items that are apparently the same have different GTINs. Companies that trade in these items need to organise their computer applications (replenishment programs for example) to cope with this eventuality. Examples of items that sometimes have no brand are apples, plasterboard, candles, drinking glasses etc.

**Customer Specific Items** - When a trade item is made specifically for one trade customer and is orderable only by this customer, it is permissible for a GTIN to be assigned by the customer. In this case the GTIN should be formed from the customer's EAN.UCC Company Prefix (see Section 2.6.6).

**Other Exceptions** - If the Brand Owner does not assign a GTIN, the importer or another intermediary can assign an item a *temporary* GTIN. This may be used until a GTIN is assigned in the normal way. Alternatively a retail organisation can assign an *internal* number, for use within its own stores only, to an item that does not yet have a GTIN assigned to it.



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### 2.1.4.3 Guidelines for Allocating Global Trade Item Number™ (GTIN™)

#### 2.1.4.3.1 Management of Uniqueness

The Global Trade Item Numbers™ (GTIN™) must be allocated uniquely. It is recommended that the GTIN does not contain any intelligence or parsable strings. The embedding of internal codes is discouraged because it is often found that the rules for changing them differ from the rules for changing a GTIN.

#### 2.1.4.3.2 Pre-defined characteristics

Although this list is not exhaustive, the basic pre-defined characteristics of a trade item are:

- The Product Name, Product Brand, and Product Description
- The trade item type and variety
- The net quantity of trade item (weight, volume, or other dimension impacting trade)
- If the trade item is a grouping, the number of elementary items contained, and their subdivision in sub-packaging units, the nature of the grouping (carton, pallet, box-pallet, flat-pallet…)

A modification to any of the basic elements that characterise a trade item will usually lead to a change in the GTIN.

***Note:*** Price is not a relevant criteria for changing a GTIN except when the price is printed directly on the trade item.

***Note:*** National, federal or local regulations may apply and take precedence over this rule. For example, in some industries such as healthcare, regulations or other requirements may dictate that any trade item changes require a new GTIN.

Typically the gross dimensions of a trade item communicated via the Item File that do not affect net trade item quantity or measure do not impact the GTIN assignment. However, as a general rule if any gross dimension (e.g. length, depth, weight, etc) changes by more than 20% a new GTIN is required. Changes below 20% may require a new GTIN at the discretion of the brand owner.

In all cases, if the GTIN for the trade item at the lowest level changes, GTINs for associated packaging at higher hierarchal levels must change.

#### 2.1.4.3.3 Pre-priced merchandise

Pre-pricing is discouraged as a trade practice as it introduces complexity for trade item file maintenance through the supply chain. If however, the price that the consumer will pay (not the "Manufacturers Recommended Retail Price" which can be ignored) is marked on the item, the Global Trade Item Number™ (GTIN™) should be changed when the priced marked on the item changes.

***Note***: National, federal or local regulations may apply and take precedence over this guideline.

#### 2.1.4.3.4 Promotional variants

A promotion is a temporary change to a trade item, which modifies the presentation of the trade item. It usually coexists with the standard trade item.

- Promotional variants of trade items that affect the net weight or volume of the trade item must be allocated a separate unique Global Trade Item Number™ (GTIN™). Examples: Attached free additional item, 10% extra free.



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- Promotional variants of trade items may impact the logistic weight or dimension of the trade item by more than 20%. In this case, the promotional variants must be allocated a separate unique Global Trade Item Number™ (GTIN™).

- Promotional variants of trade items where a price reduction is explicitly specified on the pack (flash packs) must be allocated a separate unique GTIN unless local trade practices or price marking legislation dictate otherwise. Examples: 10 cents off.

- Each seasonal promotion of a trade item should be allocated a separate unique GTIN. Example: chocolate especially over-wrapped for Easter.

- Other promotional variants should not be allocated a separate unique GTIN. Examples: Money off coupon, free gift inside (unless this causes an increase in gross weight by more than 20%), "send for" offer, competition offer, or samples sent directly to consumer bypassing retail Point-of-sale.

### 2.1.4.3.5 Trade item changes

Trade item changes are any change or improvement during the life of a trade item. The "new" trade item replaces the old one. Should the Brand Owner decide to create a variant (e.g., with different ingredients) in parallel with the standard trade item, then a separate unique Global Trade Item Number™ (GTIN™) has to be allocated.

- Minor trade item changes or improvements do not require the allocation of a different GTIN. Examples: label artwork redesign, minor trade item description changes that do not impact the supply chain, gross dimension change in any axis of less than 20% with content quantity or measure unchanged. This rule applies to retail consumer trade items (retail POS unit) and standard trade item groupings (orderable cases or pallets).

- If a trade item's quantity or measure changes or if the consumer will be expected to distinguish between an old and new brand name or product description, then a new GTIN must be allocated.

### 2.1.4.3.6 Variants for groupings

- Trade items which are a standard and stable grouping of smaller units identified by a Global Trade Item Number™ (GTIN™) must be allocated a separate GTIN whenever there is a change to the GTIN of any of the units contained.

- For trade items containing units which are themselves promotional variants or minor trade item variants of trade items whose GTINs remain unchanged, the rule is the following:

    - If the trade item has to be distinguished for effective ordering, handling and tracking, a separate GTIN must be allocated to the trade item. Examples: Promotions that are limited to certain geographical areas or date specific promotions.

    - If the identification of minor trade item variants is only relevant to the manufacturer, they should distinguish these variants by using the element string Product Variant (AI 20). Examples: Minor package design changes, side loading as opposed to top loading cases.



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### 2.1.4.4 Lead time in re-using a GTIN

A Global Trade Item Number™ (GTIN™) allocated to a trade item, which has become obsolete must not be re-used for another trade item until at least 48 months have elapsed from the date the original trade item was last supplied by the Brand Owner. In the case of clothing the minimum retention period is reduced to 30 months.

A longer period may be needed depending upon the type of goods. For example steel beams may be stored for many years before entering the supply chain. Brand owners should consider what would be a reasonable period of time for the trade item to remain in the supply chain cycle before re-using GTINs.

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.

### 2.1.4.5 Data alignment

When a new Global Trade Item Number™ (GTIN™) is assigned to a trade item, it is essential that the Brand Owner provide the detailed information to trading partners about the item's characteristics. This information should be provided at as soon as possible before the trade item is actually traded.

#### 2.1.4.5.1 Data Alignment Best Practice

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A number of actions are vital to ensure that GTINs are accurately communicated within the Supply Chain. These ensure that the data associated with any scanned bar code can be associated with accurate, up to date, data. This is particularly essential for items scanned at the Point of Sale where the absence of accurate data may have legal implications.

The GTIN provides a Supply Chain solution for the identification of any item that is traded (priced or invoiced or ordered). Overall Supply Chain costs are minimised by all partners in the Supply Chain adhering to identical allocation rules (see Section 2.1.A.1.).

The following 'Best Practices' guideline is proposed for all items. It has been developed by manufacturers, distributors and retailers to help eliminate any confusion between product identification and product listing in the Retailers Database in the Supply Chain.

1. GTIN allocation, and the bar coding of the GTIN, is a technical process the rules for which are laid down elsewhere in these General EAN.UCC Specifications. Product listing is the act of adopting a new product in an assortment by a commercial organisation. Product listing is the result of commercial negotiations between purchaser and seller.

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   Example: GTIN Allocation should be independent from Product Listing.

2. For management reasons, or to ensure that correct information is communicated to the final consumer, changes to an item may require a new GTIN. A new GTIN does not automatically imply a new listing.

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   Example: If a change requiring a new GTIN is made to a listed product, this should not be an automatic trigger for a new Product Listing.

3. GTIN allocation and database listing are to be considered as two entirely autonomous decisions: GTIN allocation is not an object of negotiation.

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~~1.~~4. The Brand Owner makes available to their client all information regarding the listed items, ideally with an EDI message or in an e-product catalogue no later than at the time of item listing. In case of time limited promotions or a product evolution, this information will be communicated largely beforehand, thus allowing the retailer to validate this information and to circulate it internally.



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## 2.1.A.1 FMCG GTIN Allocation Rules Appendix- Created based on the Input Endorsed by the Board of the Global Commerce Initiative (GCI) and submitted via GSMP Change Request 02-000062

The following terms have been included in this appendix, as they were found useful in explaining the column B and C headers.

**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.

**retail consumer trade item** - The trade item intended to be sold to the end consumer at retail Point-of-Sale. They are identified with a unique EAN/UCC-13, UCC-12, or EAN/UCC-8 GTIN.

**standard trade item grouping** – A standard composition for a trade item(s) that is not intended for Point-of-Sale scanning. They are identified with a unique EAN/UCC-14, EAN/UCC-13, or UCC-12 GTIN.

**Non-GTIN bundles** – A packaging level for trade items where there is no trading partner requirement for GTIN identification. If a GTIN is required, then this item becomes a retail consumer trade item or standard trade item grouping.

**logistic unit** - An item of any composition established for transport and/or storage that needs to be managed through the supply chain. It is identified with SSCC.

Note: These rules are intended for global use. Exceptions may occur only when local regulatory or legal requirements mandate otherwise.



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| **2.1.A.1 - 1 Market Variants (languages and traded quantities)** | | | | |
| 1.1 New Language on a package sold in one Market/Country (single language label) | New GTIN (Brand Owner may use the same GTIN for different language packs if tracking movement occurs at grouping level) | New GTIN | Efficient shipping (at Retailer's Distribution Centre) requires distinction between non-substitutable trade item at the grouping level (Note: Differing languages on other wise identical trade items are non-substitutable).<br><br>The release of a new language market/country pack requires compliance with local labelling laws (hence a new trade item and GTIN) | NOTE: The language change does not apply to the Brand Name. If the language change causes the Brand Name to change, then the GTIN at all levels must change. |
| 1.2 Add additional language on a package sold in several Markets (multi language label) | Same GTIN | Same GTIN (a separate GTIN is required for each language cluster) | A re-cluster (adding an additional language at the retail level) does not impact existing markets. For example, if languages A, B and C appear on one pack, the addition of another language (D) has no impact on existing trading partners. | Unnecessary introduction of new GTINs. |
| 1.3 Language Group Cluster Substitution | New GTIN (Brand Owner may use the same GTIN for different language packs if tracking movement occurs at Grouping level) | New GTIN | If languages A, B and C appear on one pack, and languages A, D and E on another, units cannot be substituted in all target markets and therefore must be identified uniquely. | Unable to identify trade item in supply chain. |
| 1.4 Sample or Test Trade items | Retail consumer trade Item has a unique GTIN (if ever sold at retail) | Standard trade item grouping has a unique GTIN (if ever traded in supply chain) | If the trade item is released to market for POS use in any form it requires a GTIN. The GTIN used on the test/sample trade item can be maintained if the trade item test is | Unable to identify trade item in supply chain. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| | | | successful and becomes orderable. | |
| 1.5 Groupings of same retail item containing different quantities | GTIN of retail consumer trade Item not impacted | Each standard trade item grouping has a unique GTIN | Different GTIN necessary to distinguish between the different pack sizes. | The GTIN identifies all aspects of the standard trade item grouping for ordering, stocking or billing systems. Using the same GTIN for the standard trade item grouping containing different quantities invalidates these systems. |
| **2.1.A.1 - 2 Replacement of Standard Trade Items** | | | | |
| *2.1 Minor Changes* | *Minor changes are those which are not relevant to trading partners (e.g. neither the consumer declaration nor the ordering, billing or stocking information is impacted).*<br><br>*Manufacturers may need to distinguish these minor changes in trade items variant (e.g. for tracking price impact).* | | | |
| 2.1.1 Minor formulation change that will replace the existing trade item and does not involve any change in the Declaration to the consumer (e.g., is not covered by legislation), changes for cost reduction reasons without changing the trade item characteristics (e.g., taste, viscosity, minor ingredients change, etc.)" | No change | No change | The change has no impact on supply chain partners. Minor ingredient changes do not change the trade item description. | An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost. |
| 2.1.2 Minor artwork changes | No change | No change | Minor artwork changes, possibly associated with a trade item re-vamping or seasonal/ promotional | GTIN assignment would be impractical to manage. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| | | | flow through, that do not impact other GTIN Rules, should not cause a new GTIN to be assigned | |
| 2.1.3 Minor (not declared) change in net weight / count / volume (e.g. changes in manufacturing tolerances do not impact the declaration to the consumer). | No change | No change | The changes possibly associated with an improved product manufacturing or processing tolerance that do not impact other GTIN Rules, should not cause a new GTIN to be assigned. | GTIN assignment would be impractical to manage. |
| 2.1.4 A minor change in the packaging, at the standard trade item grouping level, is made (e.g. optimisation of packaging material or changing supplier of the packaging material). | No change | No change | The change has no impact on supply chain partners.<br><br>Manufacturer assigned Batch Numbers can be used to track changes not related to "trade". | An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost. |
| 2.1.5 Minor packaging material changes on the retail consumer trade item level (e.g. PET to HDPE) that do not affect trade item "facings" dimensions when on the retail shelf. As a general guideline the change should be considered "major" (and therefore require a new GTIN) if any logistic measure increase or decreases by more than 20%. Note: Any change in Net Declared Weight requires a new GTIN. | No change | No change | Trade item dimensions for both retail consumer and standard trade item grouping should be part of the Item File Master Data, which is best communicated between trading partners via electronic catalogues (e.g., SINFOS) | (Unnecessary) changes to the GTIN at the retail consumer trade item level increase supply chain cost. Historic sales data from the point of sale can be used to assess the impact of the change by keeping a track of the date.<br><br>If a new GTIN is not assigned at the retail consumer trade item level, the required logistics information is not communicated to supply chain partners. The 20% rule meets the "reasonability" test- e.g., 0% is unacceptable to manufacturers, and 100% is unacceptable |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| | | | | to retailers. In depth canvassing of GCI companies led to 20% being selected. |
| 2.1.6 Random Packs<br><br>When a retail consumer trade item or standard trade item grouping contains a random mix of trade item (e.g. different colours/flavours of jellies) and the random mix is modified | No change | No change | If the mix is random the change to a new random mix has no impact on the consumer declaration or supply chain partners | An explosion in the number of GTIN changes - imposing unnecessary cost. |
| 2.1.7 Seasonal recipe (new line proposal)<br><br>For example "Yoghurt with seasonal fruit": fruit can change from one season to the next. | No change | No change | The consumer declaration remains the same whatever the season. | An explosion in the number of GTIN changes - imposing unnecessary cost. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 2.1.8 Change in Brand graphics (e.g. graphic colour, size, font, etc.) | No change | No change | The change has no impact on supply chain partners.<br><br>A Brand may be printed on packaging, but not used to describe and/or identify the product to the consumer (e.g. printed on a back panel in small text). In this circumstance, a change in text does not require a change in the shelf edge label, therefore no GTIN change required. | An explosion in the number of GTIN changes within the Supply Chain that imposes unnecessary cost. |
| 2.1.9 Brand addition (e.g. a corporate brand name is added to the existing product brand on the package) | No change | No change | The change has no impact on supply chain partners. | An explosion in the number of GTIN changes within the Supply Chain that imposes unnecessary cost. |
| *2.2 Major change* | *Major changes are those which require trading partners to distinguish, within their systems, between the "old" and "new" trade item (e.g., the consumer declaration has changed or the ordering, billing or stocking information is impacted).* | | | |
| 2.2.1 Declared net weight, count: number of consumer usage items in the package changes (e.g. number of tablets in an aspirin bottle or number of diapers in a pack of disposable diapers or net volume to the consumer or a retail item of 400 grams in 4 helpings of 100 grams changed to 400 grams in 8 helpings of 50 grams) | New GTIN | New GTIN | The change leads to a change in the shelf edge label (consumer declaration). Failure to distinguish between "old" and "new" retail consumer trade item could lead to inaccurate unit pricing at the shelf leading to legal penalties | Failure to provide the consumer with accurate retail consumer trade item information (e.g., via the shelf edge label) may lead to legal penalties. All supply chain partners need to "phase in" and "phase out" the new and old trade item. Using separate GTINs does this most efficiently. |
| 2.2.2 Formulation change - If the consumer is | New GTIN | New GTIN | The change leads to a change in the shelf edge label (consumer | Failure to provide the consumer with accurate retail |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| expected to distinguish the new from the old trade item and order accordingly / if regulations or other requirements dictate so (e.g., healthcare) / if changes alter the fundamental consumer benefit (e.g., new flavour, aroma) | | | declaration). | consumer trade item information (e.g., via the shelf edge label) may be against the law. Without a "new" GTIN it would not be possible to uniquely distinguish the trade item (e.g., determine if Lemon or Lime flavour was selling best). |
| 2.2.3 Major packaging changes - If the change affects the trade item name or brand or the trade item description (declaration to the consumer) | New GTIN | New GTIN | The change leads to a change in the shelf edge label (consumer declaration). Brand, or trade item, name changes must be clearly communicated and old stock phased out. | Brand, or trade item, name changes could not be registered effectively. |
| 2.2.4 Major packaging changes - any dimensional change of more than 20% in any axis | New GTIN | New GTIN | Shelf management software and logistic systems need to be updated to ensure optimal shelf space allocation. | The 20% rule meets the "reasonability" test (e.g., 0% is unacceptable to manufacturers, and 100% is unacceptable to retailers. In depth canvassing of GCI companies led to 20% being selected). |
| 2.2.5 Changes in the configuration of grouping item assortments (e.g., an assortment contains 200 retail items with 4 different flavours (configuration: 30/50/80/40). The configuration is changed (e.g. new configuration: 40/60/40/60) but the total quantity remains the same (200 retail items). | No change (changes to configuration of the grouping are not applicable to the GTIN of lower packaging levels) | New GTIN | The standard trade item grouping is a new trade item for ordering purposes. (Note this is not a random change, but a permanent configuration switch). | |
| 2.2.6 Major change | New GTIN | New GTIN | It is recommended to | Unable to Phase In, |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| in functionality - If the change introduces new features or functionality (e.g., new software Version, New features on electronic trade items, etc.) | | | assign a new GTIN at both the retail consumer and standard trade item grouping levels to ensure all supply chain partners are able to distinguish the "old" from the "new". | Phase Out old stock. |
| 2.2.7 Changes to the wording of existing product name, product brand, or product description that appear on the product and that will impact Supply Chain applications (this includes removal of existing branding used to describe the product in the Supply Chain and to the consumer). | New GTIN | New GTIN | The change leads to a change in the shelf edge label (consumer declaration). Brand, or product, name changes must be clearly communicated and old stock phased out. | Brand or product name changes could not be registered effectively. This potentially could lead to the failure to provide the consumer with accurate retail consumer trade item information (e.g. via the shelf edge label). |
| 2.2.8 Graduated change of the product brand or name (when old brand coexists with new one during a period with several stages) | New GTIN (the brand owner decides exactly when the new GTIN is assigned. This should take place when the old brand disappears from the product.) | New GTIN (timing identical to the GTIN change of the consumer Trade Item) | The change triggers a change in the supply chain (e.g. in the shelf edge label (consumer declaration) | Brand or product name changes could not be registered effectively. This potentially could lead to the failure to provide the consumer with accurate retail consumer trade item information (e.g. via the shelf edge label). |
| 2.1.A.1 - 3 Parallel Trade Items | | | | |
| 3.1 Promotions | | | | |
| 3.1 1 Promotions that do not impact GTIN | *Promotions are (normally) short-term modifications to way a trade item is presented to the customer. This section highlights examples of promotions where GTIN at retail consumer trade item level stays the same.* | | | |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 3.1.1.1 Two or more retail consumer trade items near each other (not attached or banded together) both of which can be purchased separately. For example a gift-with-purchase or buy-two, get one free offers - These items are offered at no additional cost when the primary (regular) retail consumer trade item is purchased. The promotion is sold at the same price. | No change | No change unless the two retail consumer trade items are shipped together in one physical package when originally they were shipped individually | The change has no impact on supply chain partners.<br><br>Promotions data can only be captured by knowing the date of the offer.<br><br>The shelf management software is not impacted<br><br>The consumer declaration is not impacted | An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost. |
| 3.1.1.2 Two (or more) retail consumer trade items bound together, i.e. designed to promote the trial of the attachment (One-Order Trial Packs) where the geometry of the base package and the item net weight, count or volume is not impacted and the item is not intended to be reordered because the promotion period is limited. | No change | No change | The change has no impact on supply chain partners (e.g., diapers packaged with insert pouch of 5 baby wipes)<br><br>Promotions data can only be captured by knowing the date of the offer. The shelf management software is not impacted and the consumer declaration is not impacted | An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost. |
| 3.1.1.3 Free Item<br><br>Two retail consumer trade items, not attached or banded together where one item, which cannot be purchased, is free when the other is purchased (e.g. gift- | No change (as all the items have a GTIN for sales or inventory tracking) | No change<br><br>(However, if the free item is shipped in the same physical container with the primary item, a separate GTIN should be assigned to identify the new standard trade | The change has no impact on original item. | An explosion in the number of GTIN changes within the supply chain as any change relevant only to the manufacturer will have to be signalled by a new GTIN. This imposes unnecessary cost. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| with-purchase or purchase-with purchase items). | | item grouping.) | | |
| 3.1.1.4 Free Item in Retail Consumer Trade Item - A free item packed inside the primary retail consumer trade item package with no change in quantity of trade item and the promotion package is sold at the same price as the regular package. NOTE: If the free gift affects the amount of tax payable (e.g., a taxable music CD offered as a free promotion on an untaxed product such as a multipack of baby milk) then careful consideration should be given to the communication to trading partners. | No change | No change | The change has no impact on supply chain partners. | An explosion in the number of GTIN changes - imposing unnecessary cost. |
| 3.1.1.5 Reconfiguration of Consumer Pack - A consumer package reconfigured for promotional purposes (e.g. memorial edition coffee can), which contains the same quantity of trade item as the regular package and is sold at the same price. | No change<br><br>(Where the retail consumer trade item footprint does not change more than 20% in any dimension) | No change | The change has no impact on supply chain partners.<br><br>The consumer declaration is not changed<br><br>The net weight is not affected. | An explosion in the number of GTIN changes - imposing unnecessary cost. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 3.1.1.6 Price-Off Coupon - A retail consumer trade item may have a price-off coupon on or in the package. The price-off coupon could be for the same or any other retail item. | No change | No change<br><br>(However, if the coupon is time critical it should be treated as 3.1.1.9) | The change has no impact on for pricing or ordering or invoicing<br><br>If the retail consumer is given the choice between purchasing the trade item with or without consumer price-off coupons a separate GTIN is required. | Additional complexity (cost) in the management of trade item with or without coupon. |
| 3.1.1.7 Mail in with Proof of Purchase - A retail consumer trade item may have a coupon or other identifiable printed matter that would offer proof of having purchased that item. The coupon would be returned by mail by the consumer for refund, for other items or for purchase of other items at a reduced price. | No change | No change<br><br>(However, if the coupon is time critical it should be treated as 3.1.1.9) | The change has no impact on supply chain partners. | An explosion in the number of GTIN changes - imposing unnecessary cost. |
| 3.1.1.8 Merchandise Sold with Allowance - When items are purchased by the retailer at the regular price, additional items are furnished free of charge. When the quantity of retail consumer trade items in the case can be increased. | No change | New GTIN | New reference due to increased quantity contained. NOTE: If the quantity of regular cases is increased (e.g. buy ten cases and get one case free), there is no change in the standard trade item grouping GTIN. Replenishment is based on shipped cases (which are the correct and really delivered quantity) not on the ordered quantity, which would be too low. Therefore in this case, there is not a need to change the standard trade item grouping GTIN. | The physical flow of the goods needs to be managed throughout the supply chain - even if supplied for free. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 3.1.1.9 Push promotion for a (time critical) event | No change | New GTIN (where First In First Out (FIFO) is inappropriate) | Certain time critical promotion (e.g., World Animal Day) where the promotion item has to be on display on a given day. In this instance normal FIFO rules cannot be effectively applied.<br><br>Other, longer term, critical promotions (e.g., seasonal soft drink package versus shipment that may not arrive on the shelf until a movie is launched) require no change as normal FIFO rules can be applied<br><br>Standard trade item grouping distinction required for efficient Phase In – Phase Out | Different retailers impose different rules on the same supplier causing unnecessary supply chain cost.<br><br>Keeping the retail consumer trade item level GTIN allows historic data file referral. |
| 3.1.2 Promotions that do impact GTIN. | *Promotions are (normally) short-term modifications to way a trade item is presented to the customer. This section highlights examples of promotions where a new GTIN is required at the one level.* | | | |
| 3.1.2.1 If a retail consumer trade item, (not normally pre-priced with a special price statement incorporated into the label) is changed to a retail consumer trade item that has a pricing statement on the label. | New GTIN | New GTIN | The change requires supply chain partners to distinguish old and new stock. | Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the Item File look up table). |
| 3.1.2.2 Price reduction is explicitly specified on the pack (flash packs), (e.g., 10 cents off) | New GTIN | New GTIN | The change requires supply chain partners to distinguish old and new stock. | Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the file look up table). |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 3.1.2.3 Bonus Pack: A bonus pack is an item that has increased quantity (net weight, count, volume) and is sold at the same price as the regular item. | New GTIN | New GTIN (standard trade item grouping net weight and case cube can change) | Quantity increase affect unit pricing and information found on shelf labels | Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the file look up table). |
| 3.1.2.4 Combination Pack - Items, composed of two or more retail trade items normally sold separately, that are bound together | New GTIN - Obscure the symbol (GTIN) on all individual trade items | New GTIN | A new GTIN is required for the retail consumer trade item because it is a new and unique product. For all combination packs it is important to obscure any bar code symbol on a lower packaging level. | If more than one bar code symbol (carrying a GTIN) is visible, the operator is unsure which one to scan. |
| 3.2 Prepriced Merchandise | *Prepricing is discouraged as a trade practice as it introduces complexity for retail consumer trade item and standard trade item grouping price file maintenance through the supply chain* | | | |
| 3.2.1 Retail Consumer Trade Item with price label attached per specific retailer(s) requirements | No change | No change | Retail consumer trade item where multiple retailers require specific price labelling does not require individual GTIN assignment per each price label. | An explosion in the number of GTIN changes - imposing unnecessary cost. |
| 3.2.2 When the manufacturer includes prepricing as part of the package graphics, such as is normally done with a Manufacturer's Suggested Retail Price (MSRP), and the buyer has not requested the price to be marked on the item (in other words, the selling price of the buyer may or may not have anything to do with the selling price marked on the item). Event: | New GTIN | New GTIN | The change requires supply chain partners to distinguish old and new stock. | Danger that the price declaration to the consumer (on the pack) is different to the price charged (price in the file look up table). |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| change of MSRP. | | | | |
| 3.2.3 Any other marked price as part of the packaging. Selling price is the price marked on the packaging. Event: marked price change. | New GTIN | New GTIN | Newspapers, magazines and some books tend to be price marked. If the cover price changes, the GTIN should change. Pre-Pricing needs to comply to the law | Pricing legislation normally means that the price shown must equal (or be greater than) the price charged to the consumer. If the price is shown on the trade item (not recommended) this must be communicated to supply chain partners. |
| 3.3 - 3.~~7~~8 Other parallel trade items | *Other changes which could impact GTIN allocation.* | | | |
| 3.3 Different Manufacturer for an (apparently) identical trade item made for a specific retailer. | No change (the retailer is the Brand Owner) | No change | The Retail Price is not relevant to the GTIN. | GTIN assignment would be impossible to manage. |
| 3.4 Different Retail Price (e.g., for different regions in one country) and the price is not marked on the packaging | No change (exception if the trade item is prepriced) | No change | The retail price is not relevant to the GTIN unless it is pre-priced by the supplier on the package. | GTIN assignment would be impossible to manage if linked to retailers price files. |
| 3.5 Trade item produced in different locations | No change | No change | Different GTIN for the same trade item could cause serious problems for retailer (e.g. price lookup file, replenishment) | Global players supplying the same trade item, from factories in different countries, would have to use different GTINs even though no change to the consumer. |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 3.6 New / additional pallet layout to co-exist permanently with the original layout | No change | No change at the case level but (If pallet layout is important to the retailer, then retailer should order by the pallet. This would require a GTIN at the pallet level.) | The pallet pattern / layout does not impact the quantity of retail consumer trade items or cases contained. If two pallet layout configurations are supplied to a market in parallel, and can be ordered separately, a different GTIN is required for each pallet configuration. In effect the pallet then becomes the ordering unit. | Robotic picking requires a known (predetermined) pallet layout and stacking order.<br><br>Efficient Logistics applications require pre-determined pallet configurations. |
| 3.7 EAS (Electronic Article Surveillance) system (theft protection)<br><br>Should the Retail Item be orderable with<br><br>- no anti-theft device<br><br>- an electromagnetic anti-theft system<br><br>- a radio based system<br><br>- etc | No change<br><br>(same GTIN independent of anti-theft properties) | New GTIN<br><br>(a different GTIN dependent upon the anti-theft properties of the retail unit and trading partner agreement) | Facilitate reorder within the retailer organisation and timely inventory rotation | Retailer Distribution Centre unable to distinguish between shipping to stores with theft protection systems. |
| 3.8 The addition of an EPC Tag.<br><br>NOTE: Where an item has an EPC Tag and Bar Code, the encoded GTIN must be identical. | No change | No change | The requirement to use EPC Tags is driven by trading partner agreement. Otherwise identical items, with and without an EPC Tag, must have the same GTIN to enable the smooth operation of the Supply Chain. | The introduction of EPC Tags to existing product lines would require reallocation of GTIN. This would add significant cost to the global supply chain and avoids the additional costs associated with an explosion of new GTINs. |
| **2.1.A.1 - 4 Seasonals** | | | | |



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| Type of Change to Trade item | GTIN for Retail Consumer Trade Item | GTIN for Standard Trade Item Grouping | Rationale | Consequence if rule not applied |
|---|---|---|---|---|
| 4.1 Trade items modified for seasonal reason (e.g. holiday pack, candy over-wrapped for Easter) | New GTIN<br><br>Note Recurring Seasonals (e.g., White T-shirt sold each summertime or a cake supplied only during the Christmas period) should use the same GTIN each season. | New GTIN | Facilitates efficient pricing, invoicing, reordering and stock-management at the standard trade item grouping level and seamless trade item substitution at the retail consumer trade item level. | Additional complexity (cost) in the phase-in phase-out of seasonal trade items.<br><br>Rate sale, re-order and (seasonal) promotions management more complex. |
| 4.2 Same Brand - Trade item Vintage (e.g. Wine) | New GTIN (vintage impacts pricing or ordering or invoicing at any point in the supply chain)<br><br>Same GTIN (vintage has no impact on pricing or ordering or invoicing at any point in the supply chain) | Same as for Retail Unit. | *An assigned GTIN must never be changed as long as the item is not modified so that it needs to be discriminated from the initial trade item for ordering, stocking or billing. The example of "wine" clearly highlights the grey area within this definition. For exactly the same "brand" of wine, the price of top quality vintage varies enormously by year. For other "brands" of wine, the year is of no consequence. Therefore it is ultimately for the Brand Owner (whoever markets the wine) to decide GTIN allocation rules.* | The Brand Owner is ultimately responsible for the correct GTIN assignment to their trade items. The GTIN assignment impacts how their trade items are traded. Failure to use the Brand Owners identification scheme means that all benefit of source numbering is lost. |



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# Section 2.2:

# Numbering and Symbol Marking of Logistic Units

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## 2.2.1 Introduction

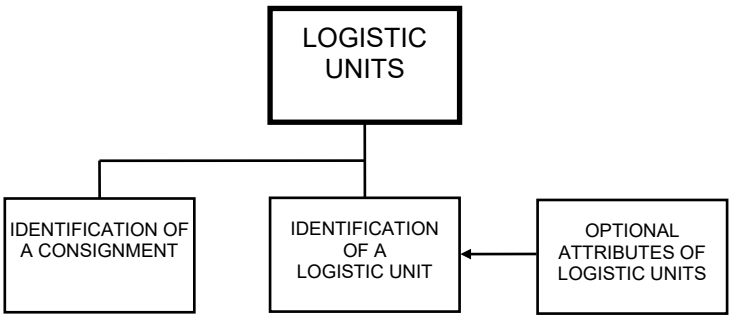
A logistic unit is an item of any composition established for transport and/or storage that needs to be managed through the supply chain.

Tracking and tracing logistic units in the supply chain is a major application of the EAN.UCC System. Scanning the standard identification number, marked on each logistic unit, allows the physical movement of units to be individually tracked and traced by providing a link between the physical movement of items and the associated information flow. It also opens up the opportunity to implement a wide range of applications, such as cross docking, shipment routing, and automated receiving.

Logistic units are identified with an EAN.UCC Identification number called the SSCC. The SSCC ensures that logistic units are identified with a number that is unique worldwide.

Attribute information, such as a Consignment Number, AI (401), may be optionally encoded using internationally agreed data structures and a bar code symbology that allow unambiguous interpretation.

Figure 2.2.1 – 1




## 2.2.2 Definition and Identification of Logistic Units

A logistic unit is an item of any composition established for transport and/or storage which needs to be managed through the supply chain. The identification and symbol marking of logistic units enables a large number of user applications. In particular, the SSCC provides a link between the physical logistic unit and information pertaining to the logistic unit that is communicated between trading partners using Electronic Data Interchange (EDI).

The SSCC Element String AI (00) is used for the identification of logistic units (see Section 3.6.1). Each individual logistic unit is allocated a unique number, which remains the same for the life of the logistic unit. When assigning an SSCC, the rule is that an individual SSCC number must not be reallocated within one year of the shipment date from the SSCC assignor to a trading partner. However, prevailing regulatory or industry organization specific requirements may extend this period.

In principle, the SSCC provides a unique reference number that can be used as the key to access information regarding the logistic unit in computer files. However, attributes relating to the logistic unit (e.g., ship to information, logistic weights) are also available as standardised Element Strings.



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### 2.2.2.1 Element Strings Used on Logistic Units

The use of attribute information on logistic units is optional. However, when used, attribute information should be processed with the SSCC that identifies the logistic unit.

#### 2.2.2.1.1 Identification of Trade Items Contained in a Logistic Unit: AIs (02) and (37)

When a logistic unit is a grouping of trade items, it is sometimes useful to indicate the Global Trade Item Number™ (GTIN™) of the contained items in association with the SSCC. The Element String AI (02), which has a mandatory association with AI (37), may be used only on a unit that is not itself a trade item and only if all trade items that are contained within the unit have the same GTIN.

#### 2.2.2.1.2 Logistic Measures: AI (33nn), (34nn), (35nn), (36nn)

The EAN.UCC System provides standard Element Strings for representing logistic weights and measures in metric and other units of measure. In principle a particular logistic measure should be applied in only one unit of measure on a given logistic unit. However, application of the same attribute in several units of measure does not impede the correct processing of the transmitted data.

#### 2.2.2.1.3 Consignment Number: AI (401)

The Consignment Number, AI (401), identifies a logical grouping of goods (one or more physical entities) that has been consigned to a freight forwarder and is intended to be transported as a whole. The Consignment Number, AI (401), must be allocated by a freight forwarder, carriers acting as a freight forwarder, or a consignor, but only if the prior agreement of the freight forwarder is given. Typically AI (401) encodes a House Way Bill Number (HWB).

#### 2.2.2.1.4 Shipment Identification Number: AI (402)

The Shipment Identification Number (Bill of Lading) is assigned by a consignor. It is a globally unique number that identifies a logical grouping of physical units in a transport shipment. It may be used as a communication reference by all parties in the transport chain, such as in (Electronic Data Interchange) (EDI) messages where it can be used as a shipment reference and/or a consignor's loading list.

#### 2.2.2.1.5 Routing Code: AI (403)

The Routing Code, AI (403), is assigned by a parcel carrier. It is intended to provide a migration path to the adoption of a yet to be defined international, multi-modal solution. The routing code, AI (403), must not be used to encode information that could be encoded in a separate AI (such as AI (420), ship to postal code).

#### 2.2.2.1.6 Ship to - Deliver to EAN.UCC Global Location Number: AI (410)

This Element String has been designed to allow the automatic sortation of logistic units using the EAN.UCC Global Location Number (GLN).

#### 2.2.2.1.7 Ship for - Deliver for - Forward to EAN.UCC Global Location Number: AI (413)

This Element String has been designed to allow the cross docking of logistic units using the EAN.UCC Global Location Number (GLN). It is used in conjunction with the Element String AI (410) to indicate the cross docking station and the final destination of the logistic unit.



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#### 2.2.2.1.8 Ship to - Deliver to Postal Code Within a Single Postal Authority: AI (420)

This Element String has been designed to allow the automatic sortation of logistic units using the postal code in a single postal area.

#### 2.2.2.1.9 Ship to - Deliver to Postal Code with Three-Digit ISO Country Code: AI (421)

This Element String has been designed to allow the automatic sortation of logistic units using the postal code. As the postal code is prefixed by the ISO country code, it may be used internationally.

### 2.2.3 Special Considerations

By their nature, units that need to be tracked and traced individually in a supply chain require unique identification numbers. The SSCC provides this identification number.

Because each logistic unit must be assigned its own unique SSCC, it is not practical to preprint the bar code symbol containing the SSCC on the logistic unit packaging. A more logical approach is to create a label that can be affixed to the logistic unit when the unit is constructed.

Further, a logistic unit may also be a trade item and hence be subject to the EAN.UCC System specifications for trade items (See Section 2.1). If this is the case, it is logical to generate a single label containing all of the information required.

EAN International and the Uniform Code Council (UCC™), along with representatives from manufacturers, retailers, transporters, and EAN Member Organisations, have developed a voluntary standard for bar code symbol label applications: the EAN.UCC Logistics Label. The SSCC and its application on logistic units are the central focus of the EAN.UCC Logistics Label.

### 2.2.4 EAN.UCC Logistics Label Design

These specifications constitute the basis for all EAN.UCC Logistics Labels. Other sections, most notably Section 3.0, Definitions of the Element Strings, and Section 5.3, UCC/EAN-128 Symbology Specifications, should be read in conjunction with the following sub-sections.

#### 2.2.4.1 Scope

These specifications detail the structure and layout of EAN.UCC Logistics Labels. Emphasis is given to the basic requirements for practical application in an open trade environment. Primary topics include:

- The unambiguous identification of logistic units
- The efficient presentation of text and machine readable data
- The information requirements of the key partners in the supply chain: suppliers, customers, and carriers
- Technical parameters to ensure systematic and stable interpretation of labels



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## 2.2.4.2 Concepts

### 2.2.4.2.1 Logistics Information Flow

As a logistic unit moves through the supply chain, a series of events occur that defines the information related to the unit. The whole supply chain process of manufacturing, finished goods distribution, transportation, and deployment into the marketplace adds layers of information related to the logistic unit.

For example, the physical content of the unit is typically defined at finished goods distribution. At that point in time the identification of the logistic unit as an entity is possible. Other elements of information, such as final destination or the composition of a multi-unit shipment, are not typically known until later in the supply chain process. In a trading relationship, different elements of information are generally known and applied by the supplier, carrier, and customer.

Figure 2.2.4.2.1 – 1

### 2.2.4.2.2 Representation of Information

The information included on an EAN.UCC Logistics Label comes in two basic forms. Human Readable Interpretation is used by people and is comprised of text and graphics. Machine readable information is designed for data capture by a machine. Bar code symbols are machine readable and are a secure and efficient method for conveying structured data, while Human Readable Interpretation allows people general access to basic information at any point in the supply chain. Both methods add value to EAN.UCC Logistics Labels, and often co-exist on the same label.

The EAN.UCC Logistics Label has three sections. The top section of the label contains free format information. The middle section contains text information and the Human Readable Interpretation of the bar code symbol(s). The lowest section contains the bar code symbol(s).

### 2.2.4.2.3 Specific Bar Code Symbol Structures

The UCC/EAN-128 Symbology is used for EAN.UCC Logistics Labels. This symbology, which is used exclusively for EAN.UCC System defined data structures, is a subset of Code 128, a highly refined, secure, and space efficient alphanumeric symbology. The data formats carried include the Element Strings and their Application Identifiers (AIs) (see Section 3.0). Each AI is a two-, three-, or four-digit prefix that defines the meaning of the data that follows. AIs allow data to be represented in bar code symbols in a form that is unambiguously and securely interpreted when scanned.

### 2.2.4.2.4 Identification of a Logistic Unit

The one mandatory field for all EAN.UCC Logistics Labels is the SSCC. The SSCC is an identification number that is unique to each logistic unit. The SSCC is represented by AI (00) and in principle is sufficient for all logistics applications.

In an environment where Electronic Data Interchange (EDI) is used to transmit detailed information about a logistic unit, or where that information is already resident in a database, the SSCC acts as a reference pointer to information.



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However, when EDI is not available at each point in the supply chain, or when replicated data is desired, certain additional elements of information are desirable in bar code form. Each of these is also represented through the use of AIs.



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## 2.2.4.3 Label Design

The layout of the EAN.UCC Logistics Label groups information into three logical sections for the supplier, customer, and carrier. Each label section may be applied at a different point in time as relevant information becomes known. Additionally, within each section, bar code symbols are segregated from text information to facilitate interpretation by both machines and people.

The labeller, the organisation responsible for printing and applying the label, determines the content, format, and dimensions of the label. The SSCC is the single mandatory element for all EAN.UCC Logistics Labels. Other information, when required, should comply with the specifications of this document and with the proper use of Application Identifiers.

## 2.2.4.3.1 Supplier, Customer, Carrier Sections

A section is a logical grouping of information that is generally known at a particular time. There are three label sections on an EAN.UCC Logistics Label, each representing a group of information. Generally, the order of the sections, from top to bottom, is: carrier, customer, and supplier. However, this order and top/down alignment may vary depending on the size of the logistic unit and the business process being served.

#### 2.2.4.3.1.1 Supplier Section

The supplier 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 Global Trade Item Number™ (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 lot, batch and serial numbers.

#### 2.2.4.3.1.2 Customer Section

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

#### 2.2.4.3.1.3 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. Typical information includes ship to postal codes, AI (420), Consignment Numbers, AI (401), and carrier-specific routing and handling information.



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### 2.2.4.3.2 Bar Code Symbol and Human Readable Interpretation Layout

Bar code symbols are represented in the lower part of each section, while Human Readable Interpretation is shown in the upper part of the section. This facilitates access to each component.

Figure 2.2.4.3.2 – 1

### 2.2.4.3.3 Label Dimensions

The physical dimensions of the label are determined by the labeller, but the size of the label should be consistent with the data requirements for all sections of the label. Factors influencing label dimensions include the amount of data required, the content and X-dimension of the bar code symbols used, and the dimensions of the logistic unit to be labelled.

The size of the label is determined by the amount of bar coded data required. The standard A6 (105 mm x 148 mm) or 4 x 6 inch formats are ideal when only the SSCC is coded. Other dimensions are typically variations driven by data requirements or logistic unit size. As a guideline to users, the width of the label is best held constant at 105 mm (4 in.), while the height of the label varies depending on data requirements.



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## 2.2.4.4 Technical Specifications

## 2.2.4.4.1 Bar Code Symbols

UCC/EAN-128 Bar Code Symbols shall be used on the EAN.UCC Logistics Label.

#### 2.2.4.4.1.1 Concatenation

Concatenation is an effective means for presenting multiple Element Strings in a single bar code symbol and should be used to conserve label space and optimise scanning operations. However, concatenation shall not be used with the UCC/EAN-128 bar code symbol containing the SSCC on cartons or outer-cases due to the scanning environment. SSCC concatenation is not recommended on standard A6 (105 mm x 148 mm) or 4 x 6 inch formats when SSCC concatenation is used on pallets. This helps to maintain the required symbol height and X-dimension of the bar code containing the SSCC, which is the identifier for the logistics unit and the most fundamental element on the label.

#### 2.2.4.4.1.2 X-Dimension (Symbol Magnification)

In the past, the term symbol magnification was extensively used to specify the size of a bar code symbol. This technique relied upon setting a nominal size (100%) that was directly related to a given X-dimension. Since January 2000, the more precise X-dimension has been used to specify permissible symbol sizes (see Section 5.4).

The recommended X-dimension range is between 0.495 mm (0.0195 in.) and 0.94 mm (0.037 in.) The target X-dimension recommended for the UCC/EAN-128 Bar Code Symbol encoding the SSCC is 0.495 mm (0.0195 in.).

The reliability of scanning will always be enhanced by selecting the same X-dimension for all the bar codes on the label. However, if the information required cannot be accommodated in the space available, a lower X-dimension may be used. In any case, the minimum X-dimension is 0.250 mm (0.00984 in.) Using smaller symbols reduces reading distance and makes the production of quality symbols more difficult to maintain.

#### 2.2.4.4.1.3 Bar Code Symbol Height

Taller symbols present a better target for readers. The recommended bar code symbol height of at least 32 mm (1.25 in.) applies to all of the bar codes on the label, especially the UCC/EAN-128 Bar Code encoding the SSCC (see Section 5.4). January 1, 2004 is the end of the migration from the previous minimum height of 27 mm (1.1 in.). Space constraints may not allow a bar code to be printed at the recommended height, but in no case shall a bar code symbol be less than 13 mm (0.5 in.) high.

#### 2.2.4.4.1.4 Quiet Zones

Bar codes should be printed with leading and trailing Quiet Zones that are at least 10 modules wide.

#### 2.2.4.4.1.5 Orientation and Placement

Picket Fence Orientation Bar Code Symbols should be used on logistic units. In other words, the bars and spaces shall be perpendicular to the base on which the logistic unit stands. In all cases, the UCC/EAN-128 Bar Code Symbol encoding the SSCC shall be placed in the lowest portion of the label.



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#### 2.2.4.4.1.6 Human Readable Interpretation

As a back up key entry and diagnostic aid, a Human Readable Interpretation of each bar code symbol shall be provided above or below the symbol. It includes Application Identifiers, data content, and a Check Digit, but no representation of special symbol characters or the Symbol Check Character.

To facilitate key entry, AIs should be set apart from the data by parentheses.

This Human Readable Interpretation characters shall be no less than 3 mm high and clearly legible and preferably below the symbol.

### 2.2.4.4.2 Text

#### 2.2.4.4.2.1 Plain Text

Text that has no bar code symbol equivalent is often required on a label. The name and address of the sender and receiver are typical examples. In many instances companies may also wish to add specific text to a label (e.g., company logos). All text shall be clearly legible and no less than 3 mm high.

#### 2.2.4.4.2.2 Human Readable Interpretation

Human Readable Interpretation is text designed to support manual operations and to facilitate key entry in menu driven systems. It is the equivalent of data elements represented in bar code symbols and is comprised of data titles and data content. The data content should be at least 7 mm in height. If there is no language agreed between trading partners, data titles must be printed in English. As an option left at the discretion of the labeller, a second language can be added. Application Identifiers are not included in Human Readable Interpretation.

#### 2.2.4.4.2.3 Data Titles

Data titles are the standard abbreviated descriptions of data fields used to denote the Human Readable Interpretation of encoded data. They are prefixes of the Human Readable Interpretation to support manual interpretation of data fields. They can also be used adjacent to other text or bar code symbols to clarify content, such as the word “from” adjacent to a sender’s address.

All data titles are shown in Section 3.A.4.



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### 2.2.4.4.3 Label Location

Label placement specifications are maintained in Section 6.7.

### 2.2.4.5 Label Examples

Figure 2.2.4.5 – 1

The Basic Label: An SSCC

Figure 2.2.4.5 – 2

Label with Supplier and Carrier Sections

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Figure 2.2.4.5 – 3

Label with Supplier Section with Concatenated Data

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Figure 2.2.4.5 – 4

Label with Supplier, Customer, and Carrier Sections

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# Section 2.4:

# Numbering and Symbol Marking of Locations

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## 2.4.1 Introduction

The EAN.UCC Global Location Number (GLN) makes possible the unique and unambiguous identification of physical, functional, and legal entities. The EAN/UCC-13 Data Structure is used for this purpose, and the numbers represented are non-significant. There is no restriction on the allocation of the same EAN/UCC-13 Identification Number to a trade item and to a location.

In business operations, location numbers are meaningless if they are not associated with a particular function or purpose. All Element Strings described in this section indicate the particular function of the GLN represented in the bar code symbol.

Each company or organisation holding an EAN.UCC Company Prefix may assign GLNs to its own locations. It is the responsibility of the company using the GLNs to keep business partners informed of all numbers issued as well as the company's name and address details. Special care is needed if ownership of the company changes.

The use of GLNs is a pre-requisite for efficient Electronic Data Interchange (e.g., EANCOM®). Special procedures may be applied to provide GLNs for small companies or businesses that have not been assigned an EAN.UCC Company Prefix.

In addition to the GLN, the EAN.UCC System provides for a standard data structure to encode the official postal code of the "ship to" address. Postal codes are normally maintained by the national postal body in conjunction with the Universal Postal Union (UPU).

## 2.4.2 Data Carrier

The only data carrier used to represent the EAN.UCC Global Location Number (GLN) is the UCC/EAN-128 Bar Code Symbology. When encoding the GLN, UCC/EAN-128 Bar Code Symbols should be printed at an X-dimension between 0.25 mm (0.00984 in.) and 1.016 mm (0.040 in.). However, if the GLN is carried by a bar code symbol on an EAN.UCC Logistics Label, the recommendations contained in Section 2.2, Logistics Units, apply.



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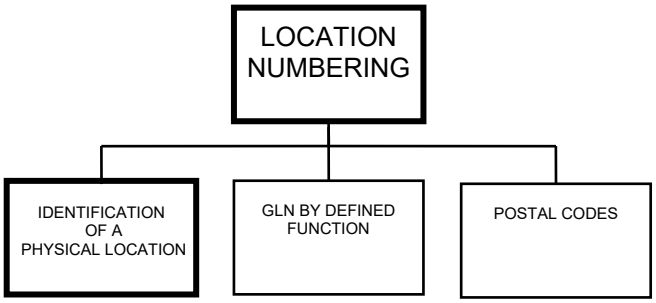
## 2.4.3 Application Overview

### 2.4.3.1 Identification of a Physical Location

Figure 2.4.3.1 – 1




#### 2.4.3.1.1 EAN.UCC Global Location Number to Identify a Physical Location: AI (414)

The function assigned to this Element String is the identification of a physical location. This implies that this Element String is represented in a data carrier on the location itself. Physical locations may, for example, be a room, a door of a warehouse, an x-ray room in a hospital, a control point, or a particular machine.

This Element String may be used to record and confirm presence at a given location for any purpose.

A typical application using this Element String is the identification of storage locations within a warehouse. The forklift driver scans the EAN.UCC Global Location Number (GLN), identifying the storage location whenever an item is brought to, or taken from, the identified location. The electronic message from the scanner is then used to automatically update the warehouse's stock management system.



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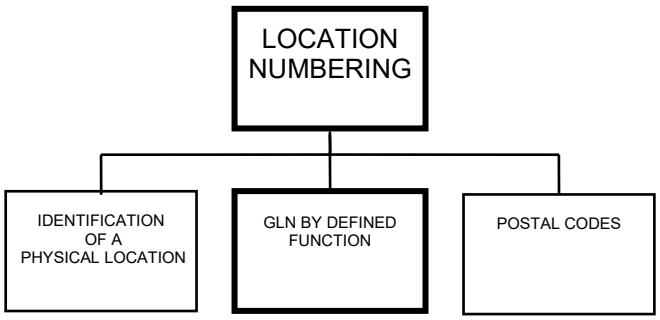
### 2.4.3.2 Location Numbering by Defined Function

Figure 2.4.3.2 – 1




#### 2.4.3.2.1 Ship to – Deliver to EAN.UCC Global Location Number: AI (410)

This Element String represents the EAN.UCC Global Location Number (GLN) of the recipient of a transport unit. The GLN refers to the address where a particular consignment is to be delivered. This Element String is typically used in single leg transport operations. A transport unit may include a bar code symbol carrying the GLN of the unit's intended destination. When scanning this Element String, the data transmitted may be used to retrieve the related address and/or to sort the item by destination.

#### 2.4.3.2.2 Bill to - Invoice to EAN.UCC Global Location Number: AI (411)

This Element String represents the EAN.UCC Global Location Number (GLN) of the addressee of an invoice. The GLN refers to the name and address of the business partner to which an entity shall be invoiced and includes accounting-related information that may be used wherever required.

#### 2.4.3.2.3 Purchased from EAN.UCC Global Location Number: AI (412)

In business it is sometimes important to know from where a particular trade item was purchased. Applied on a trade item, this Element String provides the EAN.UCC Global Location Number (GLN) of the company that supplied and invoiced the item. The GLN always refers to the Global Trade Item Number™ (GTIN™) of the trade item on which the Element String has been applied.



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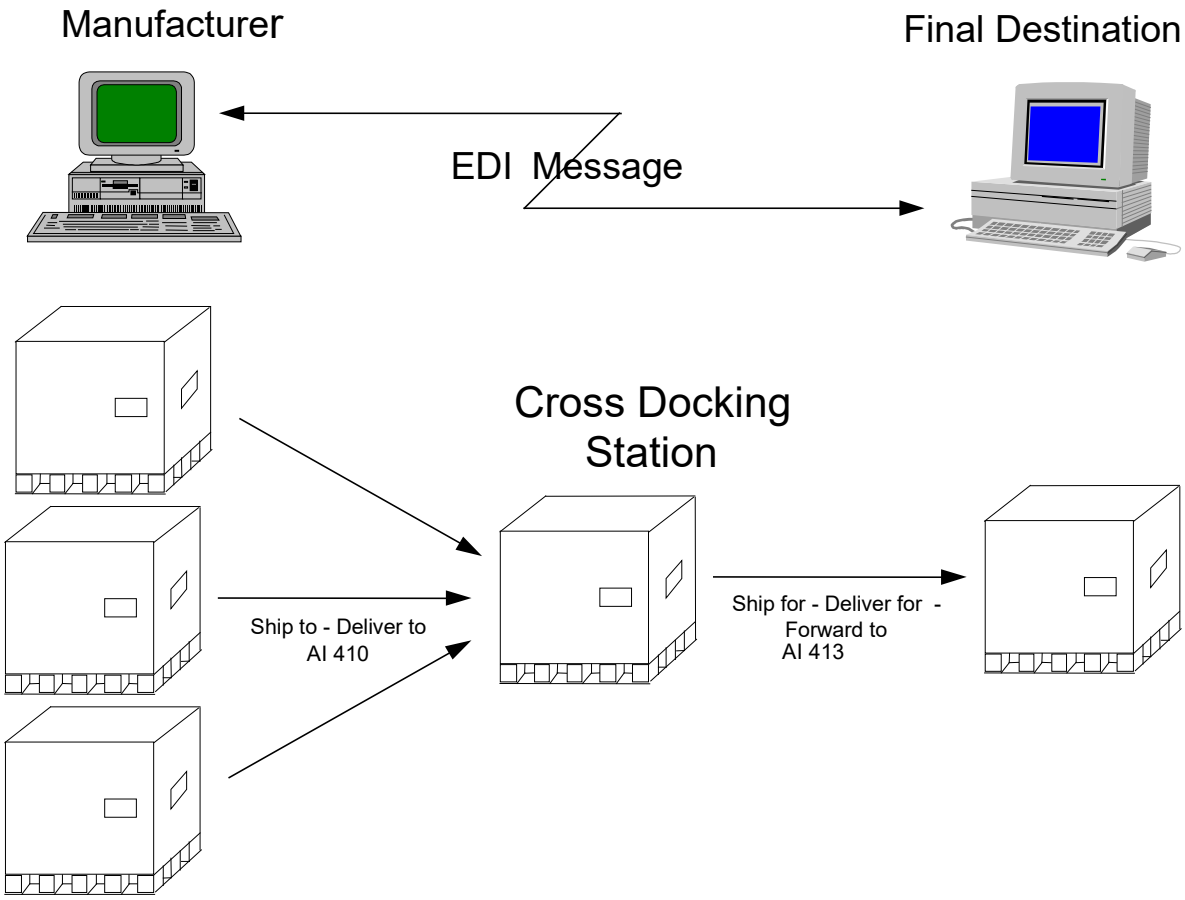
### 2.4.3.2.4 Ship for - Deliver for - Forward to EAN.UCC Global Location Number: AI (413)

This Element String is used by the consignee for determining the internal or subsequent final destination of a physical unit.

A typical application using this Element String is in cross docking. Here, a bar code symbol carrying the Element String AI (410) is placed on a logistic unit at the point of creation to direct the goods to the intermediate destination (e.g., a distribution centre). The Element String AI (413) is also carried by the bar code symbol to direct the goods to their final destination (e.g., a retail store served by the distribution centre).

Figure 2.4.3.2.4 – 1




### 2.4.3.2.5 EAN.UCC Global Location Number of the Invoicing Party: AI (415)

This Element String is used to indicate the EAN.UCC Global Location Number (GLN) of the invoicing party. The GLN is mandatory information for the payment slip application (see Section 2.6.5).



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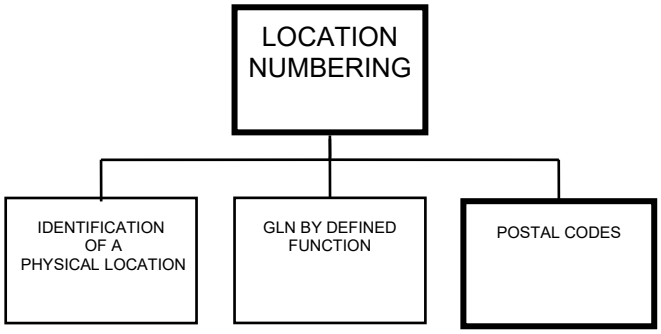
### 2.4.3.3 Postal Codes

Figure 2.4.3.3 – 1




Within the EAN.UCC System, it is possible to encode the official postal code of the ship to address. The Element Strings for postal codes are described in the following subsections.

#### 2.4.3.3.1 Ship to - Deliver to Postal Code Within a Single Postal Authority: AI (420)

This Element String represents the postal code of a given unidentified postal authority. It may not be used for items leaving the area of the concerned postal authority. The Element String has been designed to allow the automatic sorting of logistic units.

When postal code Element Strings were developed, AI (420), national applications, often used a different schema than international applications and was created to give more detail (e.g., down to the level of the household). For international postal codes, this level of detail was not felt necessary.

#### 2.4.3.3.2 Ship to - Deliver to Postal Code with Three-Digit ISO Country Code: AI (421)

This Element String represents the postal code of a postal authority identified by the ISO country code. It may be used for items leaving the area of the concerned postal authority. The Element String has been designed to allow the automatic sorting of logistic units worldwide.

This Element String represents the national postal codes preceded by the ISO country code. It may be used as logistic information in the international logistic operations wherever appropriate.

A typical application using this Element String is in a single leg transport operation. Here, a logistic unit has a bar code symbol carrying the international version of the postal code of its intended destination. The electronic message from the scanner is then used to automatically route the logistic unit.



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## 2.4.4 Allocating EAN.UCC Global Location Numbers

### 2.4.4.1 General Rule

EAN.UCC Global Location Numbers (GLNs) can be used to identify anything that can be addressed (e.g., companies, departments, functions, rooms, factories, shelves, delivery points, EDI network addresses). A separate unique number is required to identify each different location. Once assigned at the source (e.g., usually by the party owning the location), the GLN becomes a unique and universal reference that can be used by all.

### 2.4.4.2 Location Changes

From time to time the details related to an EAN.UCC Global Location Number (GLN) might change. The location identified by the GLN may change ownership or the business carried out at one address may be transferred to a new address. The following are general cases on the use (or re-use) of GLNs due to a change in the circumstances in which the number was originally established.

If a company (possibly because of liquidation) sells a location to another party who may or may not be using GLNs, the GLN for the address that is associated with the previous owner should be closed. If the new owner of the address wishes to identify the location with a GLN, a new number should be assigned.

If a company closes one address and opens a similar operation at a new address, the company may either transfer the existing GLN to the new address or assign a new GLN for the new address. The reason for requesting a new GLN may be that the owner wants to maintain records on his computer files that show the performance of the old location. At a later date, this performance may be compared with the performance of the new location.

If a function identified by a GLN changes, the details associated with the GLN should be changed by the party responsible for it on the related computer file record.

A GLN that has stopped being used should remain so for at least three years before being reallocated. The delay must allow time for all references of the old GLN to be removed from trading partners' files. When the GLN is put into use once again, the details relating to the new party and/or location must be retransmitted (e.g., using a PARTIN EANCOM® message).

### 2.4.4.3 Recommendation on Allocating EAN.UCC Global Location Numbers

The exact method used to allocate the EAN.UCC Global Location Number (GLN) is at the discretion of the issuing organisation. The GLN must be unique for each individual location being identified.

For ease of administration, EAN International and the Uniform Code Council (UCC™) recommend GLNs be allocated sequentially without classifying elements.



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### 2.4.4.4 Information Associated with an EAN.UCC Global Location Number

The characteristics of a party or location should be established on a computer file using the EAN.UCC Global Location Number (GLN) as the key to the information.

An example of the type of information held includes the full name and address of the party, bank details and account number, sales department that deals with the party, and profile of a company.



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# Section 2.5:

# Numbering and Symbol Marking of Service Relationships

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## 2.5.1 Introduction

The EAN.UCC Global Service Relation Number (GSRN) is used to identify the recipient of services in the context of a service relationship. It provides a unique and unambiguous identification number for the service provider to store data relevant to service(s) provided to the recipient. The GSRN is the key to access information stored on computer systems or reference information transferred via Electronic Data Interchange (EDI).

The GSRN can be used to identify the service relationships in:

- A hospital admission, where it could be used to record a patient's room charges, medical tests, and patient charges
- A membership in a frequent flyer programme, where it could be used to record awards, claims, and preferences
- A membership in a loyalty scheme, where it could be used to record visits, purchase value, and awards
- A membership in a club, where it could be used for recording entitlements, use of facilities, and subscriptions
- A service agreement, where it could be used to manage agreed upon services, such as maintenance services for a television or computer

## 2.5.2 Data Carrier

The data carrier for the EAN.UCC Global Service Relation Number (GSRN) is the UCC/EAN-128 Bar Code Symbol. When encoding the GSRN, the UCC/EAN-128 Bar Code Symbol should be printed at an X-dimension between 0.25 mm (0.00984 in.) and 1.016 mm (0.040in.).

## 2.5.3 Application Overview

### 2.5.3.1 EAN.UCC Global Service Relation Number (GSRN): AI (8018)

The EAN.UCC Global Service Relation Number (GSRN) is a non-significant number used to identify a database entry for recording recurring services. These services are activities carried out by a service provider for a service user, based upon a bilateral agreement. Consequently, the GSRN identifies a particular service arrangement with reference to a particular service provider and to a particular user. It may in some instances identify the user as a participant (or member) in a programme or scheme. However, it never constitutes a person's personal identification number because it is always related to a given service arrangement.

A typical application using this Element String is the identification of membership in a student library. The library would issue all members a card that includes a unique GSRN identifying the relationship between the library and a student. The library would then scan the GSRN whenever a book was lent or returned. The electronic message from the scanner would then be used to automatically update the library's stock management database. See Figure 2.5.3.1 – 1 for an example of how the GSRN would appear on this membership card.

The worldwide, unique GSRN may also be used in other applications. For example, it could be used to give students access to other libraries that have formed a cooperative lending agreement.



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GSRNs also can be used to identify hospital patients. In this case, the service provider is the hospital and the service recipient is the patient. The EAN.UCC Company Prefix used is the one allocated to the hospital. The hospital generates a GSRN for each of its patients and encodes it in a UCC/EAN-128 Bar Code Symbol on the patient's wristband as well as his or her corresponding medical record.

When a product or service is administered (e.g., a particular treatment is given) it can easily be associated with the patient by scanning the patient's GSRN and the Global Trade Item Number™ (GTIN™) of the product or service.

It should be noted that the GSRN is not meant to identify a single service as a trade item. Neither is it used to identify a physical unit as a trade item. It may identify a physical unit for service purposes (e.g., a computer with a service agreement).



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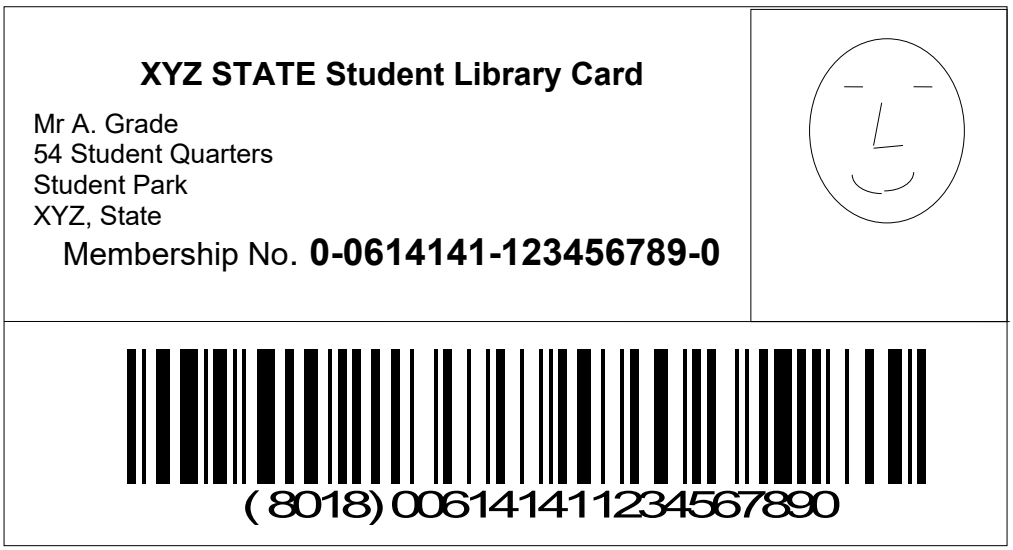
Figure 2.5.3.1 – 1




## 2.5.4 Allocating EAN.UCC Global Service Relation Numbers

### 2.5.4.1 General Rule

The EAN.UCC Global Service Relation Number (GSRN) can be used to identify any service relationship. A separate, unique number can be issued, normally by the service provider, to identify any given service relationship. Once assigned, the GSRN becomes a unique and universal reference that can be used by all parties involved in the service relationship.

### 2.5.4.2 Changes in a Service Relationship

From time to time the details related to an EAN.UCC Global Service Relation Number (GSRN) may change. The following are general cases that may occur if the circumstances under which the GSRN was originally set up change:

- If a service provider ceases trading (possibly because of liquidation), any GSRNs allocated by that organisation should be phased out. If the activity covered by the GSRN is transferred, the new service provider may continue to use existing GSRNs, but should allocate further GSRNs using the new provider's EAN.UCC Company Prefix.

- If the range of services identified by a GSRN changes, the service provider should change the details associated with the GSRN on the related computer file record. The assignment of a new GSRN is not required in this case.

- A GSRN used to identify a particular service relationship that has terminated should not be reallocated for a period well beyond the lifetime of the relevant records.



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### 2.5.4.3 Recommendation for Allocating EAN.UCC Global Service Relation Numbers

The exact method used to allocate the EAN.UCC Global Service Relation Number (GSRN) is left to the discretion of the issuing organisation. However, the GSRN must be unique for each individual service recipient and remain unique for a period well beyond the lifetime of the records relevant to the service relationship.

For ease of administration, EAN International and the Uniform Code Council (UCC™) recommend that GSRNs be allocated sequentially and do not contain classifying elements.

### 2.5.4.4 Information Associated with an EAN.UCC Global Service Relation Number

The EAN.UCC Global Service Relation Number (GSRN) is a standalone Element String. All information required by the service provider should be established on a computer file using the GSRN as the key to access the information. The type of information stored is determined by the nature of the service relationship. Typical information includes the service recipient's full name, address, and details on services rendered.



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# Section 2.6:

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## 2.6.1 Coupons

### 2.6.1.1 Introduction

A coupon is a voucher that can be redeemed at the Point-of-Sale for a cash value or free item. Coupon identification is organised at the local level. Determining the data structure of a coupon is, therefore, the responsibility of the Uniform Code Council (UCC™) or the EAN Member Organisations for their area of jurisdiction.

The purpose of coupon numbering and symbol marking is to automate and speed up coupon handling procedures at the Point-of-Sale. Moreover, coupon issuers and retailers may be able to reduce the costs involved in sorting coupons, administering manufacturers' payments, and producing reports on redemption.

All EAN.UCC System coupon standards presented here allow for coupon validation" (e.g., to check whether the item(s) covered by the coupon are within the customer's order).

If either validation or value look up is performed, manufacturers must advise their distributors and retailers of the impending issue of a coupon so that retailers' files can be updated to process the information at the Point-of-Sale.

### 2.6.1.2 Application Overview

An EAN.UCC System coupon number is used for numbering promotional coupons for manufacturers and retailers as well as tokens with monetary value, such as gift tokens, book tokens, food stamps, record vouchers, luncheon vouchers, and social security tokens.

The structure of EAN.UCC System coupon numbers ensures uniqueness against all other EAN.UCC System numbers only when used within the monetary area of the appropriate EAN Member Organisation(s).

### 2.6.1.3 Coupon Identification for Restricted Geographic Distribution

#### 2.6.1.3.1 Coupon Identification for Restricted Geographic Distribution (EAN.UCC Prefix 99)

The prefix 99 has been released for use with coupon numbers.

The internationally agreed standard for EAN.UCC System coupon numbers is shown in Figure 2.6.1.3.1 – 1.

Figure 2.6.1.3.1 – 1

| EAN.UCC Prefix | Coupon Data (Structure Determined by EAN Member Organisation and the Uniform Code Council) | Check Digit |
|---|---|---|
| 9 9 | $N_3$ $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | $N_{13}$ |

Within this structure, the Uniform Code Council (UCC™) and each EAN Member Organisation are free to develop a national coupon solution. Four recommended structures provide a degree of equipment standardisation.



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These recommended structures are shown in Figure 2.6.1.3.1 – 2.

Figure 2.6.1.3.1 – 2

| EAN.UCC Prefix | Recommended Coupon Data Structures (Exact Structure Determined by EAN Member Organisation) | Check Digit |
|---|---|---|
| 9 9 | Y Y Y Y R R R V V V | C |
| 9 9 | Y Y Y R R R V V V V | C |
| 9 9 | Y Y Y Y Y R R R T T | C |
| 9 9 | Y Y Y Y Y R R R R R | C |

Where: Y = Coupon issuer number (issued by the UCC or an EAN Member Organisation)
R = Coupon reference number (allocated by a coupon issuer)
V = Redemption value
T = Value Code (standardised by the UCC or an EAN Member Organisation)
C = Check Digit calculated according to the standard algorithm

The UCC, EAN Member Organisations, or retailers may require that the third digit of the coupon numbers (990 to 999) be programmable in order to cope with specific demands such as:

- Taxable or non-taxable coupons
- Different currencies
- Indication of the decimal position

### 2.6.1.3.2 EAN.UCC Common Currency Coupon Identification (EAN.UCC Prefixes 981 and 982)

The EAN.UCC Prefixes 981 and 982 have been released for use with coupons expressing a value in a common currency.

The internationally agreed standard for EAN.UCC Common Currency Coupon Codes is shown in Figure 2.6.1.3.2 – 1.

Figure 2.6.1.3.2 – 1

| EAN.UCC Prefix | Coupon Data (Structure Determined in Agreement with EAN International) | Check Digit |
|---|---|---|
| 9 8 1 or 9 8 2 | $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | $N_{13}$ |

Within this structure, EAN Member Organisations in a common currency area should develop a common coupon solution that is valid throughout the common currency area.


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#### 2.6.1.3.2.1 Use of EAN.UCC Common Currency Coupon Code for the Euro

At present the only application of EAN.UCC Prefixes 981 and 982 is for the euro. The euro is a new currency that began to replace the national currencies of some countries on 1 January 1999. A migration period of several years is planned, with notes and coins being introduced in 2002.

Within the euro area, coupon issuer numbers are administered by:

EAN BELGIUM•LUXEMBOURG
Rue Royale 29
1000 Brussels
Belgium

Tel: + 32.2.229.18.80, Fax: + 32.2.217.43.47, Email <info@eanbelgilux.be>

See Figure 2.6.1.3.2.1 – 1 for the coupon data structure in the euro area.

Figure 2.6.1.3.2.1 – 1

| EAN.UCC Prefix | Coupon Data | | | Check Digit |
|---|---|---|---|---|
| **9 8 1** | $Y_1\ Y_2\ Y_3\ Y_4$ | $R_1\ R_2$ | E E , E | C |
| **9 8 2** | $Y_1\ Y_2\ Y_3\ Y_4$ | $R_1\ R_2$ | E , E E | C |

Where: Y = Coupon issuer number (issued by an EAN Member Organisation)
R = Coupon reference number (allocated by a coupon issuer)
E = Redemption value (expressed in euro); value 000 indicates free gift
C = Check Digit calculated according to the standard algorithm

Note: The only difference between the two structures is the position of the implied decimal point.


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### 2.6.1.3.3 UCC Coupon Code Identification for use in North America (EAN.UCC Prefix 05)

Prefix 05 is reserved for use in North America only. The structure is given in Section 3.2.6.

Coupons using the EAN.UCC Prefix 05 are constructed using the UCC Company Prefix assigned to a given organisation. For UCC Company Prefixes beginning with a digit other than zero, the presence of one of the Element Strings AI (8100), (8101), or (8102) is required.

See the *Application Standard for UCC Coupon Codes* for detailed information on UCC Coupon Code data content and applied numbers.

#### 2.6.1.3.3.1 UCC Coupon Extended Code: AI (8100 – 8102)

Element Strings AI (8100) to AI (8102) represent supplementary data related to a particular UCC Coupon Code using the EAN.UCC Prefix 05. They are never used as a stand-alone Element String.

The Element String AI (8100) enables the representation of an Offer Code and the extension of the use of UCC Coupon Codes to companies whose UCC Company Prefix does not begin with the UCC Prefix 0.

The Element String AI (8101) enables the representation of an Offer Code and expiration data, and extends the use of UCC Coupon Codes to companies whose UCC Company Prefix does not begin with the UCC Prefix 0.

The Element String AI (8102) enables the extension of the use of UCC Coupon Codes to companies whose UCC Company Prefix does not begin with the UCC Prefix 0.

See the *Application Standard for UCC Coupon Codes* for detailed information on data content and applied numbers.


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### 2.6.1.4 Symbol Marking of Coupons

A coupon with the EAN.UCC Prefix 99, 981, or 982 is carried by the EAN-13 Bar Code Symbol.

A coupon with the EAN.UCC Prefix 05 is carried by the UPC-A Bar Code Symbol.

The UCC Coupon Extended Code, AIs (8101 to 8103), is carried by the UCC/EAN-128 Bar Code Symbol.

### 2.6.1.5 Allocating EAN.UCC System Coupon Data

#### 2.6.1.5.1 General Rule

EAN.UCC System coupon identification specifications are flexible and have been designed to cater for current and future requirements.

Due to the nature of coupon numbering, a range of national solutions is offered, each of which is defined by the respective EAN Member Organisation or the Uniform Code Council (UCC™). National coupon solutions are not unique worldwide and must be operated in the restricted area defined by the EAN Member Organisation or the UCC.

In the interest of consistency and to avoid misinterpretation by equipment vendors, when defining national specifications, EAN Member Organisations should include appropriate mention of all EAN.UCC System coupon data structures.

Coupon reference numbers must not be re-used for a period of three years.

#### 2.6.1.5.2 Recommendation on Allocating Coupon Reference Numbers

The exact method used to allocate EAN.UCC System coupon reference numbers is left to the discretion of the issuing organisation. However, the UCC Coupon Code must be unique for each individual promotion.

For ease of administration, coupon reference numbers should be allocated sequentially.



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## 2.6.2 Refund Receipts

### 2.6.2.1 Introduction

Refund Receipts are vouchers produced to automate payment for returned empty containers.

Refund Receipts automate and expedite the handling of empty containers (e.g., bottles, crates) that have a refund value in a retail store.

When customers return empty containers (which have a refund value), the containers have to be checked and valued. This process can be done manually or by automated equipment capable of handling empty containers. When the returned containers have been valued, a Refund Receipt is printed and given to the customer. The customer presents the Refund Receipt at the store checkout, and the corresponding amount is refunded in cash or deducted from the customer's bill.

An EAN-13 Bar Code Symbol can be printed on the Refund Receipt to encode the required data including a security number and the monetary value.

### 2.6.2.2 Application Overview

The structure of Refund Receipts ensures uniqueness against all other EAN.UCC System ID numbers only when used within the restricted environment defined by the appropriate EAN Member Organisation or the Uniform Code Council (UCC™).

#### 2.6.2.2.1 EAN.UCC System Identification of Refund Receipts - Restricted Geographic Distribution (EAN.UCC Prefix 980)

The EAN.UCC Prefix 980 has been released for use with Refund Receipt data.

The internationally agreed standard for EAN.UCC System Refund Receipt data is shown in Figure 2.6.2.2.1 – 1.

Figure 2.6.2.2.1 – 1

| EAN.UCC Prefix | Refund Receipt Data (Structure Determined by EAN Member Organisation or the Uniform Code Council) | Check Digit |
|---|---|---|
| 9 8 0 | $N_4$ $N_5$ $N_6$ $N_7$ $N_8$ $N_9$ $N_{10}$ $N_{11}$ $N_{12}$ | $N_{13}$ |

Within this structure each EAN Member Organisation or the Uniform Code Council (UCC™) develops its own national Refund Receipt solution. The recommended structure shown in Figure 2.6.2.2.1 – 2 aims at some degree of equipment standardisation.


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Figure 2.6.2.2.1 – 2

| Prefix | Recommended Structure | Check Digit |
|---|---|---|
| 9 8 0 | S S S S S V V V V | C |

Where: S = Security number
This number is used to provide some security in the handling of the Refund Receipt. For example, it consists of a sequential number, which is incremented by 1, for each ticket generated. In this case, the Point-of-Sale system will be able to recognise a Refund Receipt that had already been refunded. The security number can also include a two-digit machine number and a three-digit sequential number, in the case where several machines are available to the customers at the same location.
V = Monetary value of the refund
The scale factor (decimal places) will depend on the currency used.
C = Check Digit
Calculated according to the standard algorithm

### 2.6.2.3 Symbol Marking of Refund Receipts

EAN-13 Bar Code Symbols are used with Refund Receipts.

### 2.6.2.4 Allocating Refund Receipts

#### 2.6.2.4.1 General Rule

Refund Receipt specifications are flexible and have been designed to cater for current and future requirements.

Due to the nature of Refund Receipt identification, several national solutions are offered, each of which is defined by the respective EAN Member Organisation or the Uniform Code Council (UCC™). National Refund Receipt solutions are not unique worldwide and must be operated in the restricted circulation defined by the EAN Member Organisation or the UCC.


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## 2.6.3 Electronic Serial Identifier for Cellular Mobile Telephones (CMTI): AI (8002)

### 2.6.3.1 Introduction

The purpose of an Electronic Serial Identifier, AI (8002), for cellular mobile telephones (CMTI) is to uniquely identify a cellular phone within a given jurisdiction.

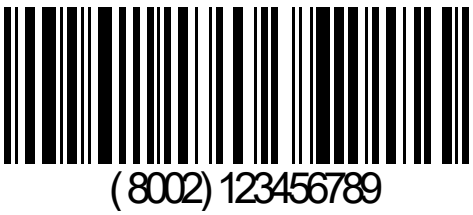
The information from the bar code symbol can be used to automate and speed up the capture of CMTIs.

### 2.6.3.2 Application Overview

The Cellular Mobile Telephone (CMTI) is usually assigned by a national or pluri-national authority. Issuing authorities must ensure that the Electronic Serial Identifier is unique for each cellular phone. However, because Electronic Serial Identifiers are assigned by different issuing authorities, they are not unique worldwide.

Figure 2.6.3.2 – 1 illustrates Electronic Serial Identifier, AI (8002), 123456789 carried by a UCC/EAN-128 Bar Code Symbol.

Figure 2.6.3.2 – 1




### 2.6.3.3 Allocating Electronic Serial Identifiers: AI (8002)

An Electronic Serial Identifier, AI (8002) is assigned by the appropriate national or pluri-national body and can be carried by a bar code symbol placed directly on the cellular phone. The Electronic Serial Identifier, AI (8002), is unique for each cellular telephone within the jurisdiction of the issuing body.



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## 2.6.4 Internal Applications

### 2.6.4.1 Introduction

The EAN.UCC System has been established as an open standard. The primary benefits derived from the EAN.UCC System are that the same bar code symbols and unique identification numbers are used by all participants in the supply chain. This significantly reduces supply chain costs by standardising the data exchanged between trading partners and allowing “label once, scan many” operations.

However, organisations that have the capability to process EAN.UCC System data may have the requirement to encode, in machine readable form, data for a company’s internal purposes. The EAN.UCC System makes available the following guidelines to meet purely internal applications. The guidelines are compatible with the overall EAN.UCC System, but to avoid the possibility of causing ambiguity elsewhere in the supply chain. It is strongly recommended that any bar codes containing data for internal-use are destroyed before items carrying them leave the organisation.

### 2.6.4.2 Application Overview

#### 2.6.4.2.1 Definition

An internal application is broadly defined as any numbering and symbol marking system that is restricted to within the operations of a company.

Facilities are available within the EAN.UCC System to identify items only within the operations of a company. In these cases, the identified units have a restricted distribution, as the identification numbers they bear are not unique worldwide.

#### 2.6.4.2.2 Data Carrier

Internal application ID numbers are carried by UPC-A, EAN-13, EAN-8 or UPC-E Bar Code Symbols (using certain EAN.UCC Prefixes) or the UCC/EAN-128 Bar Code Symbol (using certain AIs).


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### 2.6.4.3 Allocating Internal Application Numbers

Specifications for internal ID numbers are flexible and leave the choice of data structure, following the appropriate EAN.UCC Prefix or Application Identifier, completely at the discretion of the issuing organisation.

### 2.6.4.4 Company Internal Applications Using EAN/UPC Symbology

#### 2.6.4.4.1 Company Internal Applications Using EAN.UCC Prefixes

Full details related to the use of EAN.UCC Prefixes 02and 20 to 29, for internal applications, can be found in Section 3.0.

Organisations wishing to use these EAN.UCC Prefixes for purely internal applications should contact their EAN Member Organisation for the guidelines prevailing in their area.



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### 2.6.4.5 Internal Applications Using UCC/EAN-128 Symbology

In addition to the EAN.UCC Prefixes noted above, the EAN.UCC System makes available Application Identifiers for internal applications. Like all other data structures using Application Identifiers, internal application AIs may only be carried by UCC/EAN-128 Bar Code Symbols.

#### 2.6.4.5.1 Information Mutually Agreed Between Trading Partners (Including FACT Data Identifiers: AI (90)

Element String AI (90) may be used to represent any information that has been mutually agreed between two trading partners. The agreement may include the use of FACT DIs (Data Identifiers). If a FACT DI is used, it should appear immediately after the AI (90), followed by the appropriate data. The use of FACT DIs gives little security to users.

The bar code symbol carrying this Element String should be removed from any item that leaves the jurisdiction of the trading partners. Failure to remove the symbol may cause problems if another trading partner using the same AI for a separate internal application scans the item.

#### 2.6.4.5.2 Company Internal Information: AIs (91 to 99)

Element Strings AI (91) to (99) may contain any internal information relevant to a company's internal applications.

The bar code symbol containing these Element Strings should be removed from any item that leaves the jurisdiction of the company. Failure to remove the symbol may cause problems if a trading partner using the same AI for a separate internal application scans the item.



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## 2.6.5 Numbering and Symbol Marking for Payment Slips

EAN International, in conjunction with representatives of banks, utility service providers, and retailers, has developed this voluntary standard for applications of bar code symbols on payment slips.

This standard is based on the use of EAN.UCC System Application Identifiers and utilises UCC/EAN-128 Bar Code Symbols. It is a complement to, and should be read in conjunction with:

- Other sections of these specifications
- *EANCOM*®, the Electronic Data Interchange (EDI) standard providing implementation guidelines for UN/EDIFACT messages.

Organisations wishing to automate the payment process should use this standard as a basis to produce specific implementation guidelines pertinent to their application. The implementation guidelines in the following subsections consider issues such as domestic versus international payments and local banking laws.

### 2.6.5.1 Introduction

#### 2.6.5.1.1 Business Demand for the Application

The use of EAN.UCC System standards has led to major innovations in the retail sector. The EAN.UCC System family of bar code symbols has enabled automation at the Point-of-Sale (POS). Studies have shown that identifying goods with EAN.UCC System bar code symbols and ID numbers reduces the amount of time required to process a transaction, increases the accuracy of data, and enables efficient Electronic Data Interchange (EDI).

This success has led other industries to introduce the EAN.UCC System into their business processes. One such application of the EAN.UCC System is the automation of payment for billable services.

Utility companies (e.g., electricity, gas, water) and other service providers (e.g., insurance, government agencies) have sought to improve their customer service through automating the payment system. This requires that the information needed by all partners in the payment process be in a form that can be automatically captured. Bar code symbols are one of the most cost-effective means of capturing data.

The information flow that accompanies the physical payment demand is communicated between trading partners in a variety of ways; however, EDI is the most optimal means. In practice, fully automated communication channels that make it possible to rely exclusively on electronic files for retrieving information are not always available.

For this reason, there may be a need to indicate relevant information on the payment slip, in addition to an identification number of the invoicing party and a reference number for the payment slip. The various fields of information that must be communicated need to be organised in a standard way in order to facilitate their interpretation and processing by the partners involved.



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### 2.6.5.2 Potential Benefits

The potential benefits of payment slips carrying bar code symbols include:

- For the customer (invoicee):

  - Provides flexible payment facilities. Payment can be made, for example, at banks, post offices, automatic teller machines, supermarkets, and on the Internet.

  - Increases quality in the capture of payment reference information for use in international banking

- For the issuer of the invoice (invoicing party):

  - Using bar code symbols to represent critical payment data greatly reduces the possibility of key entry error.

  - By offering customers more payment locations, the issuer of the invoice provides an increased level of service to customers.

- For the payment receiving agency:

  - The agency can use its investment in scanning technology to provide a payment collection service to customers while being able to charge the invoicing party a collection fee.

  - For retailers, the provision of such a service could provide a commercial advantage, because customers may choose to use a retailer who provides such a service over one that does not.

- For the bank:

  - Provides an opportunity to use symbol and scanning technology at the cashier's desk to process payments quickly and accurately. In addition this technology could be extended to ATM machines in bank lobbies, allowing customers to pay their bills 24 hours a day.

  - Provides an opportunity in some countries to offer new services to batch payments issued by the payment receiving agency on behalf of large invoice issuers (e.g., utility suppliers)


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### 2.6.5.3 Application Rules

#### 2.6.5.3.1 Definition of a Payment Slip

A payment slip is that part of a paper invoice used to facilitate payment. The payment slip covers a wide range of payment demands, such as telephone bills, electricity bills, and insurance renewals. The payment slip is normally issued by a service provider (the invoicing party) to a final customer (the invoicee) and represents a payment demand. Normally the payment slip would outline in Human Readable Interpretation:

- Details of the customer
- Details of the service provider
- A detailed invoice for the service(s) provided
- A reference number
- The amount payable
- The payment conditions (e.g., pay before date, where to pay)

#### 2.6.5.3.2 Bar Code Symbology

The UCC/EAN-128 Bar Code Symbol is used with payment slips. They in no way replace the need for Human Readable information.

#### 2.6.5.3.3 Bar Code Symbol Information

##### 2.6.5.3.3.1 EAN.UCC Global Location Number of the Invoicing Party

The Application Identifier to indicate the EAN.UCC Global Location Number (GLN) of the invoicing party is AI (415).

The GLN of the invoicing party identifies the issuer of the payment slip. It is used as a key to access database information about the invoicing party (normally held by the payment receiving agency). The same GLN is used for all payment slips issued by the invoicing party under identical payment conditions. The GLN of the invoicing party is used by the payment receiving agency to reference the characteristics of the contract with the invoicing party, such as:

- Whether the payment can be accepted
- Contact details of the invoicing party
- Action to take if the due date has expired
- Transfer arrangement of funds to the invoicing party's bank

A different GLN shall be used whenever the payment conditions are different. For more information, see Section 2.6.A.2.


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#### 2.6.5.3.3.2 International Bank Account Number (IBAN): AI (8007)

The Application Identifier to indicate the International Bank Account Number (IBAN) is AI (8007).

The bank account identifier of the invoicing party is defined in ISO 13616. It is used to identify where to send the payment and, in the receiving country, which bank holds the account for international bank payment.

#### 2.6.5.3.3.3 Payment Slip Reference Number: AI (8020)

The Application Identifier to indicate a Payment Slip Reference Number is AI (8020).

By their nature, payment slips need to be individually tailored for the invoicee and therefore require a unique reference number the Payment Slip Reference Number, AI (8020). Reminder notices should use the same number as the original notice. The Payment Slip Reference Number, (AI (8020), is issued by the invoicing party and is a unique number in the system. Payment Slip Reference Numbers, AI (8020), should be sequentially allocated.

The Payment Slip Reference Number, AI (8020), uniquely identifies the payment slip when used in conjunction with the EAN.UCC Global Location Number (GLN) of the invoicing party. It is used to communicate details of payment between all the partners involved: invoicing party, invoicee, payment receiving agency, and bank(s). It is also used to access locally held information.

#### 2.6.5.3.3.4 Amount Payable

There are two Application Identifiers to indicate the amount payable:

- AI (390n) = amount payable for a single monetary area
- AI (391n) = amount payable with ISO three-digit currency code

  n = indicates the implied decimal point position

If the amount payable is expressed in a bar code symbol, AI (391n) should be used, as this ensures the currency of the payment can be automatically processed and verified by the system. However, if the currency is unambiguously implied by the system, AI (390n) may be used. To avoid ambiguity, only one AI encoding the amount payable shall be used, and the currency must be clearly indicated in human readable form.

Scanning systems should have the facility to override the amount payable. This functionality is required should the invoicee wish to make the minimum required payment, which could be less than the total amount due. The amount due is attribute information and, when used, must be processed with the EAN.UCC Global Location Number (GLN) of the invoicing party.

#### 2.6.5.3.3.5 Due Date

The Application Identifier to indicate the due date is AI (12).

The due date indicates the date by which the invoice should be paid (by the invoicee). It is attribute information and, when used, must be processed with the EAN.UCC Global Location Number (GLN) of the invoicing party.

Note: The due date must be represented in the YYMMDD format in the bar code symbol; however the human readable data can be presented in whatever form is appropriate.



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### 2.6.5.4 Application Overview

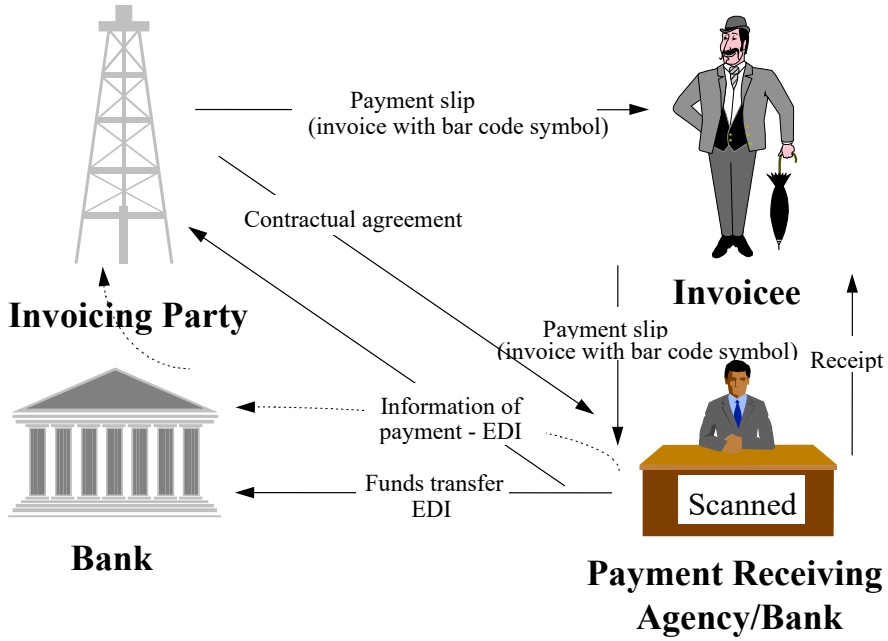
#### 2.6.5.4.1 Application Requirements

These international guidelines outline the EAN.UCC System standards for payment slips used in an open environment. The guidelines provide information on how to use bar code symbols on payment slips and how they can help automate the payment process.

Note: Legislation in certain countries may require that the payment receiving agency be a bank.

#### 2.6.5.4.2 Overview of the Key Steps When Using Bar Code Symbols with Payment Slips

Figure 2.6.5.4.2 – 1





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Step 1: The invoicing party and payment receiving agency must conclude a working agreement, under the appropriate legal framework, regarding the system for receiving payment on an agency basis.

Step 2: The payment receiving agency informs and trains all receiving points on the processing of payment slips. The EAN.UCC Global Location Number (GLN) of the invoicing party is used to discriminate between payment slips that can and cannot be accepted.

Step 3: The invoicing party issues payment slips with bar code symbols to the customer (invoicee)

Step 4: The invoicee takes the payment slip to the payment receiving agency. The payment slip is scanned, the payment is made, and a receipt is issued.

Note: The working agreement between the invoicing party and payment receiving agency should cover the appropriate action if the due date has expired.

Step 5: The payment receiving agency logs all payment slips received using the Payment Slip Reference Number (8020). This information is centrally collated and transmitted to the relevant invoice issuing party directly or via the banking system after an agreed time frame. The funds are then transferred to the designated bank account.

Step 6: The invoicing party updates its database information using the Payment Slip Reference Number, AI (8020).

Note: This is a simplified model and may not be applicable in all countries or for international payments.



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## 2.6.5.A.1 Appendix 1: Example of a Payment Slip

Figure 2.6.5.A.1 – 1

ABC-Electric Company

Electricity consumption for period:
1 January 2001
to
31 March 2001

Mr A.N. Customer
45 Sunrise Drive
Cape Town, TX
765444

**PAY TO**: 5412345678908
**REF NO.**: ABC123

**Amount Payable** South African Rand

12.50

**DUE DATE** 25 April 2001

### UCC/EAN-128 Symbols

To facilitate efficient scanning, all bar code symbols shall be printed at an X-dimension between 0.25 mm (0.00984 in.) and 0.495 mm (0.0195 in.) and be a minimum of 13 mm (0.5 in.) in height.

Payment slips should be carried by UCC/EAN-128 Bar Code Symbols.

Example: (415) 5412345678908

AI (415) indicates the EAN.UCC Global Location Number (GLN) of the invoicing party.

The GLN is a fixed length 13-digit number terminated by a standard Check Digit. The rules for allocating GLNs ensure that this number is unique worldwide. GLNs are used by the payment receiving agent to distinguish between payment slips that can and cannot be accepted.

Example: (12) 010425

AI (12) indicates the due date by which the payment should made.

The due date is always encoded YYMMDD; however, other formats may be used for the Human Readable Interpretation equivalent. The use of the due date is optional, but if used, the payment receiving agent and the invoicing party should agree about what action will be taken if the due date has expired.

Example: (3911) 710125

AI (3911) indicates the amount payable with ISO currency number. From ISO 4217, “710” indicates South African Rand.

It is strongly recommended to use the ISO currency number when encoding this optional data element. The fourth digit of this AI is the decimal point indicator. For example, the digit 1 in this position would indicate one digit after the decimal point; a 2 would indicate two digits after the decimal point.

Example: (8020) ABC123

AI (8020) indicates the Payment Slip Reference Number.

The Payment Slip Reference Number, AI (8020) is a mandatory data element for this application. It is processed with the GLN of the invoicing party and provides a unique reference for all communications between the payment agent and the invoicing party.



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## 2.6.5.A.2 Appendix 2: Guideline on the Use of EAN.UCC Global Location Numbers

### 2.6.5.A.2.1 Introduction

On a daily basis information related to parties and locations is generated and communicated throughout the business world in vast quantities. For example, names and addresses are put on envelopes, the delivery destination is noted on transport documentation, and the bank account number of the payee is identified on an invoice. These are just a few examples of the many applications in existence that identify parties in everyday business communications.

With the advent of electronic communication, and particularly Automatic Data Capture (ADC) and Electronic Data Interchange (EDI), the need for unambiguous and globally unique identification of parties and locations has become more acute. Using bar code symbol identification rather than exclusively using alphanumeric information is key to successfully implementing an automated payment project. EAN.UCC Global Location Numbers (GLNs) offer an internationally recognised standard solution to the identification of parties and locations.

Full information on GLNs is available from the Uniform Code Council (UCC™) or the local EAN Member Organisation. This appendix presents an overview of their use with payment slips.

### 2.6.5.A.2.2 What is an EAN.UCC Global Location Number?

EAN.UCC Global Location Numbers (GLNs) are reference keys to computer files. When scanned or received in an EDI transmission, the GLN is used as the key to look up all relevant information in a computer database.

GLNs are unique, non-significant, international in their application, and have strictly defined rules assigned to them. In short, a GLN must always be numeric and have a fixed length of 13 digits. Each location number contains, in the thirteenth position, a Check Digit, which ensures the correctness of the number. Once assigned, usually the invoicing party, the GLN becomes a unique and universal reference.

### 2.6.5.A.2.3 What Information is Associated with an EAN.UCC Global Location Number?

The attributes of an EAN.UCC Global Location Number (GLN) should be established on a computer file using the GLN as the key to the information. The type of attribute information held by the payment agent might be the invoicing party's full name and address, bank details and account number, contractual payment conditions, and the action to be taken if the due date has expired. Whenever any of the attribute information changes, the invoicing party should assign a new GLN.

The use of the GLN is based on the assumption that the payment agent maintains a computer database to reference information related to the invoicing party. Where the payment agent is a bank, the invoicing parties International Bank Account Number (IBAN), AI (8007), and Payment Slip Reference Number, AI (8020), may be sufficient to process the payment.

### 2.6.5.A.2.4 Are EAN.UCC Global Location Numbers Used in EDI?

The EDIFACT Interchange Header segment (UNB) is used in all EDI interchanges complying with the EDIFACT syntax rules. The identity of the sender and receiver of the interchange must be specified in this segment. The use of EAN.UCC Global Location Numbers (GLNs) is mandatory in *EANCOM*® for the identification of EDI parties at this level.



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**2.6.5.A.2.5 How to Obtain an EAN.UCC Global Location Number**

EAN.UCC Global Location Numbers (GLNs) are available through any EAN Member Organisation or the Uniform Code Council (UCC™).


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### 2.6.5.A.3 Appendix 3: Introduction to the International Bank Account Number (IBAN): AI (8007)

The International Bank Account Number (IBAN), AI (8007), is defined by *ISO 13616*. The standard specifies the elements of an IBAN that are used to facilitate international processing of data in financial environments and other industries.

The IBAN is constructed using the Basic Bank Account Number (BBAN). The BBAN is the identifier used by financial institutions in individual countries as part of the national account numbers scheme. This ensures the unique identification of a customer's bank account within a country. The BBAN is used to construct the IBAN as follows:

- The first two positions (a2) shall always be filled by the two-character country code (alpha version), as defined in *ISO 3166*, of the county in which the bank branch servicing/maintaining the IBAN resides.
- The third and fourth positions (n2) shall be filled by the Check Digits as calculated from the defined scheme (see *ISO 13616*).
- In electronic transmission of the IBAN (including in bar code symbol form), the remaining positions shall be filled by the BBAN without separators or special characters (see *ISO 13616*).

Examples:

Country: Canada (ISO 3166 two-character country code = CA)

BBAN : 012323456-123 123456789012

IBAN : CA9501232345612312345678901 2

Country: Belgium (ISO 3166 two-character country code = BE)

BBAN : 320-0347134-41

IBAN : BE88320034713441

Note that only the financial institution that services (maintains) the account is allowed to generate its IBAN (including the Check Digit).



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## 2.6.6 Customer Specific Articles

### 2.6.6.1 Introduction

The EAN.UCC System guidelines for trade items (see Section 2.1) state that each item of trade is assigned a non-significant number that uniquely identifies the item in an unrestricted environment. The same number is used to identify a series of identical items, with every variant being allocated a separate unique identification number whenever the variation is apparent and significant between partners in the supply chain or to the final user.

This system enables the use of Automatic Data Capture (ADC) and Electronic Data Interchange (EDI) in an open environment, globally. However, in a number of business sectors, because of the vast number of possible different manifestations of certain made-to-order articles, pre-allocation of Global Trade Item Numbers™ (GTINs™) at the lowest level is not feasible.

For organisations that trade in such made-to-order products, EAN International, in association with trade representatives, has developed the following guideline. This guideline has been designed to improve supply chain efficiency by enabling ADC and, in particular, efficient ordering via EDI.

This guideline is fully compatible with, and should be treated as a special case of, the EAN.UCC System recommendations for the numbering and symbol marking of trade items.

### 2.6.6.2 Application Overview

#### 2.6.6.2.1 Definition

A Customer Specific Article (CSA) is broadly defined as any item where the supplier defines all possible manifestations of the article from which the customer may choose, and pre-allocation of article numbers at the lowest level is not feasible. CSAs are never made for stock, and hence are always made to order. However, made-to-order articles are not necessarily customer specific, but could be standard.

A typical example of a CSA is a chair that is available in 300 different types of upholstery for the seat, back, and armrest. This list of available upholstery could also be used for other types of furniture the supplier offers. There are 27,000,000 ordering possibilities for this chair (300 x 300 x 300). Typically the supplier's catalogue lists a generic style of chair as well as the 300 different upholstery options. The customer chooses the style of chair and selects upholstery for the seat, back, and armrest.

On receipt of order, the supplier produces the customer specific chair and makes it available to the customer. Because the supplier defines the customer's options, and because the customer must specify his or her choices based on those options, the order contains all the information the supplier requires to manufacture the chair.


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This example highlights four separate process steps:

- The supplier makes available all the possible manifestations of an article.
- The customer specifies the actual article required using the supplier catalogue.
- The supplier manufactures the article in accordance with the customer's specifications.
- The CSA is delivered.

The EAN.UCC System has formalized this process, enabling efficient Automatic Data Capture (ADC) and Electronic Data Interchange (EDI) throughout the supply chain. The CSA data model is based on the assumption that the supplier defines the possible components (either in a paper or electronic catalogue) and the customer specifies the actual article required.

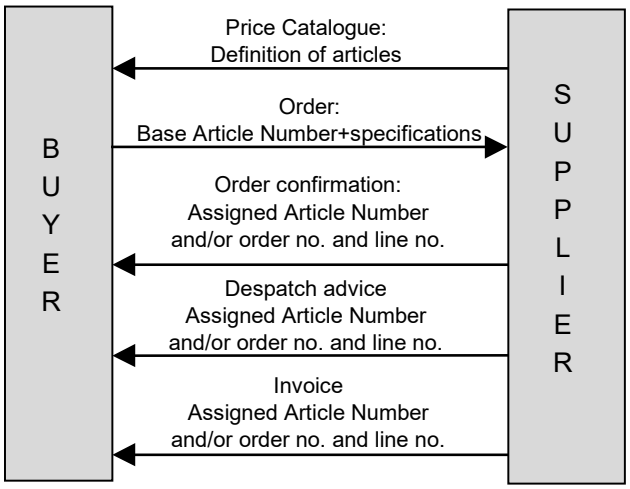
The processes for identifying and ordering the article are dealt with separately. Although these processes are closely related, each requires separate consideration in an open system.

### 2.6.6.2.2 Customer Specific Articles Data Flow

The data flow model is organised on a series of assumptions designed to ensure that the model is independent of the type of article and the sector: It is a generic model. Because many different procedures may be applied by various manufacturers, the generic model is meant to be a general guide. By using this model, companies can communicate in a standard way and (re)organise the automated handling of Customer Specific Article (CSA) specification according to this guideline.

The model assumes that the supplier informs the customer of all available ordering options and specifications. This is achieved by means of an electronic catalogue (see Figure 2.6.6.2.2 - 1). From this catalogue the customer can determine which article(s) to order. In the order message the Base Article Number and the chosen specifications are communicated.

Figure 2.6.6.2.2 – 1





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In the order confirmation the supplier may confirm that the article ordered can be manufactured (that is, that the buyer has made a correct combination of specifications). This should be the case assuming the customer has up-to-date database information. The order confirmation may also be used to notify the customer of the assigned article number. The assigned article number may be used in all subsequent communications. For example, the despatch advice and invoice messages use the assigned article number and, if required, the order number plus the order line number to establish an unambiguous link with the CSA.

The article produced may not be numbered with a string of numbers representing the Base Article Number plus the applicable specifications (see Section 2.6.6.3.3).

## 2.6.6.3 Allocating EAN.UCC System Numbers for Customer Specific Articles

### 2.6.6.3.1 General Rule

Each different product must be identified by a unique number. This implies that each variant of a product is assigned a different number. For example, each different size or colour of a garment has its own individual identification number. Article numbers should be sequentially allocated for this purpose.

### 2.6.6.3.2 Ordering of Customer Specific Articles

The ordering process of Customer Specific Articles (CSAs), the customer specification process, is based on a supplier's catalogue definitions. Internal identification systems are often manual and become increasingly complex and prone to error as the number of trading partners increases. In addition, the use of internal codes can be cumbersome, inflexible, and prone to duplication between different suppliers. These recommendations, which are based on the open systems principle, seek to avoid internally-based systems. Catalogue products using EAN.UCC System identification numbers are guaranteed to be uniquely identifiable worldwide.

A Customer Specific Articles *EANCOM*® User Profile for the price catalogue (PRICAT), orders (ORDERS), and the response to order (ORDRSP) messages has been published that utilises the numbering system outlined below.

#### 2.6.6.3.2.1 Base Article Number

A supplier assigned Base Article Number is given to each generic product type for ordering purposes. An EAN/UCC-13 Identification Number is used for this functionality. The EAN/UCC-13 ID Number is defined by the supplier and must be unique with respect to all other EAN.UCC System identification numbers. Because it does not identify an item, the Base Article Number will never be carried by a bar code symbol on an article. It is solely used for ordering purposes.

The Base Article Number indicates to the customer that a number of supplier defined questions have to be answered by the customer. These specifications (questions and associated answers), which are relevant to a Base Article Number, are communicated via an electronic catalogue. The specifications available for each different article are defined by the supplier.


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#### 2.6.6.3.2.2 Specifications

Specifications are linked to the different Base Article Numbers for the purposes of ordering. The same specifications may be used with different Base Article Numbers. Specifications fall into one of the categories described in the following subsections.

##### 2.6.6.3.2.2.1 Option

An option is a specification with a discrete value that is pre-defined by the supplier and associated with a Base Article Number.

Each option may be identified with an EAN/UCC-13 Identification Number. The EAN/UCC-13 Identification Number is defined by the supplier and must be unique with respect to all other EAN.UCC System identification numbers. An ID number of an option will never be carried by a bar code symbol on an article. It solely is used for communication purposes.

Options, such as red leather seat cover, may be valid for different base articles.

##### 2.6.6.3.2.2.2 Parameter

A parameter is a specification within a range of values (e.g., dimensions) ranging from a minimum to a maximum and including a step size.

Each parameter may be identified with an EAN/UCC-13 Identification Number. The EAN/UCC-13 Identification Number is defined by the supplier and must be unique with respect to all other EAN.UCC System identification numbers. The parameter identification will never be carried by a bar code symbol on an article. It is solely used for ordering purposes.

Parameters should be communicated using the standard EANCOM® syntax and should be related to a Base Article Number.

##### 2.6.6.3.2.2.3 Part

A part is a physical article that may also be ordered separately.

Parts are identified within Global Trade Item Identification Numbers™ (GTINs™) . The EAN/UCC-13 Identification Number for the part may be used in association with a Base Article Number to create a composite, an article made up of one or more individual parts.

A part may be associated with a number of different base articles.

##### 2.6.6.3.2.2.4 External References

An external reference is often required for a customer-designed or custom-made item. External references are specified through a separate, non-EDI communication channel, such as a fax or CAD/CAM drawing. A secondary source can be used to communicate a set of customer-defined specifications (not pre-defined by the supplier).


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#### 2.6.6.3.2.3 Data Carrier

EAN.UCC System identification numbers used to identify Customer Specific Articles (CSAs) for ordering purposes may never be carried by a bar code symbol on the physical article. However, suppliers may wish to utilise bar code scanning as part of the order process. This may be achieved by representing base articles and identification numbers in machine readable form in a paper catalogue. UCC/EAN-128 Bar Code Symbols, utilising an Application Identifier for internal applications, should be used for this purpose.

### 2.6.6.3.3 Identification of the Physical Article Actually Produced

In environments with automated systems the physical article needs to be identified and the identification of the produced article is required in machine readable form (as a bar code symbol). The identification of the physical article must be communicated from the supplier to the customer. Both supplier and customer should be able to use the same identification number and each needs to keep a record of this number.

For open systems, the most appropriate identification number is the EAN/UCC-13 Identification Number. Identifying a physical article with an EAN/UCC-13 ID Number and a bar code symbol allows Customer Specific Articles (CSAs) to be integrated within a system that manages all other items identified using the EAN.UCC System. During order confirmation, the supplier assigns an EAN/UCC-13 Identification Number to the product. It is not necessary to pre-assign numbers to all possible articles, only to those that are actually produced.

#### 2.6.6.3.3.1 Data Carrier

The bar code symbol requirements for Customer Specific Articles (CSAs) are the same as those for trade items. The data carrier used to carry the EAN.UCC System identification number of a physical article shall be one of the following:

- EAN-13 or UPC-A Bar Code Symbol
- ITF-14 Bar Code Symbol
- UCC/EAN-128 Bar Code Symbol (attribute information always uses UCC/EAN-128 Bar Code Symbols)

With CSAs, the choice of data carrier is left to the discretion of the organisation responsible for issuing the EAN.UCC System identification number. Trade items that will be scanned at a Point-of-Sale always should be marked using the EAN/UPC Symbology.

~~2.6.7Application of Global Identifier Serialised for Trade (GIST)~~

~~The Global Identifier Serialised for Trade (GIST) may be used to provide a standard identification number, that may then be bar coded on the physical product, for one-off traded products such as:~~

- ~~Highly complex Configure To Order products that are built only once to meet a specific customer order.~~
- ~~Intangible or unique items designed to meet an individual buyer's requirement.~~
- ~~Extracts of intellectual property that are traded.~~

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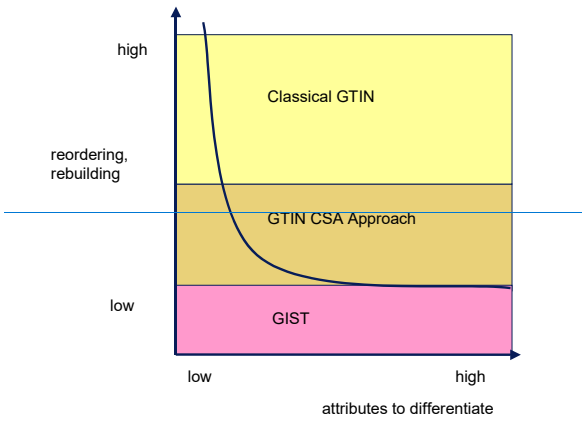
The GIST provides a unique data key that can be used to find all the details of the traded item, including the entire item's attributes, in the supplier's database. The GIST is the unique key used to access this information.

The GIST is typically assigned by the manufacturer (seller) of the product, and can then be communicated to the assembler and the buyer along with access to the master data. Until confirmed business need is substantiated no concrete application rules can be provided. The possible use of GIST is limited by the dominating concepts of GTIN™ and CSA (customer specified articles) approach, Figure 2.6.7-1 serves orientation purposes.

**Figure 2.6.7 – 1**




Note: The assignment of a unique product identification number, assigned at source by the manufacturer, has a potential impact on business applications.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## 2.6.7 Numbering and Symbol Marking for Document Control

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EAN International, in conjunction with representatives of user organisations, has developed this voluntary standard for applications of bar code symbols on documents and pre-defined forms.

This standard is based on the use of EAN.UCC System Application Identifiers and utilises UCC/EAN-128 Bar Code Symbols. It is a complement to, and should be read in conjunction with:

- Other sections of these specifications
- *EANCOM®*, the Electronic Data Interchange (EDI) standard providing implementation guidelines for UN/EDIFACT messages.
- XML (eXtensible Mark-up Language), an EAN.UCC supported application for data exchange.

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Organisations wishing to automate the processing of documents to ensure correct control procedures may use this standard as a basis to produce specific implementation guidelines pertinent to their exact application. The implementation guidelines in the following subsections consider issues such as domestic versus international requirements and local legal requirements.

### 2.6.7.1 Introduction

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#### 2.6.7.1.1 Business Demand for the Application

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The use of EAN.UCC System standards has led to major innovations in the retail sector. The EAN.UCC System family of bar code symbols has enabled automation at the Point-of-Sale (POS). Studies have shown that identifying goods with EAN.UCC System bar code symbols and ID numbers reduces the amount of time required to process a transaction, increases the accuracy of data, and enables efficient Electronic Data Interchange (EDI).

This success has led other industries to introduce the EAN.UCC System into their business processes. One such application of the EAN.UCC System is the automation of the control of documents.

Official organisations, like Government Ministries, Local Authorities, Insurance Organisations, Real Estate Registration Authorities, Freight Forwarders Associations, etc. are required to identify their documents and ensure internal controls are in place to provide full processes visibility. The information flow that accompanies the physical document is often communicated and/or stored in a variety of ways including the use of EDI (EANCOM or XML) communications. In practice, however, fully automated communication channels and data storage, that make it possible to rely exclusively on electronic files for retrieving information, are not always available.

For this reason, there may be a need to indicate relevant information on the document itself to help automate processing and provide a secure basis for control procedures. The various fields of information that must be communicated need to be organised in a standard way in order to facilitate their interpretation and processing by all the partners involved. The EAN.UCC System standards, based upon the use of UCC/EAN-128 Bar Code Symbols and the EAN.UCC Application Identifiers may be used to provide this standard solution as outlined in the guideline below.



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### 2.6.7.2 Potential Benefits

The potential benefits for using bar code symbols on documents include:

- Greater control of documents within each organisation.
- Traceability of documents through the process
- Reduced complexity by having a standard system that can be easily implemented by any interested party.
- Using bar code symbols to represent critical control data greatly reduces the possibility of key entry error.
- Ensure the world-wide unique identification of documents as an indispensable base for electronic documents.
- To help prevent misuse and fraud of official documents and improve acceptance.
- To ensure a consistent approach on both electronic and printed documents
- Provides an opportunity in some countries to offer new services

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### 2.6.7.3 Application Rules

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#### 2.6.7.3.1 Definition of a Document requiring Internal Control

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The term *document* is applied broadly to cover any official or private papers that infer a right (e.g. proof of ownership) or obligation (e.g. notification a call for military service) upon the bearer. The issuer of the document is normally responsible for all the information contained upon the document - both bar coded and human readable. Such documents typically require storage of the appropriate information contained on the document. Examples include:

- Land registration papers
- Tax demands
- Proof of shipment / receipt forms
- Custom's clearance forms
- Insurance policies
- Internal invoices.
- National press documents
- Educational papers
- Transporting company documents
- Mail companies documents
- Among others

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#### 2.6.7.3.2 Bar Code Symbology

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The UCC/EAN-128 Bar Code Symbol is used for Documents that require control. The bar code in no way replaces the need for Human Readable information.



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### 2.6.7.3.3 Bar Code Information

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#### 2.6.7.3.3.1 UCC/EAN-128 Symbol Requirements

To facilitate efficient scanning, all bar code symbols shall be printed at an X-dimension between 0.25 mm (0.00984 in.) and 0.495 mm (0.0195 in.) and be a minimum of 13 mm (0.5 in.) in height.

The information required for the internal Control of Documents should be carried by UCC/EAN-128 Bar Code Symbols.

#### 2.6.7.3.3.2 EAN.UCC Global Document Type Identifier

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The Application Identifier to indicate the Global Document Type Identifier is AI (253).

The Global Document Type Identifier is assigned by the document issuer. The Global Document Type is used as a key to access database information that is required for document control purposes (normally held by issuing organisation). The same Document Type is used for all document classes which are issued with an identical purpose. This can then be used to reference the characteristics of the document, such as:

- The issuer of the document
- The exact right or obligation the document imposes
- The document type (insurance policy, governmental paper, etc.)
- ....

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A different Document Type shall be used whenever characteristics of the document are different.

By their nature, each document needs to be individually tailored for the intended recipient and therefore requires a unique reference number in addition to the Document Type. Any duplicates of a document should use the same number as the original. The Serial Component is optional and assigned by the document issuer and is a unique number in a series of documents issued under the same Document Type. Ideally the Serial Component should be sequentially allocated for each new document generated.

The serial component is used to communicate exact details pertinent to the individual document such as:

- The name and address of the recipient
- The cross-reference to individual details
- ....

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## 2.6.7.4 Application Overview

### 2.6.7.4.1 Application Requirements

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These international guidelines outline the EAN.UCC System standards for documents used in an open environment. The guidelines provide information on how to use bar code symbols on documents and how they can help to provide internal controls.

Note: Legislation in certain countries may require additional controls.

### 2.6.7.4.2 Overview of Using Bar Code Symbols for Document Control

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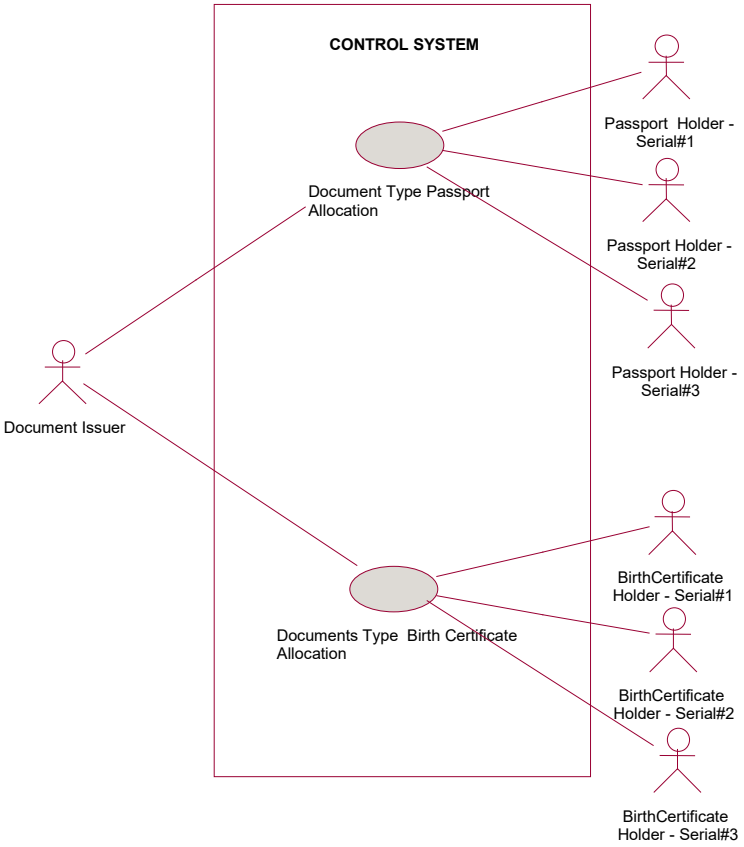
Figure 2.6.7.4.2 – 1





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Step 1: The document issuer assigns a unique Document Type for each of its document types that require control.

Step 2: For each document that is issued, a unique serial component is allocated if required.

Step 3: The document issuer provides a bar code symbol on the document. The Global Document Type Identifier, the combination of document type and serial component, provide a globally unique reference number that can be used for document control.

Step 4: The bar code containing the Global Document Type Identifier may be scanned to access the required information for a database whenever a query is required.



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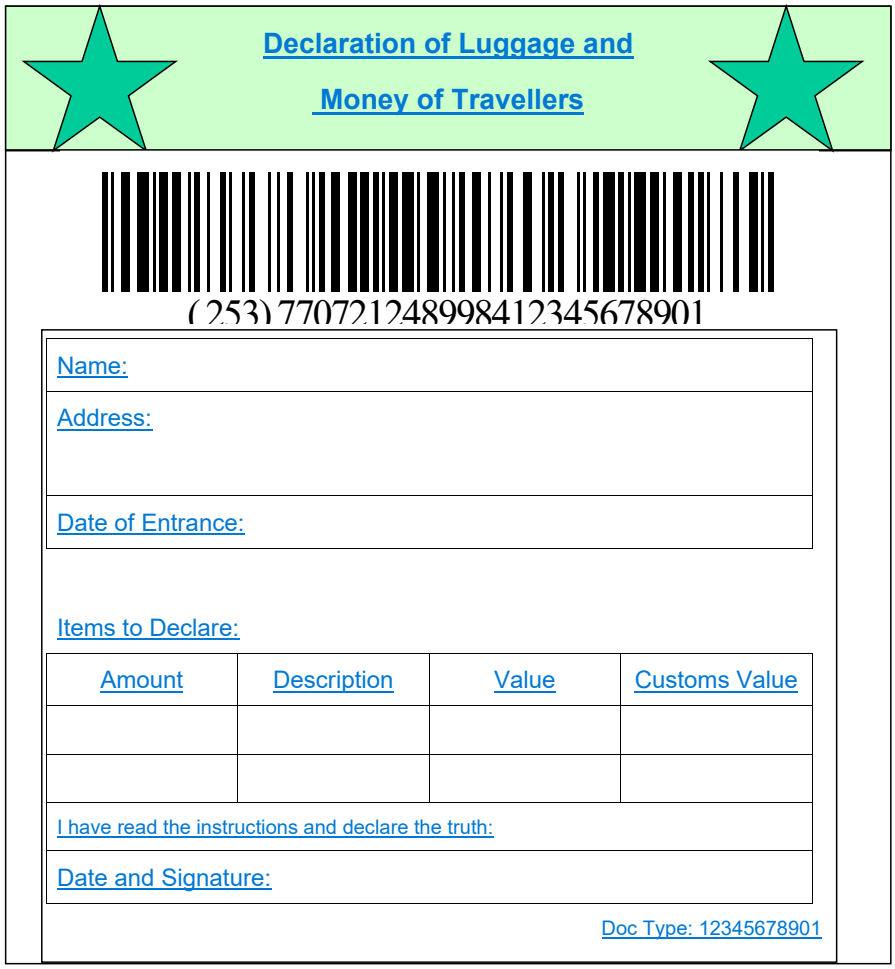
## 2.6.7.A.1 Appendix 1: Examples of Documents using UCC/EAN-128 Symbols for Internal Control

### Example 1: Legally required declaration prior to travel

This example shows how UCC/EAN-128 Bar Codes can be used to automate the capture of information for traveller who enters or leaves the country.

**Figure 2.6.7.A.1 - 1 Legally required travel declaration**





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**Example 2: Insurance Policy**

This example shows how UCC/EAN-128 Bar Codes can be used to automate the capture of information on Insurance Policies. This standard solution provides benefit for both the insurer, the insured, any potential beneficiaries as well as facilitating the automation of any monitoring and inspection of the requirement to fulfill the legal norms.

**Figure 2.6.7.A.1 - 2 Insurance Policy**

Policy Number:

67890543210987

Insurance Company

| | |
|---|---|
| **Branch:** Bogota | **Date of Policy:** March 23, 2005 |
| **Name:** Name of Insured | |
| **Age:** 24 | **Valid From**: March 23, 2005 |
| | **Valid To:** March 22, 2007 |
| **Contract Cover:** Life | **Value:** 10,000 |

**Date and Signature:**

(253)77099980001006789054321098 7

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**Example 3: Application Form**

This example shows how UCC/EAN-128 Bar Codes can be used to automate the capture of information on application forms. There are many organisations that require their clients to complete an application form: social clubs, unions, associations, universities, schools, etc.

**Figure 2.6.7.A.1 - 3 Membership Application Form**

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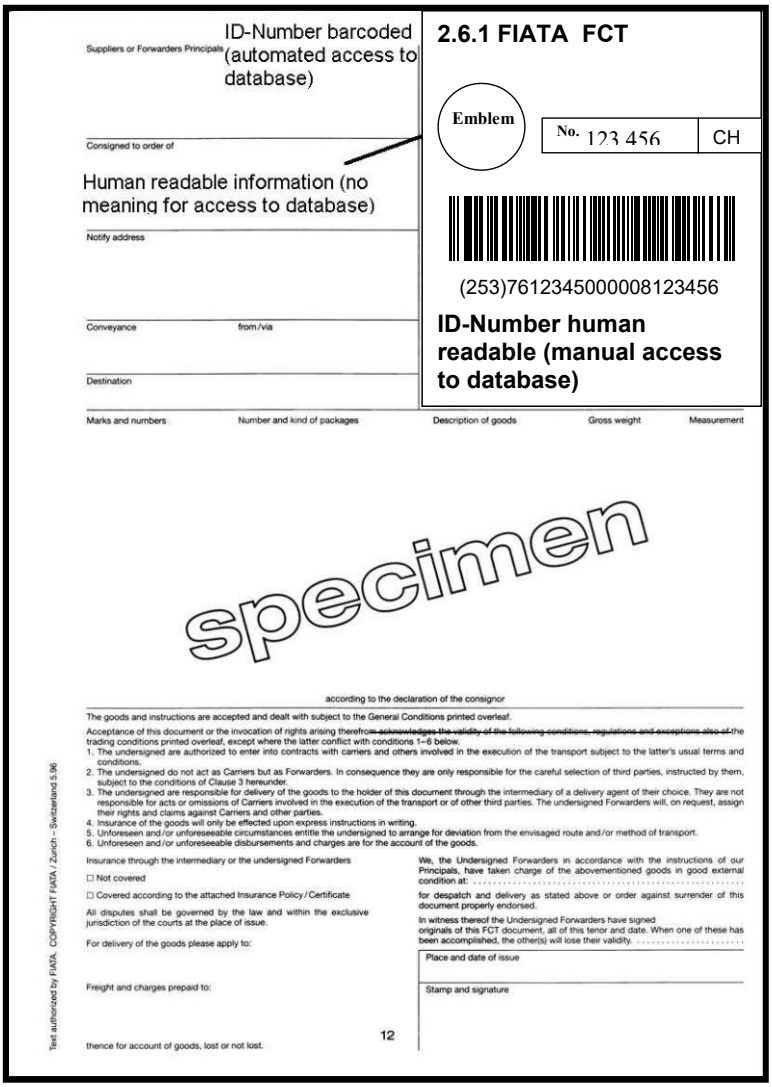
**Example 4: Freight-Forwarding Authorisation**

This example shows how UCC/EAN-128 Bar Codes can be used to automate the capture of information on Freight-Forwarding forms. There are many organisations that require documentary evidence that goods have been dispatched prior to making payment.

**Figure 2.6.7.A.1 - 4 Freight-Forwarding Authorisation**





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# Section 2.7:

# Numbering and Symbol Marking for Very Small Healthcare Items

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### 2.7.1 Introduction

The Reduced Space Symbology® (RSS), EAN.UCC System Composite Symbology®, and Data Matrix (see Section 5.5 and Section 5.6) were specially developed for applications where traditional bar codes symbols were limited or not available. The EAN.UCC System currently limits use of these symbologies~~, use, currently,~~ to very small healthcare items. This application guideline has been globally agreed ~~to as a stand-alone addition to the *General EAN.UCC Specifications*. Further work is underway to re-organise these specifications to allow for flexible use of new technologies according to business need. For this reason, this stand-alone application is not yet fully integrated with other sections~~.

Very small healthcare items are an application for which there exists no encoding method ~~today~~ with traditional EAN.UCC bar code standards. ~~Within the area of very small healthcare items, the unit-of-use items and unit dose items dispensed to the patient at the hospital bedside have a high importance for product identification~~Product identification for unit-of-use items and unit dose items dispensed at bedside is extremely important. The lack of automatic identification of pharmaceuticals and medical-surgical items leads to high manual effort and errors during administration, documentation, ~~or at the stock control~~and stocking or inventory.

The following guidelines provide the current best practice for use and application of ~~the Reduced Space~~RSS, Composite Symbology, and Data Matrix ~~Symbologies~~ symbologies in healthcare applications with limited space marking requirements.

### 2.7.2 Scope

#### 2.7.2.1 Purpose

These guidelines provide a foundation for the implementation of RSS-14™® Stacked, RSS Limited®™, RSS-14®™ Stacked Omnidirectional, Composite, and Data Matrix Symbologies in healthcare. They provide:

- Application requirements for RSS-14 Stacked, RSS Limited, RSS-14 Stacked Omnidirectional, Composite Component®, and Data Matrix Symbologies.
- Methods for evaluating RSS-14 Stacked, RSS Limited, RSS-14 Stacked Omnidirectional, Composite Component, and Data Matrix readability and scannability.

#### 2.7.2.2 Applicability

These guidelines are only for healthcare items. They apply to the appropriate use of RSS-14® Stacked, RSS Limited™, RSS-14 Stacked Omnidirectional, Composite Component®, and Data Matrix on healthcare items that are too small for other EAN.UCC System linear symbologies. The majority of uses for Reduced Space Symbology® (RSS) will be on very small items, such as vials, ampoules, very small bottles, and blister packs. The majority of uses for Data Matrix will be on very small items with limited printing area and medical-surgical items that lack a traditionally printable surface or area.

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#### 2.7.2.3 Who Should Use These Guidelines

These guidelines are written for the entire healthcare supply chain, from the label printer to the healthcare provider and everyone in between. They provide sufficient information to implement this technology, assuming that the hardware and software being used supports the RSS, ~~EAN.UCC Composite~~EAN.UCC Composite Symbology, and Data Matrix Symbologies according to *ITS/99-001:1999, ITS/99-002:1999,* and *ISO/IEC 16022*.

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### 2.7.3 References

The standards listed below are referenced in these guidelines. The relevant provisions contained in the referenced specifications constitute provisions of these guidelines.

| | |
|---|---|
| ITS/99-001:1999 | International Symbology Specification Reduced Space Symbology® (RSS) |
| ITS/99-002:1999 | International Symbology Specification EAN.UCC Composite Symbology™® |
| ISO/IEC 16022 | Information Technology – International Symbology Specification – Data Matrix |
| ISO/IEC 15416 | Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – Linear symbols |
| ISO/IEC 15415 | Information Technology – Automatic identification and data capture techniques – Bar code print quality test specification – 2D symbols |
| ISO 1073-2 | Alphanumeric character sets for optical recognition – Part 2: Character set OCR-B – Shapes and dimensions of the printed image |

### 2.7.4 Definitions

**Terms and definitions**

The terms and definitions provided here and those from the Glossary (see Section 8) apply to these guidelines:

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| | |
|---|---|
| bBar height | The dimension of a bar (line) measured from its top to its bottom. |
| bBar width | The thickness of a bar (line) measured from one of its edges to the other. |
| Bar Width Reduction / Increase | The uniform reduction / increase of each bar code symbol in the film Film master Master or digital image file to correct for anticipated bar growth / shrinkage in the imaging or printing process. |
| Very very Small small Healthcare healthcare Itemsitems | All kinds of very small pharmaceutical and medical products, mainly unit-of-use items and unit dose items, but also very small packages. |
| Selective selective Bar Height Reduction | The uniform Bbar height Height reduction Reduction of a bar code symbol in the film Film master Master or digital bar code file to correct for anticipated bar growth in the imaging or printing process. |
| dDirect Part part Markingmarking | Any method of directly marking (as opposed to applying) the part or surface. Sometimes abbreviated as DPM. |



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**Abbreviations**

| | |
|---|---|
| 2D | Two-dimensional |
| CC | Composite Component® |
| RSS | Reduced Space Symbology® |
| GTIN™ | Global Trade Item Number™ |
| YYMMDD | Expression of date – Year Year-/-Month Month-/-Date Date |

## 2.7.5 Marking Requirements

RSS-14® Stacked, RSS Limited®™ and RSS-14 Stacked Omnidirectional have been developed for small unit healthcare packages and are designed to encode the Global Trade Item Number™ (GTIN™). The optional Composite Component® can contain additional data elements that refer to that particular item. Data Matrix shall encode GTINs and can contain additional elements that refer to that particular item.

RSS-14 Stacked has the first priority to be used for identification of very small healthcare items. RSS Limited, RSS-14 Stacked Omnidirectional, or Data Matrix shall be used in exceptional cases for certain application requirements. The RSS Limited can be used if the item needs a relatively long but limited height symbol. RSS-14 Stacked Omnidirectional is designed for omnidirectional scanning environments.

In general, all participants of the healthcare supply chain shall be able to read and process all of these variants of RSS symbols.

Data Matrix should be used where printing area is .375 in." (9.525mm) square or smaller or where the marking area will preclude the application of ink (et al) thus requiring the symbol to be applied by means of "direct part marking".

**Marking & Reading (Scanning Requirements)**

| Symbology | Print Area Available | Print Density | Scanner Technology Required |
|---|---|---|---|
| RSS Stacked | 12.7 mm Xx 6.35 mm (0.5" in. x 0.25 in.") | ≥ 6.7 mil | Laser or Imaging sScanner |
| RSS Limited | 12.7 mm Xx 6.35 mm (0.5" in. x 0.25") in.) | ≥ 6.7 mil | Laser or Imaging Sscanner |
| RSS Stacked Omni-dDirectional | 12.7 mm Xx 25.4 mm (0.5" in. x 1.0 in.") | ≥ 8.0 mil | Retail sStyle Sslot Sscanner |
| Data Matrix | 9.525 mm (.375 in.") square | ≥10.05 mil | Imaging Sscanner |

Note: Data Matrix is not intended for general retail scanning.



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### 2.7.5.1 Mandatory Data Elements

Item level marking shall contain the Global Trade Item Number™ (GTIN™) in the RSS-14® Stacked Symbol (or in the RSS Limited™, RSS-14 Stacked Omnidirectional, or Data Matrix Symbol depending on the application requirements previously described ~~above~~).

### 2.7.5.2 Optional Data Elements

An item may also contain a symbol encoding secondary attribute data. It is recommended to adopt the expiry date and the lot number in the encoded data. Expiry date and ~~Lot~~ lot ~~Number~~ number must, legally, be expressed minimally in ~~human readable~~Human Readable Interpretation on the label or package. Automatic handling (scanning and electronic delivery) of this data facilitates many maintenance and documentation duties. Within the Composite Component® and Data Matrix, the secondary information is structured according to the rules of the UCC/EAN 128 Bar Code Symbol Application Identifier (AI) ~~Concept~~concept. ~~Refer to the *General EAN.UCC Specifications* for complete Application Identifier information.~~

Neither Composite Component nor Data Matrix is omnidirectionally scannable using a retail style slot scanner and, therefore, ~~not~~ neither is suitable for retail applications. Nevertheless, the automatic handling of secondary data offers several possibilities and benefits ~~which~~ that may become important even in retail applications (e.g., scanning of best before or expiry dates, lot numbers in case of recalls).

**Example[1]:** RSS-14® Stacked Composite Symbol, Global Trade Item Number™ (GTIN™) in RSS-14 Stacked, ~~Application Identifiers~~AIs (17) e~~E~~xpiry ~~Date~~date, and (10) ~~Lot~~ lot ~~Number~~ number in Composite Component A

(17)050101(10)ABC123

(01)04012345678901

**Example:** RSS Limited™ Composite Symbol, GTIN in RSS Limited, ~~Application Identifier~~AIs (17) ~~Expiry~~ expiry ~~Date~~date, and (10) ~~Lot~~ lot ~~Number~~ number in Composite Component A

(17)050101(10)ABC123

(01)04012345678901

**Example:** RSS-14 Stacked Omnidirectional Composite Symbol, GTIN in RSS-14 Stacked Omnidirectional, ~~Application Identifier~~AIs (17) ~~Expiry~~ expiry ~~Date~~date, and (10) ~~Lot~~ lot ~~Number~~ number in Composite Component A

(17)050101(10)ABC123

(01)04012345678901

[1] Please note that all symbol examples shown in these guidelines are for illustration purposes and do not correspond to the metrics described ~~in Chapter 2.6.7.6.2.1.1~~elsewhere.



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**Example:** Data Matrix Symbol, GTIN, ~~Application Identifier~~AIs (17) ~~Expiry~~ expiry ~~Date~~date, and (10) ~~Lot~~ lot ~~Number~~number

(17) 050101 (10) ABC123

(01) 04012345678901

## 2.7.6 Data Representation

### 2.7.6.1 Syntax

#### 2.7.6.1.1 Mandatory GTIN™

The data syntax for the mandatory Global Trade Item Number™ (GTIN™) is:

- A two-digit Application Identifier (AI) (01) indicating a GTIN
- A ~~14-~~14-~~digit~~ GTIN

As the RSS-14® Stacked, RSS Limited™ and RSS-14 Stacked Omnidirectional always exclusively contain a GTIN, the ~~Application Identifier~~AI (01) indicating a GTIN is not encoded in these RSS symbols. It must be noted that for Data Matrix, FNC1 (Function Code 1) must be encoded first to indicate a symbol within the EAN.UCC System.

The 14-digit GTIN is structured as follows:

- A one-digit Indicator (value from 0 to 9). However, only 0 to 8 can be used as 9 is the variable measure prefix. The RSS Limited is restricted to the GTIN with Indicator value "0" or "1".
- The EAN.UCC Company Prefix (or the UCC Company Prefix)~~Company Prefix~~
- The Item Reference (designated by the holder of the EAN.UCC Company Prefix (or the UCC Company Prefix)~~Company Prefix~~)
- A Check Digit (calculated from the first 13 digits of the GTIN)

#### 2.7.6.1.2 Optional Data

Any optional data shall be contained in the 2D Composite Component®, or following the Global Trade Item Number™ (GTIN™) in a Data Matrix Ssymbol. The data syntax for each of the optional data fields is:

- A two- to four-digit Application Identifier (AI) to indicate data type and field size
- The data indicated by the ~~Application Identifier~~AI. This may be a fixed or variable length field, depending ~~upon~~ on the ~~Application Identifier~~AI.

Multiple ~~Application Identifier~~AI data elements may be concatenated in a single 2D Composite Component message~~,~~ or in a Data Matrix Ssymbol. Note that if a Data Matrix Ssymbol is used, the optional data must follow the GTIN information.

All ~~Application Identifiers~~AIs of pre-defined length[2] should precede the variable field ~~Application Identifiers~~AIs for the most efficient encoding. The FNC1 (Function Code 1) separator character shall separate variable length ~~Application Identifier~~AI fields. ~~Refer to the *General EAN.UCC Specifications* for guidelines on concatenation and for a complete list of EAN.UCC Application Identifiers.~~

In healthcare applications, the following ~~Application Identifier~~AI elements should be used ~~as~~ because this data is legally required ~~information~~ and implies certain liabilities:

[2] See ~~Chapter~~ Section 7.9.2

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**Expiry (Expiration) Date:**

The data syntax for the expiry date is n2 + n6:

- A two-digit ~~Application Identifier~~AI (17) indicating the maximum durability date
- A fixed length field of six digits indicating expiry date as YYMMDD

**Lot ~~/~~ Batch Number:**

The data syntax for the lot number is n2 + an..20:

- A two~~-~~ digit ~~Application Identifier~~AI (10) indicating lot number
- A variable length field of up to ~~twenty~~ 20 alphanumeric characters of lot number data

## 2.7.6.2 Symbol Metrics

### 2.7.6.2.1 RSS & Data Matrix

#### 2.7.6.2.1.1 X-Dimension (Module Size) and Symbol Height (Y Dimension)

| Symbol(s) Specified | X-Dimension mm (inches) | | | Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | | *Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | Right | |
| RSS-14® Stacked | 0.170 (0.0067 in.") | 0.20 (0.008 in.") | 0.41 (0.016 in.") | 2.21 (0.087 in.") | 2.64 (0.104 in.") | 5.28 (0.208 in.") | *Not Applicable* | *Not Applicable* | 1.5/06/670 |
| RSS Limited™ | 0.170 (0.0067 in.") | 0.20 (0.008 in.") | 0.41 (0.016 in.") | 1.70 (0.067 in.") | 2.03 (0.080 in.") | 4.07 (0.160 in.") | *Not Applicable* | *Not Applicable* | 1.5/06/670 |
| RSS-14 Stacked Omni-directional | 0.170 (0.0067 in.") | 0.20 (0.008 in.") | 0.41 (0.016 in.") | 11.73 (0.4623 in.") | 13.8 (0.552 in.") | 28.51 (1.104 in.") | *Not Applicable* | *Not Applicable* | 1.5/06/670 |
| Data Matrix | 0.255 (0.01005 in.") | 0.3 (0.012 in.") | 0.615 (0.024 in.") | Entirely dependent on quantity of data encoded | | | Symbol must be surrounded by a 1X Quiet Zone | | 1.5/06/670 |

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* See Section 2.7.7 for full details on ~~M~~minimum ~~q~~Quality ~~S~~specifications.

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#### 2.7.6.2.1.2 Symbol Size

##### 2.7.6.2.1.2.1 RSS-14™ ® Stacked

This symbol is, at minimum, 50X (50 modules) wide by 13X (13 modules) high. The top row is 5X (5 modules) high and the bottom row is 7X (7 modules) high. The separator pattern between rows is, at minimum, 1X (1 module) high. No Quiet Zones are required. The adjacent background colour can be the same as the guard bar, light on the left and dark on the right side of the symbol respectively.

##### 2.7.6.2.1.2.2 RSS Limited™

This symbol is 74X (74 modules) wide by a minimum of 10X (10 modules) high. No Quiet Zones are required. The adjacent background colour can be the same as the guard bar, light on the left and dark on the right side of the symbol respectively.



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#### 2.7.6.2.1.2.3 RSS-14™® Stacked Omnidirectional

This symbol is, at minimum, 50X (50 modules) wide by 69X (69 modules) high. Each is 33X (33 modules) high minimum, with a 3X (3 modules) high separator pattern between the two rows. No Quiet Zones are required. The adjacent background colour can be the same as the guard bar, light on the left and dark on the right side of the symbol respectively.

#### 2.7.6.2.1.2.4 Composite Component™®

The X-dimension shall be nominally the same as the X-dimension of the associated primary Reduced Space Symbology® (RSS) linear symbol. The overall dimensions of the Composite Component® depend ~~upon~~ on the data content. See *International Symbology Specification EAN.UCC Composite Symbology*™ for details on calculating the dimension of a specific Composite Component Symbol and the allowed tolerances between the linear and the C~~c~~omposite C~~c~~omponent.

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#### 2.7.6.2.1.2.5 Data Matrix

The X-~~Dimension~~ dimension shall be nominally 1.5X as the X-~~Dimension~~ dimension of a like Reduced Space Symbology® (RSS) ~~RSS~~ linear symbol. The overall dimensions of the Data Matrix Symbol depend ~~upon~~ on the data content. See *ISO/IEC 16022 Information Technology - International Symbology Specification - Data Matrix* for details on calculating the dimensions of a specific Data Matrix Symbol.

### 2.7.6.3 Human Readable Interpretation

#### 2.7.6.3.1 RSS

#### 2.7.6.3.1.1 Location

The Global Trade Item Number™ (GTIN™) shall be printed in human-readable form underneath the symbol.

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**Example:** RSS-14® Stacked Symbol containing the GTIN

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(01)04012345678901

#### 2.7.6.3.1.2 Font

A clearly legible font shall be used for the human-readable digits (~~,~~ e.g., OCR-B as defined in *ISO 1073-2*). Reasonable alternative type fonts and character sizes are acceptable provided the interpretation is clearly legible. The font should be ~~one that is considered as~~ suitable and compatible with other printed materials. When necessary, the font used shall be in accordance with applicable government laws and regulations.

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#### 2.7.6.3.1.3 Format

The Global Trade Item Number™ (GTIN™) ~~GTIN~~ shall be printed as a single 14-digit number proceeded by the corresponding Application Identifier (AI) (01) enclosed in ~~a parenthesis~~parentheses. Although the ~~Application Identifier~~AI (01) is not encoded in the Reduced Space Symbology® (RSS), it shall be printed to ensure the consistent and unambiguous interpretation of data in the case of a Composite Component® Symbol. The parentheses are not part of the data and are not encoded in the bar code symbol.

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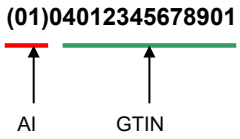


#### 2.7.6.3.1.4 Data Overflow

There will be instances where there is insufficient space on the very small healthcare item for the Reduced Space Symbology®~~RSS~~ (RSS) Symbol and the human readable Global Trade Item Number™ (GTIN™)~~GTIN~~. When this situation occurs and this information is already printed on the label because of government mandates or by trade practice, then, at the supplier's discretion and in accordance with applicable government regulations, the identification number's Human Readable Interpretation requirement can be waived.

For a consistent representation of the GTIN printed independently from the symbology, the EAN.UCC System data title should be used. For example:

| AI | Full Title | Data Title |
|---|---|---|
| 01 | Global Trade Item Number | GTIN |

### 2.7.6.3.2 Composite Component®™

#### 2.7.6.3.2.1 Location

If there is sufficient space to print the ~~human~~ Human ~~readable~~ Readable ~~interpretation~~ Interpretation of the ~~composite~~ Composite ~~component~~Component®, it shall be printed above the symbol in proper sequence of the Application Identifiers (AIs) (the Reduced Space Symbology® (RSS) Human Readable Interpretation is printed below). The data shall be printed from top to bottom and left to right. A single ~~Application Identifier~~AI with accompanying data shall be displayed on one line and not broken into two lines.

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**Example:** RSS-14® Stacked Composite Symbol - Global Trade Item Number™ (GTIN™) ~~GTIN~~ printed below RSS-14 Stacked, ~~Application Identifiers~~AIs (17) e~~E~~xpiry ~~Date~~ date and (10) ~~Lot~~ lot ~~Number~~ number printed above the Composite Component in one single line.

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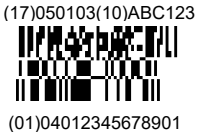
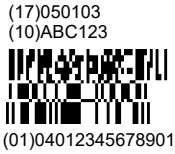



**Example:** RSS-14 Stacked Composite Symbol – GTIN printed below RSS-14 Stacked, ~~Application Identifiers~~ (AIs (17) ~~Expiry~~ expiry ~~Date~~ date and (10) ~~Lot~~ lot ~~Number~~ number printed above the Composite Component from top to bottom and left to right.



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#### 2.7.6.3.2.2 Font

The font should be ~~one that is considered as~~ suitable and compatible with other printed materials and the Reduced Space Symbology® (RSS) ~~RSS~~ Human Readable Interpretation. The font size should be scaled for easy legibility. The font used shall be in accordance with applicable government laws and regulations.

#### 2.7.6.3.2.3 Format

The data should be printed with the proceeding Application Identifiers (AIs) enclosed in ~~parenthesis~~parentheses. The order of the data should be the same as encoded in the Composite Component® according to the rules in the *General EAN.UCC Specifications*. The parentheses are not part of the data and are not encoded in the bar code symbol, though the AIs are.

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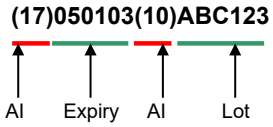


#### 2.7.6.3.2.4 Data Overflow

On many packages there will be insufficient space to print both the Human Readable Interpretation for Reduced Space Symbology® (RSS) ~~RSS~~ (Global Trade Item Number™ (GTIN™)) ~~(GTIN)~~ and the Composite Component® information. Printing the RSS (GTIN) or Data Matrix information shall take precedence over the Human Readable Interpretation for the Composite Component or the remainder of data encoded in the Data Matrix Symbol.

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The GTIN, expiry date, and lot number are already routinely printed on the label because of government mandates or by trade practice. ~~In the case that~~ If there is no space for printing the encoded data above or below the symbol, the data not belonging directly to the symbology should be consistently represented using the EAN.UCC System data titles. For example:

| AI | Full Title | Data Title |
|---|---|---|
| 01 | Global Trade Item Number | GTIN |
| 17 | Expiration Date | USE BY or EXPIRY |
| 10 | Batch or Lot Number | BATCH/LOT |

**Note:** If the RSS Composite Symbol fails to scan, manual input of the data is necessary. As expiry date and lot number should always be part of the information stored in the Composite Symbol and as this information is already printed on the label because of legal requirements, a software solution can be implemented to prompt the user for this data after keying in the GTIN.

### 2.7.6.3.3 Data Matrix

#### 2.7.6.3.3.1 Location

The Global Trade Item Number™ (GTIN™) ~~GTIN~~ shall be printed in human-readable form underneath the symbol.



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If there is sufficient space to print the ~~human~~ Human ~~readable~~ Readable ~~interpretation~~ Interpretation of the optional attribute data it shall be printed above the symbol in proper sequence of the Application Identifiers (AIs). The data shall be printed from top to bottom and left to right. A single ~~Application Identifier~~AI with accompanying data shall be displayed on one line and not broken into two lines.



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#### 2.7.6.3.3.2 Font

A clearly legible font shall be used for the human-readable digits~~,~~ (e.g., OCR-B as defined in *ISO 1073-2*). Reasonable alternative type fonts and character sizes are acceptable provided the interpretation is clearly legible. The font should be ~~one that is considered as~~ suitable and compatible with other printed materials. When necessary, the font used shall be in accordance with applicable government laws and regulations.

#### 2.7.6.3.3.3 Format

The Global Trade Item Number™ (GTIN™) ~~GTIN~~ shall be printed as a single 14-digit number proceeded by the corresponding Application Identifier (AI) (01) enclosed in ~~a parenthesis~~parentheses.

**(01)04012345678901**

AI GTIN

The optional attribute data should be printed with the proceeding AIs enclosed in ~~parenthesis~~parentheses. The order of the data should be the same as encoded in the Composite Component® according to the rules in the *General EAN.UCC Specifications*. The parentheses are not part of the data and are not encoded in the bar code symbol, though the AIs are.

**(17)050103(10)ABC123**

AI Expiry AI Lot

### 2.7.7 Print Quality

The minimum print quality grade for RSS-14® Stacked, RSS Limited™ and RSS-14 Stacked Omnidirectional Symbols in healthcare applications shall be a 1.5/6/670 overall symbol grade when measured in accordance with *ISO/IEC 15416*. The measurement of the quality parameters shall be made by a verifier conforming ~~with~~to *ISO/IEC 15416*, using a 0.15 mm (0.006 in.) aperture at a nominal illumination wavelength of 670 ~~nanometers~~nanometres. According to this standard, minimum print quality requirements are shown in the form:

**1.5 / 6 / 670**

where 1.5 is the overall symbol quality grade (sometimes expressed as letter grade “C”)
6 is the measuring aperture reference number (corresponding to an 0.15 mm or 0.006 in. diameter aperture)
670 is the peak response wavelength in ~~nanometers~~nanometres.

For the 2D Composite Component®, ink spread in the direction of the bar y-axis (perpendicular to the bar width or x direction) requires a compensating Bar Width Reduction in the y direction.

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### 2.7.8 Label Location

General principles on placement of bar code labels are described in Section 6 and apply to the label location of Reduced Space Symbology® (RSS)/Composite Symbols.

The majority of uses for RSS will be on very small items with curved surfaces, such as vials, ampoules, and very small bottles. For guidance in locating the RSS/Composite Symbol on curved surfaces, refer to Section 6.2.3.2.

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# Section 2.8:

# Numbering and Direct Part Marking Using Data Matrix (ECC 200)

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## 2.8.1 Introduction

These guidelines provide the generic requirements for applying Data Matrix symbols to items using direct part marking (DPM). Direct part marking refers to the process of marking a symbol on an item using an intrusive or non-intrusive method.

Guidelines for specific application guidelines that may have additional requirements are listed in the reference section. In lieu of specific industrial or retail applications, these guidelines will provide the minimum requirements.

The use of Data Matrix in direct part marking applications is endorsed by EAN.UCC for those applications that require permanent marking for cradle-to-grave history of the part's lifecycle.

### 2.8.1.1 Criteria for Direct Part Marking

- Traceability at the component level is required to ensure product integrity.
- The component identification number is required to be tracked through the manufacturing process and throughout the lifecycle of the product.
- The component or product is in harsh operational and overhaul environments.
- Adherent materials (e. g., labels) are prohibited on the component or product.
- The area allotted for the bar code symbol is limited and poses a problem for other methods.
- Permanent marking is required.

### 2.8.1.2 Guidance for Symbology Selection with Direct Part Marking Process

Use Data Matrix if:

- The use of Data Matrix is allowed in the application specification.
- The marking method will not produce an acceptable linear symbol but will produce an acceptable Data Matrix, e.g., dot peen marking and high-speed ink jet.
- An EAN.UCC key plus attribute element string are to be encoded
- Data Matrix is the only symbology that will fit on the item at the application specified X-dimension.
- Low contrast signal is expected from the application.
- The use of 2D (two-dimensional) array scanners and/or vision systems are specified exclusively for the application and can read Data Matrix.



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## 2.8.2 References

The standards listed below are referenced in these guidelines. The relevant provisions contained in the referenced specifications constitute provisions of these guidelines.

ISO/IEC 16022 Information Technology- International Symbology Specification – Data Matrix

ISO/IEC 15415 Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – 2D symbols

ISO/IEC 15416 Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – linear symbols

ISO 1073-2 Alphanumeric character sets for optical recognition – Part 2: Character set OCR-B – Shapes and dimensions of the printed image

The industrial standards listed below provide guidance on the direct part marking process.

SAE AS9132 Data Matrix (2D) Coding Quality Requirements for Parts Marking

NASA-STD-6003A Application of Data Matrix Identification Symbols to Aerospace Parts Using Direct Part Marking Methods/Techniques

## 2.8.3 Definitions

### 2.8.3.1 Terms and Definitions

The terms and definitions provided here and those from the glossary (see Section 8) apply to these guidelines:

| | |
|---|---|
| Dot | A localized region with a reflectance, which differs from that of the surrounding surface. |
| Cell | The area within a Data Matrix symbol where a mark may be placed to indicate a binary value |
| Intrusive marking | Marking by removing or altering substrate material |
| Non-Intrusive marking | Does not alter the substrate material, and usually adds to that surface. |
| Peen | Hemispherical or wedged shaped instrument that is mechanically driven to produce a dot on the surface |



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### 2.8.3.2 Abbreviations

| | |
|---|---|
| 2D | Two-dimensional |
| DPM | Direct Part Marking |
| GALE | Gas Assisted Laser Etching |
| LISI | Laser Inductive Surface Improvement |
| LIVD | Laser Induced Vapor Deposition |

## 2.8.4 Data Requirements

In general, all participants in the supply chain shall be able to read and process all of variants of symbols based on ECC 200 that include mandatory and agreed to optional data elements.

### 2.8.4.1 Mandatory Data Elements

Data Matrix must minimally encode a Function Code One (FNC1) and an EAN.UCC Key with its associated Application Identifier (AI). Some common examples for EAN.UCC keys that can be directly marked with Data Matrix include:

- (01) GTIN (Global Trade Item Number)
- (8003) GRAI (Global Returnable Asset Identifier
- (8004) GIAI (Global Individual Asset Identifier)

### 2.8.4.2 Optional Data Elements

Using Application Identifiers, additional elements that refer to the particular key can be encoded using similar rules to concatenate AI's as documented in section 4.0.

Refer to Section 3 of the *General EAN.UCC Specifications* for a complete description of Application Identifiers.

For Example:

- Healthcare: Using AI's (17) and (10) with GTIN
- Parts Identification: Using AI (21) with GTIN



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Figure 2.8.4.2-1

Example of Data Matrix Symbol Encoded with GTIN and AI's (17) and (10) per Section 2.7

(17) 050101 (10) ABC123

(01) 04012345678901

Figure 2.8.4.2-2

Example of Data Matrix Symbol Encoded with GTIN and Serial Number AI (21)

(21) ABCDEFG123456789

(01) 04012345678901

## 2.8.5 Marking Methods

It is important to analyse the selected method of marking in relation to several considerations:

- Finishes that cause an excess of shadowing or glare
- Surfaces that do not provide sufficient contrast - less than 20% difference in surface reflectance.
- Safety critical parts that can not be marked with intrusive methods
- Marking method must comply with the users requirements
- Location of the symbol should not be:
    - In direct air/water etc. streams
    - On sealing surfaces
    - On surfaces subject to wear or exposure to heavy contact



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### 2.8.5.1 Intrusive (Subtractive Methods)

Intrusive marking refers to methods that remove or alter the material of the host.

- Abrasive blast
- Dot peen
- Electro-chemical marking, colouring or etching
- Engraving/milling
- Fabric embroidery/weaving
- Direct laser marking
- Laser shot peening
- Laser Inducted Surface Improvement (LISI)
- Gas Assisted Laser Etch (GALE)
- Laser Induced Vapor Deposition (LIVD)

### 2.8.5.2 Non-Intrusive (Additive Methods)

Non-Intrusive marking does not affect the host material; it usually involves the addition of material.

- Cast, forge, mold
- Inkjet
- Laser bonding
- Liquid metal jet
- Silk screen
- Stencil

### 2.8.5.3 Host (Substrate) Surface

Direct part marking of Data Matrix should be reserved for surfaces no rougher than 250 micro-inches (millionths of an inch) and for surfaces that are no smoother than 8 micro-inches. Surfaces that fall outside these parameters need to be re-surfaced or marked using an alternative method.

Consideration of the surface colour must be taken. A minimum 20% difference in contrast between the host and the symbol is required.



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Altering the cell size in relation to the surface roughness should provide adequate contrast on cast surfaces.

(Cell size = (6E –05 X Roughness) + 0.0067) (See Table 2.8.5.3-1)

Table 2.8.5.3-1

| Average Roughness | Cell Size Minimum |
|---|---|
| .508 micrometers (20 micro inches) | .1905mm (.0075”) |
| 1.524 micrometers (60 micro inches) | .2286mm (.009”) |
| 3.048 micrometers (120 micro inches) | .381mm (.015”) |
| 5.08 micrometers (200 micro inches) | .508mm (.020”) |
| 7.62 micrometers (300 micro inches) | .635mm (.025”) |
| 10.668 micrometers (420 Micro inches) | .762mm (.030”) |

## 2.8.5.4 Substrate Surface Thickness

A minimum host surface thickness is recommended as is a maximum marking depth. Both are outlined in the table below.

Table 2.8.5.4-1

| Method | Min. Thickness | Max Marking Depth |
|---|---|---|
| Dot Peen | (.04”) | (.004”) |
| Laser Shot peening | (.020”) | (.002”) |
| Laser Bonding | (.001”) | Surface Mark |
| Abrasive Blast | (.003”) | (.0003”) |
| Electro-Chemical Colouring | (.02”) | (.002”) |
| Laser Etch | (.03”) | (.003”) |
| LISI | (.04”) | (.004”) |
| Laser Engraving | (.05”) | (.005”) |
| Electro-Chemical Etch | (.100”) | (.01”) |
| Micro-Milling | (1.250”) | (.125”) |



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## 2.8.6 Symbol Metrics

### 2.8.6.1 X and Y Dimensions

Some sources express the height of the 2D cell in terms of a Y dimension. For Data Matrix the cells are considered the same size under optimal print conditions so that X = Y. Consult System Symbol Specification Table 7: 2D Symbols Using Data Matrix, Figure 5.4.2.8-8, for minimum and maximum printing densities and other sizing requirements. Symbol size is determined by the amount of data and the number of rows and columns required to encode the data for the printing density selected. Consult Section 5.6 and Tables 5.6.3.2-1 and 5.6.3.2-2

### 2.8.6.2 Human Readable Interpretation

#### 2.8.6.2.1 Location

If printed, the GTIN shall be printed in human-readable form underneath the symbol.

If there is sufficient space to print the human readable interpretation of the optional attribute data, it shall be printed above the symbol in proper sequence of the Application Identifiers. The data shall be printed from top to bottom and left to right. A single Application Identifier with accompanying data shall be displayed on one line and not broken into two lines.

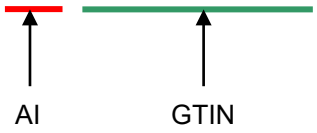
#### 2.8.6.2.2 Font

A clearly legible font shall be used for the human-readable digits, e.g. OCR-B as defined in *ISO 1073-2*. Reasonable alternative type fonts and character sizes are acceptable provided the interpretation is clearly legible. The font should be one that is considered suitable and compatible with other printed materials. When necessary, the font used shall be in accordance with applicable government laws and regulations.

#### 2.8.6.2.3 Format

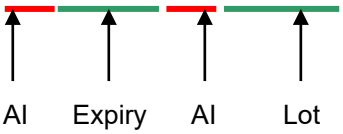
The GTIN shall be printed as a single 14-digit number proceeded by the corresponding Application Identifier (01) enclosed in a parenthesis.

**(01)04012345678901**




The data should be printed with the proceeding AI's enclosed in parenthesis. The order of the data should be the same as encoded in the Data Matrix symbol according to the rules in the *General EAN.UCC Specifications*. The parentheses are not part of the data and are not encoded in the bar code symbol, though the AI's are.

**(17)050103(10)ABC123**



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### 2.8.6.3 Symbol Quality

The minimum Symbol quality grade for Data Matrix Symbols shall be specified by the application specification. The measurement of the quality parameters shall be made by a verifier conforming to *ISO/IEC 15415.* According to this standard an overall grade is shown in the form:

**Grade/Aperture/Light/Angle**

Where:

- "Grade" is the overall symbol quality grade as defined in *ISO/IEC 15415*. For Data Matrix, the grade number may be followed by an asterisk, *, which indicates that the surroundings of the symbol contain extremes of reflectance that may interfere with reading. For most applications, this should be specified as causing the symbol to fail.

- "Aperture" is the aperture reference number (from *ISO/IEC 15416* for linear scanning techniques, or the diameter in thousandths of an inch [rounded to the nearest thousandth]).

- "*Light"* defines the illumination: a numeric value indicates the peak light wavelength in nanometers (for narrow band illumination); the alphabetic character W indicates that the symbol has been measured with broadband illumination ("white light") the spectral response characteristics of which must imperatively be defined or have their source specification clearly referenced.

- *"Angle"* is an additional parameter defining the angle of incidence (relative to the plane of the symbol) of the illumination. It shall be included in the reporting of the overall symbol grade when the angle of incidence is other than 45°. Its absence indicates that the angle of incidence is 45°.

The aperture is normally specified as being 80% of the minimum X-dimension allowed for the application. The printing method must produce the Data Matrix "L" pattern with gaps between the dots less than 25% of the specified aperture. If symbols with greater than the minimum X dimension are allowed by the application, the same absolute maximum gap dimension must be maintained.

### 2.8.6.4 Location

General principles on placement of bar codes are described in Section 6 and apply to the location of Data Matrix Symbols.

The majority of uses for these symbols will be on very small items with curved surfaces such as vials, ampoules, and very small bottles. For guidance in locating these symbols on curved surfaces, refer to Section 6.2.3.2.

## 2.8.7 Scanning Requirements

Data Matrix requires a two-dimensional imaging scanner or vision system to read the Data Matrix symbol. Data Matrix is not omni-directionally scannable using a retail style slot scanner. Handheld laser scanners or linear array imagers cannot scan Data Matrix.



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# Section 4.0:

# Association of Element Strings to Form Valid Messages

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## 4.1 Introduction

The main purpose of automatic data capture (ADC) is to replace manual entry of visually captured information. This implies that an ADC message has to provide all information required for a transaction without human intervention. EAN.UCC System data may be used, for example, to record entities in computer files, to sort goods on conveyor belts, to check completeness of a consignment, to verify dates, and to record physical stock taking.

Element Strings may be applied directly on physical goods or printed in catalogues or documents. The scanning source and the type of transaction determine the required information in a given business application. Since all ADC data is being used in Electronic Data Processing (EDP) applications, strict validation of data to be processed is an absolute prerequisite.

For correct processing of scanned data, certain business applications may require the association of Element Strings representing a particular combination of identification data. The EAN.UCC System enables users to achieve the needed level of data accuracy through the use of adequate Element Strings.

The logical set up of the data standard of the EAN.UCC System enables system users to validate scanned data messages (see Section 7.0, System Processing in EDP Applications).

Validation is effected on two levels. The first is validation of the data for conformity with system rules (e.g., to provide a message that contains all information to be processed logically without human intervention). The second level is validation of the data for conformity with the requirements of a particular business application.

Figures 4.3 – 1 and 4.4 - 1 show the rules for the first verification level (e.g., validate data to conform with the system logic). Figure 4.3 - 1 defines the pairs of Element Strings that cannot appear on the same physical entity. Figure 4.4 – 1 defines the Element Strings that mandate the appearance of another Element String on the same physical entity. All other combinations of Element Strings are possible at the first level of verification, although they may not make sense at the second, the application level.

## 4.2 Basic Considerations

The Element Strings that require specialised software and/or scanner set up are not covered by these rules. These are the Element Strings with EAN.UCC Prefixes 0001 to 0007, 02, 04, 05, 20 to 29, 980, and 99; EAN/UCC-8 Prefixes 0 and 2; two-digit and five-digit Add-On Symbols; and AIs (8100) to (8102).

Duplicate Element Strings appearing on the same physical entity must have the same value.

In Figures 4.3–1 and 4.4–1, the Application Identifiers (AIs) are used to indicate the Element String. The AI (01) is used to indicate Global Trade Item Number™ (GTIN™), however the Element Strings that encode GTINs are defined in Sections 3.2.1, 3.3.1, 3.5.1, 3.5.2, 3.5.3, 3.6.2, 3.6.3, and 3.6.52. GTINs may be encoded in bar code symbols from the EAN/UPC Symbology family, ITF-14 Bar Code Symbols, RSS Symbology family, and UCC/EAN-128 Bar Code Symbols using AI (01) or AI (8006).



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## 4.3 Invalid Pairs of Element Strings

Figure 4.3 – 1 defines the pairs of Element Strings that cannot appear on the same physical entity.

Figure 4.3 – 1

| Pair of Element Strings | | | | Comment |
|---|---|---|---|---|
| **AI** | **Designation** | **AI** | **Designation** | |
| 01 | Identification of a trade item | 01 | Identification of a trade item | Duplicate Global Trade Item Numbers™ (GTINs™) with different values |
| 01 | Identification of a trade item | 02 | Identification of logistic unit contents | AI (02) must not be used for the identification of trade items contained in a trade item. |
| ~~10~~ | ~~Batch/lot number~~ | ~~23n~~ | ~~Lot number (transitional use)~~ | ~~Duplicate lot numbers with different values~~ |
| 22 | Secondary data for the health industry | 30 | Count | Duplicate counts with different values |
| 22 | " | 10 | Batch/lot number | Duplicate lot numbers with different values |
| 22 | " | 17 | Expiration date | Duplicate expiration date with different values |
| 22 | " | 21 | Serial number | Duplicate serial numbers with different values |
| ~~22~~ | ~~"~~ | ~~23n~~ | ~~Lot number (transitional use)~~ | ~~Duplicate lot numbers with different values~~ |
| ~~252~~ | ~~Global Identifier Serialized for Trade~~ | ~~01~~ | ~~Identification of a trade item~~ | ~~Duplicate Trade Item Identification. AI (252) should only be used for one-off products.~~ |
| ~~252~~ | ~~Global Identifier Serialized for Trade~~ | ~~21~~ | ~~Serial Number~~ | ~~Only one serial number may be applied on an item.~~ |
| 420 | Ship to postal code, single postal authority | 421 | Ship to postal code with ISO country code | Only one ship to postal code may be applied on an item. |
| 422 | Country of origin of a trade item | 426 | Country of full processing | Duplication of country of origin of a trade item (covered by country of full processing) |
| 423 | Country of initial processing | 426 | Country of full processing | Duplication of country of initial processing (covered by country of full processing) |
| 424 | Country of processing | 426 | Country of full processing | Duplication of country of processing (covered by country of full processing) |



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| Pair of Element Strings | | | | Comment |
|---|---|---|---|---|
| **AI** | **Designation** | **AI** | **Designation** | |
| 425 | Country of disassembly | 426 | Country of full processing | Duplication of country of disassembly (covered by country of full processing) |
| 390n | Amount payable – single monetary area | 391n | Amount payable – with ISO currency code | Only one amount payable Element String may be applied on a payment slip. |
| 8006 | Component identification | 01 | Identification of a trade item | Other GTINs cannot be used with AI (8006). The trade item is identified by a GTIN contained in the AI (8006). |


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## 4.4 Mandatory Association of Element Strings

Figure 4.4 – 1 defines the Element Strings that mandate the appearance of another Element String on the same physical entity.

Figure 4.4 – 1

| If Element String AI | Designation | Then Mandatory Associated Element String | Comment |
|---|---|---|---|
| 01 or 02 with $N_1 = 9$ | Identification of a Variable Measure Trade Item | 30, 3nnn[1] or 3nnn[2] or 8001 | Mandatory association with variable measure information Only UCC/EAN-128, ITF-14, and RSS Expanded Bar Code Symbols can encode a GTIN with N1 = 9. |
| 02 | Identification of logistic unit contents | 00 | Mandatory association with a Serial Shipping Container Code (SSCC) |
| 02 | Identification of logistic unit contents | 37 | Mandatory count of the contained trade items |
| 10 | Batch/lot number | 01 or 02 | Mandatory association with a Global Trade Item Number™ (GTIN) or with the identification of logistic unit contents |
| 11, 13, 15, 17 | Dates | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 12 | Due date | 8020 and 415 | Mandatory association with the Payment Slip Reference Number (AI (8020)) and the EAN.UCC Global Location Number (GLN) of the invoicing party |
| 20 | Product variant | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 21 | Serial number | 01 | Mandatory association with a GTIN of a single trade item (a serial number cannot apply to a grouping of trade items) |
| 22 | Secondary data health industry | 01 | Mandatory association with a GTIN |
| ~~23n~~ | ~~Lot number~~ | ~~01 or 02~~ | ~~Mandatory association with a GTIN or with the identification of logistic unit contents~~ |
| 240 | Additional product identification | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 241 | Customer part number | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |


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| If Element String AI | Designation | Then Mandatory Associated Element String | Comment |
|---|---|---|---|
| 250 | Secondary serial number | 01 | Mandatory association with a GTIN (a secondary serial number cannot apply to a grouping of trade items) |
| 251 | Reference to source entity | 01 | Mandatory association with GTIN of the trade item |
| 30 | Variable count | 01 or 02 | Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) or the identification of variable measure content of a logistic unit |
| 3nnn* | Trade measures which cannot be summed | 01 | Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) |
| 3nnn** | Trade measures which can be summed | 01 or 02 | Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) or the identification of variable measure content of a logistic unit |
| 3nnn*** | Logistic measures | 00 or 01 | Mandatory association with an SSCC or a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) |
| 337n | Kilograms per square metre | 01 | Mandatory association with a GTIN |
| 37 | Count of units contained | 02 | Mandatory association with the identification of logistic unit contents |
| 390n | Amount payable – single monetary area | 8020 and 415 | Mandatory association with the Payment Slip Reference Number, AI (8020). and the GLN of the invoicing party |
| 391n | Amount payable – with ISO currency code | 8020 and 415 | Mandatory association with the Payment Slip Reference Number, AI (8020), and the GLN of the invoicing party |
| 392n | Amount payable – single monetary unit | 01 | Mandatory association with variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) |
| 393n | Amount payable – with ISO currency code | 01 | Mandatory association with variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) |
| 403 | Routing code | 00 | Mandatory association with an SSCC |


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| If Element String AI | Designation | Then Mandatory Associated Element String | Comment |
|---|---|---|---|
| 415 | GLN of the invoicing party | 8020 | Mandatory association with Payment Slip Reference Number, AI (8020) |
| 422 | Country of origin | 01 or 02 | Mandatory association with a GTIN |
| 423 | Country of initial processing | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 424 | Country of processing | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 425 | Country of disassembly | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 426 | Country of full processing | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 7001 | NATO Stock Number | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 7002 | UN/ECE Meat Carcasses and Cuts Classification | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 703(s) | Approval number of processor | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 8001 | Variables of roll products | 01 | Mandatory association with a variable measure GTIN (e.g., an EAN/UCC-14 Identification Number starting with the digit 9) |
| 8005 | Price per unit of measure | 01 or 02 with $N_1 = 9$ | Mandatory association with a variable measure GTIN or the identification of variable measure content of a logistic unit |
| 8007 | International Bank Account Number, AI (8007) | 8020 and 415 | Mandatory association with the Payment Slip Reference Number, AI (8020), and the GLN of the invoicing party |
| 8008 | Date and time of production | 01 or 02 | Mandatory association with a GTIN or with the identification of logistic unit contents |
| 8020 | Payment Slip Reference Number, AI (8020) | 415 | Mandatory association with the GLN of the invoicing party |


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*AIs (3nnn) where the first three digits are 312, 313, 324, 325, 326, 327, 328, and 329.

**AIs (3nnn) where the first three digits are 310, 311, 314, 315, 316, 320, 321, 322, 323, 350, 351, 352, 356, 357, 360, 361, 364, 365, and 366.

***AIs (3nnn) where the first three digits are 330, 331, 332, 333, 334, 335, 336, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 353, 354, 355, 362, 363, 367, 368, and 369.



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# Section 5.0:

# Data Carriers

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## 5.0.1 Introduction

A data carrier is a means of representing data in machine readable form. Data carriers that are endorsed by EAN International and the Uniform Code Council (UCC™) are described in Sections 5.1, 5.2, and 5.3, and bar code production and quality assessment are covered in Section 5.4.

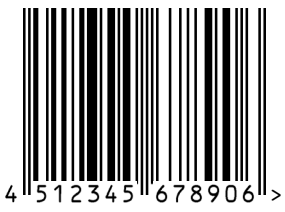
The EAN.UCC System specifies the data carrier used to represent any given Element String. Section 2.0 covers rules indicating which data carrier should be used to represent which Element Strings in particular applications.

The EAN.UCC System uses the following data carriers:

The EAN/UPC Symbology family of bar code symbols (UPC-A, UPC-E, EAN-13, and EAN-8 Bar Code Symbols and the two- and five-digit Add-On Symbols) can be read omnidirectionally. These symbols must be used for all items that are scanned at the Point-of-Sale and may be used on other trade items.

Figure 5.0.1 - 1

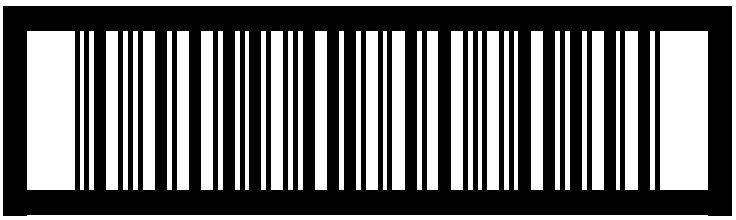
EAN-13




UPC-A

ITF-14 (Interleaved 2-of-5) Bar Code Symbols carry ID numbers only on trade items that are not expected to pass through the Point-of-Sale. ITF-14s are better suited for direct printing onto corrugated fibreboard.

Figure 5.0.1 – 2



**18931234567894**



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The UCC/EAN-128 is a subset of the Code 128 Bar Code Symbology. Its use is exclusively licensed to EAN International and the UCC™. This extremely flexible symbology encodes Element Strings using Application Identifiers.

Figure 5.0.1 – 3

Reduced Space Symbology® (RSS) is a family of linear symbologies used within the EAN.UCC System. This family of linear symbologies in most cases implicitly encodes Application Identifier (01) and in the case of RSS Expanded explicitly encodes Element Strings using Application Identifiers.

Figure 5.0.1 – 4

Composite Component™ Symbols do not exist in isolation. The primary identification number is always encoded in the linear symbol and supplementary AI Element Strings may be encoded in the two-dimensional (2D) component where they take up less space.

Figure 5.0.1 – 5

## 5.0.2 International Standards

A number of national and regional standardisation bodies have developed bar code symbol technical standards. The International Standards Organisation (ISO) has published standard bar code symbology specifications via a subcommittee of ISO/IEC JTC1 (International Standards Organisation/International Electronics Committee Joint Technical Committee 1).



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EAN International, the Uniform Code Council (UCC™), and the EAN Member Organisations are actively involved in developing these standards. The objective is that EAN.UCC System standards remain fully compatible with relevant published national, regional, and international symbology standards. The pertinent documents for Section 5 include:

Section 5.0: ISO/IEC 15424 information technology; automatic identification and data capture techniques; Data carrier/Symbology Identifiers

Section 5.1: ISO/IEC15420 information technology; automatic identification and data capture techniques; bar code symbology specifications; EAN/UPC

Section 5.2: ISO/IEC 16390 information technology; automatic identification and data capture techniques; bar code symbology specifications; ITF-14 (Interleaved 2-of-5)

Section 5.3: ISO/IEC 15417 information technology; automatic identification and data capture techniques; bar code symbology specifications; Code 128

Section 5.5: ISO/IEC 15438 – Automatic identification and data capture techniques - Symbology specification - PDF417.



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## 5.0.3 Symbology Identifiers

The symbology identifier is not encoded in the bar code symbol, but is generated by the decoder after decoding and is transmitted as a preamble to the data message.

All scanning equipment has the ability to recognise the symbology that has been scanned. Some scanners have the optional feature of being able to transmit a symbology identifier. The symbology identifier is a three-character data string comprising a flag character, code character, and a modifier character.

] is the flag character (which has an ASCII value of 93). This denotes that the two characters following are symbol identifier characters.

c is the code character. This denotes the type of symbology.

m is the modifier character. This indicates the mode in which the symbology is used.

Note: If used, the symbology identifier is transmitted as a prefix to the data message.

The symbology identifiers used in the EAN.UCC System are as follows:

Figure 5.0.3 – 1

| Symbology Identifier* | Symbology Format | Content |
|---|---|---|
| ] E 0* | EAN-13, UPC-A, or UPC-E | 13 digits |
| ] E 1 | Two-digit Add-On Symbol | 2 digits |
| ] E 2 | Five-digit Add-On Symbol | 5 digits |
| ] E 3 | EAN-13, UPC-A, or UPC-E with Add-On Symbol** | 15 or 18 digits |
| ] E 4 | EAN-8 | 8 digits |
| ] I 1 | ITF-14 | 14 digits |
| ] C 1 | UCC/EAN-128 | Standard AI Element Strings |
| ] e 0 | RSS*** | Standard AI Element Strings |
| ] d 2 | Data Matrix | Standard AI Element Strings |

Notes:

* Symbology identifiers are case sensitive.

**Bar code symbols with Add-On Symbols may be considered either as two separate symbols, each of which is transmitted separately with its own symbology identifier, or as a single data packet. The system designer shall select one of these methods, but the method using symbology identifier ]E3 is preferable for data security.

*** The RSS symbology has several symbol types and the full list of modifier characters is found in Section 5.5.



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# Section 5.1:

# EAN/UPC Symbology Specifications

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### 5.1.1 Symbology Characteristics

Characteristics of bar code symbols in the EAN/UPC Symbology family include:

- Numeric encodable character set (0 to 9) (e.g., ASCII characters 48 to 57 inclusive, in accordance with ISO 646)
- Symbology type: continuous
- Symbol character density: seven modules per symbol character
- Four elements per symbol character comprising two bars (dark bars) and two spaces (light bars), each of one, two, three, or four modules in width (auxiliary guard patterns have differing numbers of elements)
- Character self-checking
- Fixed data string length encodable: 8, 12, or 13 characters including Check Digit, depending on specific symbol type
- Omni-directionally decodable
- One mandatory Check Digit (described in Section 3.A.1)
- Non-data overhead not including the Check Digit or Quiet Zones:

  - 11 modules for EAN-13, EAN-8, and UPC-A Bar Code Symbols (left Guard Bar Pattern/centre Guard Bar Pattern/right Guard Bar Pattern)

  - Nine modules for UPC-E Bar Code Symbols (left Guard Bar Pattern/right Guard Bar Pattern)

#### 5.1.1.1 Symbol Types

The bar code symbols in the EAN/UPC Symbology family are:

- EAN-13, UPC-A, and UPC-E Bar Code Symbols, all of which may be accompanied by an Add-On Symbol
- EAN-8 Bar Code Symbols

The four symbol types are described in Sections 5.1.1.3.1, 5.1.1.3.2, 5.1.1.3.3, and 5.1.1.3.4, and the optional Add-On Symbols are described in Section 5.1.1.3.5.


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### 5.1.1.2 Symbol Encodation

#### 5.1.1.2.1 Symbol Character Encodation

Symbol characters shall encode digit values in seven module characters selected from different number sets known as A, B, and C, as shown in Figure 5.1.1.2.1 – 1.

Figure 5.1.1.2.1 – 1

Number Sets A, B, and C

| Digit Value | Set A Element Widths | | | | Set B Element Widths | | | | Set C Element Widths | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | B | S | B | S | B | S | B | B | S | B | S |
| 0 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 1 | 1 |
| 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| 2 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 |
| 3 | 1 | 4 | 1 | 1 | 1 | 1 | 4 | 1 | 1 | 4 | 1 | 1 |
| 4 | 1 | 1 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 3 | 2 |
| 5 | 1 | 2 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 2 | 3 | 1 |
| 6 | 1 | 1 | 1 | 4 | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| 7 | 1 | 3 | 1 | 2 | 2 | 1 | 3 | 1 | 1 | 3 | 1 | 2 |
| 8 | 1 | 2 | 1 | 3 | 3 | 1 | 2 | 1 | 1 | 2 | 1 | 3 |
| 9 | 3 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 2 |

Note: S denotes a space (light bar), B denotes a bar (dark bar), and the element widths are in modules.

Figure 5.1.A.2 – 1 graphically illustrates Figure 5.1.1.2.1 – 1. The sum of the bar (dark bar) modules in any symbol character determines its parity. Symbol characters in number set A are odd parity characters. Symbol characters in number sets B and C are even parity characters. Number set C characters are mirror images of number set B characters.


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Symbol characters in number sets A and B always begin on the left with a space module and end on the right with a dark module. Symbol characters in number set C begin on the left with a dark module and end on the right with a light module.

A data character shall normally be represented by a symbol character. However, in certain specific instances defined in Sections 5.1.1.3.1, 5.1.1.3.4, and 5.1.1.3.5, the combination of number sets in a symbol may itself represent either data or a Check Digit value. This technique is referred to as variable parity encodation.


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#### 5.1.1.2.2 Auxiliary Pattern Encodation

Auxiliary patterns shall be composed as shown in Figure 5.1.1.2.2 – 1.

Figure 5.1.1.2.2 – 1
Auxiliary Patterns

| Auxiliary Pattern | Number of Modules | Element Widths in Modules | | | | | |
|---|---|---|---|---|---|---|---|
| | | S | B | S | B | S | B |
| Normal Guard Bar Pattern | 3 | | 1 | 1 | 1 | | |
| Centre Guard Bar Pattern | 5 | 1 | 1 | 1 | 1 | 1 | |
| Special Guard Bar Pattern | 6 | 1 | 1 | 1 | 1 | 1 | 1 |
| Add-on Guard Bar Pattern | 4 | | 1 | 1 | 2 | | |
| Add-On delineator | 2 | 1 | 1 | | | | |
| Note: S denotes a space (light) element and B denotes a bar (dark) element. | | | | | | | |

Section 5.1.A.3 graphically illustrates these patterns.

The normal Guard Bar Pattern corresponds to the start and stop patterns in other symbologies, and the special Guard Bar Pattern is used as a stop pattern in UPC-E Bar Code Symbols.

### 5.1.1.3 Symbol Formats

#### 5.1.1.3.1 EAN-13 Bar Code Symbols

The EAN-13 Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern


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- Six symbol characters from number sets A and B
- A centre Guard Bar Pattern
- Six symbol characters from number set C
- A normal Guard Bar Pattern
- A right Quiet Zone

The rightmost symbol character shall encode the Check Digit calculated in accordance with Section 3.A.1.

Since the EAN-13 Bar Code Symbol comprises only 12 symbol characters but encodes 13 digits of data (including the Check Digit), the value of the additional digit, which is the character in the leftmost position in the data string, shall be encoded by the variable parity mix of number sets A and B for the six symbol characters in the left half of the symbol. The numbering system for values of the leading digit is specified in Figure 5.1.1.3.1 – 1. Figure 5.1.1.3.1 – 2 is an example of an EAN-13 Bar Code Symbol.

Figure 5.1.1.3.1 – 1

Left Half of an EAN-13 Bar Code Symbol

| Leading Digit, Implicitly Encoded | Number Sets Used for Numbering Left Half of an EAN-13 Bar Code Symbol | | | | | |
|---|---|---|---|---|---|---|
| | Symbol Character Position | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 0* | A | A | A | A | A | A |
| 1 | A | A | B | A | B | B |
| 2 | A | A | B | B | A | B |
| 3 | A | A | B | B | B | A |
| 4 | A | B | A | A | B | B |
| 5 | A | B | B | A | A | B |
| 6 | A | B | B | B | A | A |
| 7 | A | B | A | B | A | B |
| 8 | A | B | A | B | B | A |


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| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | A | B | B | A | B | A |

*Note: The leading digit value “0” is reserved for symbols encoding UCC-12 Identification Number Element Strings.

Figure 5.1.1.3.1 – 2

EAN-13 Bar Code Symbol

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### 5.1.1.3.2 EAN-8 Bar Code Symbols

The EAN-8 Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern
- Four symbol characters from number set A
- A centre Guard Bar Pattern
- Four symbol characters from number set C
- A normal Guard Bar Pattern
- A right Quiet Zone

The rightmost symbol character shall encode the Check Digit calculated in accordance with Section 3.A.1. Figure 5.1.1.3.2 – 1 is an example of an EAN-8 Bar Code Symbol.

Figure 5.1.1.3.2 – 1

EAN-8 Bar Code Symbol

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#### 5.1.1.3.3 UPC-A Bar Code Symbols

The UPC-A Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern
- Six symbol characters from number set A
- A centre Guard Bar Pattern
- Six symbol characters from number set C
- A normal Guard Bar Pattern
- A right Quiet Zone

The rightmost symbol character shall encode the Check Digit calculated in accordance with Section 3.A.1. A UPC-A Bar Code Symbol may be decoded as a 13-digit number by adding an implied leading zero to the UCC-12 Identification Number. Figure 5.1.1.3.3 – 1 is an example of a UPC-A Bar Code Symbol.

Figure 5.1.1.3.3 – 1

UPC-A Bar Code Symbol

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### 5.1.1.3.4 UPC-E Bar Code Symbols

The UPC-E Bar Code Symbol shall be made up as follows, reading from left to right:

- A left Quiet Zone
- A normal Guard Bar Pattern
- Six symbol characters from number sets A and B
- A special Guard Bar Pattern
- A right Quiet Zone

The UPC-E Bar Code Symbol may only be used to encode UCC-12 Identification Number Element Strings which commence with a zero and contain a sequence of four or five zeroes in defined positions, as shown in Figure 5.1.1.3.4.2 – 1. These zeros are removed from the data during encoding by the zero-suppression process described in Section 5.1.1.3.4.1. Figure 5.1.1.3.4 – 1 is an example of a UPC-E Bar Code Symbol.

Figure 5.1.1.3.4 – 1

UPC-E Bar Code Symbol (Encoding 001234000057 by Zero-Suppression)

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#### 5.1.1.3.4.1 Encodation of a UPC-E Bar Code Symbol

The following algorithm describes the encodation of a data string suitable for zero-suppression:

1. Let D1, D2, and D3 through D12 denote the UCC-12 Identification Number data characters (including Check Digit). D1 shall always be zero. D12 shall be the Check Digit calculated according to the algorithm in Section 3.A.1. Let X1 and X2 through X6 denote the six symbol characters in the final UPC-E Bar Code Symbol.
2. Convert D2 through D11 into a symbol character string by removing zeroes according to the following rules:

- If D11 equals 5, 6, 7, 8, or 9
  and D7 to D10 inclusive are all 0
  and D6 is not 0
  then D7 to D10 are not encoded.

| Symbol character: | X1 | X2 | X3 | X4 | X5 | X6 |
|---|---|---|---|---|---|---|
| Data character: | D2 | D3 | D4 | D5 | D6 | D11 |

- If D6 to D10 inclusive are all 0
  and D5 is not 0
  then D6 to D10 are not encoded and X6 = 4.

| Symbol character: | X1 | X2 | X3 | X4 | X5 | X6 |
|---|---|---|---|---|---|---|
| Data character: | D2 | D3 | D4 | D5 | D11 | 4 |

- If D4 is 0, 1, or 2
  and D5 to D8 inclusive are all 0
  then D5 to D8 are not encoded.

| Symbol character: | X1 | X2 | X3 | X4 | X5 | X6 |
|---|---|---|---|---|---|---|
| Data character: | D2 | D3 | D9 | D10 | D11 | D4 |

- If D4 is 3, 4, 5, 6, 7, 8, or 9
  and D5 to D9 inclusive are all 0
  then D5 to D9 are not encoded and X6 = 3.

| Symbol character: | X1 | X2 | X3 | X4 | X5 | X6 |
|---|---|---|---|---|---|---|


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Data character: D2 D3 D4 D10 D11 3

3. Determine the number sets for the implicit encodation of D12 from Figure 5.1.1.3.4.1 – 1.

4. Encode symbol characters X1 to X6 using number sets A and B as determined in Step 3.


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Figure 5.1.1.3.4.1 – 1

| Value of Check Digit D12 | Number Sets Used for Numbering a UPC-E Bar Code Symbol | | | | | |
|---|---|---|---|---|---|---|
| | Symbol Character Position | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 0 | B | B | B | A | A | A |
| 1 | B | B | A | B | A | A |
| 2 | B | B | A | A | B | A |
| 3 | B | B | A | A | A | B |
| 4 | B | A | B | B | A | A |
| 5 | B | A | A | B | B | A |
| 6 | B | A | A | A | B | B |
| 7 | B | A | B | A | B | A |
| 8 | B | A | B | A | A | B |
| 9 | B | A | A | B | A | B |

Figure 5.1.1.3.4.1 – 2

| Example 1: | Original Data | Zero-Suppressed | Rule |
|---|---|---|---|
| | 0 1 2 3 4 5 0 0 0 0 5 8 | 1 2 3 4 5 5 | 2a |
| | | B A B A A B | |

Figure 5.1.1.3.4.1 – 3

| Example 2: | Original Data | Zero-Suppressed | Rule |
|---|---|---|---|
| | 0 4 5 6 7 0 0 0 0 0 8 0 | 4 5 6 7 8 4 | 2b |
| | | B B B A A A | |


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Figure 5.1.1.3.4.1 – 4

| Example 3: | Original Data | Zero-Suppressed | Rule |
|---|---|---|---|
| | 0 3 4 0 0 0 0 0 5 6 7 3 | 3 4 5 6 7 0 | 2c |
| | | B B A A A B | |

Figure 5.1.1.3.4.1 – 5

| Example 4: | Original Data | Zero-Suppressed | Rule |
|---|---|---|---|
| | 0 9 8 4 0 0 0 0 0 7 5 1 | 9 8 4 7 5 3 | 2d |
| | | B B A B A A | |

Note: The number sets used to implicitly encode the Check Digit are shown in the zero-suppressed column.


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### 5.1.1.3.4.2 Decoding a UPC-E Bar Code Symbol

Derivation of the 12-digit data string from the characters encoded in the UPC-E Bar Code Symbol can be performed according to Figure 5.1.1.3.4.2 – 1.

Figure 5.1.1.3.4.2 - 1
Decoding a UPC-E Bar Code Symbol

| Encoded UPC-E Bar Code Symbol Digits | | | | | | | | | Decoded Number | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P1 | P2 | P3 | P4 | P5 | P6 | | | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| (0) | X1 | X2 | X3 | X4 | X5 | 0 | (C) | | (0) | X1 | X2 | 0 | 0 | 0 | 0 | 0 | X3 | X4 | X5 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 1 | (C) | | (0) | X1 | X2 | 1 | 0 | 0 | 0 | 0 | X3 | X4 | X5 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 2 | (C) | | (0) | X1 | X2 | 2 | 0 | 0 | 0 | 0 | X3 | X4 | X5 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 3 | (C) | | (0) | X1 | X2 | X3 | 0 | 0 | 0 | 0 | 0 | X4 | X5 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 4 | (C) | | (0) | X1 | X2 | X3 | X4 | 0 | 0 | 0 | 0 | 0 | X5 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 5 | (C) | | (0) | X1 | X2 | X3 | X4 | X5 | 0 | 0 | 0 | 0 | 5 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 6 | (C) | | (0) | X1 | X2 | X3 | X4 | X5 | 0 | 0 | 0 | 0 | 6 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 7 | (C) | | (0) | X1 | X2 | X3 | X4 | X5 | 0 | 0 | 0 | 0 | 7 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 8 | (C) | | (0) | X1 | X2 | X3 | X4 | X5 | 0 | 0 | 0 | 0 | 8 | (C) |
| (0) | X1 | X2 | X3 | X4 | X5 | 9 | (C) | | (0) | X1 | X2 | X3 | X4 | X5 | 0 | 0 | 0 | 0 | 9 | (C) |

Notes:
- The symbol characters at positions P1 and P2 through P5 of the UPC-E Bar Code Symbol are represented by X1 and X2 through X5.
- Re-inserted zeroes are indicated by underlining.
- The leading digit for UPC-E Bar Code Symbols, which is not encoded, is indicated by "0".
- The Check Digit implicitly encoded in UPC-E Bar Code Symbols is indicated by "C".

### 5.1.1.3.5 Add-On Symbols

The Add-On Symbols were designed to encode information supplementary to that in the main bar code symbol on periodicals and paperback books. Because they provide reduced security, use of Add-On Symbols shall be limited to applications where rules in the application specification governing data format and content provide appropriate safeguards.


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#### 5.1.1.3.5.1 Two-Digit Add-On Symbol

A two-digit Add-On Symbol may be used in specific applications to accompany an EAN-13, UPC-A, or UPC-E Bar Code Symbol. The two-digit Add-On Symbol is positioned following the right Quiet Zone of the main symbol and consists of the following:

- Add-on Guard Bar Pattern
- First digit of the additional number from number sets A or B
- Add-on delineator
- Second digit of the additional number from number sets A or B
- A right Quiet Zone

The Add-On Symbol has no right Guard Bar Pattern. It does not have an explicit Check Digit. Checking is done through the mix of the number sets (A or B) used for the two digits. The choice of number sets is linked to the value of the additional number as shown by Figure 5.1.1.3.5.1 – 1.

Figure 5.1.1.3.5.1 – 1

Number Sets for Two-Digit Add-On Symbols

| Value of the digits carried by the Add-On Symbol | Left-Hand Digit | Right-Hand Digit |
|---|---|---|
| Multiple of 4 (00,04,08,..96) | A | A |
| Multiple of 4+1 (01,05,..97) | A | B |
| Multiple of 4+2 (02,06,..98) | B | A |
| Multiple of 4+3 (03,07,..99) | B | B |

Figure 5.1.1.3.5.1 – 2 is an example of an EAN-13 Bar Code Symbol with a two-digit Add-On Symbol.

Figure 5.1.1.3.5.1 - 2

EAN-13 Bar Code Symbol with Two-Digit Add-On Symbol

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#### 5.1.1.3.5.2 Five-Digit Add-On Symbol

A five-digit Add-On Symbol may be used in specific applications to accompany an EAN-13, UPC-A, or UPC-E Bar Code Symbol. The five-digit Add-On Symbol is positioned following the right Quiet Zone of the main symbol and consists of the following:

- Add-on Guard Bar Pattern
- First digit of the add-on number from number sets A or B
- Add-on delineator
- Second digit of the add-on number from number sets A or B
- Add-on delineator
- Third digit of the add-on number from number sets A or B
- Add-on delineator
- Fourth digit of the add-on number from number sets A or B
- Add-on delineator
- Fifth digit of the add-on number from number sets A or B
- A right Quiet Zone

The Add-On Symbol has no right Guard Bar Pattern. It does not have an explicit Check Digit. Checking is done through the mix of the number sets (A or B) used for the five digits. A value V is determined by the following procedure:

1. Sum the digits in Positions one, three, and five.
2. Multiply the result of step 1 by 3.
3. Sum the remaining digits (Positions two and four).
4. Multiply the result of step 3 by 9.
5. Sum the results of steps 2 and 4.
6. The value of V is the unit's position (lowest-order digit) of the result of step 5.


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Example: To calculate the value of V for an Add-On Symbol carrying the number 86104, follow these steps:

1. 8 + 1 + 4 = 13
2. 13 x 3 = 39
3. 6 + 0 = 6
4. 6 x 9 = 54
5. 39 + 54 = 93
6. V = 3

The number sets can then be determined by using Figure 5.1.1.3.5.2 – 1.

Figure 5.1.1.3.5.2 - 1

Number Sets for Five-Digit Add-On Symbol

| Value of V | Number Sets Used for Symbol Characters | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| 0 | B | B | A | A | A |
| 1 | B | A | B | A | A |
| 2 | B | A | A | B | A |
| 3 | B | A | A | A | B |
| 4 | A | B | B | A | A |
| 5 | A | A | B | B | A |
| 6 | A | A | A | B | B |
| 7 | A | B | A | B | A |
| 8 | A | B | A | A | B |
| 9 | A | A | B | A | B |

Since V = 3 in Figure 5.1.1.3.5.2 - 1, the sequence of number sets used to encode the value 86104 is B A A A B.


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Figure 5.1.1.3.5.2 – 2 shows an example of an EAN-13 Bar Code Symbol with a five-digit Add-On Symbol.

Figure 5.1.1.3.5.2 - 2

EAN-13 Bar Code Symbol with Five-Digit Add-On Symbol

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### 5.1.1.4 Dimensions and Tolerances

#### 5.1.1.4.1 Nominal Dimensions of Characters

Bar code symbols can be printed at various densities to accommodate a variety of printing and scanning processes. The significant dimensional parameter is X, the ideal width of a single module element. The X-dimension must be constant throughout a given symbol.

The dimensions of EAN-13, UPC-A, EAN-8 and UPC-E Bar Code Symbols may be referenced to a defined set of dimensions referred to as the nominal size symbol. Refer to Section 5.1.A.7 for dimensioned drawings of nominal size symbols.

The X-dimension at nominal size is 0.33 mm (0.013 in.).

The width of each bar (dark bar) and space (light bar) is determined by multiplying the X-dimension by the module width of each bar (dark bar) and space (light bar) (1, 2, 3, or 4). There is an exception for characters 1, 2, 7, and 8. For these characters, the bars (dark bars) and spaces (light bars) are reduced or enlarged by one-thirteenth of a module to provide a uniform distribution of bar width tolerances and thus improve scanning reliability.

The reduction or enlargement in millimetres at nominal size of the bars (dark bars) and spaces (light bars) for the characters 1, 2, 7, and 8 in the number sets A, B, and C is shown in Figure 5.1.1.4.1 – 1:

Figure 5.1.1.4.1 –1

Reduction/Enlargement for Characters 1, 2, 7, and 8

| Character Value | Number Set A | | Number Sets B and C | |
|---|---|---|---|---|
| | Bar (Dark Bar) mm | Space (Light Bar) mm | Bar (Dark Bar) mm | Space (Light Bar) mm |
| 1 | - 0.025 | +0.025 | +0.025 | - 0.025 |
| 2 | - 0.025 | +0.025 | +0.025 | - 0.025 |
| 7 | +0.025 | - 0.025 | - 0.025 | +0.025 |
| 8 | +0.025 | - 0.025 | - 0.025 | +0.025 |

Note: The existing symbol generation equipment that uses a value of 0.030 mm for the reduction/enlargement factor at nominal size may continue to be used for the foreseeable future.


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#### 5.1.1.4.2 Symbol Height

For EAN-13, UPC-A, and UPC-E Bar Code Symbols~~,~~ the approximate height of the symbol, including the human readable information, at the ~~the bars (dark bars) in the~~ nominal size ~~symbol~~ is 25.9mm (1.0 in.)~~22.85 mm (0.9 in.)~~.

For EAN-8 Bar Code Symbols~~,~~ the approximate height of the symbol, including the human readable information, at the ~~the bars (dark bars) in the~~ nominal size ~~symbol~~ is 21.3mm (0.8 in.)~~.18.23 mm (0.718 in.).~~

The height of any ~~For~~ two-digit ~~and~~ or five-digit Add-On Symbol used, including the human readable information, must not extend outside the symbol height dimensions of the primary symbol.~~s, the height of the bars (dark bars) in the nominal size symbol is 21.9 mm (0.86 in.).~~

In EAN-13, EAN-8, UPC-A, and UPC-E Bar Code Symbols, the bars (dark bars) forming the left, centre, and right Guard Bar Patterns shall be extended downward by 5x (e.g., 1.65 mm (0.065 in.). This shall also apply to the bars (dark bars) of the first and last symbol characters of the UPC-A Bar Code Symbol.

Symbol height is not modular.

#### 5.1.1.4.3 Quiet Zone (Light Margin)

The minimum Quiet Zone width required by the main bar code symbol is 7x. However, other minimum Quiet Zone dimensions are specified for some symbol types due to the size and location of their Human Readable Interpretation. These dimensions are noted in Figure 5.1.1.4.3 – 1.


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Figure 5.1.1.4.3 – 1

Quiet Zone Lengths by Version

| Symbol Version | Left Quiet Zone (Light Margin) | | Right Quiet Zone (Light Margin) | |
|---|---|---|---|---|
| | Modules | mm* | Modules | mm |
| EAN-13 | 11 | 3.63 | 7 | 2.31 |
| EAN-8 | 7 | 2.31 | 7 | 2.31 |
| UPC-A | 9 | 2.97 | 9 | 2.97 |
| UPC-E | 9 | 2.97 | 7 | 2.31 |
| Add-Ons (EAN) | 7-10 | 2.31-3.30 | 5 | 1.65 |
| Add-Ons (U.P.C.) | 9-12 | 2.97-3.96 | 5 | 1.65 |

*This is an example using an X-dimension of 0.33 mm.

Note: A useful device to help maintain the Quiet Zone in some production processes is to include a less than (<) and/or greater than (>) character in the Human Readable Interpretation field, with its apex aligned with the edge of the Quiet Zone. If this device is used, the character(s) shall be positioned in accordance with the appropriate drawings in Section 5.1.A.6.

**5.1.1.4.4 X-Dimension (Magnification Factor)**

In the past the term "magnification factor" was extensively used to specify the size of a bar code symbol. This technique relied upon setting a nominal size (100%) that was directly related to a given X-dimension. Since January 2000, the more precise term “X-dimension” has been used to specify permissible symbol sizes (see Section 5.4).

The X-dimension of an Add-On Symbol shall be the same as the X-dimension of its associated main symbol.


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#### 5.1.1.4.5 Symbol Length

The symbol length in modules, including the minimum Quiet Zones, shall be as indicated in Figure 5.1.1.4.5 – 1.

Figure 5.1.1.4.5 - 1

Symbol Length in Modules

| Symbol Type | Length |
|---|---|
| EAN-13 | 113 |
| UPC-A | 113 |
| EAN-8 | 81 |
| UPC-E | 67 |
| Two-digit Add-On | 25 |
| Five-digit Add-On | 52 |
| EAN-13 or UPC-A and two-digit Add-On | 138 |
| UPC-E and two-digit Add-On | 92 |
| EAN-13 or UPC-A and five-digit Add-On | 165 |
| UPC-E and five-digit Add-On | 119 |

#### 5.1.1.4.6 Positioning of the Add-On Symbol

The Add-On Symbol shall not encroach on the right Quiet Zone of the main symbol. The maximum separation shall be 12x.

The bottom edge of the bars (dark bars) in the Add-On Symbol shall be horizontally aligned with the bottom edge of the guard bars of the main symbol.

### 5.1.2 Reference Decode Algorithm

Decode algorithms are used by scanning equipment to convert the bar and space patterns of the bar code into data characters. As a matter of policy, EAN International and the Uniform Code Council (UCC™) make no attempt to specify or standardise equipment beyond stating that it should be capable of reading symbols produced in accordance with the specifications laid out in this manual.

Bar code reader systems are designed to read imperfect symbols to the extent that practical algorithms permit. This section describes the reference decode algorithm


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used to determine decode and decodability in symbol verification in accordance with *ISO 15416*.


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For each symbol character, let S equal the total measured width of the character. The value S is used to determine reference threshold (RT) values. Individual edge to similar edge measurements (e) are then compared to the reference threshold to determine E values. Character values are determined from E values.

Value e1 is defined as the measurement from the leading edge of a bar (dark bar) to the leading edge of the adjacent bar (dark bar). Value e2 is defined as the measurement from the trailing edge of a bar (dark bar) to the trailing edge of the adjacent bar (dark bar). For number sets A and B, the right edge of each of the two bars (dark bars) is considered to be leading, while for number set C, the left edge of each bar (dark bar) is considered to be leading. These relationships are illustrated in Figure 5.1.2 – 1.

Figure 5.1.2 - 1

Symbol Character Decode Measurements


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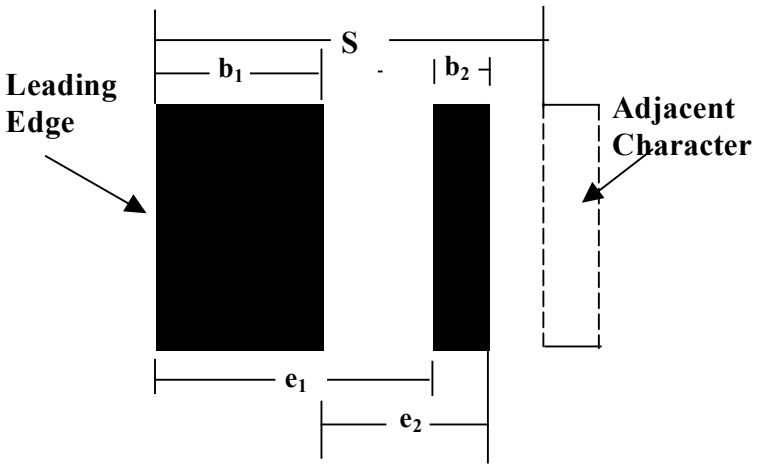
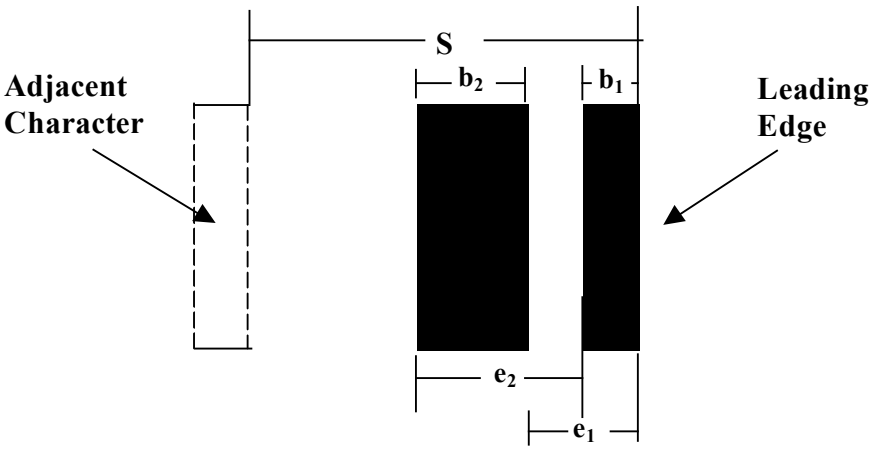
**Number Set C**




**Number Sets A and B**





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Reference thresholds RT1, RT2, RT3, RT4, and RT5 are given by:

- RT1 = (1.5/7)S
- RT2 = (2.5/7)S
- RT3 = (3.5/7)S
- RT4 = (4.5/7)S
- RT5 = (5.5/7)S

Within each character, the measurements e1 and e2 are compared with the reference thresholds. The corresponding integer values E1 and E2 are considered to be equal to 2, 3, 4, or 5 as follows:

- If RT1 <= ei < RT2, Ei = 2
- If RT2 <= ei < RT3, Ei = 3
- If RT3 <= ei < RT4, Ei = 4
- If RT4 <= ei < RT5, Ei = 5

Otherwise the character is in error.

In Figure 5.1.2 – 2, use the values of E1 and E2 as the primary determinant for the symbol character value.


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Figure 5.1.2 – 2

Bar Code Symbol Decoding

| Character | Number Set | Primary Determinant | | Secondary Determinant |
|---|---|---|---|---|
| | | E1 | E2 | $7(b_1 + b_2)/S$ |
| 0 | A | 2 | 3 | |
| 1 | A | 3 | 4 | <= 4 |
| 2 | A | 4 | 3 | <= 4 |
| 3 | A | 2 | 5 | |
| 4 | A | 5 | 4 | |
| 5 | A | 4 | 5 | |
| 6 | A | 5 | 2 | |
| 7 | A | 3 | 4 | >4 |
| 8 | A | 4 | 3 | >4 |
| 9 | A | 3 | 2 | |
| 0 | B and C | 5 | 3 | |
| 1 | B and C | 4 | 4 | >3 |
| 2 | B and C | 3 | 3 | >3 |
| 3 | B and C | 5 | 5 | |
| 4 | B and C | 2 | 4 | |
| 5 | B and C | 3 | 5 | |
| 6 | B and C | 2 | 2 | |
| 7 | B and C | 4 | 4 | <= 3 |
| 8 | B and C | 3 | 3 | <= 3 |
| 9 | B and C | 4 | 2 | |

Note: $b_1$ and $b_2$ are the widths of the two bar (dark bar) elements

The character is uniquely determined for all combinations of E1 and E2 except for the following four cases:

- E1 = 3 and E2 = 4 (characters 1 and 7 in number set A)


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- E1 = 4 and E2 = 3 (characters 2 and 8 in number set A)
- E1 = 4 and E2 = 4 (characters 1 and 7 in number sets B and C)
- E1 = 3 and E2 = 3 (characters 2 and 8 in number sets B and C)


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These cases require that the combined width of the two bars (dark bars) be tested as follows:

- For E1 = 3 and E2 = 4:

  - Character is 1 if 7 x ($b_1$ + $b_2$) / S <= 4

  - Character is 7 if 7 x (b1 + b2) / S > 4

- For E1 = 4 and E2 = 3:

  - Character is 2 if 7 x (b1 + b2) / S <=4

  - Character is 8 if 7 x (b1 + b2) / S > 4

- For E1 = 4 and E2 = 4:

  - Character is 1 if 7 x (b1 + b2) / S > 3

  - Character is 7 if 7 x (b1 + b2) / S <= 3

- For E1 = 3 and E2 = 3:

  - Character is 2 if 7 x (b1 + b2) / S > 3

  - Character is 8 if 7 x (b1 + b2) / S <= 3

The requirements on ($b_1$ + $b_2$) are shown in Figure 5.1.2 – 2.

The same procedures shall be used to decode the symbol characters in any Add-On Symbol.

Use Figure 5.1.2 – 3 to determine the appropriate S measurement for calculating the reference threshold values RT1 and RT2 applicable to the auxiliary patterns of the main symbol. For each symbol or half symbol the measurements of the appropriate auxiliary pattern $e_i$ values are then compared to the reference thresholds to establish the integer Ei values. The determined values of E1, E2, E3, and E4 shall match those of valid auxiliary patterns as shown in Figure 5.1.2 – 4. Otherwise the symbol is in error.


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Figure 5.1.2 – 3

Auxiliary Pattern Measurements

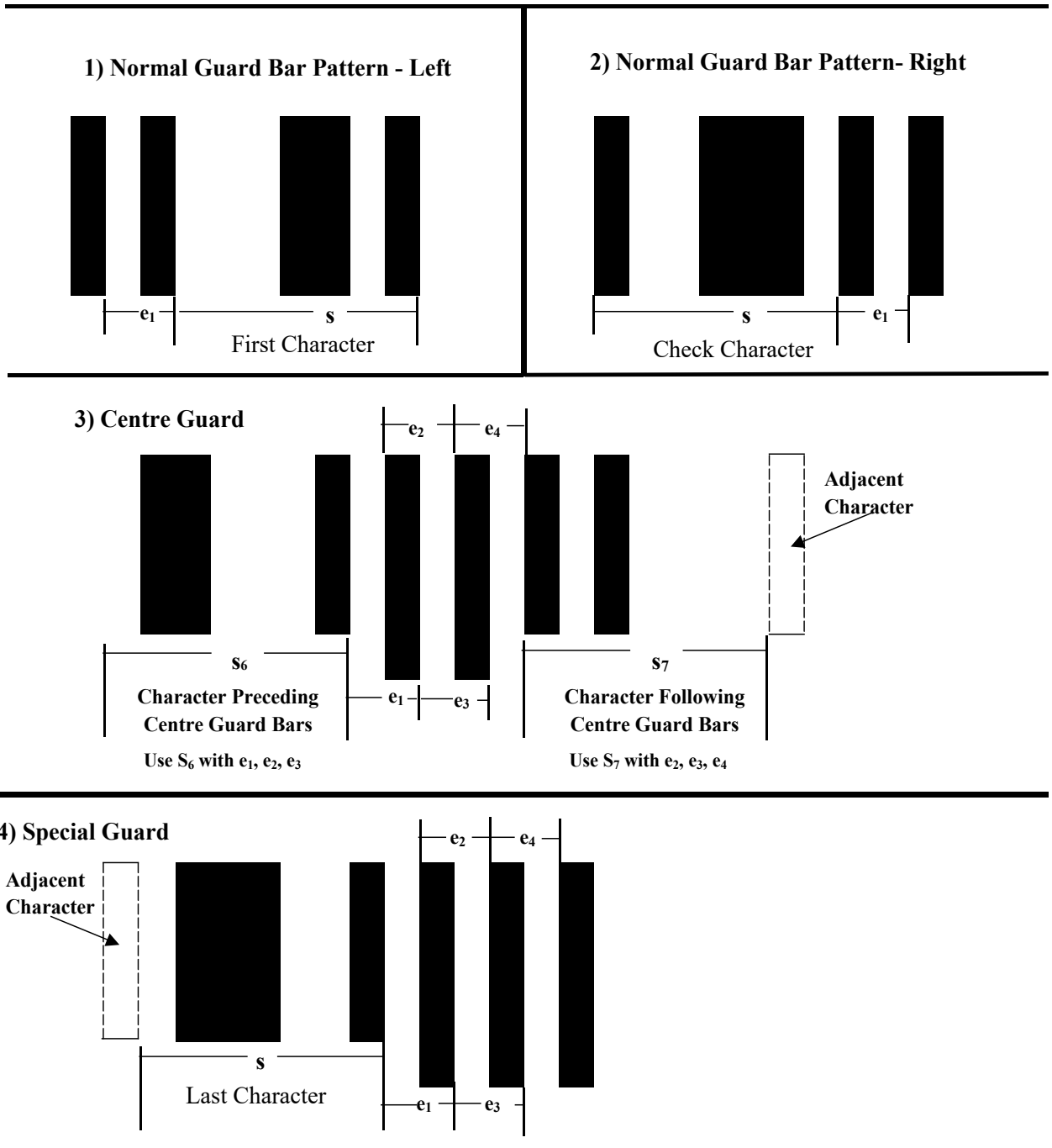



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Figure 5.1.2 - 4

Main Symbol Auxiliary Pattern E Values

| **Auxiliary Guard Patterns** | **E1** | **E2** | **E3** | **E4** |
|---|---|---|---|---|
| Normal Guard Bar Pattern | 2 | | | |
| Centre Guard Bar Pattern (left half) | 2 | 2 | 2 | |
| Centre Guard Bar Pattern (right half) | | 2 | 2 | 2 |
| Special Guard Bar Pattern | 2 | 2 | 2 | 2 |

### 5.1.3 Human Readable Interpretation

The human readable digits shall be printed underneath the main symbol and above the Add-On Symbol. A clearly legible font shall be used for the these digits, and OCR-B as defined in ISO 1073-2 is recommended. This font is referenced only as a convenient standard typeface, and it is not intended that these characters be machine read or verified. Reasonable alternative type fonts and character sizes are acceptable provided the Human Readable Interpretation is clearly legible.

All the encoded digits for EAN-13, UPC-A, and EAN-8 Bar Code Symbols, and the Add-On Symbols shall be shown in Human Readable Interpretation form. For UPC-E Bar Code Symbols, the six digits directly encoded together with the leading zero and the implicitly encoded Check Digit shall be shown in Human Readable Interpretation form. Figures 5.1.1.3.1 – 2, 5.1.1.3.2 – 1, 5.1.1.3.3 – 1, 5.1.1.3.4 – 1, 5.1.1.3.5.1 – 2, and 5.1.1.3.5.2 – 2 illustrate each type of symbol and its Human Readable Interpretation.

The height of the digits in the nominal size symbol is 2.75 mm. The minimum space between the top of the digits and the bottom of the bars (dark bars) shall be 0.5X. Normally the minimum is one module, which is close enough to keep the Human Readable Interpretation associated with the symbol.

In the EAN-13 Bar Code Symbol, the leftmost digit, which is encoded by variable parity, is printed to the left of the Start Character in line with the other digits.

For UPC-A and UPC-E Bar Code Symbols, the size of the first and last digits should be reduced to a maximum width equivalent to four modules. The height is reduced proportionally. The right-hand side of the first digit is positioned five module widths to


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the left of the leftmost guard bar. The left-hand side of the last digit is positioned five module widths to the right of the rightmost guard bar for UPC-A Bar Code Symbols and three module widths for UPC-E Bar Code Symbols. The bottom edge of the first and last digit shall be aligned with the bottom edge of the remaining full size digits.


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The Human Readable Interpretation of the Add-On Symbol shall be above it. The digits shall be the same height as those of the main symbol. The upper edges of the digits are aligned with the upper edges of the bars (dark bars) of the main symbol. The minimum space between the bottom of the digits and the top of the bars (dark bars) shall be 0.5X.

Some industries use specific variations of the recommended Human Readable Interpretation, such as inserted hyphens to segment the number field. An example of this is shown in Section 5.1.A.6.


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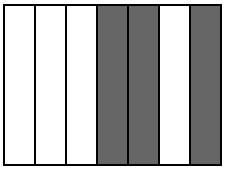
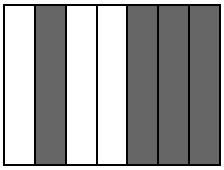
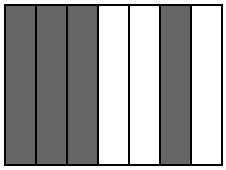
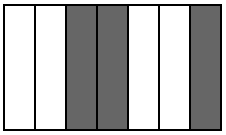
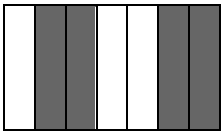
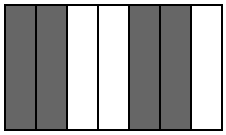
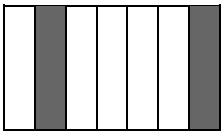
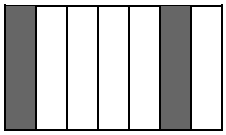
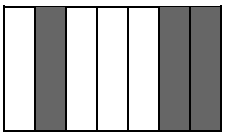
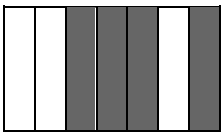
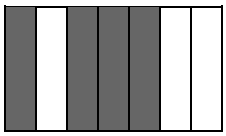
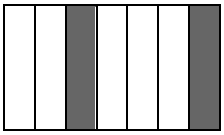
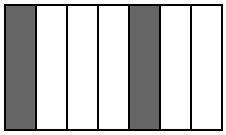
### 5.1.A.1 Appendix 1 Character Values in the EAN/UPC Symbology Family

Figure 5.1.A.1 – 1

| Value of Character | Number Set A (Odd) | Number Set B (Even) | Number Set C (Even) |
|---|---|---|---|
| **0** |  |  |  |
| **1** |  |  |  |
| **2** | | | |
| **3** | |  |  |
| **4** |  |  |  |
| **5** | | | |
| **6** | | | |
| **7** | |  |  |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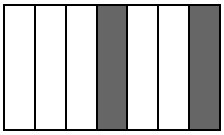
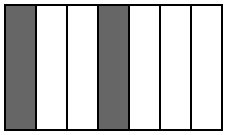
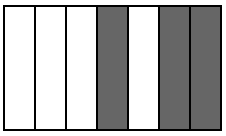
| | | | |
|---|---|---|---|
| **8** | |  |  |
| **9** |  | | |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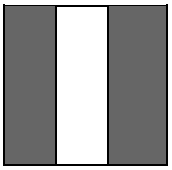
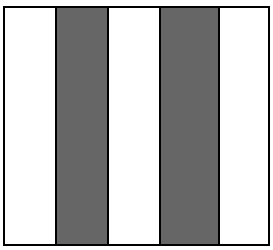
### 5.1.A.2 Appendix 2: Auxiliary Characters in the EAN/UPC Symbology Family

Figure 5.1.A.2 – 1

| Auxiliary Character | |
|---|---|
| **Normal Guard Bar Pattern (right and left)** |  |
| **Centre Guard Bar Pattern** |  |
| **UPC-E Right Guard Bar Pattern** | |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### 5.1.A.3 Appendix 3: Logical Structure of an EAN-13 and UPC-A Bar Code Symbol Excluding Quiet Zones

Figure 5.1.A.3 – 1

| **Logical Structure of an EAN-13 or UPC-A Bar Code Symbol (Excluding Quiet Zones)** | | | | |
|---|---|---|---|---|
| Left Guard Bar Pattern | Characters 12 Through 7 (Left Half) | Centre Guard Bar Pattern | Characters 6 Through 1 (Right Half) | Right Guard Bar Pattern |
| 3 modules | 42 modules (6x7) | 5 modules | 42 modules (6x7) | 3 modules |
| Total number of modules = 95 | | | | |

Figure 5.1.A.3 – 2

| **Character Position** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Value of the Thirteenth Character | Number Set Used for Representing Characters 12 Through 7 | | | | | | Number Set Used for Representing Characters 6 Through 1 | | | | | |
| | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 0 | A | A | A | A | A | A | ALWAYS USE NUMBER SET C | | | | | |
| 1 | A | A | B | A | B | B | | | | | | |
| 2 | A | A | B | B | A | B | | | | | | |
| 3 | A | A | B | B | B | A | | | | | | |
| 4 | A | B | A | A | B | B | | | | | | |
| 5 | A | B | B | A | A | B | | | | | | |
| 6 | A | B | B | B | A | A | | | | | | |
| 7 | A | B | A | B | A | B | | | | | | |
| 8 | A | B | A | B | B | A | | | | | | |


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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | A | B | B | A | B | A | |


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### 5.1.A.4 Appendix 4: Logical Structure of an EAN-8 Bar Code Symbol Excluding Quiet Zones

Figure 5.1.A.4 – 1

| **Logical Structure of an EAN-8 Bar Code Symbol (Excluding Quiet Zones)** | | | | |
|---|---|---|---|---|
| Left Guard Bar Pattern | Characters 8 Through 5 (Left Half) | Centre Guard Bar Pattern | Characters 4 Through 1 (Right Half) | Right Guard Bar Pattern |
| 3 modules | 28 modules (4x7) | 5 modules | 28 modules (4x7) | 3 modules |
| Total number of modules = 67 | | | | |

Figure 5.1.A.4 – 2

| **Character Position** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number Set Used for Representing Characters 8 Through 5 | | | | Number Set Used for Representing Characters 4 Through 1 | | | |
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| ALWAYS USE NUMBER SET A | | | | ALWAYS USE NUMBER SET C | | | |


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### 5.1.A.5 Appendix 5: Logical Structure of a UPC-E Bar Code Symbol Excluding Quiet Zones

Figure 5.1.A.5 – 1

| **Logical Structure of a UPC-E Bar Code Symbol (Excluding Quiet Zones)** | | |
|---|---|---|
| Normal Guard Bar Pattern | Six Symbol Characters (Note the Use of Variable Parity) | Special Guard Bar Pattern (UPC-E) |
| 3 modules | 42 modules (6x7) | 6 modules |
| Total number of modules = 51 | | |

Figure 5.1.A.5 – 2

| **Value of Prefix Digit** | **Value of Check Digit** | **Number Sets Used for Numbering a UPC-E Bar Code Symbol** | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| 0 | 0 | B | B | B | A | A | A |
| 0 | 1 | B | B | A | B | A | A |
| 0 | 2 | B | B | A | A | B | A |
| 0 | 3 | B | B | A | A | A | B |
| 0 | 4 | B | A | B | B | A | A |
| 0 | 5 | B | A | A | B | B | A |
| 0 | 6 | B | A | A | A | B | B |
| 0 | 7 | B | A | B | A | B | A |
| 0 | 8 | B | A | B | A | A | B |
| 0 | 9 | B | A | A | B | A | B |


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## 5.1.A.6 Appendix 6: Symbol Formats at Nominal Dimensions (Not to Scale)

Figure 5.1.A.6 - 1

EAN-13 Bar Code Symbol

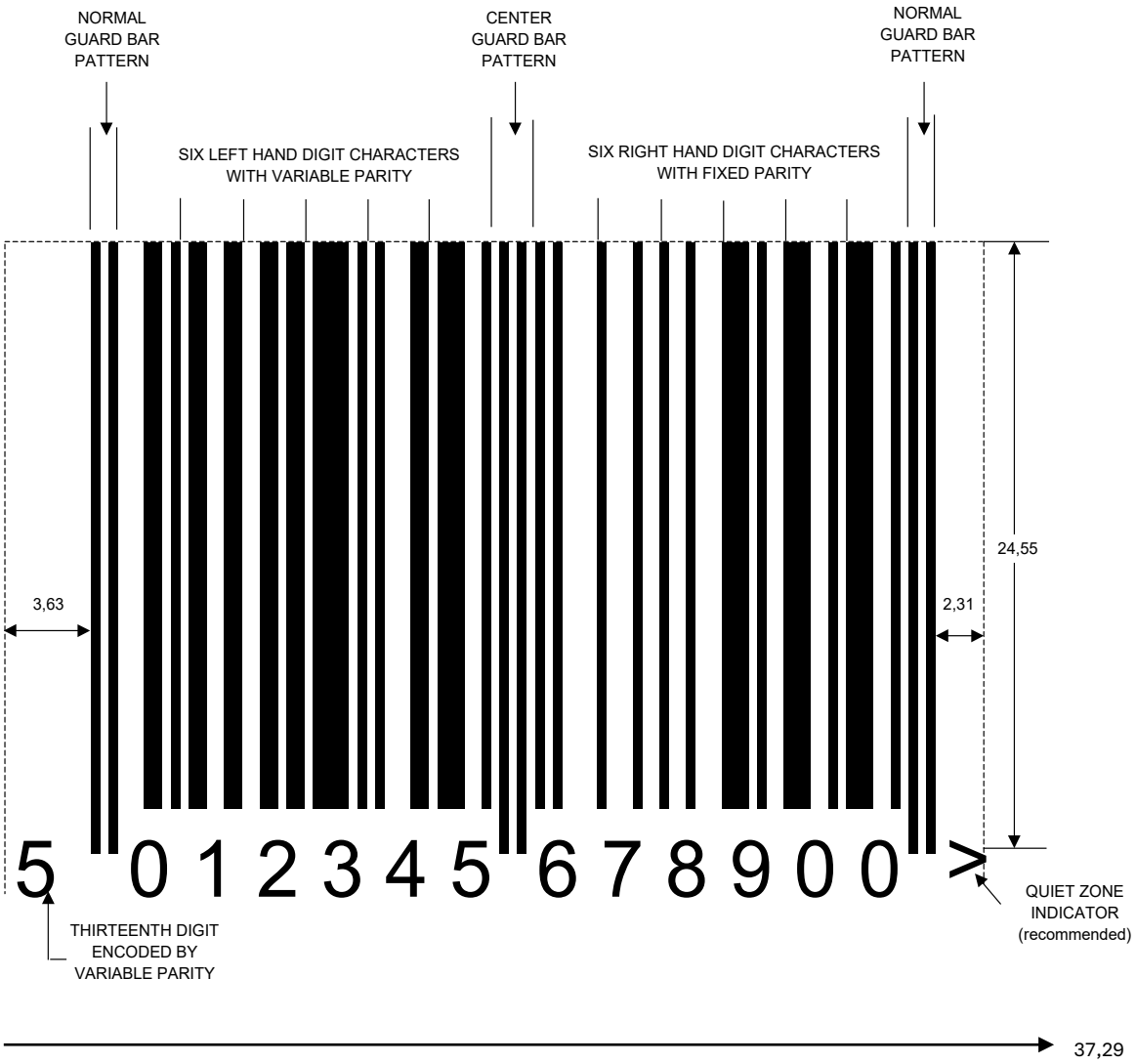



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Figure 5.1.A.6 - 2

UPC-A Bar Code Symbol

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Figure 5.1.A.6 – 3

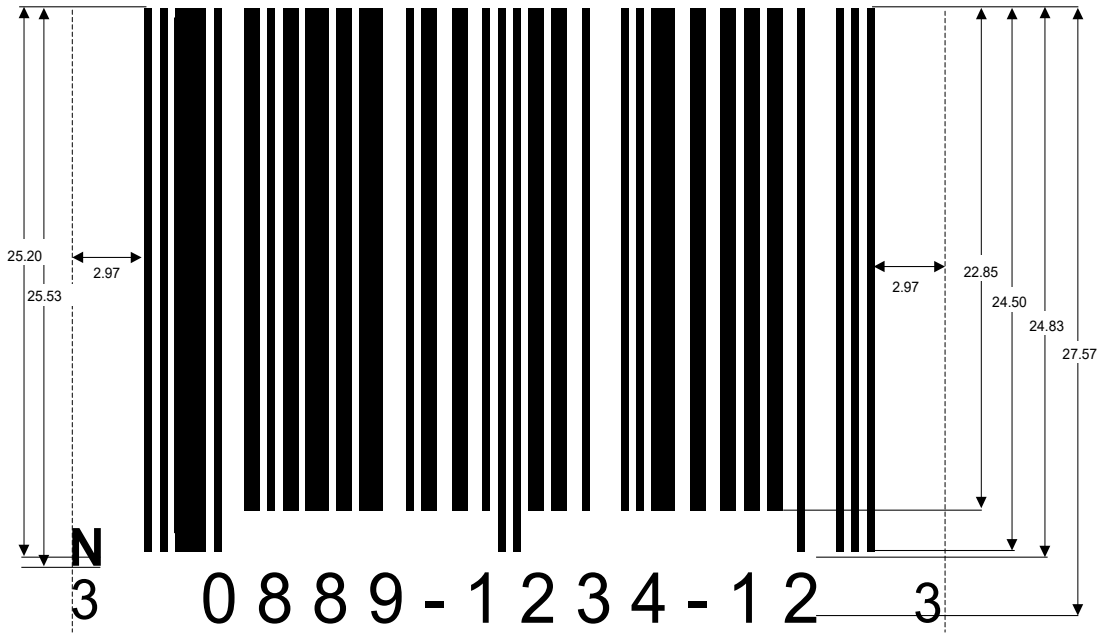



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Figure 5.1.A.6 – 4

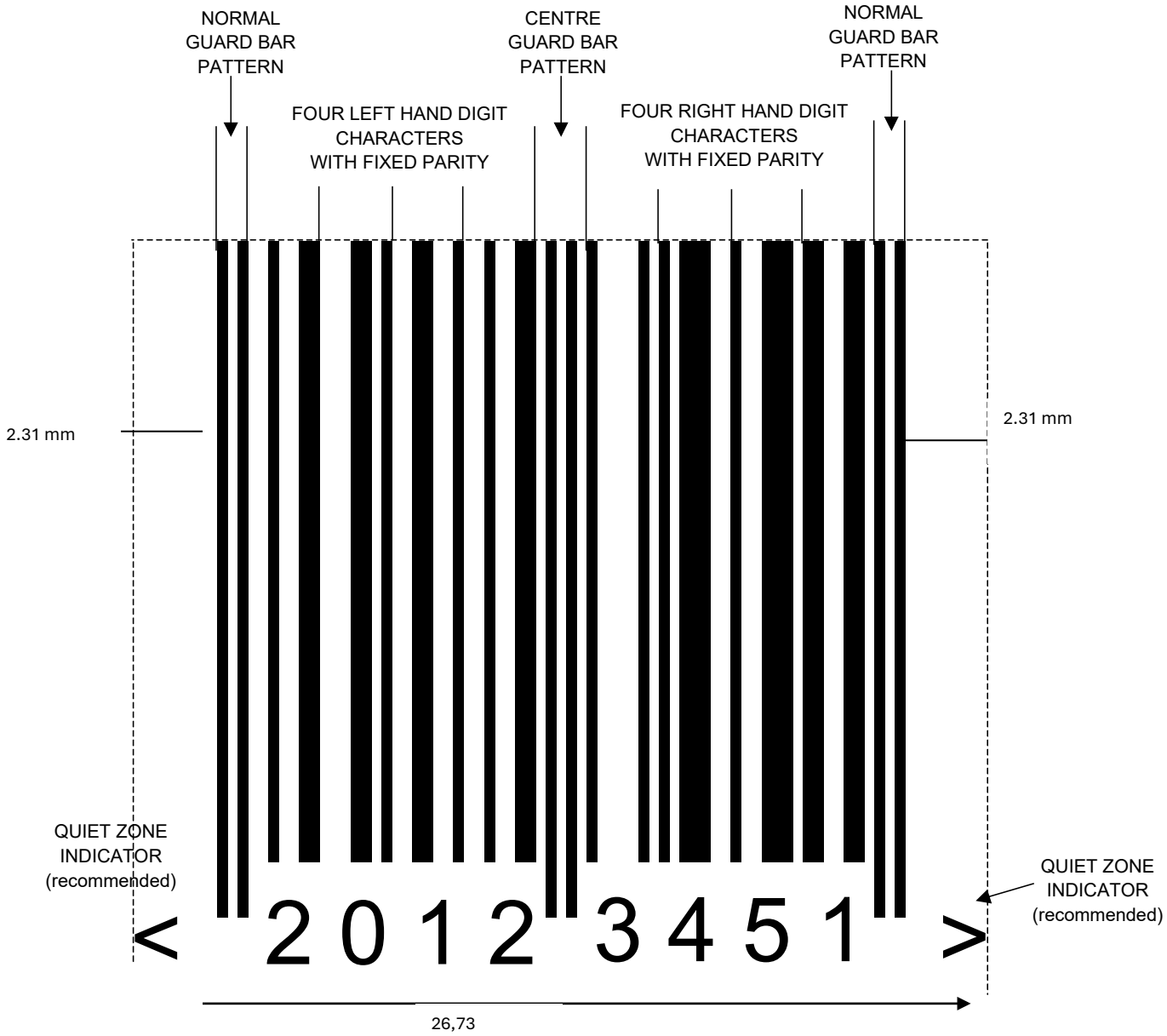



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Figure 5.1.A.6 - 5

UPC-E Bar Code Symbol

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Figure 5.1.A.6 – 6

UPC-A Bar Code Symbol with Two-Digit Add-On Symbol

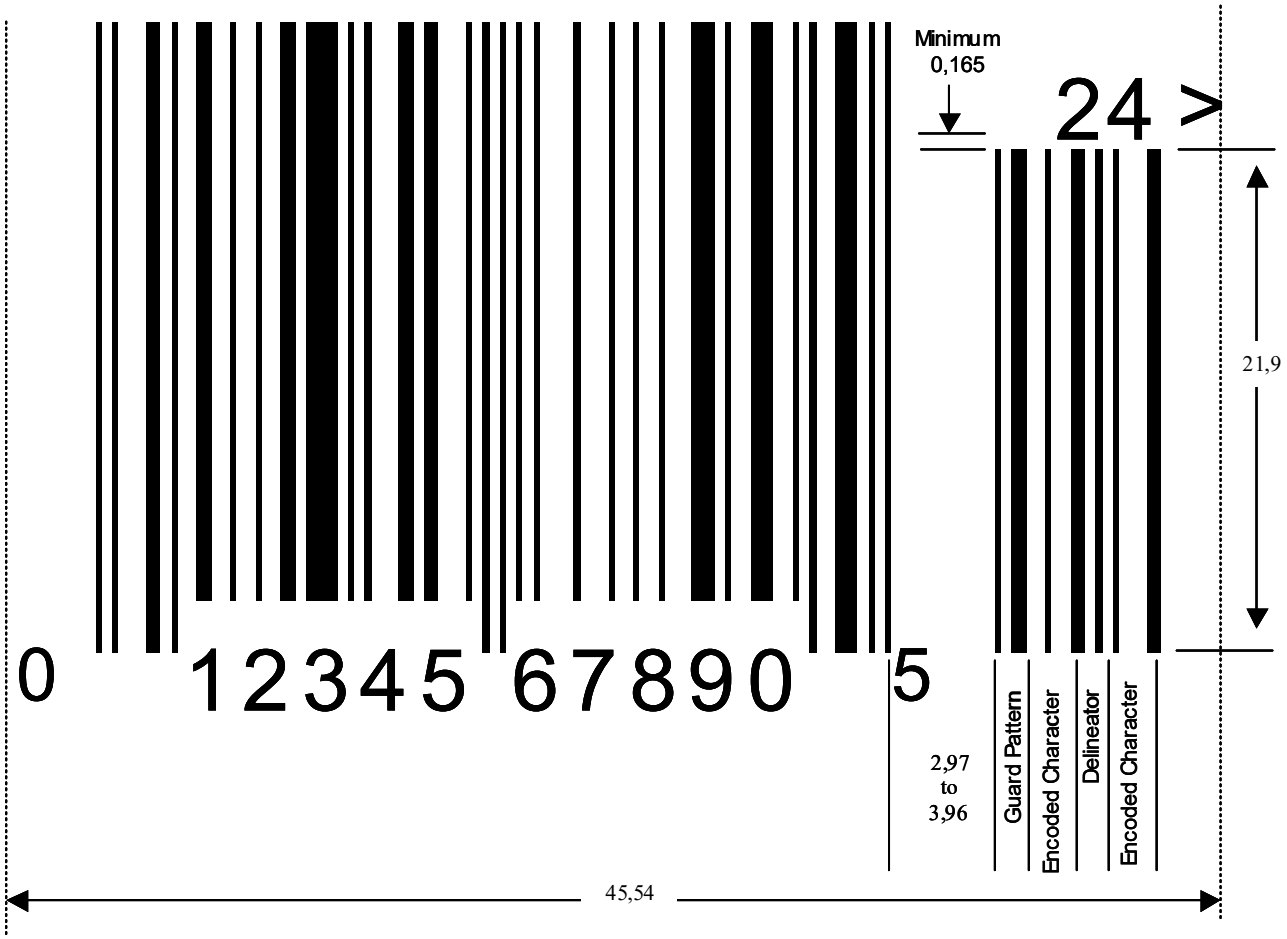



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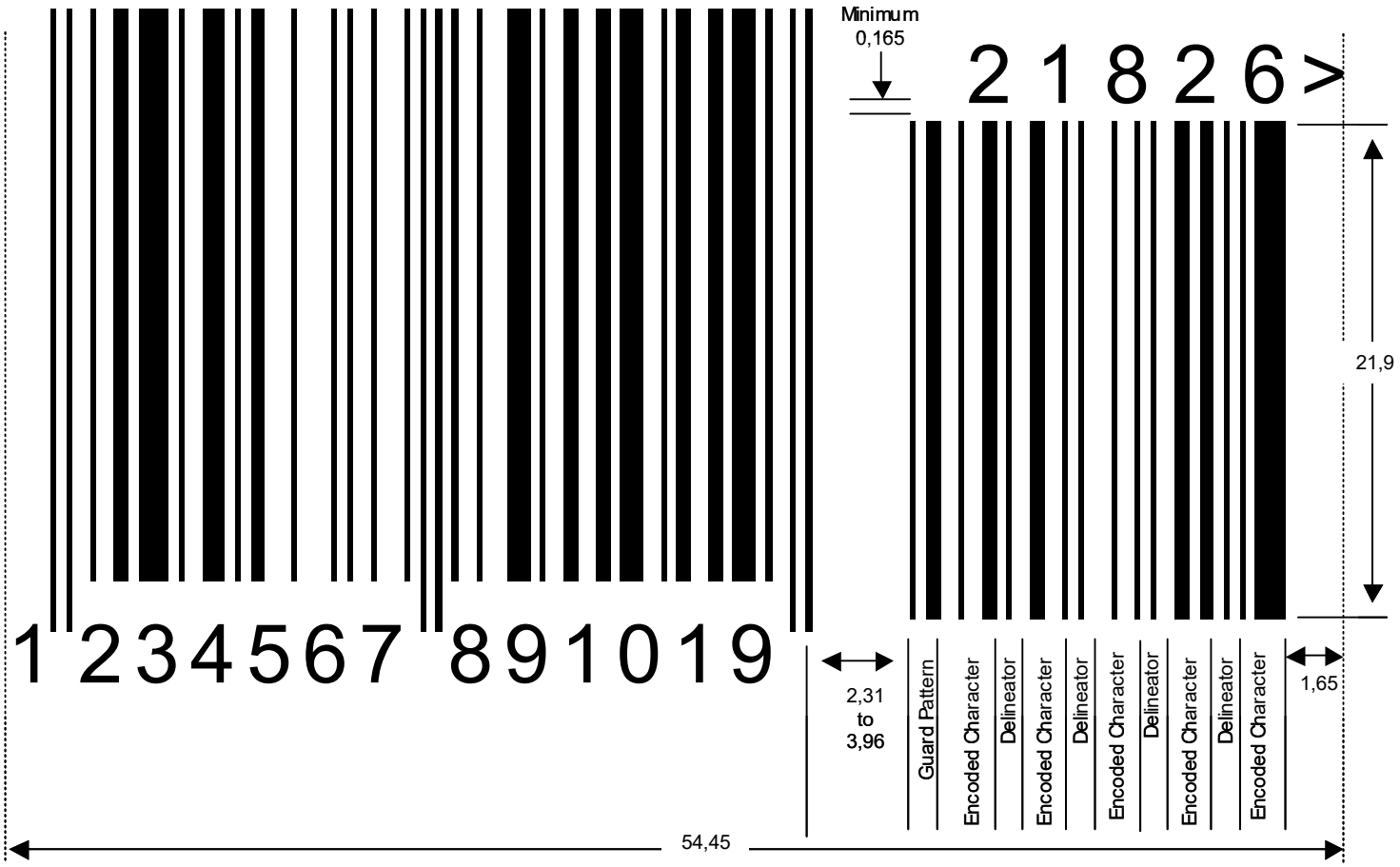
Figure 5.1.A.6 – 7

EAN-13 Bar Code Symbol with Five-Digit Add-On Symbol





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### 5.1.A.7 Appendix 7: Dimensions of Modules and Symbols at Different Levels of Magnification

Figure 5.1.A.7 – 1

| Magnification Factor | Ideal Module Width [mm] | EAN-13/UPC-A Dimensions [mm] | | EAN-8 Dimensions [mm] | |
|---|---|---|---|---|---|
| | | Width | Height | Width | Height |
| 0.80 | 0.264 | 29.83 | 20.73 | 21.38 | 17.05 |
| 0.85 | 0.281 | 31.70 | 22.02 | 22.72 | 18.11 |
| 0.90 | 0.297 | 33.56 | 23.32 | 24.06 | 19.18 |
| 0.95 | 0.313 | 35.43 | 24.61 | 25.39 | 20.24 |
| 1.00 | 0.330 | 37.29 | 25.91 | 26.73 | 21.31 |
| 1.05 | 0.346 | 39.15 | 27.21 | 28.07 | 22.38 |
| 1.10 | 0.363 | 41.02 | 28.50 | 29.40 | 23.44 |
| 1.15 | 0.379 | 42.88 | 29.80 | 30.74 | 24.51 |
| 1.20 | 0.396 | 44.75 | 31.09 | 32.08 | 25.57 |
| 1.25 | 0.412 | 46.61 | 32.39 | 33.41 | 26.64 |
| 1.30 | 0.429 | 48.48 | 33.68 | 34.75 | 27.70 |
| 1.35 | 0.445 | 50.34 | 34.98 | 36.09 | 28.77 |
| 1.40 | 0.462 | 52.21 | 36.27 | 37.42 | 29.83 |
| 1.45 | 0.478 | 54.07 | 37.57 | 38.76 | 30.90 |
| 1.50 | 0.495 | 55.94 | 38.87 | 40.10 | 31.97 |
| 1.55 | 0.511 | 57.80 | 40.16 | 41.43 | 33.03 |
| 1.60 | 0.528 | 59.66 | 41.46 | 42.77 | 34.10 |
| 1.65 | 0.544 | 61.53 | 42.75 | 44.10 | 35.16 |
| 1.70 | 0.561 | 63.39 | 44.05 | 45.44 | 36.23 |
| 1.75 | 0.577 | 65.26 | 45.34 | 46.78 | 37.29 |
| 1.80 | 0.594 | 67.12 | 46.64 | 48.11 | 38.36 |


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| | | | | | |
|---|---|---|---|---|---|
| 1.85 | 0.610 | 68.99 | 47.93 | 49.45 | 39.42 |
| 1.90 | 0.627 | 70.85 | 49.23 | 50.79 | 40.49 |
| 1.95 | 0.643 | 72.72 | 50.52 | 52.12 | 41.55 |
| 2.00 | 0.660 | 74.58 | 51.82 | 53.46 | 42.62 |
| Note: Refer to Section 5.4 for the minimum, nominal, and maximum X-dimensions, and symbol heights for bar code symbols | | | | | |


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# Section 5.2:

# ITF-14 Symbology Specifications

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### 5.2.1 Symbology Characteristics

In the EAN.UCC System, the characteristics of ITF-14 Symbol are:

- Encodable character set: numeric 0 to 9 (ASCII characters 48 to 57 inclusive, in accordance with ISO 646)
- Code type: continuous
- Elements per symbol character: five (two wide and three narrow) encoded as either five bars (dark bars) or five spaces (light bars)
- Self-checking symbol character
- Data string length encodable: fixed length at 14 digits
- Bidirectionally decodable
- One Check Digit is required (see Section 3.A.1)
- The symbol character density for ITF-14 is 16 to 18 modules per symbol character pair, depending on the wide-to-narrow ratio. The value is 16, based on the target ratio of 2.5 to 1.
- The non-data overhead is eight to nine modules, depending on the wide-to-narrow ratio. The value is 8.5, based on the target ratio of 2.5 to 1.

#### 5.2.1.1 Symbol Structure

An ITF-14 Symbol includes:

- A leading Quiet Zone
- A start pattern
- Seven pairs of symbol characters representing data
- A stop pattern
- A trailing Quiet Zone


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### 5.2.1.2 Character Encodation

#### 5.2.1.2.1 Data Character Encodation

Figure 5.2.1.3.1 – 1 defines the ITF-14 Symbol's character encodation. In the binary representation column, the character 1 represents a wide element and 0 represents a narrow element.

Figure 5.2.1.3.1 – 1
**Binary Representation of Character Encodation**

| Data Character | Binary Representation | | | | |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 1 | 0 | 0 | 1 |
| 3 | 1 | 1 | 0 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 | 1 |
| 5 | 1 | 0 | 1 | 0 | 0 |
| 6 | 0 | 1 | 1 | 0 | 0 |
| 7 | 0 | 0 | 0 | 1 | 1 |
| 8 | 1 | 0 | 0 | 1 | 0 |
| 9 | 0 | 1 | 0 | 1 | 0 |

Figure 5.2.1.3.1 – 1 uses a modified binary coded decimal encoding scheme. The four leftmost bit positions for each character are assigned weights of 1, 2, 4, and 7, from left to right; the fifth position is used for an even parity bit. The sum of the positional weights of the 1 bits is equivalent to the data character value, except in the case of data character 0, where the weights 4 and 7 are applied. The parity bit ensures that there are always two 1 bits per character.


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The algorithm shown in Figure 5.2.1.3.1 – 2 defines the rules for converting numeric data into the symbol characters of an ITF-14 Symbol (numeric data equals the Global Trade Item Number™ (GTIN™) and, therefore, already contains the Check Digit).

Figure 5.2.1.3.1 - 2

| Step in Algorithm | Example |
|---|---|
| 1. Calculate Check Digit for 0367123456789 | 367 |
| 2. With ITF-14 Symbols, the data string, including the Check Digit, will always be a 14-digit number. The leftmost four digits of this number are 0367. | 0367 |
| 3. Subdivide the numeric string into digit pairs. The leftmost four digits of the number are 0367. | 0367<br>03 and 67 |
| 4. Encode the digit pairs as follows: | |
| -- Encode the leading digit of each pair into bar patterns, as shown in Figure 5.2.1.3.1 – 1. | 0 and 6 |
| -- Encode the second digit of each pair into space patterns, as shown in Figure 5.2.1.3.1 – 1. | 3 and 7 |
| 5. Form each symbol character pair by taking the bar (dark bar) and space (light bar) elements alternately from the patterns derived from the two steps in 4, commencing with the first bar (dark bar) of the pattern for the first digit, followed by the first space (light bar) of the pattern for the second digit. | |

Figure 5.2.1.3.1 – 3 illustrates the sequence of bar (dark bar) and space (light bar) elements corresponding to the data character pairs 03 and 67.


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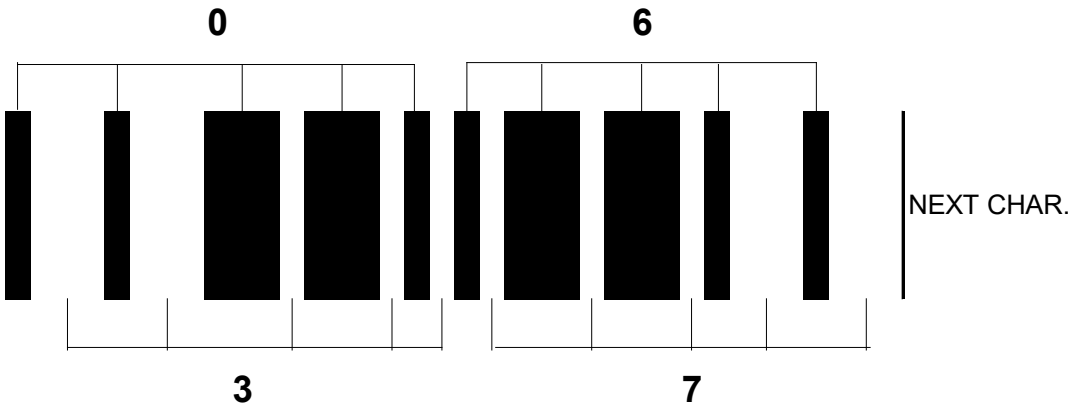
Figure 5.2.1.3.1 – 3

**ITF-14 Symbol Character Pairs Encoding 03 and 67**




#### 5.2.1.2.2 Start and Stop Patterns

The start pattern shall consist of four narrow elements in the sequence “bar (dark bar) - space (light bar) - bar (dark bar) - space (light bar).” The stop pattern shall consist of a “wide bar (dark bar) - narrow space (light bar) - narrow bar (dark bar)” sequence.

The start pattern shall be positioned at the normal left end of the symbol characters adjacent to the first bar (dark bar) of the most significant digit. The stop pattern shall be positioned at the normal right end of the symbol characters adjacent to the final space (light bar) of the least significant digit.

There is no assigned Human Readable Interpretation of the start and stop patterns, and they shall not be transmitted by the decoder.

Figure 5.2.1.3.2 – 1 illustrates the start and stop patterns and their relationship to the symbol characters.

Figure 5.2.1.3.2 – 1

**Start and Stop Patterns**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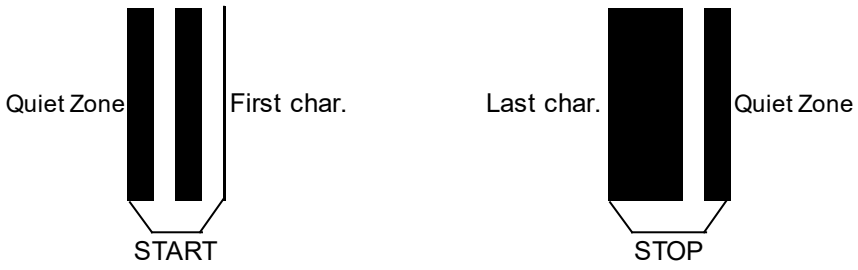
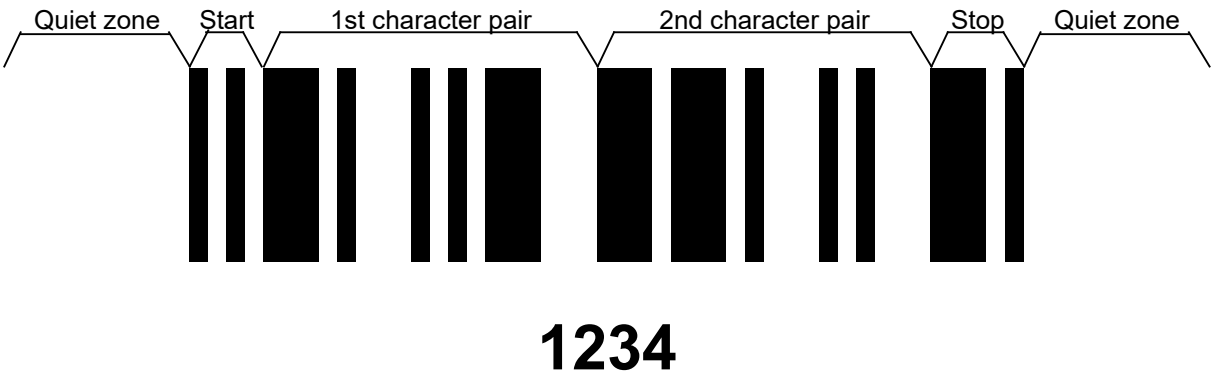



Figure 5.2.1.3.2 – 2 illustrates a complete bar code for the number 1234, showing the necessary Quiet Zones.

Figure 5.2.1.3.2 – 2

**ITF-14 Symbol Inclusive of Quiet Zones**




#### 5.2.1.2.3 Check Digit

A Check Digit is required in the ITF-14 Symbology. Section 3.A.1 defines the Check Digit position and calculation.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### 5.2.1.3 Dimensions and Tolerances

ITF-14 Symbols shall use the following target dimensions:

The X-dimension of ITF-14 Symbols is defined by the application specification based on the needs of the application. Refer to Section 5.4.2.6 for specifications by application area.

In the ITF-14 Symbol target size, the theoretical widths of the bars (light or dark) are:

Narrow bar = 1.016 mm (0.04 in.)

Wide bar = 2.540 mm (0.10 in.). The target width of the wide bars (dark bars) is 2.5 times the width of the narrow bars (dark bars).

The target width of an ITF-14 Symbol ten element character pair is 16.256 mm (0.64 in.), and the corresponding widths of auxiliary characters are:

Start Character = 4.064 mm (0.16 in.)

Stop Character = 4.572 mm (0.18 in.)

The Quiet Zones to the right and left of the symbol are compulsory. The minimum width of the Quiet Zone is 10X. Both Quiet Zones in an ITF-14 Symbol have target widths of 10.2 mm (0.40 in.).

A minimum Quiet Zone of 1 mm (0.04 in.) between the bottom line of the Bearer Bar and the top of the human readable characters is required.

For ITF-14 Symbols, the height of the bars (dark bars) in the target size symbol is 32 mm (1.25 in.).

Note: All dimensions given are ideal, theoretical values corresponding to the target size of symbols as used in the general distribution operating environment. These dimensions are not intended to be used directly in the preparation of bar codes.

The length of an ITF-14 Symbol, including Quiet Zones, can be calculated from the following expression:

$$W = (P(4N+6)+N+6)X+2Q$$

Where:

W is the length in millimetres

P is the number of character pairs

N is the wide-to-narrow ratio


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X is the width of a narrow element in millimetres

Q is the width of the Quiet Zone in millimetres

An ITF-14 Symbol has seven character pairs, a target wide-to-narrow ratio of 2.5:1, a target X width of 1.016 mm (0.04 in.), and Quiet Zone widths of 10.2 mm (0.40 in.). This corresponds to a total symbol width of 142.748 mm (5.8 in.).


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#### 5.2.1.4 Reference Decode Algorithm

Bar code reading systems are designed to read imperfect symbols to the extent that practical algorithms permit. This section describes the reference decode algorithm used in the computation of the Decodability value described in *ISO/IEC 15416*.

Decodability shall be determined as follows:

- Within each ITF-14 Symbol character (representing two digits), sort the bars ($b_i$) and spaces ($s_i$) such that:

  $b_1<b_2<b_3<b_4<b_5$

  $s_1<s_2<s_3<s_4<s_5$

- The determined X-dimension (Z) is given by:

  $Z = b_1 + b_2 + b_3 + s_1 + s_2 + s_3 / 6$

- Separation value ($V_1$) is:

  $V_1 = (d/Z) – 0.5$
  where d = the smaller of $(b_4 – b_3)$ or $(s_4 – s_3)$

- Uniformity value ($V_2$) is:

  $V_2 = 1 – u/Z$
  where u = the largest of:

  $b_5 – b_4$

  $b_3 – b_1$

  $s_5 – s_4$

  $s_3 – s_1$

- Narrowest element value ($V_3$) is:

  $V_3 = [(n/Z) – 0.25] / 0.75$
  where n = the smaller of $s_1$ or $b_1$

- For each symbol character, determine the Decodability value V. V is the smallest of $V_1$, $V_2$, or $V_3$.

- The scan profile Decodability value is the smallest value of V measured in a Scan Reflectance Profile (SRP). The reference decode algorithm fails when V exhibits a negative value.

- The Decodability grade for each profile is determined from the Decodability value according to ANSI X3.182, Table 3.


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### 5.2.1.5 ITF-14 Symbols

#### 5.2.1.5.1 Bearer Bar

The purpose of a Bearer Bar is to equalise the pressure exerted by the printing plate over the entire surface of the symbol, and to enhance reading reliability by helping to reduce the probability of misreads or short scans that may occur when a skewed scanning beam enters or exits the bar code symbol through its top or bottom edge.

The Bearer Bar is mandatory unless it is not technically feasible to apply it (in which case reading reliability will be reduced).

For printing methods requiring printing plates, the nominal Bearer Bar has a constant thickness of 4.8 mm (0.19 in.) and must completely surround the symbol, including its Quiet Zones, and butt directly against the top and bottom of the bars (dark bars) of the symbol.

For printing methods that do not require printing plates, the Bearer Bar should be a minimum of twice the width of a narrow bar (dark bar) and need only appear at the top and bottom of the symbol, butting directly against the top and bottom of the symbol bars (dark bars). The Bearer Bar may extend above and below the Quiet Zones. However, it is not mandatory to print the vertical sections of the Bearer Bar. See Figure 5.2.1.6.1 – 1.

Figure 5.2.1.6.1 – 1

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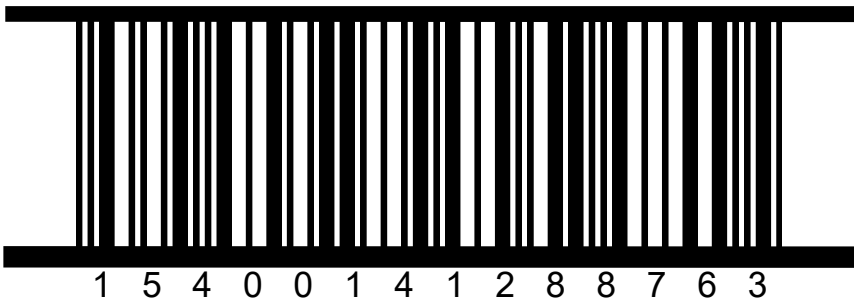



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#### 5.2.1.6 Human Readable Interpretation

A clearly legible Human Readable Interpretation of the data characters (proportional to the size of the symbol) including a Check Digit should normally be printed with the symbol encoding the data characters. Start and stop patterns do not have Human Readable Interpretation. Character size and font are not specified, and the Human Readable Interpretation may be printed anywhere in the area surrounding the symbol as long as the Quiet Zones are not encroached upon.


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### 5.2.A.1 Appendix 1: (Informative) Additional Features

#### 5.2.A.1.1 Protection Against Short Scans

In ITF-14 Symbols, the bar (dark bar) patterns of the start and stop patterns may be found at the respective end and beginning of certain encoded symbol characters within the code. There is, therefore, no guarantee that a partial scan of the symbol will not produce a valid read for an embedded symbol having fewer characters.

In the EAN.UCC System, short scans are very unlikely to happen, as the symbol must always contain 14 digits. However, a symbol containing more than 14 digits may cause a short scan of 14 digits. In this instance, the Check Digit offers a certain security to detect this error.

These are the measures that should be taken to minimise the risk of partial read.

#### 5.2.A.1.2 Fixed Length Symbols

In any application standard, the number of characters encoded in an ITF-14 Symbol should be fixed for that application, and reading or data processing equipment should be programmed to only accept messages of that defined length. An ITF-14 Symbol must always carry a 14-digit number.

#### 5.2.A.1.3 Bearer Bars

For information regarding Bearer Bars, refer to Section 5.2.1.6.1.


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### 5.2.A.2 Appendix 2: (Informative) Guidelines for the Use of ITF-14

#### 5.2.A.2.1 Autodiscrimination Compatibility

ITF-14 Symbols may be read by suitably programmed bar code readers that are designed to autodiscriminate the ITF Symbology from other symbologies. The ITF Symbology is, in particular, fully distinguishable from, and thus compatible with, many symbologies including the ISO standard symbologies.

The decoder's valid set of symbologies should be limited to those needed by a given application to maximize reading security.

#### 5.2.A.2.2 System Considerations

It is important that the various components making up a bar code installation system (e.g., printers, labels, readers) operate in concert. A failure in any component, or a mismatch between components, can compromise the performance of the overall system.


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### 5.2.A.3 Appendix 3: (Informative) Symbology Identifier

The symbology identifier allocated to the ITF-14 Symbol in *ISO/IEC 15424*, which may be added as a preamble to the decoded data by a suitably programmed bar code reader, is

]Im

where:

] is ASCII character 93

I (upper case I) is the code character for the ITF-14 Symbology

m is a modifier character

Note: The symbology identifier ]I1 is the only symbology identifier used by the Uniform Code Council (UCC™) and EAN International with the ITF-14 Symbol. This information shall not be encoded in the bar code symbol, but should be generated by the decoder after decoding and transmitting as a preamble to the data message. The value of "m" in the symbology identifier is equal to 1, which indicates the Check Digit has been validated and transmitted by the scanner.


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### 5.2.A.4 Appendix 4: (Informative) Test Specifications

To verify whether a symbol meets the specifications in the EAN.UCC System, it shall be tested using the specification defined in ISO/IEC 15416, which details the conditions under which measurements should be made. The specification defines methods of determining an overall quality grade based on the attributes of the bar code symbol and determining its conformity with the system. For ITF-14 Symbols, the reference decode algorithm shall be the algorithm specified in Section 5.2.A.3.

Full details on bar code production and quality assessment can be found in Section 5.4.

The verifier shall determine the average wide-to-narrow ratio (N) for each profile. The value N should be computed character by character, then averaged over all characters in the symbol. The range indicated below is passing:

$2.25 < N < 3.00$

N is calculated for each symbol character (pair of data digits) according to the following rule:

$$N_i = 1.5*[(b_4 + b_5 + s_4 + s_5)/(b_1 + b_2 + b_3 + s_1 + s_2 + s_3)]$$

The value N for the profile is then obtained by averaging the $N_i$ for all characters in the symbol.


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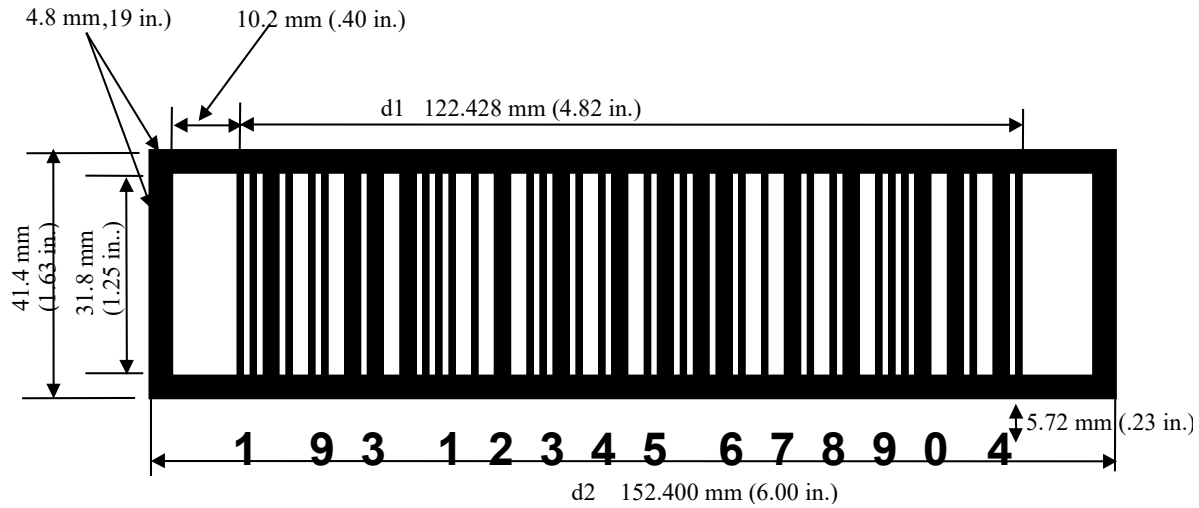
Figure 5.2.A.4 – 1

**ITF-14 Symbol: Main Dimensions at X-Dimension 1.016 mm (0.040 in.)**




This diagram is not intended to be used as a basis for measurement.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# Section 5.3:

# UCC/EAN-128 Symbology Specifications

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### 5.3.1 Symbology Characteristics

The UCC/EAN-128 Bar Code Symbol has been carefully designed through joint co-operation among EAN International, the Uniform Code Council (UCC™) and Automatic Identification Manufacturers, Inc. (AIM). Use of UCC/EAN-128 Bar Code Symbols provides a high degree of security and distinguishes EAN.UCC System Element Strings from extraneous non-standard bar code symbols.

The UCC/EAN-128 Symbology is a subset of the more general Code 128 Symbology. By agreement among AIM, Inc., EAN International and the UCC, use of the ~~Function 1 Character~~Function Code 1 (FNC1) in Code 128 Symbols in the first symbol character position following the Start Character has been reserved exclusively for the EAN.UCC System.

Code 128 is fully described in "*ISO/IEC 15417, Information Technology - Automatic Identification and Data Capture Techniques - Bar code Symbology Specification - Code 128*.

The information covered in Section 5.3 includes:

- Sections 5.3.1 – 5.3.6: UCC/EAN-128 Symbology subset (using "*ISO/IEC 15417*" for reference)
- Section 5.3.7: EAN.UCC System application-defined parameters
- Section 5.3.8: EAN.UCC System rules for encoding/decoding Element Strings in UCC/EAN-128 Bar Code Symbols

#### 5.3.1.1 UCC/EAN-128 Symbology Characteristics

The characteristics of the UCC/EAN-128 Symbol~~ol~~ogy are:

- Encodable character set:

  - The Code 128 ASCII characters are in accordance with *ISO 646*. Refer to Figure 3.A.3 – 1 for more details. Spaces are not encoded in UCC/EAN-128 Bar Code Symbols).

  - Characters with ASCII values 128 to 255 may also be encoded in Code 128 Symbols. Characters with ASCII values 128 -to 255 accessed by Function 4 Character (FNC4) are reserved for future use and are not used in UCC/EAN-128 Bar Code Symbols.


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- Four non-data function characters. FNC2 and FNC4 are not used in UCC/EAN-128 Bar Code Symbols.

- Four code set selection characters (including single character code set shift)

- Three Start Characters

- One Stop Character

- Continuous code type
- Six elements per symbol character comprising three bars (dark bars) and three spaces (light bars), each one, two, three, or four modules in width. The Stop Character is made up of seven elements comprising four bars (dark bars) and three spaces (light bars).
- Character self-checking
- Variable symbol length
- Bi-directionally decodable
- One mandatory Symbol Check Character (see Section 5.3.A.1).
- Data character density is 11 modules per symbol character (5.5 modules per numeric character in code set C, 13 modules per Stop Character)
- Non-data overhead:

  - UCC/EAN-128 Bar Code Symbols have a special double character start pattern consisting of the appropriate Start Character and immediately followed by a ~~Function 1 Character~~Function Code 1 (FNC1). The FNC1 adds to the symbol's non-data overhead. The total symbol overhead is 46 modules.

  - The FNC1 character may also be used as a separator character between Element Strings not contained in the pre-defined table shown in Figure 5.3.8.2.1 – 1.

- UCC/EAN-128 Bar Code Symbol size characteristics:

  - The maximum physical length is 165 mm (6.5 in.) including Quiet Zones.

  - The maximum number of data characters in a single symbol is 48.

  - For a given length of data, the symbol size is variable between limits in X-dimension to accommodate the ranges in quality achievable by the various printing processes.


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### 5.3.2 UCC/EAN-128 Bar Code Symbol Structure

The UCC/EAN-128 Bar Code Symbol is made up as follows, reading from left to right:

* Leading Quiet Zone
* A Start Character (A, B, or C)
* The ~~Function 1 Character~~Function Code 1 (FNC1)

The double character Start pattern

* Data (including the Application Identifier represented in character set A, B, or C)
* A Symbol Check Character
* The Stop Character
* Trailing Quiet Zone

The data characters represented in the symbol are shown in Human Readable Interpretation underneath or above the symbol.


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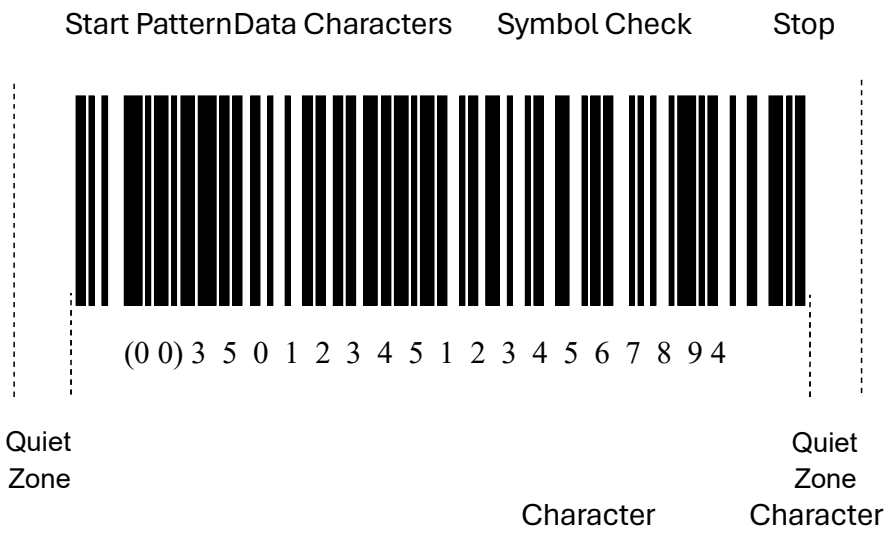
Figure 5.3.2 – 1

**General Format of a UCC/EAN-128 Bar Code Symbol**




### 5.3.3 UCC/EAN-128 Symbology Character Assignments

Figure 5.3.3.2 – 1 defines all the Code 128 character assignments. In the element width column, the numeric values represent the widths of the elements in modules or multiples of the X-dimension.

UCC/EAN-128 Bar Code Symbol character assignments are identical to Code 128 Symbol character assignments.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### 5.3.3.1 Symbol Character Structure

The sum of the bar modules in any symbol character is always even (even parity) and the sum of the space modules is, therefore, always odd. This parity feature enables character self-checking.

Figure 5.3.3.1 – 1

**UCC/EAN-128 Bar Code Symbol Start Character A**

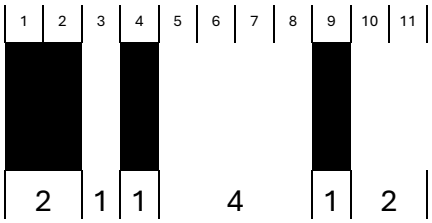



Figure 5.3.3.1 – 2 illustrates the encodation of the symbol character value 35, which represents data character C in code sets A or B or the digits 35 in code set C.

Figure 5.3.3.1 – 2

**Symbol Character Value 35**

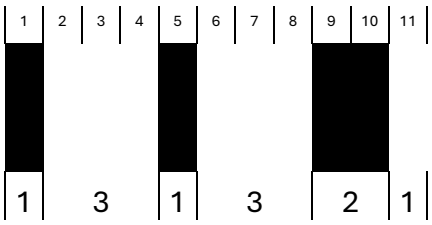
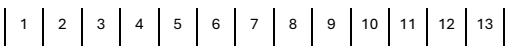



Figure 5.3.3.1 – 3

**UCC/EAN-128 Bar Code Symbol Stop Character**





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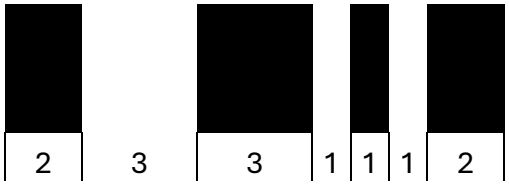



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### 5.3.3.2 Data Character Encodation

Code 128 has three character sets, which are shown in Figure 5.3.3.2 – 1 as code sets A, B, and C.

UCC/EAN-128 Symbology specifies the identical character set, as defined by the International *ISO/IEC 646* Standard, to ensure international compatibility. For more information see Figure 3.A.3 – 1.

The symbol character bar (dark bar) and space (light bar) patterns shown in Figure 5.3.3.2 – 1 represent the data characters listed under the columns for code set A, B, or C. The choice of code set depends on the Start Character, the use of code A, code B, or code C characters, or the shift character. If the symbol begins with Start Character A, then code set A is defined initially. Code set B and code set C are similarly defined by beginning the symbol with Start Character B or C, respectively. The code set can be redefined within the symbol by using code A, code B, and code C characters or the shift character (see Section 5.3.3 for the use of special characters).

The same data may be represented by different Code 128 Symbols through the use of different combinations of Start, code set, and shift characters. The individual applications do not specify code sets A, B, or C. Section 5.3.A.3 contains rules to minimise the length of the symbol for any given data.

Each symbol character is assigned a numeric value listed in Figure 5.3.3.2 – 1. This value is used in calculating the Symbol Check Character value. It may also be used to provide a conversion to and from ASCII values (see Section 5.3.A.2).


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Figure 5.3.3.2 – 1

**Code 128 Character Encodation**

| Symbol Character Value | Code Set A | ASCII Value for Code Set A | Code Set B | ASCII Value for Code Set B | Code Set C | Element Widths (Modules) | | | | | | Element Pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B | S | B | S | B | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 0 | space | 32 | space | 32 | 00 | 2 | 1 | 2 | 2 | 2 | 2 | | | | | | | | | | | |
| 1 | ! | 33 | ! | 33 | 01 | 2 | 2 | 2 | 1 | 2 | 2 | | | | | | | | | | | |
| 2 | " | 34 | " | 34 | 02 | 2 | 2 | 2 | 2 | 2 | 1 | | | | | | | | | | | |
| 3 | # | 35 | # | 35 | 03 | 1 | 2 | 1 | 2 | 2 | 3 | | | | | | | | | | | |
| 4 | $ | 36 | $ | 36 | 04 | 1 | 2 | 1 | 3 | 2 | 2 | | | | | | | | | | | |
| 5 | % | 37 | % | 37 | 05 | 1 | 3 | 1 | 2 | 2 | 2 | | | | | | | | | | | |
| 6 | & | 38 | & | 38 | 06 | 1 | 2 | 2 | 2 | 1 | 3 | | | | | | | | | | | |
| 7 | apos-trophe | 39 | apos-trophe | 39 | 07 | 1 | 2 | 2 | 3 | 1 | 2 | | | | | | | | | | | |
| 8 | ( | 40 | ( | 40 | 08 | 1 | 3 | 2 | 2 | 1 | 2 | | | | | | | | | | | |
| 9 | ) | 41 | ) | 41 | 09 | 2 | 2 | 1 | 2 | 1 | 3 | | | | | | | | | | | |
| 10 | * | 42 | * | 42 | 10 | 2 | 2 | 1 | 3 | 1 | 2 | | | | | | | | | | | |
| 11 | + | 43 | + | 43 | 11 | 2 | 3 | 1 | 2 | 1 | 2 | | | | | | | | | | | |
| 12 | comma | 44 | comma | 44 | 12 | 1 | 1 | 2 | 2 | 3 | 2 | | | | | | | | | | | |
| 13 | - | 45 | - | 45 | 13 | 1 | 2 | 2 | 1 | 3 | 2 | | | | | | | | | | | |
| 14 | full stop | 46 | full stop | 46 | 14 | 1 | 2 | 2 | 2 | 3 | 1 | | | | | | | | | | | |
| 15 | / | 47 | / | 47 | 15 | 1 | 1 | 3 | 2 | 2 | 2 | | | | | | | | | | | |
| 16 | 0 | 48 | 0 | 48 | 16 | 1 | 2 | 3 | 1 | 2 | 2 | | | | | | | | | | | |
| 17 | 1 | 49 | 1 | 49 | 17 | 1 | 2 | 3 | 2 | 2 | 1 | | | | | | | | | | | |


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| Symbol Character Value | Code Set A | ASCII Value for Code Set A | Code Set B | ASCII Value for Code Set B | Code Set C | Element Widths (Modules) | | | | | | Element Pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B | S | B | S | B | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 18 | 2 | 50 | 2 | 50 | 18 | 2 | 2 | 3 | 2 | 1 | 1 | | | | | | | | | | | |
| 19 | 3 | 51 | 3 | 51 | 19 | 2 | 2 | 1 | 1 | 3 | 2 | | | | | | | | | | | |
| 20 | 4 | 52 | 4 | 52 | 20 | 2 | 2 | 1 | 2 | 3 | 1 | | | | | | | | | | | |
| 21 | 5 | 53 | 5 | 53 | 21 | 2 | 1 | 3 | 2 | 1 | 2 | | | | | | | | | | | |
| 22 | 6 | 54 | 6 | 54 | 22 | 2 | 2 | 3 | 1 | 1 | 2 | | | | | | | | | | | |
| 23 | 7 | 55 | 7 | 55 | 23 | 3 | 1 | 2 | 1 | 3 | 1 | | | | | | | | | | | |
| 24 | 8 | 56 | 8 | 56 | 24 | 3 | 1 | 1 | 2 | 2 | 2 | | | | | | | | | | | |
| 25 | 9 | 57 | 9 | 57 | 25 | 3 | 2 | 1 | 1 | 2 | 2 | | | | | | | | | | | |
| 26 | colon | 58 | colon | 58 | 26 | 3 | 2 | 1 | 2 | 2 | 1 | | | | | | | | | | | |
| 27 | semi-colon | 59 | semi-colon | 59 | 27 | 3 | 1 | 2 | 2 | 1 | 2 | | | | | | | | | | | |
| 28 | < | 60 | < | 60 | 28 | 3 | 2 | 2 | 1 | 1 | 2 | | | | | | | | | | | |
| 29 | = | 61 | = | 61 | 29 | 3 | 2 | 2 | 2 | 1 | 1 | | | | | | | | | | | |
| 30 | > | 62 | > | 62 | 30 | 2 | 1 | 2 | 1 | 2 | 3 | | | | | | | | | | | |
| 31 | ? | 63 | ? | 63 | 31 | 2 | 1 | 2 | 3 | 2 | 1 | | | | | | | | | | | |
| 32 | @ | 64 | @ | 64 | 32 | 2 | 3 | 2 | 1 | 2 | 1 | | | | | | | | | | | |
| 33 | A | 65 | A | 65 | 33 | 1 | 1 | 1 | 3 | 2 | 3 | | | | | | | | | | | |
| 34 | B | 66 | B | 66 | 34 | 1 | 3 | 1 | 1 | 2 | 3 | | | | | | | | | | | |
| 35 | C | 67 | C | 67 | 35 | 1 | 3 | 1 | 3 | 2 | 1 | | | | | | | | | | | |
| 36 | D | 68 | D | 68 | 36 | 1 | 1 | 2 | 3 | 1 | 3 | | | | | | | | | | | |
| 37 | E | 69 | E | 69 | 37 | 1 | 3 | 2 | 1 | 1 | 3 | | | | | | | | | | | |


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| Symbol Character Value | Code Set A | ASCII Value for Code Set A | Code Set B | ASCII Value for Code Set B | Code Set C | Element Widths (Modules) | | | | | | Element Pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B | S | B | S | B | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 38 | F | 70 | F | 70 | 38 | 1 | 3 | 2 | 3 | 1 | 1 | | | | | | | | | | | |
| 39 | G | 71 | G | 71 | 39 | 2 | 1 | 1 | 3 | 1 | 3 | | | | | | | | | | | |
| 40 | H | 72 | H | 72 | 40 | 2 | 3 | 1 | 1 | 1 | 3 | | | | | | | | | | | |
| 41 | I | 73 | I | 73 | 41 | 2 | 3 | 1 | 3 | 1 | 1 | | | | | | | | | | | |
| 43 | J | 74 | J | 74 | 42 | 1 | 1 | 2 | 1 | 3 | 3 | | | | | | | | | | | |
| 43 | K | 75 | K | 75 | 43 | 1 | 1 | 2 | 3 | 3 | 1 | | | | | | | | | | | |
| 44 | L | 76 | L | 76 | 44 | 1 | 3 | 2 | 1 | 3 | 1 | | | | | | | | | | | |
| 45 | M | 77 | M | 77 | 45 | 1 | 1 | 3 | 1 | 2 | 3 | | | | | | | | | | | |
| 46 | N | 78 | N | 78 | 46 | 1 | 1 | 3 | 3 | 2 | 1 | | | | | | | | | | | |
| 47 | O | 79 | O | 79 | 47 | 1 | 3 | 3 | 1 | 2 | 1 | | | | | | | | | | | |
| 48 | P | 80 | P | 80 | 48 | 3 | 1 | 3 | 1 | 2 | 1 | | | | | | | | | | | |
| 49 | Q | 81 | Q | 81 | 49 | 2 | 1 | 1 | 3 | 3 | 1 | | | | | | | | | | | |
| 50 | R | 82 | R | 82 | 50 | 2 | 3 | 1 | 1 | 3 | 1 | | | | | | | | | | | |
| 51 | S | 83 | S | 83 | 51 | 2 | 1 | 3 | 1 | 1 | 3 | | | | | | | | | | | |
| 52 | T | 84 | T | 84 | 52 | 2 | 1 | 3 | 3 | 1 | 1 | | | | | | | | | | | |
| 53 | U | 85 | U | 85 | 53 | 2 | 1 | 3 | 1 | 3 | 1 | | | | | | | | | | | |
| 54 | V | 86 | V | 86 | 54 | 3 | 1 | 1 | 1 | 2 | 3 | | | | | | | | | | | |
| 55 | W | 87 | W | 87 | 55 | 3 | 1 | 1 | 3 | 2 | 1 | | | | | | | | | | | |
| 56 | X | 88 | X | 88 | 56 | 3 | 3 | 1 | 1 | 2 | 1 | | | | | | | | | | | |
| 57 | Y | 89 | Y | 89 | 57 | 3 | 1 | 2 | 1 | 1 | 3 | | | | | | | | | | | |
| 58 | Z | 90 | Z | 90 | 58 | 3 | 1 | 2 | 3 | 1 | 1 | | | | | | | | | | | |
| 59 | [ | 91 | [ | 91 | 59 | 3 | 3 | 2 | 1 | 1 | 1 | | | | | | | | | | | |


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| Symbol Character Value | Code Set A | ASCII Value for Code Set A | Code Set B | ASCII Value for Code Set B | Code Set C | Element Widths (Modules) | | | | | | Element Pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B | S | B | S | B | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 60 | \ | 92 | \ | 92 | 60 | 3 | 1 | 4 | 1 | 1 | 1 | | | | | | | | | | | |
| 61 | ] | 93 | ] | 93 | 61 | 2 | 2 | 1 | 4 | 1 | 1 | | | | | | | | | | | |
| 62 | ^ | 94 | ^ | 94 | 62 | 4 | 3 | 1 | 1 | 1 | 1 | | | | | | | | | | | |
| 63 | _ | 95 | _ | 95 | 63 | 1 | 1 | 1 | 2 | 2 | 4 | | | | | | | | | | | |
| 64 | NUL | 00 | grave accent | 96 | 64 | 1 | 1 | 1 | 4 | 2 | 2 | | | | | | | | | | | |
| 65 | SOH | 01 | a | 97 | 65 | 1 | 2 | 1 | 1 | 2 | 4 | | | | | | | | | | | |
| 66 | STX | 02 | b | 98 | 66 | 1 | 2 | 1 | 4 | 2 | 1 | | | | | | | | | | | |
| 67 | ETX | 03 | c | 99 | 67 | 1 | 4 | 1 | 1 | 2 | 2 | | | | | | | | | | | |
| 68 | EOT | 04 | d | 100 | 68 | 1 | 4 | 1 | 2 | 2 | 1 | | | | | | | | | | | |
| 69 | ENQ | 05 | e | 101 | 69 | 1 | 1 | 2 | 2 | 1 | 4 | | | | | | | | | | | |
| 70 | ACK | 06 | f | 102 | 70 | 1 | 1 | 2 | 4 | 1 | 2 | | | | | | | | | | | |
| 71 | BEL | 07 | g | 103 | 71 | 1 | 2 | 2 | 1 | 1 | 4 | | | | | | | | | | | |
| 72 | BS | 08 | h | 104 | 72 | 1 | 2 | 2 | 4 | 1 | 1 | | | | | | | | | | | |
| 73 | HT | 09 | i | 105 | 73 | 1 | 4 | 2 | 1 | 1 | 2 | | | | | | | | | | | |
| 74 | LF | 10 | j | 106 | 74 | 1 | 4 | 2 | 2 | 1 | 1 | | | | | | | | | | | |
| 75 | VT | 11 | k | 107 | 75 | 2 | 4 | 1 | 2 | 1 | 1 | | | | | | | | | | | |
| 76 | FF | 12 | l | 108 | 76 | 2 | 2 | 1 | 1 | 1 | 4 | | | | | | | | | | | |
| 77 | CR | 13 | m | 109 | 77 | 4 | 1 | 3 | 1 | 1 | 1 | | | | | | | | | | | |
| 78 | SO | 14 | n | 110 | 78 | 2 | 4 | 1 | 1 | 1 | 2 | | | | | | | | | | | |
| 79 | SI | 15 | o | 111 | 79 | 1 | 3 | 4 | 1 | 1 | 1 | | | | | | | | | | | |
| 80 | DLE | 16 | p | 112 | 80 | 1 | 1 | 1 | 2 | 4 | 2 | | | | | | | | | | | |
| 81 | DC1 | 17 | q | 113 | 81 | 1 | 2 | 1 | 1 | 4 | 2 | | | | | | | | | | | |


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| Symbol Character Value | Code Set A | ASCII Value for Code Set A | Code Set B | ASCII Value for Code Set B | Code Set C | Element Widths (Modules) | | | | | | Element Pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B | S | B | S | B | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 82 | DC2 | 18 | r | 114 | 82 | 1 | 2 | 1 | 2 | 4 | 1 | | | | | | | | | | | |
| 83 | DC3 | 19 | s | 115 | 83 | 1 | 1 | 4 | 2 | 1 | 2 | | | | | | | | | | | |
| 84 | DC4 | 20 | t | 116 | 84 | 1 | 2 | 4 | 1 | 1 | 2 | | | | | | | | | | | |
| 85 | NAK | 21 | u | 117 | 85 | 1 | 2 | 4 | 2 | 1 | 1 | | | | | | | | | | | |
| 86 | SYN | 22 | v | 118 | 86 | 4 | 1 | 1 | 2 | 1 | 2 | | | | | | | | | | | |
| 87 | ETB | 23 | w | 119 | 87 | 4 | 2 | 1 | 1 | 1 | 2 | | | | | | | | | | | |
| 88 | CAN | 24 | x | 120 | 88 | 4 | 2 | 1 | 2 | 1 | 1 | | | | | | | | | | | |
| 89 | EM | 25 | y | 121 | 89 | 2 | 1 | 2 | 1 | 4 | 1 | | | | | | | | | | | |
| 90 | SUB | 26 | z | 122 | 90 | 2 | 1 | 4 | 1 | 2 | 1 | | | | | | | | | | | |
| 91 | ESC | 27 | { | 123 | 91 | 4 | 1 | 2 | 1 | 2 | 1 | | | | | | | | | | | |
| 92 | FS | 28 | \| | 124 | 92 | 1 | 1 | 1 | 1 | 4 | 3 | | | | | | | | | | | |
| 93 | GS | 29 | } | 125 | 93 | 1 | 1 | 1 | 3 | 4 | 1 | | | | | | | | | | | |
| 94 | RS | 30 | ~ | 126 | 94 | 1 | 3 | 1 | 1 | 4 | 1 | | | | | | | | | | | |
| 95 | US | 31 | DEL | 127 | 95 | 1 | 1 | 4 | 1 | 1 | 3 | | | | | | | | | | | |
| 96 | FNC 3 | | FNC3 | | 96 | 1 | 1 | 4 | 3 | 1 | 1 | | | | | | | | | | | |
| 97 | FNC 2 | | FNC2 | | 97 | 4 | 1 | 1 | 1 | 1 | 3 | | | | | | | | | | | |
| 98 | SHIFT | | SHIFT | | 98 | 4 | 1 | 1 | 3 | 1 | 1 | | | | | | | | | | | |
| 99 | CODE C | | CODE C | | 99 | 1 | 1 | 3 | 1 | 4 | 1 | | | | | | | | | | | |
| 100 | CODE B | | FNC4 | | CODE B | 1 | 1 | 4 | 1 | 3 | 1 | | | | | | | | | | | |
| 101 | FNC | | CODE | | CODE | 3 | 1 | 1 | 1 | 4 | 1 | | | | | | | | | | | |


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| Symbol Character Value | Code Set A | ASCII Value for Code Set A | Code Set B | ASCII Value for Code Set B | Code Set C | Element Widths (Modules) | | | | | | Element Pattern | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B | S | B | S | B | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | 4 | | A | | A | | | | | | | | | | | | | | | | | |
| 102 | FNC 1 | | FNC1 | | FNC1 | 4 | 1 | 1 | 1 | 3 | 1 | | | | | | | | | | | |
| 103 | Start A | | | | | 2 | 1 | 1 | 4 | 1 | 2 | | | | | | | | | | | |
| 104 | Start B | | | | | 2 | 1 | 1 | 2 | 1 | 4 | | | | | | | | | | | |
| 105 | Start C | | | | | 2 | 1 | 1 | 2 | 3 | 2 | | | | | | | | | | | |

| Symbol Character Values | Code Set A | Code Set B | Code Set C | Element Widths (Modules) | | | | | | | Element Pattern | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | B | S | B | S | B | S | B | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| | Stop | | | 2 | 3 | 3 | 1 | 1 | 1 | 2 | | | | | | | | | | | | | |

Note: The Stop Character comprises 13 modules in four bars (dark bars) and three spaces (light bars). Every other character comprises 11 modules , starts with a bar (dark bar), ends with a space (light bar), and comprises six elements, each of which varies from one to four modules in width. The numeric values in the B and S columns represent the number of modules in each bar (dark bar) or space (light bar) element respectively in the symbol characters.


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#### 5.3.3.3 Code Sets

##### 5.3.3.3.1 Code Set A

Code set A includes all of the standard upper case alphanumeric characters and punctuation characters together with the symbology elements (e.g., characters with ASCII values from 00 to 95) and seven special characters.

##### 5.3.3.3.2 Code Set B

Code set B includes all of the standard upper case alphanumeric characters and punctuation characters together with the lowercase alphabetic characters (e.g., ASCII characters 32 to 127 inclusive) and seven special characters.

##### 5.3.3.3.3 Code Set C

Code set C includes the set of 100 digit pairs from 00 to 99 inclusive, as well as three special characters. This allows numeric data to be encoded as two data digits per symbol character.

#### 5.3.3.4 Special Characters

The last seven characters of code sets A and B (character values 96 to 102) and the last three characters of code set C (character values 100 to 102) are special non-data characters that, though they have particular significance to the bar code reader, have no ASCII character equivalents.


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#### 5.3.3.4.1 Code Set and Shift Characters

Code set and shift characters shall be used to change from one code set to another within a symbol. The decoder shall not transmit them.

- Code set characters: Code A, B, or C characters change the symbol code set from the code set previously defined to the new code set, which is defined by the code character. This change applies to all characters following the code set character until either the end of the symbol, another code set character, or the shift character is encountered.
- Shift character: The shift character changes the code set from A to B or B to A for the single character following the shift character. Characters following the affected character shall revert to the code set A or B defined prior to the shift character.

#### 5.3.3.4.2 Function Characters

Function Characters (FNC) provide special operations and application instructions to the bar code reading device.

- The ~~Function 1 Character~~Function Code 1 (FNC1) shall be subject to the special considerations defined in Section 5.3.A.2. An FNC1 in the first position following the Start Character of a Code-128 Symbol is at all times a reserved use, which identifies the EAN.UCC System.
- The Function 2 Character (FNC2) (Message Append) is not used in the EAN.UCC System. It instructs the bar code reader to temporarily store the data from the symbol containing the FNC2 and transmit it as a prefix to the data of the next symbol. This may be used to concatenate several symbols before transmission. This character may occur anywhere in the symbol. Where the sequence of data is significant, provision should be made to ensure reading of the symbols in the correct sequence.
- The Function 3 Character (FNC3) (Initialise) instructs the bar code reader to interpret the data from the symbol containing the FNC3 as instructions for initialisation or reprogramming of the bar code reader. The data from the symbol shall not be transmitted by the bar code reader. This character may occur anywhere in the symbol.
- The Function 4 Character (FNC4) is not used in the EAN.UCC System. In Code 128 Symbols, FNC4 is used to represent an extended ASCII character set (byte values 128 to 255) as specified in ISO 8859-1 or otherwise in an application specification. If a single FNC4 is used, the value 128 is added to the ASCII value


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of the following data character in the symbol. A shift character may follow the FNC4 if it is necessary to change the code set for the following data character. Subsequent data characters revert to the standard ASCII set. If two consecutive FNC4s are used, the value 128 is added to the ASCII value of the following data characters until two further consecutive FNC4s are encountered or the end of the symbol is reached. If, during this sequence of extended ASCII encodation, a single FNC4 is encountered, it is used to revert to standard ASCII encodation for the next data character only. Shift and code set characters shall have their normal effect during such a sequence. The default reference character set for extended ASCII values 128 to 255 is the corresponding half of ISO 8859-1, Latin alphabet 1, but application specifications may define or reference alternative sets corresponding to byte values 128 to 255.


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#### 5.3.3.5 Start and Stop Characters

- Start Characters A, B, and C define the corresponding code set to be used initially in the symbol.
- The Stop Character is common to all code sets.
- The decoder shall not transmit Start and Stop Characters.

#### 5.3.3.6 Symbol Check Character

The Symbol Check Character shall be included as the last symbol character before the Stop Character. Section 5.3.A.1 defines the algorithm for its calculation. The Symbol Check Character shall not be represented in the Human Readable Interpretation, nor shall it be transmitted by the decoder.

#### 5.3.3.7 UCC/EAN-128 Symbology Start Pattern

The UCC/EAN-128 Symbology has special double character start patterns consisting of Start (A, B, or C) FNC1. These special Start Characters differentiate UCC/EAN-128 Bar Code Symbols from the more generalised Code 128 Symbols.

In other words, a Code 128 Symbol, which begins with one of the UCC/EAN-128 Symbology double character start patterns, is always a UCC/EAN-128 Bar Code Symbol; a Code 128 Symbol, which does not begin with this start pattern, is never a UCC/EAN-128 Bar Code Symbol.

A ~~Function 1 Character~~Function Code 1 (FNC1) may be the Symbol Check Character (in less than 1 percent of cases). It is also used as a Separator Character, when appropriate, if Application Identifiers (AIs) and their data fields are concatenated into a single bar code.

- Start A begins the UCC/EAN-128 Symbol data encodation according to character set A.
- Start B begins the UCC/EAN-128 Symbol data encodation according to character set B.
- Start C begins the UCC/EAN-128 Symbol data encodation according to character set C. Start Character C should always be used when the data inclusive of the AI begins with four or more numeric characters.


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### 5.3.4 Dimensional Requirements

UCC/EAN-128 Bar Code Symbols shall conform to the dimensions in the subsections that follow.

#### 5.3.4.1 Minimum Width of a Module (X-Dimension)

The minimum X-dimension is defined by the application specification and requirements (see Section 5.4), while considering the equipment available for symbol production and scanning. For UCC/EAN-128 Bar Code Symbols, the absolute minimum X-dimension is 0.250 mm (0.00984 in.). The maximum X-dimension is 1.016 mm (0.040 in.). Application specifications stipulate a target and range of the X-dimension.

The X-dimension shall be constant throughout a given symbol.

#### 5.3.4.2 Quiet Zone (Light Margin)

The minimum width of the Quiet Zone to the left and right of the UCC/EAN-128 Bar Code Symbol is 10x.

### 5.3.5 Reference Decode Algorithm

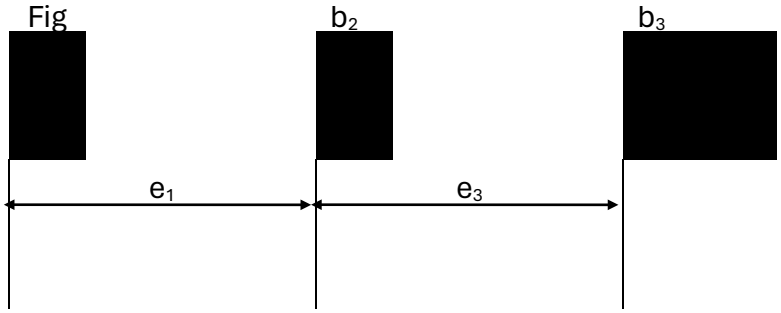
Bar code reading systems are designed to read imperfect symbols to the extent that practical algorithms permit. This section describes the reference decode algorithm used in the computation of the Decodability value described in *ISO/IEC 15416*.

The algorithm contains the following steps to decode each character:

1. Calculate eight width measurements p, e1, e2, e3, e4, b1, b2, and b3 (see Figure 5.3.5 – 1).

Figure 5.3.5 – 1

**Decode Measurements**





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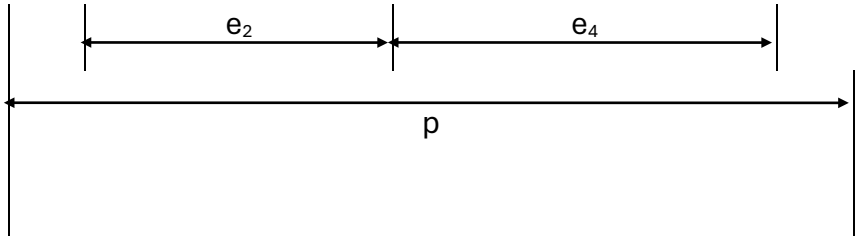



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2. Convert measurements $e_1$, $e_2$, $e_3$, and $e_4$ to normalised values $e_1$, $e_2$, $e_3$, and $e_4$, which will represent the integral module width ($e_i$) of these measurements. The following method is used for the i-th value:

   If $1{,}5p/11 \leq e_i < 2{,}5p/11$, then $E_i = 2$

   If $2{,}5p/11 \leq e_i < 3{,}5p/11$, then $E_i = 3$

   If $3{,}5p/11 \leq e_i < 4{,}5p/11$, then $E_i = 4$

   If $4{,}5p/11 \leq e_i < 5{,}5p/11$, then $E_i = 5$

   If $5{,}5p/11 \leq e_i < 6{,}5p/11$, then $E_i = 6$

   If $6{,}5p/11 \leq e_i < 7{,}5p/11$, then $E_i = 7$

   Otherwise the character is in error.

3. Look up the character in the decode table using the four values E1, E2, E3, and E4 as the key (see Figure 5.3.5 – 2).

4. Retrieve the self-checking symbol character value V, which is stored in the table with the character. The value V is equal to the sum of the modules for the bars (dark bars) as defined for that character.

5. Verify that:

   $(V\text{-}1, 75)p / 11 < (b1 + b2 + b3) < (V + 1, 75)p / 11$

   Otherwise the character is in error.

   The calculation indirectly uses character parity to detect all decode errors caused by single non-systematic one-module edge errors.

Using these five steps, decode the first character. If it is a Start Character, continue decoding the symbol in the normal forward direction. If it is not a Start Character but decodes as a Stop Character, attempt to decode all subsequent characters in the reverse direction.

After all characters have been decoded, make sure there was a valid Start Character, a valid Stop Character, and that the Symbol Check Character is correct.

Translate the symbol characters into the appropriate data characters from code set A, B, or C according to the Start Character, code characters, and shift characters used in the symbol.


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In addition, perform other secondary checks on Quiet Zones, beam acceleration, absolute timing, and dimensions that are appropriate considering the specific reading device and intended application environment.

Note: In this algorithm the symbol is decoded using edge to similar edge measurements (e) and an additional measurement of the sum of the three bar (dark bar) widths.


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Figure 5.3.5 – 2

**Edge Differences for Decoding Code 128 Symbols**

| Char. Value | E1 | E2 | E3 | E4 | V | Char. Value | E1 | E2 | E3 | E4 | V |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 00 | 3 | 3 | 4 | 4 | 6 | 54 | 4 | 2 | 2 | 3 | 6 |
| 01 | 4 | 4 | 3 | 3 | 6 | 55 | 4 | 2 | 4 | 5 | 6 |
| 02 | 4 | 4 | 4 | 4 | 6 | 56 | 6 | 4 | 2 | 3 | 6 |
| 03 | 3 | 3 | 3 | 4 | 4 | 57 | 4 | 3 | 3 | 2 | 6 |
| 04 | 3 | 3 | 4 | 5 | 4 | 58 | 4 | 3 | 5 | 4 | 6 |
| 05 | 4 | 4 | 3 | 4 | 4 | 59 | 6 | 5 | 3 | 2 | 6 |
| 06 | 3 | 4 | 4 | 3 | 4 | 60 | 4 | 5 | 5 | 2 | 8 |
| 07 | 3 | 4 | 5 | 4 | 4 | 61 | 4 | 3 | 5 | 5 | 4 |
| 08 | 4 | 5 | 4 | 3 | 4 | 62 | 7 | 4 | 2 | 2 | 6 |
| 09 | 4 | 3 | 3 | 3 | 4 | 63 | 2 | 2 | 3 | 4 | 4 |
| 10 | 4 | 3 | 4 | 4 | 4 | 64 | 2 | 2 | 5 | 6 | 4 |
| 11 | 5 | 4 | 3 | 3 | 4 | 65 | 3 | 3 | 2 | 3 | 4 |
| 12 | 2 | 3 | 4 | 5 | 6 | 66 | 3 | 3 | 5 | 6 | 4 |
| 13 | 3 | 4 | 3 | 4 | 6 | 67 | 5 | 5 | 2 | 3 | 4 |
| 14 | 3 | 4 | 4 | 5 | 6 | 68 | 5 | 5 | 3 | 4 | 4 |
| 15 | 2 | 4 | 5 | 4 | 6 | 69 | 2 | 3 | 4 | 3 | 4 |
| 16 | 3 | 5 | 4 | 3 | 6 | 70 | 2 | 3 | 6 | 5 | 4 |
| 17 | 3 | 5 | 5 | 4 | 6 | 71 | 3 | 4 | 3 | 2 | 4 |
| 18 | 4 | 5 | 5 | 3 | 6 | 72 | 3 | 4 | 6 | 5 | 4 |
| 19 | 4 | 3 | 2 | 4 | 6 | 73 | 5 | 6 | 3 | 2 | 4 |
| 20 | 4 | 3 | 3 | 5 | 6 | 74 | 5 | 6 | 4 | 3 | 4 |
| 21 | 3 | 4 | 5 | 3 | 6 | 75 | 6 | 5 | 3 | 3 | 4 |
| 22 | 4 | 5 | 4 | 2 | 6 | 76 | 4 | 3 | 2 | 2 | 4 |
| 23 | 4 | 3 | 3 | 4 | 8 | 77 | 5 | 4 | 4 | 2 | 8 |
| 24 | 4 | 2 | 3 | 4 | 6 | 78 | 6 | 5 | 2 | 2 | 4 |
| 25 | 5 | 3 | 2 | 3 | 6 | 79 | 4 | 7 | 5 | 2 | 6 |
| 26 | 5 | 3 | 3 | 4 | 6 | 80 | 2 | 2 | 3 | 6 | 6 |
| 27 | 4 | 3 | 4 | 3 | 6 | 81 | 3 | 3 | 2 | 5 | 6 |
| 28 | 5 | 4 | 3 | 2 | 6 | 82 | 3 | 3 | 3 | 6 | 6 |
| 29 | 5 | 4 | 4 | 3 | 6 | 83 | 2 | 5 | 6 | 3 | 6 |
| 30 | 3 | 3 | 3 | 3 | 6 | 84 | 3 | 6 | 5 | 2 | 6 |
| 31 | 3 | 3 | 5 | 5 | 6 | 85 | 3 | 6 | 6 | 3 | 6 |
| 32 | 5 | 5 | 3 | 3 | 6 | 86 | 5 | 2 | 3 | 3 | 6 |
| 33 | 2 | 2 | 4 | 5 | 4 | 87 | 6 | 3 | 2 | 2 | 6 |
| 34 | 4 | 4 | 2 | 3 | 4 | 88 | 6 | 3 | 3 | 3 | 6 |
| 35 | 4 | 4 | 4 | 5 | 4 | 89 | 3 | 3 | 3 | 5 | 8 |
| 36 | 2 | 3 | 5 | 4 | 4 | 90 | 3 | 5 | 5 | 3 | 8 |
| 37 | 4 | 5 | 3 | 2 | 4 | 91 | 5 | 3 | 3 | 3 | 8 |
| 38 | 4 | 5 | 5 | 4 | 4 | 92 | 2 | 2 | 2 | 5 | 6 |
| 39 | 3 | 2 | 4 | 4 | 4 | 93 | 2 | 2 | 4 | 7 | 6 |
| 40 | 5 | 4 | 2 | 2 | 4 | 94 | 4 | 4 | 2 | 5 | 6 |
| 41 | 5 | 4 | 4 | 4 | 4 | 95 | 2 | 5 | 5 | 2 | 6 |
| 42 | 2 | 3 | 3 | 4 | 6 | 96 | 2 | 5 | 7 | 4 | 6 |
| 43 | 2 | 3 | 5 | 6 | 6 | 97 | 5 | 2 | 2 | 2 | 6 |
| 44 | 4 | 5 | 3 | 4 | 6 | 98 | 5 | 2 | 4 | 4 | 6 |
| 45 | 2 | 4 | 4 | 3 | 6 | 99 | 2 | 4 | 4 | 5 | 8 |
| 46 | 2 | 4 | 6 | 5 | 6 | 100 | 2 | 5 | 5 | 4 | 8 |
| 47 | 4 | 6 | 4 | 3 | 6 | 101 | 4 | 2 | 2 | 5 | 8 |
| 48 | 4 | 4 | 4 | 3 | 8 | 102 | 5 | 2 | 2 | 4 | 8 |
| 49 | 3 | 2 | 4 | 6 | 6 | 103 | 3 | 2 | 5 | 5 | 4 |
| 50 | 5 | 4 | 2 | 4 | 6 | 104 | 3 | 2 | 3 | 3 | 4 |
| 51 | 3 | 4 | 4 | 2 | 6 | 105 | 3 | 2 | 3 | 5 | 6 |
| 52 | 3 | 4 | 6 | 4 | 6 | $Stop_A$ | 5 | 6 | 4 | 2 | 6 |
| 53 | 3 | 4 | 4 | 4 | 8 | $Stop_B$ | 3 | 2 | 2 | 4 | 6 |


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Note: $Stop_A$ values are for decoding in a forward direction. $Stop_B$ values apply to the first six elements of the Stop Character starting at the rightmost side when scanned in a reverse direction.


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### 5.3.6 Symbol Quality

#### 5.3.6.1 General

*ISO/IEC 15416* defines a standardised methodology for measuring and grading bar code symbols. Code 128 Symbols shall be evaluated according to that standard. The reference decode algorithm defined in Section 5.3.5 shall be used for the assessment of the decode and Decodability parameters under ISO/IEC 15416.

For UCC/EAN-128 Bar Code Symbol minimum quality levels, refer to Section 5.3.7.

#### 5.3.6.2 Decodability

Decodability is a measure of how closely the decode algorithm measurement values approach those in a theoretically perfect symbol. Thus, Decodability is a parameter that measures how closely the Scan Reflectance Profile is to approaching decode failure for a given printed symbol.

For the calculation of the Decodability value V, the following provisions apply, which supplement those described in *ISO/IEC 15416* for edge to similar edge decodable symbologies:

Substitute V1 for $V_C$ in the formula $V_C = K / (S / 2n)$.

Where: K = the smallest difference between a measurement and a reference threshold

N = 11 (number of modules in a symbol character)

S = total width of the character

Calculate V2:

$$V2 = \frac{1{,}75 - (ABS((W_b \times 11/S) - M))}{1{,}75}$$

Where: M = number of dark modules in the character

S = total width of the character

$W_b$ = sum of the bar (dark bar) widths in the character

ABS = mathematical term for taking the absolute of the calculation that follows it

$V_C$ is the lesser of V1 and V2.


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The Stop Character includes an additional terminating bar (dark bar). For the purpose of measuring Decodability, the Stop Character should be checked twice: first using the six leftmost elements and then using the six rightmost elements from right to left. Both sets of six elements are equivalent in width to a standard character.


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#### 5.3.6.3 Quiet Zones (Light Margins)

The Quiet Zones to the right and left of the UCC/EAN-128 Bar Code Symbol are compulsory. Both Quiet Zones have a minimum width of 10x.

I*SO/IEC 15416* allows for additional pass/fail criteria to be stipulated by a symbology specification. In the case of a UCC/EAN-128 Bar Code Symbol, a minimum Quiet Zone of 10Z is specified. Both left and right Quiet Zones on each Scan Reflectance Profile (SRP) under *ISO/IEC 15416* shall be measured and graded as follows:

Quiet Zone ≥ 10Z: Grade 4 (A)

Quiet Zone < 10Z: Grade 0 (F)

Where Z = the average measured width of the narrow bars (dark bars) and spaces (light bars) (one module) in the symbol

#### 5.3.6.4 Transmitted Data

Transmitted data from a decoded UCC/EAN-128 Bar Code Symbol shall comprise the byte values of the data characters. It is prefixed by the symbology identifier ]C1, if used. The Start and Stop Characters, function characters, code set and shift characters, and Symbol Check Character shall not be included in the transmitted data.

For UCC/EAN-128 Symbology implementation, see Section 5.3.7.

### 5.3.7 UCC/EAN-128 Symbology Application Parameters

#### 5.3.7.1 Symbol Height

For UCC/EAN-128 Bar Code Symbols used in general distribution, the minimum height of the bars (dark bars) in the symbol is 32 mm (1.25 in.). The actual symbol height used depends on the specific application requirements.

#### 5.3.7.2 Symbol Length

The dimensions of the UCC/EAN-128 Bar Code Symbol depend on the number of characters encoded:

| | | |
|---|---|---|
| 1 Start Character | x 11 modules = | 11 |
| ~~Function 1 Character~~Function Code 1 (FNC1) | x 11 modules = | 11 |
| 1 Symbol Check Character | x 11 modules = | 11 |


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| | | | |
|---|---|---|---|
| 1 Stop Character | x 13 modules | = | 13 |
| N symbol characters | x 11 modules | = | 11N |
| | | | (11N + 46) modules |

Where N is the number of symbol characters, any auxiliary characters (shift and code characters) embedded in the data are included.


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A module is equal to the X-dimension of the symbol.

Character set C allows two digits to be encoded in one symbol character. Thus, numeric data can be encoded with twice the density of other data when using character set C.

In addition, Quiet Zones to the right and left of the bar code are compulsory and both have widths of 10 modules.

Thus total symbol length, including Quiet Zones, is:

(11N + 66) modules = (11N + 66) x

#### 5.3.7.3 Maximum Symbol Length

Two parameters have to be taken into consideration for defining the maximum length of a UCC/EAN-128 Bar Code Symbol: the physical length, which depends on the number of characters encoded and the module width (or X-dimension) used, and the number of data characters encoded excluding the auxiliary characters.

The maximum length of any UCC/EAN-128 Bar Code Symbol must be within the following limits:

- The physical length, including Quiet Zones, cannot exceed 165 mm (6.5 in.).
- The maximum number of encoded data characters is 48, including the Application Identifier(s) and ~~Function 1 Character~~Function Code 1 (FNC1) when used as a Separator, but excluding the auxiliary characters and the Symbol Check Character.

#### 5.3.7.4 Human Readable Interpretation

The Human Readable Interpretation of the data in the bar code symbol must be shown below the symbol. Start, Stop, shift, and function characters, as well as the Symbol Check Character, are not shown in the human readable format.

The precise location of the Human Readable Interpretation and the font used to represent the characters are not specified for UCC/EAN-128 Bar Code Symbols. However, the characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol. The Quiet Zones must not be violated.

Application Identifiers should be clearly recognisable to facilitate key entry. This is achieved by putting parentheses around Application Identifiers in the Human Readable Interpretation.


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Note: The parentheses are not part of the data and are not encoded in the bar code symbol.


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#### 5.3.7.5 Transmitted Data (FNC1)

The following UCC/EAN-128 Symbology implementation specifications are in accordance with *ISO/IEC 15417 Appendix 2* for transmitted data:

- The ~~Function 1 Character~~Function Code 1 (FNC1) may validly occur as the Symbol Check Character.
- FNC1 in the third or subsequent character position is transmitted as the ASCII character 29 (GS).
- Symbols using FNC1 in the first data position should have symbology identifiers enabled.
- When FNC1 is used in the first position it shall not be represented in the transmitted message, although its presence is indicated by the use of modifier value 1 in the symbology identifier.

### 5.3.8 Rules for Encoding/Decoding Element Strings in UCC/EAN-128 Symbology

#### 5.3.8.1 The Basic Structure of UCC/EAN-128 Bar Code Symbols

All bar code symbologies use particular symbol characters to mark the beginning and the end of the bar code symbol. A UCC/EAN-128 Bar Code Symbol may begin with the Start Character A, B, or C, which determines the interpretation of the subsequent symbol characters. UCC/EAN-128 Symbology uses the ~~Function 1 Character~~Function Code 1 (FNC1) in the position following the Start Character. This double start pattern is reserved for EAN.UCC System applications worldwide. This makes it possible to distinguish UCC/EAN-128 Bar Code Symbols from extraneous non-standard bar code symbols.


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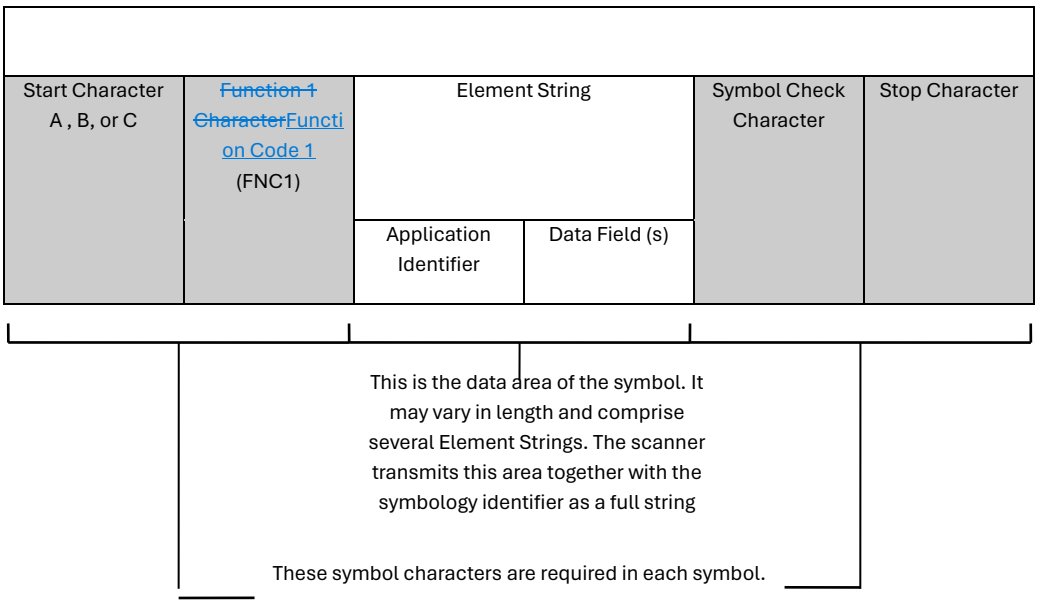
### 5.3.8.2 The Basic Structure of Each UCC/EAN-128 Bar Code Symbol

Figure 5.3.8.2 – 1

**UCC/EAN-128 Bar Code Symbol Structure**




Since UCC/EAN-128 Bar Code Symbols vary in length, it is important to ensure that:

- Not more than 48 data characters are encoded (see the data area of Figure 5.3.8.2 – 1)
- The physical length does not exceed 165 mm (6.5 in.) including Quiet Zones

The maximum length allows several Element Strings to be encoded in one bar code symbol, 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 code symbols 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 code symbols, have to be analysed and processed. To simplify this procedure and reduce the symbol size, the lengths of some Element Strings are pre-defined (see Figure 5.3.8.2.1 –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1). Element Strings that are not contained in Figure 5.3.8.2.1 – 1 and that do not appear at the end of the symbol (encoded immediately before the Symbol Check Character) must immediately be followed by an FNC1 to separate it from the Element String that follows.


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#### 5.3.8.2.1 Pre-Defined Length Application Identifiers

Figure 5.3.8.2.1 – 1 contains all Application Identifiers that have a predefined length and, therefore, do not require a ~~Function 1 Character~~Function Code 1 (FNC1) separator.

Figure 5.3.8.2.1 – 1

| **Element Strings with Pre-Defined Length Using Application Identifiers** | | | |
|---|---|---|---|
| First Two Digits of the Application Identifier | Number of Characters (Application Identifier and Data Field) | First Two Digits of the Application Identifier | Number of Characters (Application Identifier and Data Field) |
| 00 | 20 | 17 | 8 |
| 01 | 16 | (18) | 8 |
| 02 | 16 | (19) | 8 |
| (03) | 16 | 20 | 4 |
| (04) | 18 | 31 | 10 |
| 11 | 8 | 32 | 10 |
| 12 | 8 | 33 | 10 |
| 13 | 8 | 34 | 10 |
| (14) | 8 | 35 | 10 |
| 15 | 8 | 36 | 10 |
| (16) | 8 | 41 | 16 |

Figure 5.3.8.2.1 – 1 is limited to the listed numbers and will remain unchanged. Those numbers in parentheses are not yet assigned.

#### 5.3.8.2.2 Application Identifier Digits ~~(23n)~~

The first two digits of the Application Identifier (23n) presented a special case. The first digit following AI (23n) indicates the length of the Element String. No Separator Character ~~is~~ was required when AI (23n) is used in a concatenated Element String. Application Identifier (23n) is no longer supported.

#### 5.3.8.3 Concatenation


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Using the UCC/EAN-128 Bar Code Symbol, it is possible to concatenate (chain together) discrete Element Strings. Figure 5.3.8.2.1 – 1 specifies the total Element String length (including the Application Identifier) associated with the first two digits of an Application Identifier. Application Identifiers starting with two digits that are not included in Figure 5.3.8.2.1 – 1 have a variable length even if the definition of the Application Identifier specifies a fixed length data field.


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#### 5.3.8.3.1 Concatenation of the Pre-Defined Length Element Strings

Concatenated Element Strings constructed from Application Identifiers with a pre-defined length do not require a Separator Character. Each Element String is immediately followed by either the next Application Identifier or the Symbol Check Character and Stop Character.

For example, concatenation of net weight (4 kg) with the associated Global Trade Item Number™ (GTIN™) 95012345678903 does not require the use of a Separator Character. From Figure 5.3.8.2.1 – 1, Element Strings with Pre-Defined Length Using Application Identifiers:

- 01 has a pre-defined Element String length of 16 digits.
- 31 has a pre-defined Element String length of 10 digits.

Figure 5.3.8.3.1 – 1

GTIN 95012345678903 Net weight 4.00 kg

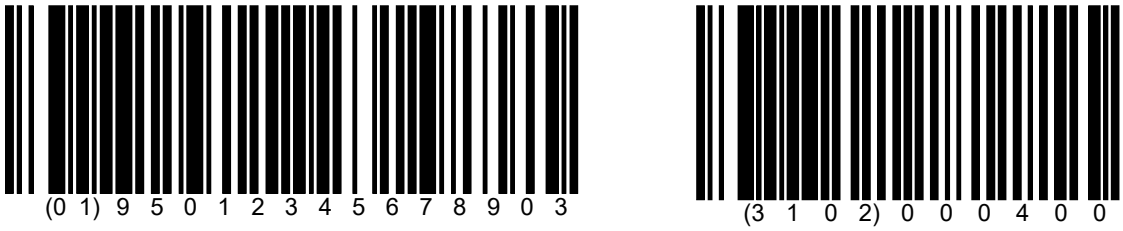
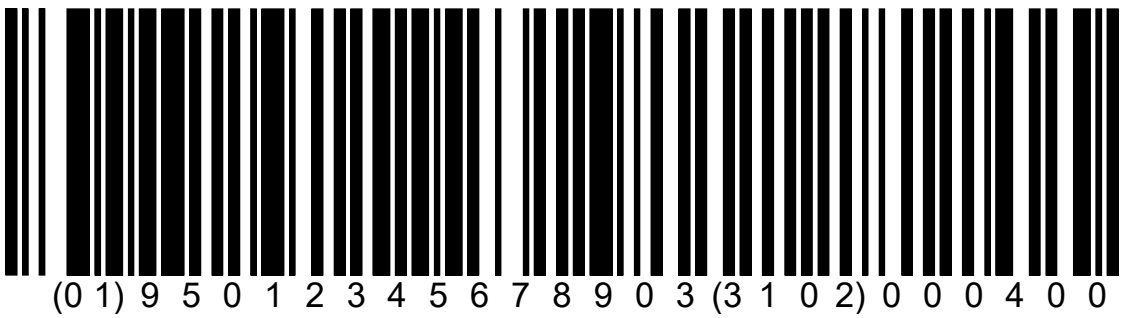



Figure 5.3.8.3.1 – 2

GTIN 95012345678903 + Net weight 4.00 kg





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### 5.3.8.3.2 Variable Length Data Strings

Concatenating Element Strings of variable length, which includes all Application Identifiers that do not start with two characters contained in Figure 5.3.8.2.1 – 1, involves the use of a Separator Character. The Separator Character used is the ~~Function 1 Character~~Function Code 1 (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, it is followed by the Symbol Check and Stop Characters and not the FNC1 Separator Character.

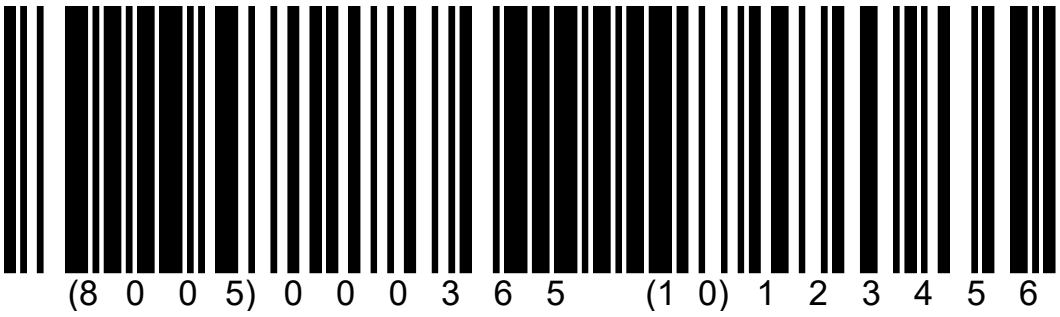
For example, concatenation of price per unit of measure (365 currency units) and batch number (123456) requires the use of a Separator Character immediately after the price per unit of measure.

Figure 5.3.8.3.2 – 1

Price per unit of measure 365 Batch number 123456

Figure 5.3.8.3.2 – 2

Price per unit of measure 365 Batch number 123456




Note: The FNC1 is not shown in Human Readable Interpretation.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#### 5.3.8.3.3 Pre-Defined and Variable Length Element Strings

When concatenating a mixture of pre-defined and other Element Strings, place the pre-defined Element Strings before the variable length Element Strings. The Separator Character is not used to terminate pre-defined Element Strings, and hence, fewer symbol characters are required in the concatenated bar code.


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#### 5.3.8.4 The Separator Character (FNC1)

The Separator Character appears in the decoded data string as <GS> (ASCII character 29, 7-bit character set ISO 646). All Element Strings not of pre-defined length must be followed by a ~~Function 1 Character~~Function Code 1 (FNC1) separator when followed by another Element String in a single bar code symbol. An FNC1 is not  is required at the end of the last Element String represented in a UCC/EAN-128 Bar Code Symbol. The processing routine shown on the next page allows for a FNC1 entered by error after an Element String contained in Figure 5.3.8.3.2 – 1.

Refer to Section 5.3.7 for additional information on encoding/decoding FNC1.

#### 5.3.8.5 Mixing UCC/EAN-128 Symbology with Other Symbologies

Global Trade Item Numbers™ (GTINs™) may be carried in any of the EAN.UCC System endorsed symbologies. When additional data is required beyond the GTIN, UCC/EAN-128 Bar Code Symbols are used. The UCC/EAN-128 Symbology specification does not eliminate other EAN.UCC Symbologies. In these cases, the GTIN is printed using an ITF-14 Symbol or other EAN.UCC System symbologies and additional data using a UCC/EAN-128 Bar Code Symbol.

#### 5.3.8.6 Symbol Placement

The preferred placement for a supplementary UCC/EAN-128 Symbol is on the same horizontal plane as the bar code symbol containing the Global Trade Item Number™ (GTIN™), SSCC, or other stand-alone EAN.UCC System identification number. The supplementary symbol(s) should be as close as possible to the main symbol and must not interfere with the Quiet Zones.

- Orient the supplementary symbols in the same direction as the main symbol. Main symbol placement guidelines are given in Section 6.0.
- 
- Concatenated symbols must follow the symbol placement guidelines given in Section 6.0. based upon the EAN.UCC System ID number they encode (GTIN, SSCC).

#### 5.3.8.7 Processing UCC/EAN-128 Bar Code Symbols - Basic Required Logic


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See Figure 7.9 – 1 for a flow chart of the logic required to accurately parse UCC/EAN-128 Bar Code Symbols from the full data strings output from a scanner.


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### 5.3.A.1 Appendix 1: (Normative) Additional Features of Code 128

#### 5.3.A.1.1 Symbol Check Character

The Code 128 Symbol Check Character shall be calculated according to the following rules.

1. Retrieve the symbol character value from Figure 5.3.3.2 – 1.
2. Each symbol character position is given a weight. The Start Character is weighted 1. Then, beginning on the left with the first symbol character following the Start Character, the weights are 1, 2, 3, and 4 to...n for all following symbol characters up to, but not including, the Symbol Check Character itself; n denotes the number of symbol characters representing data or special information in the symbol, exclusive of the Start and Stop Characters and Symbol Check Character.

   Note: Both the Start Character and the first symbol character following the Start Character (the ~~Function 1 Character~~Function Code 1 (FNC1) for all UCC/EAN-128 Bar Code Symbols) are weighted by one.
3. Each symbol character value is multiplied by its weight.
4. The products of the calculations in step 3 are totalled.
5. The sum of the products is divided by 103.
6. The remainder derived from the calculation in step 5 is the symbol character value of the Symbol Check Character.

Figure 5.3.A.1 –1 shows how to calculate the Symbol Check Character value for the batch number 2503X using the UCC/EAN-128 Bar Code Symbol.

Figure 5.3.A.1 – 1

Start C FNC1 10[ϒ] 25 03 Code B X [Symbol Check Character] Stop

| Characters | Start C | FNC1 | 10 | 25 | 03 | Code B | X |
|---|---|---|---|---|---|---|---|
| Character values (Step 1) | 105 | 102 | 10 | 25 | 3 | 100 | 56 |
| Weights (Step 2) | 1 | 1 | 2 | 3 | 4 | 5 | 6 |
| Products (Step 3) | 105 | 102 | 20 | 75 | 12 | 500 | 336 |
| Sum of products (Step | | 115 | | | | | |

[ϒ] Application Identifier (10) is defined as batch or lot number.


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| | |
|---|---|
| 4) | 0 |
| Divide by 103 (Step 5) | 1150 / 103 = 11 |
| Remainder = Symbol Check Character value | 17 |

The Symbol Check Character shall be positioned immediately following the final data or special character and before the Stop Character.

Note: The Symbol Check Character shall not be shown in the Human Readable Interpretation.


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### 5.3.A.2 Appendix 2: (Informative) Relationship of Symbol Character Value to ASCII Value

In order to convert symbol character value (S) to ASCII decimal value or vice versa, the following relationships are applicable for code set A and code set B.

- Code set A

  If $S \leq 63$,

  ASCII value = S + 32

  If $64 \leq S \leq 95$,

  ASCII value = S - 64

- Code set B

  If $S \leq 95$,

  ASCII value = S + 32

The resulting values are shown in Figure 5.3.3.2 – 1.

Note: As described in Section 5.3.3, the Function 4 Character (FNC4) is not used in the EAN.UCC System. However, the presence of FNC4 in Code 128 Symbols has the effect of adding 128 to the ASCII value of the following data character or characters derived from the rules given above.


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### 5.3.A.3 Appendix 3: (Informative) Use of Start, Code Set, and Shift Characters to Minimise Symbol Length

The same data may be represented by different UCC/EAN-128 Bar Code Symbols through the use of different combinations of Start, code set, and shift characters.

The following rules should normally be implemented in printer control software to minimise the number of symbol characters needed to represent a given data string (and, therefore, reduce the overall symbol length).

1. Determine the Start Character:

    a. If the data consists of two digits, use Start Character C.

    b. If the data begins with four or more numeric data characters, use Start Character C.

    c. If an ASCII symbology element (e.g., NUL) occurs in the data before any lowercase character, use Start Character A.

    d. Otherwise, use Start Character B

2. If Start Character C is used and the data begins with an odd number of numeric data characters, insert a code set A or code set B character before the last digit, following rules 1c and 1d above to determine between code sets A and B.

3. If four or more numeric data characters occur together when in code sets A or B and:

    a. If there is an even number of numeric data characters, then insert a code set C character before the first numeric digit to change to code set C.

    b. If there is an odd number of numeric data characters, then insert a code set C character immediately after the first numeric digit to change to code set C.

4. When in code set B and an ASCII symbology element occurs in the data:

    a. If following that character, a lowercase character occurs in the data before the occurrence of another symbology element, then insert a shift character before the symbology element.

    b. Otherwise, insert a code set A character before the symbology element to change to code set A

5. When in code set A and a lowercase character occurs in the data:


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a. If following that character, a symbology element occurs in the data before the occurrence of another lowercase character, then insert a shift character before the lowercase character.

b. Otherwise, insert a code set B character before the lowercase character to change to code set B

6. When in code set C and a non-numeric character occurs in the data, insert a code set A or code set B character before that character, and follow rules 1c and 1d to determine between code sets A and B.


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Note 1: In these rules, the term “lowercase” is used for convenience to mean any code set B character with Code 128 Symbol character values 64 to 95 (ASCII values 96 to 127) (e.g., all lowercase alphanumeric characters plus `{|}~DEL). The term “symbology element” means any code set A character with Code 128 Symbol character values 64 to 95 (ASCII values 00 to 31).

Note 2: If the ~~Function 1 Character~~Function Code 1 (FNC1) occurs in the first position following the Start Character, or in an odd-numbered position in a numeric field, it should be treated as two digits for the purpose of determining the appropriate code set.


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### 5.3.A.4 Appendix 4: (Informative) Guidelines for the Use of Code 128

#### 5.3.A.4.1 Autodiscrimination Compatibility

Code 128 Symbols may be read by suitably programmed bar code readers that have been designed to autodiscriminate these symbols from other symbologies. Code 128 Symbology is fully distinguishable from, and thus compatible with, the following linear symbologies:

- ITF (Interleaved 2-of-5)
- Codabar
- Code 39
- Code 93
- EAN/UPC
- Telepen
- Reduced Space


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# Section 5.4:

# Bar Code Production and Quality Assessment

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### 5.4.1 Introduction

This section of the *General EAN.UCC Specifications* has been evolving to meet the changes to data carriers and their use within the EAN.UCC System. Some of those changes are, for example, dimension requirement, the introduction of new symbols (e.g. Reduced Space Symbology® and Composite Component®), and the shift from the use of analogue Film Masters to digital bar code files.

In this atmosphere of change, due consideration must be given to how this change affects bar code symbol production and the maintenance of quality in the production process.

### 5.4.2 EAN.UCC System Symbol Specification Tables

Over the years, operational requirements of EAN.UCC System users have influenced the dimensional specifications for of EAN.UCC System symbols, and these dimensional specifications, have in turn, influenced the development of scanning system optics and printing processes. The EAN.UCC System Symbol Specification Tables (SSTs) relate to the application areas defined in Section 2. Each Symbol Specification Table provides the following bar code symbol specification detail:

- The bar code symbol(s) specified by the EAN.UCC System for each application area.
- The minimum, target, and maximum X-dimension (narrow element width) for the symbol, based on the scanning environment.
- The minimum and target bar code symbol height, based on the scanning environment.
- The Quiet Zone width and, for primary/secondary symbols, the minimum and maximum separation between the two symbols.

  Note: These measurements are expressed as multiples of the X-dimension in the form nX.

- The minimum ISO quality specification.

  Note: Expressed as g.g/aa/www, where g.g is the minimum overall symbol grade to one decimal place (on a 4.0 scale), aa is the effective measuring aperture in thousandths of an inch, and www is the wavelength of the light source in nanometres.

  Note: Please refer to Section 2 for any specific application guidelines (such as Section 2.7, Global Application Guideline for Coding Very Small Healthcare Items and Section 2.8, Direct Part Marking Using Data Matrix) that may

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supplement or supersede these symbol specification table for specific application areas.

Before determining the exact symbol specification required, additional factors, such as scanning environment, should be considered. These are summarised in ~~the following section~~Section 5.4.2.1.



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#### 5.4.2.1 Role of the Symbol's Dimensional Specifications

The three major dimensional specifications are the symbol's nominal (target) X-dimension, the symbol's allowable X-dimension range, and the symbol's minimum bar height. These dimensional characteristics are always specified based on the operating environment. The X-dimension target and range determine the scanner's operating range (field of view). The bar code symbol's height along with its X-dimension target and range help determine the ergonomic aspects of product handling when using a scanner. These dimensional specifications are critical components ~~to~~ of the efficient use of all scanners.

#### 5.4.2.2 Omnid~~-D~~irectional Scanning and the Term Magnification (X-Dimension)

The EAN/UPC Symbology was originally designed for omni~~-~~directional scanners. Based on this type of scanner, the specifications include a fixed relationship between the symbol's nominal (target) width and height. The term "symbol magnification" has been used extensively to refer to this fixed relationship. For example, EAN-13 Symbols have a fixed relationship between the symbol target width and height (100 percent magnification) based on the symbol height (including text) of 25.93 mm (1.02 in.) and a target X-dimension of 0.33 mm (.013 in.). The term magnification has been used to refer to a range of magnification percentages below and/or above a target value that are specified based on the omni~~-~~directional scanning environment. The Symbol Specification Tables (SSTs) do not use magnification values and instead list the target, minimum, and maximum values for the symbol's X-dimension and height.

#### 5.4.2.3 Laser Versus Image Based Scanning

Most scanners based on laser technology can scan all linear symbologies in the EAN.UCC System. New laser and linear array scanners are even capable of scanning Reduced Space Symbology® (RSS) and Composite Component~~®s~~ Symbols. 2D Imaging technology, such as array scanners and vision systems, are capable of scanning all symbols in the EAN.UCC System, including Data Matrix. Note that linear imagers, like laser scanners, cannot scan Data Matrix; only 2D or array imaging scanners can scan Data Matrix, as well as camera based or vision systems. For this reason, Data Matrix applications shall be limited to niche markets and direct part marking where the business case is justified for using this technology exclusively to read Data Matrix Symbols. Read the section on Operative Scanning Environments for EAN.UCC System s~~S~~ymbols.

#### 5.4.2.4 Printing Considerations

The functional and operative bands provide printers and labellers with the flexibility needed to produce quality symbols over a wide range of processes. Once a scanning operational environment is determined and the allowable specification range is known, the printer should be consulted for guidance on:



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- The minimum recommended symbol size based on printing press or print characterisation tests~~.~~
- Colour/substrate considerations (e.g., separate print station for symbol or double ink layer)~~.~~
- The optimum orientation of the symbol on the printed web (the direction of movement of the media in relation to a printing plate on a printing press)~~.~~
- Direct part marking, such as is done by dot peening on items, requires special considerations for material properties.
- Laser or chemically etched parts with low contrast or light marked elements on a dark background ~~(~~, ~~e~~e.g.~~.~~, circuit boards and electronic components, medical instruments, and surgical implants~~)~~.
- High-speed ink jet printed parts and components where the marked dots cannot form a scannable linear symbol~~.~~
- Very small items that require a symbology with a square aspect ratio and/or cannot be marked within the allocated packaging space by existing Reduced Space Symbology® (RSS) ~~RSS~~ and EAN.UCC System Composite symbols.

#### 5.4.2.5 Packaging Considerations

Once a scanning operational environment is determined and the allowable symbol characteristics ~~have been determined~~ is known, the package designer should be consulted to:

- Ensure the symbol will not be obstructed by other graphics or package design parameters (e.g., folds, creases, corner wraps, flaps, laminates, embossed logos/patterns, text)
- Ensure that only the symbol intended for scanning will be scanned (e.g., obscure all symbols on the individual units within larger trade items so that the individual units' symbols do not scan instead of the larger unit's symbol)

Section 6 contains complete information on symbol placement criteria to meet quality and ergonomic needs.



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### 5.4.2.6 EAN.UCC System Application Area Considerations

The application where the bar code symbol will be used should be determined prior to locating the correct Symbol Specification Table (SST) entry. Figure 5.4.2.6 – 1 provides a cross-reference for all system applications defined in Section 2. Use the "See Symbol Specification Table(s) #" column to find the SST appropriate for the application area. Because most application areas provide a reference to two Symbol Specification Tables based on the operative scanning environment, a decision must be made between the two. See the decision tree in Figure 5.4.2.7.2 – 2 to determine the correct Symbol Specification Table.

**Figure 5.4.2.6 – 1: Areas of EAN.UCC System Application**

| Application Areas | See Section | See SST(s) # | Read Before Reviewing Symbol Specification Table |
|---|---|---|---|
| Fixed Measure Trade Items – Packages/Containers Scanned at POS | 2.1.2.1.2 | 1 or 3 | EAN-13, UPC-A, EAN-8, and UPC-E Symbols only |
| Fixed Measure Trade Items – Books and Serials | 2.1.2.1.5 | 1 or 3 | EAN-13, UPC-A, EAN-8, and UPC-E Symbols only |
| Fixed Measure Trade Items – Packages/Containers NOT Scanned at POS | 2.1.2.1 | 2 or 4 | |
| Fixed Measure Trade Items – Trade Item Packed in Several Physical Units NOT Scanned at POS | 2.1.2.1 | 2 or 4 | UCC/EAN-128 Symbols only |
| Fixed Measure Trade Items – Restricted Distribution | 2.1.2.3 | 1 or 3 | |
| Variable Measure Trade Items – Restricted Circulation | 2.1.2.4 | 1 | EAN-13 and UPC-A Symbols ~~Only~~only |
| Variable Measure Trade Items – Packages/Containers NOT Scanned at POS | 2.1.2.2 | 2 or 4 | UCC/EAN-128 Symbols only |
| POS Trade Item Attributes – Using Secondary EAN/UPC-2 or EAN/UPC-5 Add-On Symbols | 2.1.3.4.1 and 2.1.3.4.2 | 1 | Use the X-dimension specified for the primary EAN/UPC Symbol |
| Trade Item Attributes – Using Secondary UCC/EAN-128 Symbols | 2.1.3.1, 2.1.3.2, 2.1.3.3, 2.1.3.4.3, and 2.1.3.4.4 | 2 or 4 | Use the X-dimension specified for the primary symbol |
| Logistics – Mandatory SSCC | 2.2.2 | 5 | UCC/EAN-128 Symbols only |
| Logistics – Logistic Unit Element Strings | 2.2.2.1 | 5 | UCC/EAN-128 Symbols only |
| Assets – Global Returnable Asset Identifier | 2.3.3.1.1 | 2, 4, or 7 | UCC/EAN-128 and Data Matrix Symbols only |
| Assets – Global Individual Asset Identifier | 2.3.3.1.2 | 2, 4, or 7 | UCC/EAN-128 and Data Matrix Symbols only |
| Locations or Postal Codes | 2.4 | 2 or 4 | UCC/EAN-128 Symbols only |



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| Application Areas | See Section | See SST(s) # | Read Before Reviewing Symbol Specification Table |
|---|---|---|---|
| Global Service Relation Numbers | 2.5 | 4 | UCC/EAN-128 Symbols only |
| Coupons – Restricted Geographic Distribution Outside USA or Common Currency Area identification | 2.6.1.3.1 and 2.6.1.3.2 | 1 | EAN-13 Symbols only |
| Coupons – Restricted Geographic Distribution Inside USA - UPC-A plus UCC/EAN-128 Symbols | 2.6.1.3.3 | 4 | See *Guidelines for Supply Chain Identification* |
| Refund Receipts – Restricted Geographic Distribution | 2.6.2 | 1 | EAN-13 Symbols only |
| Electronic Serial Identifier for Cellular Mobile Telephones | 2.6.3 | 4 | UCC/EAN-128 Symbols only |
| Company Internal Application Using EAN/UPC Symbols | 2.6.4.4 | 1 | EAN-13, UPC-A, and UPC-E Symbols only |
| Internal Application Using UCC/EAN-128 Symbols | 2.6.4.5 | 2 or 4 | UCC/EAN-128 Symbols only |
| Payment Slips | 2.6.5 | 4 | UCC/EAN-128 Symbols only |
| Customer Specific Articles | 2.6.6 | 4 | |
| Very Small ~~Items in~~ Healthcare Items | 2.7 | 6 or 7 | RSS and Composite Component or Data Matrix Symbols only* |
| Direct Part Marking | 2.8 | 7 | Data Matrix |

* See Section 2.7. Data Matrix has limited use in ~~Healthcare~~ healthcare until application standards are fully developed.

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#### 5.4.2.7 Operative Scanning Environments for EAN.UCC System Symbols

##### 5.4.2.7.1 EAN.UCC System Scanner Functional Operative Bands

EAN.UCC System symbol specifications are based on six scanner functional bands because scanner technology cannot universally support the entire operating range using a single scanner and different application requirements. The six scanner functional bands that have evolved to meet user needs are illustrated in Figure 5.4.2.7.1 – 1.



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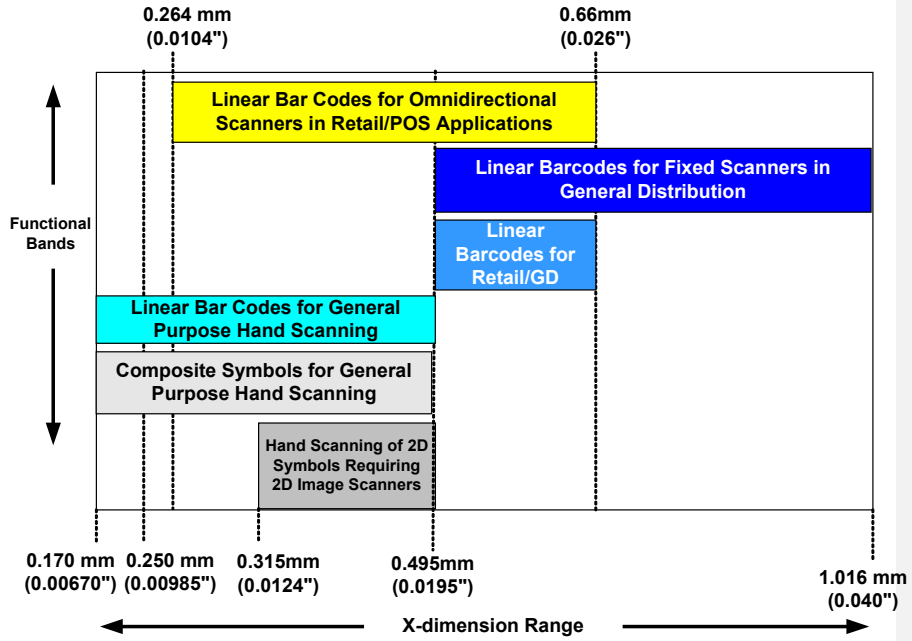
**Figure 5.4.2.7.1 – 1: EAN.UCC Scanner Functional Operative Bands**




Note: Figure not to scale and target size for each functional band can be found in the Symbol Specification Tables (see Section 5.4.2.8)

~~The near future should see~~In the future, there will be more integration of the operative bands and an extension of the bands to support small symbols.

**The Sscanner Ffunctional Bbands ~~are:~~**

- The *Omni-directional Scanners for Retail POS* band is primarily intended for retail operations to provide orientation-free scanning. Scanners are designed to read EAN/UPC over-square symbols. The approximate average distance between scanner and symbol is 100 mm (4 in.).
- The *Fixed Scanners in General Distribution* band is primarily intended to facilitate automated scanning of trade items packaged for transport and logistic units using fixed mount scanners. In this environment it is essential to maintain symbol height and location to achieve acceptable scan rates.
- Linear bar codes for both *Retail* and *General Distribution* band covers trade items in specific packaging suitable for transport purposes in General Distribution Scanning, but that are also scanned at the retail ~~point of sale~~Point-of-Sale. ~~See Overlap area between EAN/UPC Retail and General Distribution (Retail/GD). Figure 5.4.2.7.1 – 1.: Operative Scanning Environment~~ See the overlap area between EAN/UPC Retail and General Distribution (Retail/GD) in Figure 5.4.2.7.1 – 1.

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- The *General Purpose* scanner bands cover a broad range of applications. Symbol size must be within the maximum and minimum boundaries for the symbology, but the target size is directly related to the exact usage as specified by the application guidelines. It has been divided into three bands: One for linear general purpose hand scanning and two bands for two-dimensional bar codes: Composite Component and Data Matrix. In general, the rule is that Composite Components shall be printed at the same density as their linear host. Data Matrix Ssymbols shall be printed at densities that are 50 percent% greater than corresponding linear symbols with Composite Components. Therefore, the bands for linear symbols and Composite Ceomponents are very similar in density and if the same scanner types are chosen, as in the case of Ceomposite Ssymbols, the bands become one.

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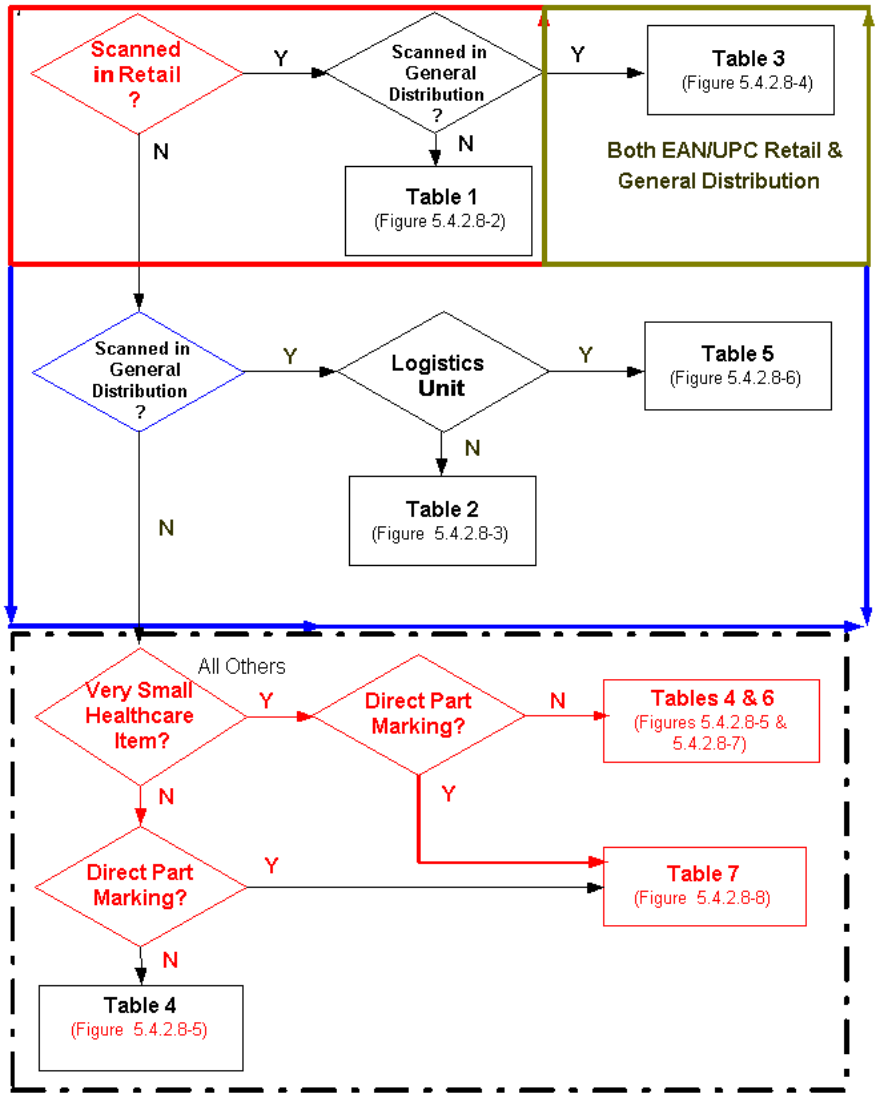
**Figure 5.4.2.7.1 – 2: EAN.UCC Symbology Operational Environment Decision Tree**



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### 5.4.2.8 EAN.UCC System Symbol Specification Tables

In order to find the correct bar code specification, you must:

- Find the appropriate EAN.UCC System application area using Figure 5.4.2.6 – 1.
- If the application area references two Symbol Specification Tables, use the decision tree in ~~(~~Figure 5.4.2.7.1 – 2~~)~~ to determine which one to use.

~~The figure below~~Figure 5.4.2.8 – 1 provides a quick reference list of the symbol quality parameters depending on their type and their application.

**Figure 5.4.2.8 – 1 Quick Rreference on Ssymbol Qquality**

| Symbology | Application or ID Code | ISO (ANSI) Symbol Grade | Aperture | Wavelength |
|---|---|---|---|---|
| EAN/UPC | EAN/UCC-8 | 1.5 (C) | 6 mils | 670 nm +/-10 |
| EAN/UPC | UCC-12 | 1.5 (C) | 6 mils | 670 nm +/-10 |
| EAN/UPC | EAN/UCC-13 | 1.5 (C) | 6 mils | 670 nm +/-10 |
| UCC/EAN-128 | Extended Coupon Code | 1.5 (C) | 6 mils | 670 nm +/-10 |
| UCC/EAN-128 | EAN/UCC-14 | 1.5 (C) | 10 mils | 670 nm +/-10 |
| UCC/EAN-128 | SSCC-18 | 1.5 (C) | 10 mils | 670 nm +/-10 |
| UCC/EAN-128 | Small Shipping Packages | 1.5 (C) | 10 mils | 670 nm +/-10 |
| ITF-14 (<0.635 mm (0.025 in.) X) | EAN/UCC-14 | 1.5 (C) | 10 mils | 670 nm +/-10 |
| ITF-14 (≥0.635 mm (0.025 in.) X) | EAN/UCC-14 | 0.5 (D) | 20 mils | 670 nm +/-10 |
| RSS and Composite | EAN/UCC-14, Other AIs | 1.5 (C) | 6 mils | 670 nm +/-10 |
| Data Matrix | Direct Part Marking, Very Small Healthcare Items | 1.5 (C) | See Guidelines (Sections 2.7 and 2.8) | 670 nm +/-10 |

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~~NOTE~~Note: An EAN/UPC based symbol should always be verified using a 6 mil (0.006 in.) aperture, a 670 nm ~~(nanometre)~~ +/-10 nm wavelength of light, and requires a minimum symbol grade of 1.5 (overall symbol grade on a 4.0 scale) equivalent to a "C" under the ANSI X3.182 standard. In the Symbol Specification Tables that follow, as well as on a typical bar code purchase order, this is expressed as 1.5/06/670.



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**Figure 5.4.2.8 – 2: EAN.UCC System Symbol Specification Table 1**

| * Primary Symbol(s) Specified | X-Dimension mm (inches) | | | *** Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | **Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | Right | |
| EAN-13 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 11*X* | 7*X* | 1.5/06/670 |
| EAN-8 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 17.03 (0.67") | 21.29 (0.84") | 42.58 (1.68") | 7*X* | 7*X* | 1.5/06/670 |
| UPC-A | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 9*X* | 1.5/06/670 |
| UPC-E | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 7*X* | 1.5/06/670 |

| * Primary Symbol(s) Specified Plus Add-on 2 or 5 | X-Dimension mm (inches) | | | ** Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | Minimum Separation Between Symbols | Maximum Separation Between Symbols | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | | | |
| EAN-13 + 2 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 11*X* | 7*X* | 12*X* | 1.5/06/670 |
| EAN-13 + 5 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 11*X* | 7*X* | 12*X* | 1.5/06/670 |
| UPC-A + 2 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 9*X* | 12*X* | 1.5/06/670 |
| UPC-A + 5 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 9*X* | 12*X* | 1.5/06/670 |
| UPC-E + 2 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 7*X* | 12*X* | 1.5/06/670 |
| UPC-E + 5 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 7*X* | 12*X* | 1.5/06/670 |

See Section 5.4.2.7 to ensure the correct Symbol Specification Table is used.

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*Special considerations exist for North American retail Point-of-Sale (POS) until a migration to international standards is completed. Until January 1, 2005, only UPC-A or UPC-E Symbols are acceptable in North America. After that date, EAN-8 and EAN-13 Symbols will also be accepted using the size specifications in Figure 5.4.2.8 – 2.

** Appendix 5.4.A.1 gives full details on when bar code symbols can be printed at less than the minimum X-dimension. In general, bar code symbols may only be printed using an X-dimension below 0.264 mm (0.0104 in.) or 80 percent magnification under the following conditions:

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- The allowance for X-dimensions between 0.2475 mm (0.00975 in.) or 75 percent magnification and 0.264 (0.014 in.) or 80 percent magnification is only applicable to on demand (e.g., thermal, laser) print processes. For all other printing processes, an X-dimension of 0.264 mm (0.0104 in.) is attainable and is the minimum allowable size.
- When printing a minimum symbol with any method of printing, the area provided for printing the symbol and the required Quiet Zone should never be less than the area required for an X-dimension of 0.264 mm (0.0104 in.).



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- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the minimum 20.73 mm (0.82 in.).

***The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation. Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height listed is tied to the minimum, target, and maximum X-dimension listed. There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.



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**Figure 5.4.2.8 – 3: EAN.UCC System Symbol Specification Table 2**

| Symbol(s) Specified | *X-Dimension mm (inches) | | | ** Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | | ***Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | Right | |
| EAN-13 | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 38.87 (1.53") | 51.82 (2.04") | 51.82 (2.04") | *11X* | *7X* | 1.5/06/670 |
| EAN-8 | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 31.94 (1.26") | 42.58 (1.68") | 42.58 (1.68") | *7X* | *7X* | 1.5/06/670 |
| UPC-A | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 38.87 (1.53") | 51.82 (2.04") | 51.82 (2.04") | *9X* | *9X* | 1.5/06/670 |
| UPC-E | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 38.87 (1.53") | 51.82 (2.04") | 51.82 (2.04") | *9X* | *7X* | 1.5/06/670 |
| ITF-14 | 0.495 (0.0195") | 0.495 (0.0195") | 1.016 (0.040") | 32.00 (1.25") | 32.00 (1.25") | 32.00 (1.25") | *10X* | *10X* | 1.5/10/670 |
| UCC/EAN-128 | 0.495 (0.0195") | 0.495 (0.0195") | 1.016 (0.040") | 32.00 (1.25") | 32.00 (1.25") | 32.00 (1.25") | *10X* | *10X* | 1.5/10/670 |

See Section 5.4.2.7 to ensure the correct Symbol Specification Table is used.

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*UPC-E and EAN-8 Symbols are designed for use on small packages. Whenever space permits, UPC-A, EAN-13, ITF-14, or UCC/EAN-128 Symbols should be used in the General Distribution Scanning environment.

The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation. Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height is tied to the minimum, target, and maximum X-dimension listed.

ITF-14 Symbols with X-dimensions below 0.635 mm (0.025 in.) should not be printed directly on corrugate with conventional (plate-based) processes. Packages and/or containers marked with ITF-14 Symbols with X-dimensions between 1.016 mm (0.040 in.) and 1.219 mm (0.048 in.) are acceptable based on historical specifications, but a migration to the 1.016 mm (0.040 in.) maximum X-dimension should be made on new artwork. The ITF-14 Symbol's bar width ratio target is 2.5:1, and the acceptable range is 2.25:1 to 3:1.

**The minimum symbol height for General Distribution Scanning is always 32 mm (1.25 in.). The minimum symbol height dimensions for ITF-14 and UCC/EAN-128 Symbols relate to the bar heights only (do not include Human Readable Interpretation text or ITF-14 Symbol Bearer Bars). There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

***For ITF-14 Symbols printed on labels with off-set, thermal, or laser print with an X-dimension 0.495 mm (0.0195 in), the minimum quality specification is 1.5/10/670. For



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ITF-14 Symbols printed directly on corrugate or labels with an X-dimension greater than or equal to 0.635 mm (0.025 in.), the minimum quality specification is 0.5/20/670.



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**Figure 5.4.2.8 – 4: EAN.UCC System Symbol Specification Table 3**

| Symbol(s) Specified | *X-Dimension mm (inches) | | | ** Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | Right | |
| EAN-13 | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 38.87 (1.53") | 51.82 (2.04") | 51.82 (2.04") | 11*X* | 7*X* | 1.5/06/670 |
| EAN-8 | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 31.94 (1.26") | 42.58 (1.68") | 42.58 (1.68") | 7*X* | 7*X* | 1.5/06/670 |
| UPC-A | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 38.87 (1.53") | 51.82 (2.04") | 51.82 (2.04") | 9*X* | 9*X* | 1.5/06/670 |
| UPC-E | 0.495 (0.0195") | 0.66 (0.026") | 0.66 (0.026") | 38.87 (1.53") | 51.82 (2.04") | 51.82 (2.04") | 9*X* | 7*X* | 1.5/06/670 |

See Section 5.4.2.7 to ensure the correct Symbol Specification Table is used.

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*Special considerations exist for North American retail POS until a migration to international standards is completed. Until January 1, 2005, only UPC-A or UPC-E Symbols are acceptable in North America. After that date, EAN-8 and EAN-13 Symbols will also be accepted using the size specifications in Figure 5.4.2.8 – 4.

UPC-E and EAN-8 Symbols are designed for use on small packages. Whenever space permits, UPC-A and EAN-13 Symbols should be used.

**The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation. Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height listed is tied to the minimum, target, and maximum X-dimension listed.

There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.



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**Figure 5.4.2.8 – 5: EAN.UCC System Symbol Specification Table 4**

| Symbol(s) Specified | *X-Dimension mm (inches) | | | ** Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | Right | |
| EAN-13 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 11*X* | 7*X* | 1.5/06/670 |
| EAN-8 | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 17.03 (0.67") | 21.29 (0.84") | 42.58 (1.68") | 7*X* | 7*X* | 1.5/06/670 |
| UPC-A | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 9*X* | 1.5/06/670 |
| UPC-E | 0.264 (0.0104") | 0.33 (0.013") | 0.66 (0.026") | 20.73 (0.82") | 25.91 (1.02") | 51.82 (2.04") | 9*X* | 7*X* | 1.5/06/670 |
| ITF-14 | 0.250 (0.00984") | 0.495 (0.0195") | 0.495 (0.0195") | 12.70 (0.50") | 12.70 (0.50") | 12.70 (0.50") | 10*X* | 10*X* | 1.5/10/670 |
| UCC/EAN- 128 | 0.250 (0.00984") | 0.495 (0.0195") | 0.495 (0.0195") | 12.70 (0.50") | 12.70 (0.50") | 12.70 (0.50") | 10*X* | 10*X* | 1.5/10/670 |

See Section 5.4.2.7 to ensure the correct Symbol Specification Table is used.

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*ITF-14 Ssymbols with X-dimensions below 0.635 mm (0.025 in.) should not be printed directly on corrugate with conventional (plate based) processes. Packages and/or containers marked with ITF-14 Symbols with X-dimensions between 1.016 mm (0.040 in.) and 1.219 mm (0.048 in.) are acceptable based on historical specifications, but a migration to the 1.016 mm (0.040 in.) maximum X-dimension should be made on new artwork. The ITF-14 Symbol's bar width ratio target is 2.5:1, and the acceptable range is 2.25:1 to 3:1.

Appendix 5.4.A.1 gives full details on when bar code symbols can be printed at less than the minimum X-dimension. In general, bar code symbols may only be printed using an X-dimension below 0.264 mm (0.0104 in.) or 80 percent magnification under the following conditions:

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- The allowance for X-dimensions between 0.2475 mm (0.00975 in.) or 75 percent magnification and 0.264 (0.014 in.) or 80 percent magnification is only applicable to on demand (e.g., thermal, laser) print processes. For all other printing processes, an X-dimension of 0.264 mm (0.0104 in.) is attainable and is the minimum allowable size.
- When printing a minimum symbol with any method of printing, the area provided for printing the symbol and the required Quiet Zone should never be less than the area required for an X-dimension of 0.264 mm (0.0104 in.).
- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the minimum 20.73 mm (0.82 in.).

**The minimum symbol height dimensions listed for EAN/UPC Symbols include the Human Readable Interpretation, but the minimum symbol height dimensions for ITF-14



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and UCC/EAN-128 Symbols relate to the bar heights only (do not include Human Readable Interpretation text or ITF-14 Bearer Bars).

Because of the operative scanning environment for EAN/UPC Symbols, there is a direct relationship between the symbol's height and width. This means the minimum symbol height listed is tied to the minimum, target, and maximum X-dimension listed.

The minimum bar height for ITF-14 and UCC/EAN-128 Symbols in this operative scanning environment is 12.7 mm (0.50 in.), but if the package is physically too small to accommodate this rule, further truncation is permitted. In no case shall the bar height be less than 5.08 mm (0.20 in.).



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There is no maximum for the symbol height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.

Whereas, linear symbol heights are set at a fixed dimension, Composite Components® are printed at the same density as the linear portion of the Composite Symbology® ~~composite symbology~~ , and the bar code height varies depending on the amount of data, the printing density, and which linear symbol is used in conjunction with the Composite Component. Note that Composite Components have to be printed with a linear symbol such as Reduced Space Symbology® (RSS), UCC/EAN-128, UPC-A, or EAN-13. ITF cannot be used with Composite Components.

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**Figure 5.4.2.8 – 6: EAN.UCC System Symbol Specification Table 5**

| Symbol(s) Specified | *X-Dimensions mm (inches) | | | ** Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone | | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | For Minimum X-dimension | For Target X-dimension | For Maximum X-dimension | Left | Right | |
| UCC/EAN-128 | 0.495 (0.0195") | 0.495 (0.0195") | 0.940 (0.037") | 32.00 (1.25") | 32.00 (1.25") | 32.00 (1.25") | 10*X* | 10*X* | 1.5/10/670 |

See Section 5.4.2.7 to ensure the correct Symbol Specification Table is used.

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*If the item is too small to accommodate the minimum X-dimension, the minimum X-dimension is 0.250 mm (0.00984 in.).

**The minimum symbol height indicated is for bar height only and does not include the Human Readable Interpretation. If the item is too small to accommodate the minimum, the minimum bar height is the greater of 15 percent of the symbol width including Quiet Zones or 12.7 mm (0.50 in.). If the package is physically too small to accommodate this rule, further truncation is permitted, but in no case shall the bar height be less than 5.08 mm (0.20 in.).

There is no maximum for the height, but if the maximum X-dimension is used, the symbol height must be equal to or greater than those listed in the Minimum Symbol Height column.



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**Figure 5.4.2.8 – 7: EAN.UCC System Symbol Specification Table 6 - 2D Symbols Using Composite Component (CC)**

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| Symbol(s) Specified | X-Dimensions mm (inches) | | | Minimum Symbol Height for Given X mm (inches) | | | Quiet Zone Left | Quiet Zone Right | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | Minimum | Target | Maximum | | | |
| CC-A | Consult Table 4, since all CCs need to be printed at the same printing densities as their linear components | | | Height is determined by X-Dimension for data that is encoded | | | 1*X* | 1*X* | 1.5/06/670 |
| CC-B | | | | Height is determined by X-Dimension for data that is encoded | | | 1*X* | 1*X* | 1.5/06/670 |
| CC-C | | | | Height is determined by X-Dimension for data that is encoded | | | 2*X* | 2*X* | 1.5/06/670 |



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**Figure 5.4.2.8 – 8: EAN.UCC System Symbol Specification Table 7 - 2D Symbols Using Data Matrix**

| Symbol(s) Specified Data Matrix (ECC 200) | **X-Dimensions mm (inches) | | | Minimum Symbol Height for Given X mm (inches) | | | *Quiet Zone | *Quiet Zone | Minimum Quality Specification |
|---|---|---|---|---|---|---|---|---|---|
| | Minimum | Target | Maximum | Minimum | Target | Maximum | Left | Right | |
| Direct Part Marking | 0.380**** (0.0150) | 0.380 (0.0150) | 0.495 (0.0195) | Height is determined by X-Dimension for data that is encoded | | | 1*X* | 1*X* | 1.5/***/670 |
| Healthcare Printing | Refer to Section 2.7 for Data Matrix Applications for small items in healthcare | | | | | | | | |

*Quiet zones for Data Matrix are 1X on all four sides.

**Because of the physics of optics, Data Matrix needs to be printed at 1.5 times the equivalent printing density allowed for linear or C~~c~~omposite S~~s~~ymbols.

***The effective aperture for Data Matrix quality measurements should be taken at 80 percent~~%~~ of the printing density. For Direct Part Marking this would equate to an aperture of 12; for Healthcare printing, an aperture of 8.

****Minimum has been set close to Target value until ~~applications~~ specifications and testing can justify changing this to a lower value.



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### 5.4.3 Bar Code Production

The following subsections will:

- Provide background on major bar code printing methods and materials~~.~~
- Provide general printing and packaging background for major application groups~~.~~

The various definitions and specialist terms used throughout this section can be found in *ISO/IEC 15419*, Information Technology, Automatic Identification and Data Capture Techniques, Bar Code Digital Imaging and Printing Performance Testing.

#### 5.4.3.1 Digital Imaging

##### 5.4.3.1.1 General Requirements

General requirements consisting of the following topics can be found in Section 4 of *ISO/IEC 15419*.

- Data input
- Quiet Zones
- Classification of imaging device categories, from informative reference Annex E of *ISO/IEC 15419*
- Programmer's examples, from informative reference Annex F of *ISO/IEC 15419*
  - Programmer's example for general-purpose printers
  - Programmer's example for indirect bar code imaging devices
  - Programmer's example for symbols distorted for plate roll circumference
- Direct bar code imaging devices
- Dedicated bar code printers
- Adjustment of target element dimensions
- Record of design elements
- General purpose printers
- Adjusted bar width compensation (BWC) (including the General Purpose Printer Dot/Pixel Comparison figure)
- Record of design attributes
- Indirect bar code imaging devices
- Adjustments for planned distortion (disproportioning)
- Adjustments for special EAN/UPC Symbol characters
- Test requirements
  - System configuration



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- Test procedure

- Conformance
- Test report, including sample test layout, from normative reference Annex A of *ISO/IEC 15419*
- Certification
- Software specification, including classification of software categories, from informative reference Annex D of *ISO/IEC 15419* and functions of bar code production software from informative reference Annex G of *ISO/IEC 15419*
- Maintenance and supplies, from informative reference Annex C of *ISO/IEC 15419*

#### 5.4.3.1.2 Dedicated Bar Code Printers

Section 5 of *ISO/IEC 15419* contains information on dedicated bar code symbol printers and includes the following topics:

- Data input requirements
- Test requirements
- Selection of equipment for testing
- Test conditions; environment, equipment configuration
- Test procedure
- Conformance
- Test report
- Certification and labelling
- Equipment specification



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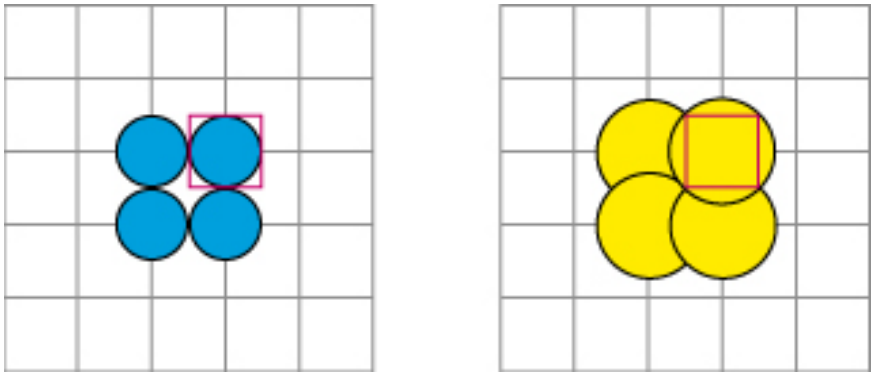
### 5.4.3.1.3 EAN/UPC On-Demand Printed Symbols at Mminimum Ssize

It is more difficult for the user to create high quality bar code symbols with general-purpose printers than it is with direct thermal transfer label printers. There are two reasons for this difficulty. First, the printed dot size for general-purpose printers is appreciably larger than the pixel dimension, as shown in the figure belowFigure 5.4.3.1.3 – 1. This causes the bars (dark bars) to be printed wider and the spaces (light bars) to be narrower than nominal, unless the software driving the printer corrects for this distortion. Second, the software that constructs the bar code may itself introduce dimensional errors.

**Figure 5.4.3.1.3 – 1 Example of Ddigital Pprinting**



**Pixel-Sized Dot** **Typical General-Purpose Printer Dot**

The most common printing densities used by on-demand, bar code symbol printers are 200 and 300 dpi. However, due to the constraints of the dot pitch, these printers cannot print a minimum X-dimension of 0.264 (0.0104 in.) or 80 percent magnification symbol correctly. The closest to 80 percent that these printers can print is 75.7 percent or 76.9 percent depending on the exact dot geometry (see Figure 5.4.3.1.3 – 2).

Even though a minimum X-dimension of 0.264 (0.0104 in. or 80 percent magnification) is the minimum value specified, users of on-demand printers have used magnifications between 75 percent and 80 percent in Point-of-Sale (POS) scanning environments for years. They have done so with no significant reduction in scan rate, as compared to symbols printed precisely at 80 percent. Because larger in-specification symbols are always easier to scan, 80 percent symbols and larger are preferred. However, when an on-demand printer is required, the 75 to 80 percent symbols are an acceptable alternative given the following qualifications for printing:

- The allowance for symbols from the EAN/UPC Symbology family of magnifications from 75 to 80 percent is only applicable to on-demand (e.g.,



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thermal, laser) print processes. For all other printing processes, 80 percent is attainable and is the minimum allowable size.

- When printing a minimum symbol with any method of printing, the area provided for printing the symbol, including the required Quiet Zones, should never be less than the area required for an 80 percent symbol. This area can be derived from the total width of an 80 percent symbol times its height.
- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the 80 percent value (20.7 mm or 0.816 in.).
- The minimum print quality grade is the same for all symbols in the EAN/UPC Symbology family: 1.5/06/670.



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**Figure 5.4.3.1.3 – 2 Achievable X-Dimensions for Thermal Printed EAN/UPC Symbols**

| Reference DPI | Actual DPI | Dots Per Millimetre | Actual Dot Width (Centre Point to Centre Point) | | Dots Per Module Width | Module Width (X-Dimension) | | *Corrected Magnification |
|---|---|---|---|---|---|---|---|---|
| | | | Inch | mm | | Mils | mm | |
| 200 | 203.2 | 8 | 0.0049 | 0.1250 | 2 | 9.84 | 0.250 | **75.76% |
| 200 | 203.2 | 8 | 0.0049 | 0.1250 | 3 | 14.7 | 0.375 | 113.64% |
| 200 | 203.2 | 8 | 0.0049 | 0.1250 | 4 | 19.6 | 0.500 | 151.52% |
| 200 | 203.2 | 8 | 0.0049 | 0.1250 | 5 | 24.6 | 0.625 | 189.39% |
| 300 | 304.8 | 12 | 0.0032 | 0.0833 | 3 | 9.84 | 0.250 | **75.76% |
| 300 | 304.8 | 12 | 0.0032 | 0.0833 | 4 | 13.1 | 0.333 | 100.01% |
| 300 | 304.8 | 12 | 0.0032 | 0.0833 | 5 | 16.4 | 0.416 | 126.26% |
| 300 | 304.8 | 12 | 0.0032 | 0.0833 | 6 | 19.6 | 0.500 | 151.52% |
| 300 | 304.8 | 12 | 0.0032 | 0.0833 | 7 | 22.9 | 0.583 | 176.77% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 4 | 9.84 | 0.250 | **75.76% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 5 | 12.3 | 0.312 | 94.70% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 6 | 14.7 | 0.375 | 113.64% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 7 | 17.2 | 0.437 | 132.58% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 8 | 19.6 | 0.500 | 151.52% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 9 | 22.1 | 0.562 | 170.45% |
| 400 | 406.4 | 16 | 0.0024 | 0.0625 | 10 | 24.6 | 0.625 | 189.39% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 6 | 9.84 | 0.250 | **75.76% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 7 | 11.4 | 0.291 | 88.38% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 8 | 13.1 | 0.333 | 101.01% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 9 | 14.7 | 0.375 | 113.64% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 10 | 16.4 | 0.416 | 126.26% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 11 | 18.0 | 0.458 | 138.89% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 12 | 19.6 | 0.500 | 151.52% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 13 | 21.3 | 0.541 | 164.14% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 14 | 22.9 | 0.583 | 176.77% |
| 600 | 609.6 | 24 | 0.0016 | 0.0416 | 15 | 24.6 | 0.625 | 189.39% |

*Note: The nominal EAN/UPC Symbol can be based on a module width (X-dimension) of either 0.013 inch or 0.33 mm. In North America, long-standing Uniform Code Council, Inc.® (UCC®) specifications ~~have~~ set the nominal module size (X-dimension) at 0.013 inch or 13 mils. EAN~~,~~ International specifications and the ISO/IEC specification for EAN/UPC Symbols set the nominal module size (X-dimension) at 0.33 mm. The



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international metric nominal is 0.0606 percent smaller than the original inch-based nominal. The data in the right-most column labelled “Corrected Magnification” are based on a nominal module width (X-dimension) of 0.33 mm.



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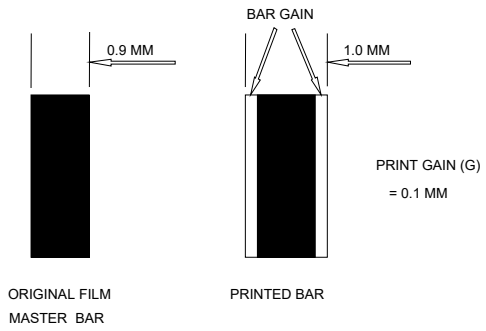
### 5.4.3.2 Film Master Production

#### 5.4.3.2.1 Introduction

For symbols in the EAN/UPC Symbology family, the biggest usage of verification has always been in conjunction with printing and production of packaging and labels by means of the conventional or "wet ink" printing processes, such as offset lithography, flexography, and photogravure. These printing processes used a Film Master as the initial artwork of the symbol, although some form of electronic origination of the symbol is increasingly replacing this high-precision article.

The first point at which one might use verification is the printability test stage prior to actual production of "real-life" symbols, where a printing run of a test symbol is carried out under normal conditions and measured in order to characterise the printing process for a particular press and printing substrate. It is necessary to assess how much bar gain (or loss) has occurred and over what range of variation, to decide how much Bar Width Adjustment (BWA) is required. BWA can be in the form of Bar Width Reduction (BWR), where there is print gain, or the less common Bar Width Increase (BWI). The required BWA is associated with the X-dimension used. These details are required in order to specify the Film Master correctly, or as input parameters for the bar code symbol origination software.

**Figure 5.4.3.2.1 – 1 Example of Bar Width Adjustment**




Verifying the Film Master on receipt confirms that the correct BWA has been applied and that it is otherwise as specified. Note that a special type of verifier using traditional measurement and capable of more precise measurement is necessary at this point, since Film Master requirements are specified in terms of element widths and are



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subject to tolerances of only plus or minus five microns for EAN/UPC Symbols. In addition, the verifier needs to be capable of measuring the intensity of light transmitted through, rather than that reflected by, the film material.~~,~~ ~~-~~ A~~a~~lso, Film Masters may be either photographic positives or negatives, and in the latter case, the light and dark characteristics of the background and bars are reversed. In the absence of such a verifier, reliance may be placed on the verification report normally provided by the F~~f~~ilm M~~m~~aster supplier with the master.

If a proof of the print job is produced, the bar code symbol should be verified as part of the approval process. Note, however, that since proofing presses are not the same as production printing presses, there may be a slight difference in the quality of the proof and the production job.



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While the presses are being made ready, a check of bar widths on the first few printed sheets can help to ensure that the press is correctly set to produce near-ideal bar widths. Once the presses have started to roll, periodic sampling should be carried out, at intervals based on experience or dictated by the company's quality control procedures, to monitor both bar widths and other aspects of symbol quality (in particular Symbol Contrast), since these are the attributes most easily adjusted during the run.

Finally, a further sample should be verified following completion of the print job. The Scan Reflectance Profile (SRP) analysis should be used as the basis for decision making, to ensure that the job has achieved at least the minimum quality grade specified by the customer or based on the application.

The following items are recommended to appear on or with a Film Master:

- X-dimension (m~~M~~agnification factor)
- Selected Bar (line) Width Reduction
- Product identification, including company name
- A test square (outside the symbol area) for emulsion studies (this should be incorporated in the film, not affixed on a separate label)
- Printing process for which the Film Master is intended
- Identification of the Film Master supplier
- Date of Film Master manufacture

**5.4.3.2.2 Terms and Definitions**

Definitions for the following terms can be found in *ISO/IEC15421: 2000(E)*, Section 4:

- Achieved bar width difference
- Bar edge
- Bar edge conformance
- Bar edge contour
- Bar edge gradient
- Bar width adjustment (BWA)
- Bar width increase (BWI)
- Bar Width Reduction (BWR)
- Bar width tolerance
- Base density
- Negative image
- Nominal bar width (EAN/UPC Family)
- Optical density profile
- Polarity



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- Positive image
- Specified bar width
- Target element width

#### 5.4.3.2.3 Physical Requirements

Physical requirements consisting of the following topics can be found in Section 6 of *ISO/IEC15421: 2000(E)*, Information Technology, Automatic Identification and Data Capture Techniques, Bar Code Master Test Specifications:

- Material
  - Dimensional stability
  - Archival properties
- Physical requirements controlled by the manufacturing process
  - Target bar width
  - Bar width adjustment (BWA)
- Tolerances
  - Tolerance A – all symbologies
  - Tolerance B – two-width symbologies
  - Tolerance C – (n,k) symbologies
  - Tolerance D – all symbologies
- Bar edge characteristics
  - Bar edge conformance
  - Bar edge gradient
- Defects
- Quiet Zones
- Corner marks
- Optical densities (including table "Reference Density Values," and, from informative reference Annex A of *ISO/IEC15421: 2000(E)*, Optical Density Profiles, the following figures: Minimum and Maximum Values of Optical Density, Measurement of Slope, Threshold Point for Bar Edge Determination, Measurements for Ratio-Based Symbologies, Measurements for (n,k) Symbologies, and Symbol Character Pitch Measurement)
  - Minimum density ($D_{min}$)
  - Maximum density ($D_{max}$)
- Orientation



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- Polarity
- Encodation
- Human Readable Interpretation
- Test Methods

  - Bar and space width measurement

  - Conditions for dimensional measurements

  - Calculation of the achieved BWA

  - Test report and traceability

#### 5.4.3.3 Quality Assessment

##### 5.4.3.3.1 Verification

Verification is the technical process by which a bar code symbol is measured to determine its conformance with the specification for that symbol. Verification is not intended to be used alone as a method for downstream rejection. For example, the Uniform Code Council, Inc.® (UCC®) and EAN International's advice is to use the *ISO/IEC 15416* methodology as a tool to improve overall scanning performance. For problem EAN.UCC System Symbols, an ISO-based verifier can be of enormous assistance in diagnosing the problem and providing a standard means of reporting ~~between~~ among printing companies and their trading partners.

It is also important to note the difference between a scanner and a verifier. A verifier is a measuring tool by which one can make certain determinations concerning the ability of the symbol to do its job, namely, to carry and deliver data on demand. Because traditional verification measurement is typically made in a single scan across the symbol, it is uncertain whether this "snapshot" is truly representative of the symbol's characteristics through the height of the bars.

When interpreting the results from verification it is also important to remember that:

- Most verifiers do not measure bar height.
- Without additional software linking the decoded data to a database, the quality and accuracy of the data content of a symbol cannot be confirmed.
- The verifier cannot confirm that the symbol dimensions are those intended and are as indicated in Symbol Specification Tables (SSTs). For example, many of the simpler verifiers cannot measure in dimensional terms (X-dimension), though they can be remarkably accurate in measuring the relationships of element widths to each other. The amount that bar widths differ from nominal width on average in a symbol is called the average bar error. This number is expressed as a fraction of X-dimension. A positive value indicates average bar growth and a negative value indicates bar shrinkage.
- The verifier does not check that the Human Readable Interpretation matches the bar code data (and it may be necessary to check that the two correspond.



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particularly where the bar code generating software does not include ~~the~~ Human Readable Interpretation data).

- Because only a sample of the symbols produced are actually verified, the quality of all the symbols in a production batch cannot be guaranteed beyond the statistical confidence limits associated with the sampling rate used.
- Even a perfect symbol at the time of production can be damaged or otherwise affected in its passage through the supply chain (e.g., scratched, frozen, dampened).
- Operator error can cause inconsistent results. Operators should be properly trained and visual checks should be made to confirm verifier results (e.g., where the bar code is expected to get a good result~~,~~ and fails the verifier test, recheck the operation of using the verifier).
- The correct bar code symbol has been printed for the scanning environment of the item (e.g., an ITF-14 S~~s~~ymbol used on an item intended for retail ~~point of sale~~Point-of-Sale).

#### 5.4.3.3.1.1 Traditional Verification

Traditional verification methods were introduced in the early to mid-1970s and were based on the measurement of two symbol parameters: print contrast signal (PCS) and the bar width deviation. If the bar (or space) widths were within a defined (but somewhat arbitrary) tolerance, and if PCS was above a defined minimum value, the symbol was regarded as being "in spec."

Initially, none of these measurements were automated, and human factors affected the accuracy and consistency of measurements. Also, checking that the symbol was correctly encoded was a laborious task. However, within a few years, instruments were developed that performed these measurements automatically. These were the first true verifiers that enabled the printer to take steps to produce the symbols as nearly perfectly as this process allowed.

Traditional verification does not necessarily give results that correlate very closely with the actual scanning performance of the symbols. One reason is that the assessment of the symbol gives only a single threshold for acceptability – "Pass" or "Fail~~.~~." In addition if the assessment is based on a single scan across the symbol, which might be through an exceptionally good or bad section of the symbol, it cannot be guaranteed to be truly representative of its condition.

Measurements of bar gain or loss are less meaningful in the case of certain symbologies, like the EAN/UPC Symbology and the UCC/EAN 128 Bar Code Symbol,



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where decoding relies primarily on edge-to-similar~~-~~ edge distances, which are relatively immune to even substantial amounts of consistent gain or loss across the symbol. These distances are measured from the leading edge of one bar to the leading edge of the next (or from one trailing edge to the next), which tends to move in the same direction if there is bar gain or loss. A more subtle factor is that the method is not standardised, either as to where the dark and light reflectance (or density) measurements are made for the calculation of PCS, or as to how the exact position of an element edge is defined, so that some models of verifier could assess a given symbol as "Pass" whereas others could "Fail" it – a source of potential and, indeed, actual disagreements ~~between~~ among suppliers and customers.

#### 5.4.3.3.1.2 ISO Verification

During the 1980s, two factors led to attempts to improve the traditional verification technique. One was the disparity between traditional verification results and the real life performance of symbols, and the other was the increasing number of product rejections by customers based on differing verification results between the supplier's instrument and his customer's.

A wide-ranging programme by a group of experts from bar code and user industries working on all types of scanning systems determined the factors that most directly affect symbol-scanning performance~~,~~ and resulted in the analysis of the Scan Reflectance Profile (SRP). This methodology was originally known as ANSI verification because it was first described in the United States' standard *ANSI X3.182*, published in 1990 under the title *Bar Code Print Quality Guidelines*. The method was then defined in a European standard (*EN 1635*), published in 1995, and an international standard (*ISO/IEC 15416*), published in 2000. *ISO/IEC 15416* is the definitive international specification of the ISO bar code verification methodology, and the numeric grading system is used.

The method, as described in the *ISO/IEC 15416* standard, is technically fully compatible with the *ANSI X3.182* and *EN 1635* method, so verifiers based on ~~this~~ these standards are not obsolete.



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In simple terms, an ISO verifier looks at the symbol in exactly the same way a scanner sees it. The ISO verifier reports its assessment of the symbol quality not as a single "Pass" or "~~/~~Fail" decision, but as one of a range of four passing grades (from 4 to 1, in order of decreasing quality) or one failing grade (0). This enables an application to set the most appropriate minimum grade for acceptability. It may be noted that the ANSI standard ~~used~~ uses the alphabetic scale A to D for ~~the~~ passing grades and F for failing symbols, but the grade thresholds are identical.

The relationship between symbol grades measured in this way and the way the symbols behaved when they were scanned was so close that users rapidly came to accept the SRP assessment method for verifying symbols received from their trading partners. Users knew that as long as a symbol achieved grade 1.5 or better it would give them acceptable performance when they had to scan it to capture the encoded data.

Note: The EAN.UCC System requires that the Quiet Zone be a measured parameter for EAN/UPC Symbology, UCC/EAN-128 Symbols, and ITF-14 Symbols per the values expressed in *ISO/IEC 15416*, Section 5.

#### 5.4.3.3.1.3 Types of Verifiers

There are many types of verifiers and almost as many ways of classifying them, but for practical purposes, it is convenient to group them into two classes related to where they are ~~to be~~ used and the extent to which all their possible functions are required. ~~These~~ This grouping corresponds reasonably closely ~~with~~ to the Class A and Class B classification respectively (as used in the European pre-standard *ENV 12647*).

The first group (broadly equivalent to the Class A category) contains the full-function type of verifier, which is mainly found in a quality control laboratory. It performs a full range of measuring functions and provides comprehensive analytical reports on the symbol, enabling the cause of problems to be diagnosed. Its use requires a good degree of knowledge of the technology, and the operator must, therefore, be specially trained. Its measurement accuracy may be substantially higher than the average; its cost almost certainly is, and the time taken to perform the necessary scans and output the results may be relatively long; however, in the expected conditions for which such an instrument is purchased, this is not likely to be a problem. This type of verifier may have motorised optical heads to improve the evenness of movement and achieve the multiple scanning requirements, and to enable accurate dimensional measurements. In addition, this verifier may have interchangeable measuring apertures and light sources to enable measurement of symbols with a wide range of X-dimensions and to meet the illumination needs of differing application standards. Some of these instruments are used in conjunction with a personal computer with special verification



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software for the symbol analysis and display/printing of results, while others are integrated stand-alone units.

The second group (corresponding to the Class B category) contains all the simpler, easy-to-use devices intended for use in the pressroom or on the receiving dock by relatively less ~~well-~~trained operators. At their simplest, these devices are used to rapidly check that symbols are of the desired grade or better and, particularly in the pressroom, to obtain an indication of bar gain or loss and of contrast to help the press operator fine-tune his machine. Typically they have a single light source and measuring aperture, though by using plug-in wands or mice, a degree of interchange ~~funcitionalty~~functionality may be achieved. Some instruments use laser beam illumination, which facilitates multiple scans of the symbol, though the effective measuring aperture may not be circular in shape, and its size may not be precisely known. They also may be more limited in their reflectance measurements.

A group of specialised verifiers is designed for mounting on printing equipment. They monitor the bar code symbols produced by the equipment and provide continuous analysis of key parameters, notably element widths, to enable the operator to control the printing process very ~~speedily~~quickly. Some are designed for high-speed presses~~,~~ and others for on-demand printers. Some are even able to automatically feed back control instructions to improve symbol quality and reprint defective labels.



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A particular verifier may be hard to fit neatly into either class, as it may resemble the simpler class of unit in its physical construction, but its functions and the amount of information that it can give on the symbol may correspond more closely to those of the laboratory unit. Partly for this reason and partly because the Class A and Class B reporting requirements did not necessarily correspond precisely to what a verifier manufacturer might wish to offer for commercial reasons, the ~~i~~international ~~S~~standard *ISO/IEC 15426-1*, which replaces *ENV 12647*, has eliminated the classification scheme in favour of a minimum set of reporting requirements for all verifiers, to which manufacturers are at liberty to add in accordance with their view of the market needs.

#### 5.4.3.3.2 Measurement Methodology

The symbol should be verified in its final configuration wherever possible (e.g., including over-laminate, package material, contents), but if this is not feasible, the following procedure is recommended to allow for the effects of show-through.

Place the symbol to be verified on a flat surface. If the substrate is not opaque (allows light through), perform the verification procedure with the symbol on a dark surface, and then repeat it on a light surface. Take the poorer set of results, unless it is known what type of material is likely to back the symbol in practice, in which case attempt to match it.

#### 5.4.3.3.3 Symbol Grading

Symbol Grading consisting of the following topics can be found in Section 6 of *ISO/IEC 15416: 2000(E)*:

- Scan Reflectance Profile (SRP) grading (further explained in normative reference Annex B of *ISO/IEC 15416: 2000(E)*)
- Decode
- Reflectance parameter grading (including the Reflectance Parameter Grading figure)
- Decodability (including the Decodability Grades figure; also covered in normative reference Annex A of *ISO/IEC 15416: 2000(E)*)
- Expression of symbol grade
- Symbol grading process flowchart is available from normative reference Annex C of *ISO/IEC 15416: 2000(E)*
- Example of verification report is available from informative reference Annex H of *ISO/IEC 15416: 2000(E)*

#### 5.4.3.3.4 Substrate Characteristics

Substrate characteristics consisting of the following topics can be found in the informative reference Annex D of *ISO/IEC 15416: 2000(E)*:



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- Substrate opacity
- Gloss
- Over-laminate
- Static reflectance measurements
- Prediction of Symbol Contrast
- Prediction of Minimum Edge Contrast ($Ec_{min}$) and Modulation (MOD)
- Acceptability of measured and derived values

#### 5.4.3.3.5 Interpretation of the Scan Reflectance Profile and Profile Grades

Interpretation of the Scan Reflectance Profile (SRP) and profile grades consisting of the following topics can be found in the informative reference Annex E of *ISO/IEC 15416: 2000(E)*:

- Significance of SRPs
- Interpretation of results
- Matching grades to applications
- Alphabetic grading

#### 5.4.3.3.6 Comparison with Traditional Methodologies

Comparison with traditional methodologies consisting of the following topics can be found in the informative reference Annex I of *ISO/IEC 15416: 2000(E)*:

- Traditional methodologies
- Correlation of print contrast signal with Symbol Contrast measurements
- Guidance on grading for applications also specifying print contrast signal (PCS)

#### 5.4.3.3.7 Process Control Requirements

Process control requirement methodologies consisting of the following topics can be found in the informative reference Annex J of *ISO/IEC 15416: 2000(E)*:

- Process control for repetitive printing
- Number of scans
- Bar width deviation
- Two-width symbologies
- (n,k) symbologies
- Average bar gain/loss



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Average bar error is not graded directly, but is used to calculate what fraction of a defined bar tolerance is consumed by the printing process. This traditional bar tolerance calculation differs by symbology and, in the case of the EAN/UPC Symbology, it also differs by the X-dimension at which the symbol is printed. Generally a smaller X-dimension yields a smaller tolerance.

#### 5.4.3.3.8 Compliance Statement

Verifiers that are suitable for use with the recommendations contained in ~~these~~ the *General EAN.UCC Specifications* will often be supplied with a statement that associates the instrument with the following calibration standards:

> "Applied Image certified EAN/UPC Symbology calibration standards are manufactured to specifications set by Applied Image and the collaboration of the Uniform Code Council, Inc.® and EAN International using *ISO/IEC 15416* methodology and are calibrated using standards traceable to the National Institute of Standards and Technology."

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#### 5.4.3.3.9 Calibrated Conformance Standard Test Cards

The verifier operator may use a variety of tools and procedures to periodically ensure maintenance of the verifier's calibration. For example, the operator may follow the manufacturer's recommended procedure for set-up, programming (if necessary), normal operational calibration, and use of the verifier prior to performing any tests. Indeed such procedures are considered essential to ensure the consistency of verification results over time.

Some verifier manufacturers may require the operator to utilise a calibration patch designed for use in maintaining instrument calibration. A common form of patch is often referred to as a "reflectance patch," which may be provided with the instrument. It is very important that the manufacturer's instructions are followed carefully and conscientiously to properly calibrate the instrument. An indication of "calibration complete" normally signals successful recalibration of the device.

Other manufacturers may require periodic factory calibration of their verifier to maintain proper calibration.

With the increasing use of verifiers as communication tools, all verifiers must be periodically checked for their calibration conformance to a traceable standard (within accuracy and repeatability limits stated by the manufacturer). For this reason, the



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Calibrated Conformance Standard Test Cards ~~for~~ are available for the verifier user (see Figure 5.4.3.3.9 – 1).

Calibrated Conformance Standard Test Cards have been designed for verifiers with 6, 10, and 20 mil apertures, and the following are currently available from EAN International and The Uniform Code Council, Inc.® (UCC®):

- EAN/UPC Calibrated Conformance Standard Test Card~~.~~
- ITF Calibrated Conformance Standard Test Card~~.~~
- UCC/EAN-128 Calibrated Conformance Standard Test Card~~.~~
- RSS Calibrated Conformance Standard Test Card~~.~~

Use of these test cards provide a number of benefits including:

- Validates verifiers for UPC-A, EAN-13, ITF, UCC/EAN~~.~~ Code 128, and Reduced Space Symbology® (RSS) linear symbols. Covers all EAN and UCC symbologies except Composite Component® (a two~~-~~dimensional bar code).
- Training tool for operators of verifiers~~.~~
- Validates that the verifier is working within its specified tolerances for the symbology selected~~.~~

Each ~~of the Cards~~ test card is designed to test particular characteristics of *ISO/IEC 15416*-based verification equipment. The standards are manufactured on special materials and are made traceable to the National Institute of Standards and Technology (NIST). This traceability is facilitated through a custom designed piece of hardware (nicknamed “the Judge”) and has been engineered to measure the various attributes outlined in *ISO/IEC 15416*. The Judge has also been made traceable to NIST in Washington, D.C.

The idea behind the standard is to regularly test the verification equipment to ensure it is operating within ISO tolerance levels as published by the verifier manufacturer. This is especially important in heavy use applications where various operators may be involved or where a new user is learning to properly verify. The operator should routinely scan each of the symbols on the ~~Test~~ test ~~Card~~ card to determine if the verifier device provides the values listed. These specifications stipulate an aperture and 670 nm +/-10 nm wavelength be used, and the exact scanning method should be determined by following all of the verifier manufacturer recommendations. This may require some practice to obtain the right touch, but it will inform the operator when the correct method has been used. If the verifier reports values that agree with the values listed on



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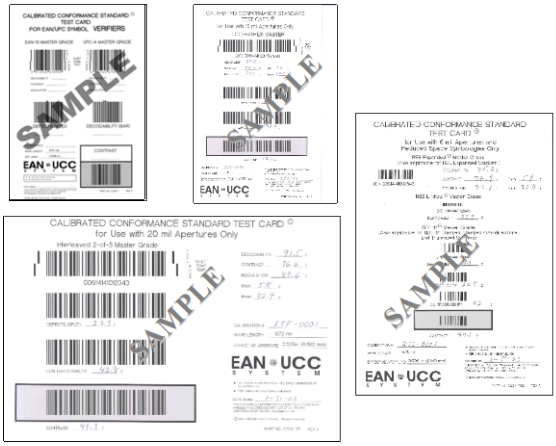
the ~~Test~~ test ~~Card~~ card (within the verifier manufacturer's stated accuracy and repeatability limits), then the operator can assume the verifier is calibrated. If, after repeated attempts, the device does not provide the value as printed on the standard (within the verifier manufacturer's stated accuracy and repeatability limits), then the device or the operator's scanning technique must be considered suspect. In this event, the operator should refer to his or her operator's manual as to the proper remedies specified by the verifier manufacturer.

~~The Test Cards~~Test cards are sensitive and should be handled with care. If the symbols show dirty areas, one can safely clean these by using a soft cotton pad and photographic grade film cleaner. If visible scratches develop on a symbol, that area of the symbol should not be used. If sufficient visible scratches develop so that a clean scan path is not available, then the ~~Test~~ test ~~Card~~ card is no longer useable and should be replaced.

**Figure 5.4.3.3.9 - 1: Sample Test Card for Verifiers**




The ~~Test~~ test ~~Card~~ card serves as a device for, or means of, confirming that an ISO-based verifier has been properly calibrated and that users are obtaining results within the accuracy limits stated by the manufacturer ~~for~~ of their instruments.



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It is possible that a defective verifier, use of a damaged or incorrect reflectance patch, or, in some cases, a careless user performing the calibration to the patch, might provide a false indication of successful calibration. The proper use of the Calibrated Conformance Standard Test Cards ~~for~~ is the only way multiple trading partners can be assured of reliable quality measurements for the printed EAN.UCC Symbol.

As a general rule, any ~~(NIST or non-NIST traceable)~~ ISO-based verifier (NIST or non-NIST traceable) should be periodically tested ~~by use of~~using a Calibrated Conformance Standard Test Card. This procedure will confirm both the accuracy of the instrument and the skill of the user.

#### 5.4.3.3.10 Special Considerations for Verification of EAN.UCC System Symbologies

##### 5.4.3.3.10.1 General

Since ISO verification does not measure dimensions, it is part of the additional visual checking that has to be carried out to ensure that, for example, the symbol height meets the application requirements.

With better digital imaging software, element dimensions can only be adjusted automatically to the nearest integer number of pixels in the output device, be it imagesetter or printer, enabling element width ratios to be maintained with allowance duly made, for example, for print gain/loss and adjustment of element widths for digits 1, 2, 7, and 8 in EAN/UPC Symbols. This means that symbol sizes may not match those input as target dimensions, but will vary in discrete steps within the permitted range, which will result in a more accurate symbol overall.

##### 5.4.3.3.10.2 EAN/UPC Symbology

The main characteristic of the EAN/UPC Symbology that affects verification is the different treatment of the three sets of symbol characters for digits 1, 2, 7, and 8 from the remaining digits (0, 3, 4, 5, 6, and 9). The reference decode algorithm uses the combined width of both bars in these characters to discriminate between a 1 and a 7, and between a 2 and an 8, which are ambiguously decodable since they share the same set of edge-to-similar-edge modular dimensions. The addition to or subtraction from the element widths of 1/13 module is intended to increase the differences between the sums of the bar widths for each pair of ambiguous characters. The Decodability parameter for these characters takes account of bar gain and loss whereas it does not for the remaining symbol characters. Consequently, a symbol not containing any of these four symbol characters may suffer substantial bar gain or loss without degrading its Decodability, whereas a symbol that does contain one or more of them is likely to have a lower Decodability grade, with the same amount of bar gain or loss. However, the laws of probability suggest that only some 6.9 percent of symbols would not be affected



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by this, so it is wise to be cautious and assume that bar gain or loss is a possible cause of a poor Decodability grade for EAN/UPC Symbols. It is also wise (for process control purposes) not to assume that the Decodability grade correlates with bar width deviation, but it is far safer and easier to rely on the traditional measurement of bar width deviation for adjusting the production process.

The measuring aperture for EAN/UPC Symbols, irrespective of X-dimension, is 6 mils (which is equivalent to 0.15 mm (0.006in.)). This is not one of the four ISO-recommended standard default aperture sizes, which are 3, 5, 10, and 20 mils, but is usually available from verifier manufacturers. This diameter was based on measurement of symbols with various apertures and much test scanning in order to determine which aperture gave results correlating best with scanning performance.

#### 5.4.3.3.10.3 UCC/EAN-128 Symbology

The important aspects to verify for an UCC/EAN-128 Symbol are its print quality ~~and structure. Print quality~~, which is assessed in the standard way, and its formatting, which may need to be visually checked from the information output by the verifier. The Code 128 Symbology is an edge-to-similar- edge decodable symbology, but its reference decode algorithm also requires a check of the sum of the widths of the three bars in each character as part of its parity checking process. Consequently, its Decodability is affected by bar gain or loss.

Measuring apertures for UCC/EAN-128 Symbols varies according to the application. For all applications except the UCC/EAN-128 Coupon Extended Code, an aperture of 10 mils is specified, giving a minimum acceptable grade of 1.5/10/670. The UCC Coupon Code requires an aperture of 6 mils and a minimum grade of 1.5/06/670.

Data contained in UCC/EAN-128 Symbols must be formatted according to these specifications for the use of Application Identifiers (AIs). Specific features to check are:

- Presence of Function ~~1 Character~~Code 1 (FNC1) as a flag for the EAN.UCC System subset of the Code 128 Symbol, in the first position after the Start Character
- Use of FNC1 as a field separator following non-predefined ~~between variable~~ length AIs ~~data fields~~
- Sequencing of AIs, with pre-defined~~fixed~~ length AIs preceding ~~variable~~ non pre-defined length ones
- Length of data fields with fixed length AIs
- Correct formatting of data in all AI fields
- Absence of encoded parentheses around AIs~~.~~

The extent to which a verifier can do this automatically will vary greatly ~~between~~ among devices, even those that have UCC/EAN-128 Symbols as a specific symbology option.



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**5.4.3.3.10.4 ITF-14 Symbology**

ITF-14 Bar Code Symbols are, unlike the others used in the EAN.UCC System, two-width (narrow/wide) symbols that cannot be decoded by the edge-to-similar-edge~~-~~ technique, but all element widths must be measured. They are, therefore, more subject to the problems caused by bar gain or loss.

The standard ISO verification technique is fully applicable to these symbols. However, in the EAN.UCC System application, additional checks must be made to ensure that the X-dimension (magnification factor) is within the permitted range.

Measuring apertures for the ITF-14 Symbol are 10 mil for symbols with an X-dimension less than 0.635 mm and 20 mil for symbols with an X-dimension equal to or greater than 0.635 mm.

The minimum acceptable grade for symbols printed with the higher range of X-dimension (above 0.635 mm) is 0.5/20/670. This is because the brown corrugated substrates on which such symbols are often printed typically have a reflectance value below 40 percent, and sometimes below 30 percent, and cannot, therefore, ever achieve a Symbol Contrast better than 40 percent (the lower threshold for a grade 2 Symbol Contrast) no matter how dense the ink ~~and~~ or how well the other attributes of the symbol are graded. As a result, the Scan Reflectance Profile (SRP) grade will most often be dictated by Symbol Contrast, so it cannot be higher than 1 for symbols on these materials, giving a maximum achievable overall symbol grade of 1.0.



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Such symbols may also be affected by the inherent ~~[~~interference~~]~~ in the background reflectance caused by the substrate's composition, which may well lead to reduced Defect grades and possibly low edge contrast and Modulation values. It is, therefore, desirable to ensure that symbols printed on these corrugated materials are of as high a quality as possible in respect of the other parameters.

#### 5.4.3.3.11 Possible Causes of Less-Than-Perfect Verification Grades

##### 5.4.3.3.11.1 Reflectance Parameters

Symbol Contrast is governed by the reflectance of the substrate and ink. A symbol printed in black ink on a white paper will almost certainly achieve the top grade 4 for Symbol Contrast, as white papers typically have reflectance in excess of 75 percent, and black ink will usually have about 3 to 8 percent reflectance. Coloured backgrounds or coloured inks will affect the result. Highly glossy materials may also appear to have a lower background reflectance than expected. The worst case may be when printing on a corrugated fibre-board material, which may have a reflectance in a range between 27 and 40 percent, so even with a very dense, low reflectance ink it can never achieve better than the minimum passing grade 1 for Symbol Contrast (grade 1 includes Symbol Contrast values from 20 to 39 percent).

The causes of low Symbol Contrast and the solutions are:

- Background too dark: Use lighter or less glossy material, or change background colour (if printed) to one with higher reflectance
- Show-through of contents: Use more opaque material for package, or print opaque white underlay prior to printing symbol
- Bars too light: Change bar colour for one with lower reflectance, and increase ink weight or print head temperature (thermal printing) (~~NOTE~~Note: watch for consequential increase in bar widths)

Minimum reflectance, or $R_{min}$, ~~-~~must always be equal to or less than half the highest reflectance value, $R_{max}$. In practice, this means that the reflectance of at least one bar must meet this criterion. For example, if $R_{max}$ is 70 percent, at least one bar must have a reflectance of 35 percent or less. A symbol that fails on this parameter will almost certainly have a low Symbol Contrast grade also.

The cause of and solution for $R_{min}$ being too high include:

- Bars too light: Change bar colour ~~for~~ to one with lower reflectance, and increase ink weight or print head temperature (thermal printing) (watch for consequential increase in bar widths)

Minimum Edge Contrast ($EC_{min}$) will always be lower than Symbol Contrast, but will only be a problem in itself if it approaches or drops below 15 percent (the pass/fail threshold). However, low edge contrast (EC) values, acceptable under this criterion, may still cause low Modulation (MOD) grades.



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The causes of a low value of $EC_{min}$, and the possible remedies are:

- Local variations in background reflectance (e.g., fragments of darker material in a recycled material): Use a more consistent substrate or one with higher reflectance
- Local variations in inking of the bars: Adjust press settings to ensure even inking
- Show-through of contents: Use more opaque material for package, or print opaque white underlay prior to printing symbol



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- Elements adjoining the edge in question are excessively narrow relative to the measuring aperture used: Increase X-dimension; ensure correct measuring aperture is used; ensure correct bar width adjustment (BWA) applied to Film Master/original symbol; print bars marginally narrower than spaces of same modular dimension

Modulation, being calculated as the percentage of Symbol Contrast represented by the $EC_{min}$, will be reduced for the same reasons as when $EC_{min}$ is low in the symbol. A scanner will tend to see spaces as narrower than bars and also to see narrow elements as less distinct than wider ones. Consequently, if there is significant bar loss, Modulation will be reduced. Measuring with an aperture that is too large for the X-dimension will also reduce Modulation.

The causes of a low value of Modulation (often listed as "MOD" on verification reports) and the possible remedies are:

- Local variations in background reflectance (e.g., fragments of darker material in a recycled material): Use a more consistent substrate or one with higher reflectance
- Local variations in inking of the bars: Adjust press settings to ensure even or darker inking
- Show-through of contents: Use more opaque material for package, or print opaque white underlay prior to printing symbol
- Element(s) adjoining the edge in question appear excessively narrow relative to the measuring aperture used: Increase X-dimension; ensure correct measuring aperture is used; apply correct BWA when originating symbol; print bars marginally narrower than spaces of same modular dimension

#### 5.4.3.3.12 Other Parameters

Decode is graded on a pass/fail basis by applying the reference decode algorithm to the edge positions and element widths determined for the symbol. A failure to decode may be evidence of the symbol being incorrectly encoded, which may include an incorrect Check Digit. It also may indicate either that the bars and spaces initially identified by the global threshold are too many or too few for a valid symbol or that one or more edge positions are ambiguous.

The possible causes of decode failure and possible remedies are:

- Symbol incorrectly encoded: Re-originate symbol; over-label with correctly encoded symbol
- Check ~~digit~~ Digit incorrectly calculated: Correct software error in origination system; re-originate symbol; over-label with correctly calculated symbol
- Gross element width errors due to excessive print gain or loss, or to defects: Apply correct bar width adjustment (BWA) when originating symbol; adjust press or printer settings
- Too many elements detected due to defects: Correct cause of defects; adjust press (relief printing processes) to reduce haloing; replace print head (thermal/ink-jet printing)



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- Too few elements detected (failure to cross global threshold): Refer to solutions for edge contrast (EC)~~)~~

In the ISO standard, a decode failure occurs because an incorrect number of elements has been perceived to be present, either because the profile of one or more elements has failed to cross the global threshold~~,~~ or because a gross defect has caused one element to be seen as three or more, corresponding to the separately graded Edge Determination failure in the ANSI standard, which may also be reported by some verifiers following the ANSI methodology.

Figure 5.4.3.3.12 – 1 shows a symbol in which the narrow spaces have been partly filled in, reducing their contrast below the global threshold and causing an Edge Determination or decode failure. This could also be interpreted as an extreme example of Modulation (MOD).

**Figure 5.4.3.3.12 – 1: Symbol with Edge Determination Problem**

Figure 5.4.3.3.12 – 2 illustrates a Scan Reflectance Profile (SRP) showing narrow space profiles failing to reach the global threshold, giving an (ISO) decode failure or (ANSI) Edge Determination failure.

**Figure 5.4.3.3.12 – 2: Scan Reflectance Profile with Narrow Space Profiles**



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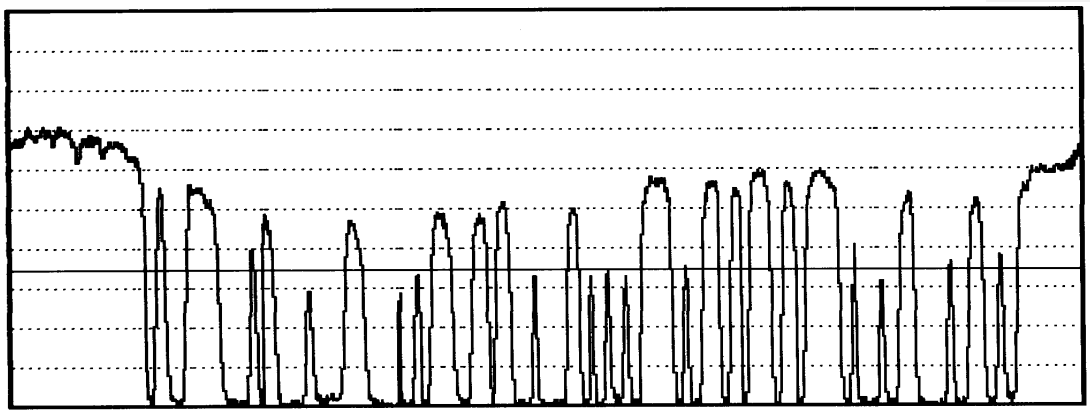

Decodability grades are influenced by bar gain or loss in most symbologies and by distortion of the symbol. Distortion can occur with relief printing processes, such as flexography, when the printing plate is stretched around the press cylinder with the bars parallel to the cylinder axis (e.g., at right angles to the print direction). A common reason for distortion with digitally-originated images is that they have been rescaled in graphics software, resulting in uneven addition or removal of pixels to or from the element widths. Print processes that tend to produce irregular bar edges, such as ink-jet and photogravure, will also be likely to give lower Decodability grades.

The causes of a low value of Decodability and the possible remedies are:

- Bar gain/loss (systematic): Apply correct Bar Width Adjustment (BWA) when originating symbol; adjust press settings
- Element width gain/loss (non-systematic): Correct missing pixels (burnt-out print head elements, blocked ink-jet nozzles); rectify cause of defects
- Distortion of symbol (uneven stretching of flexographic plate; non-linear disproportioning in plate-making process): Print symbol with height of bars parallel to direction of printing; do not disproportion bar code image in plate-making
- Rescaling of ~~digitally~~ digitally-originated images: Ensure symbol is created in correct size; ensure software matches module widths to integer number of pixels after all adjustments
- Irregular element edges (ink-jet, photogravure, screen process printing): Change print technology; increase X-dimension/magnification factor; re-orient symbol relative to cylinder engraving angle/screen mesh

The symbol in Figure 5.4.3.3.12 – 3 is taken from the EAN.UCC Calibrated Conformance Standard Test Card and has an engineered low Decodability grade of 50 percent. As may be determined from the accompanying Scan Reflectance Profile (SRP), just to the left of halfway across the symbol, the width of a two-module bar has been increased in the



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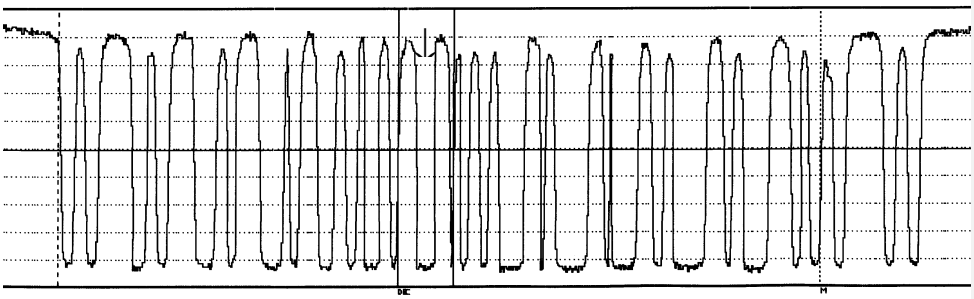
sixth digit (and since the character is a 1, its Decodability is affected by bar width). Although the original symbol has a very consistent image density, the profile also shows the effect of Modulation (MOD), most noticeably on the narrow spaces.

**Figure 5.4.3.3.12 – 3: Calibration Symbol with Engineered Low Decodability Grade**

**Figure 5.4.3.3.12 – 4: Scan Reflectance Profile of Symbol with Low Decodability Character**



Defects, which show as irregularities in the Scan Reflectance Profile, may be caused by spots of extraneous ink in Quiet Zones or in the spaces. Small voids (white areas) in the bars are also highlighted as defects. In symbols printed on recycled or some other materials, local variations in reflectance of the background will also show as defects. The significance of a defect is in direct relation to the depth of the irregularity it causes in the Scan Reflectance Profile.

Common causes and the most likely solutions include:

- Defective print head elements (thermal printing or ink-jet printing), which will tend to produce an unprinted line running through the symbol in the direction of printing: Clean or replace print head.
- Satellite (ink droplets in the white are surrounding the printed bars): Clean head; change ink formulation
- Haloing (e.g., a double line impression where there should only be a single line impression): Adjust impression pressure and/or ink viscosity.



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- Incorrect matching of thermal transfer ribbons and substrate (poor adhesion of ink to surface): Use correct ribbon for substrate; use smoother substrate~~.~~
- Measuring aperture too small~~. Solution~~: Use verifier with correct aperture~~.~~

The use of a smaller or larger measuring aperture than specified for the symbol will produce misleading Defect grades, and this is perhaps the strongest argument for ensuring that the right aperture size is used. Too small an aperture will exaggerate the apparent size of a defect; too large an aperture will tend to smooth it out.

Quiet Zones are a frequent source of scanning problems. Although the ISO standard does not directly require measurement of the Quiet Zones, it requires any additional requirements specified by the application specification to be graded on a pass/fail basis. The *General EAN.UCC Specifications* establish Quiet Zone requirements for all symbols used in the EAN.UCC System, and a Quiet Zone less than the minimum width will, therefore, cause the profile grade to fail.

Possible causes of Quiet Zone failure and the remedies are:

- Printed box surrounding symbol or other interfering print: Enlarge box; ensure symbol registration to other print allows adequate margins; use Quiet Zone Indicators if possible
- Symbol too close to label edge: Adjust label feed; reposition symbol farther from edge; use larger label size or smaller symbol



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### 5.4.A.1 Appendix 1: Print Process Characterisation Techniques

#### *5.4.A.1.1 Introduction*

This technical bulletin is written to document and specify when EAN/UPC Symbols can be printed at less than the current~~,~~ minimum specification of 0.264 mm or 10.4 mils X-dimension (80% magnification).

#### *5.4.A.1.2 Background*

Many printer users have asked the Uniform Code Council, Inc.® (UCC®) and EAN International if the magnifications in the 75~~%~~ to 80 percent~~%~~ range for EAN/UPC Symbols printed by thermal and laser on-demand printers are acceptable for use. The most common printing densities used by on-demand, bar code printers are 200 and 300 dpi. However, due to the constraints of the dot pitch, these printers cannot print an 80~~%~~ percent symbol correctly. The nearest to 80~~%~~ percent that these printers can print is 75.7~~%~~ or 76.9~~%~~ percent depending on the exact dot geometry[1].

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Even though 80~~%~~ percent magnification is the minimum value specified in the EAN/UPC Symbol specification, users of on-demand printers have used magnifications between 75~~%~~ and 80 percent~~%~~ in P~~p~~oint-O~~o~~f-S~~s~~ale scanning environments for years. They have done so with no significant reduction in scan rate, as compared to symbols printed precisely at 80 percent~~%~~. Because larger in-specification EAN/UPC Symbols are always easier to scan, 80~~%~~ percent symbols and larger are preferred. However, when an on-demand printer is required, the 75~~%~~ to 80 percent~~%~~ EAN/UPC Symbols are an acceptable alternative given ~~the following conditions:~~the conditions in Section 5.4.A.1.3.

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#### *5.4.A.1.3 New Qualifications for Printing*

- The allowance for EAN/UPC Symbol magnifications from 75~~%~~ to 80~~.0%~~ percent is only applicable to "on demand" (e.g., thermal or laser) print processes. For all other printing processes, 80~~.0%~~ percent is attainable and is the minimum allowable size.
- When printing a minimum symbol with any method of printing, the area provided for printing the symbol and the required Quiet Zone should never be less than the area required for an 80 percent~~%~~ symbol. This area can be derived from the total width of an 80 percent~~%~~ symbol times its height as shown in the dimensions in ~~Figure 1~~Figure 5.4.A.1.3 – 1.
- When printing a minimum symbol with any method of printing, the symbol height should never be truncated below the 80 percent~~%~~ value [2] (20.7 mm or 0.816 inches).



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The minimum print quality grade should be the same for all EAN/UPC Symbols; at least an ISO/ANSI[3] grade of 1.5 (or C). ~~If possible,~~ it is advisable to print EAN/UPC Symbols that are at least a 2.5 (B) grade at the time of printing regardless of size.



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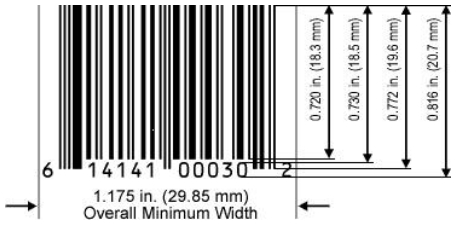
**Figure 5.4.A.1.3 - 1 EAN/UPC Symbol Shown with Minimum Height and Overall Width Dimensions for Magnifications of 75% to 80%**




Note: In ~~the figure above~~Figure 5.4.A.1.3 – 1, as you move from 80~~%~~ to 75 percent~~%~~ magnification, the Quiet Zone increases from 0.0936 in. (2.38 mm) to 0.124 in. (3.16 mm) in order to keep the overall width constant at 1.175 in. (29.85 mm).

### *5.4.A.1.4 Summary*

When printing with on-demand printers (e.g., thermal or laser) the resulting element widths for EAN/UPC Symbols should never be less than 75 percent~~%~~ magnification. If the symbol printed with element widths is less than 80 percent~~%~~, ~~than~~ then the overall symbol shall have both larger Quiet Zones and taller bars such that the resulting area is not less than that of 80 percent~~%~~ magnification symbols. The symbol print quality must still meet the EAN/UPC Symbol requirements of 1.5/06/670.



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# Section 5.5:

# Reduced Space Symbology® and EAN.UCC Composite Symbology®

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## 5.5.1 Introduction

This section provides technical specifications for the Reduced Space Symbol, Composite Component™ Symbol and Composite Symbols. EAN International and the Uniform Code Council (UCC™) have developed these new symbologies with the intent of making them available for open application use. While work is currently underway to define a number of application standards for these symbologies, to date only the Very Small Healthcare Items application guideline (see Section 2.7) has been approved and published. Only when application standards and rollout schedules are established will EAN International and the UCC endorse the use of these symbologies for use in other open supply channels.

The Reduced Space Symbology family of bar code symbols and associated Composite Components have been developed to meet the expressed needs of EAN.UCC System members. The challenge was to provide better ways to automatically identify:

- Very small items (e.g., syringes, vials, and telecommunications circuit boards)
- Random measure retail items utilising full product identification (e.g., meat, poultry, and bagged produce)
- Individual produce items (e.g., apples and oranges)
- Logistic units that required more data to accompany the item than there was space available (e.g., content information for mixed trade item pallets)

To provide a solution for this application requirement, the following minimum technical issues needed to be resolved:

- Some symbols had to perform in an omnidirectional scanning environment.
- The symbol had to fit in a space-constrained area and provide strong performance for its size.
- The symbol had to maximise compatibility with an existing broad-based collection of applications and technologies.
- The symbol had to complement the selection of existing EAN.UCC System data carriers
- The symbol had to provide the simplest set of solutions to fit the largest user base.

The UCC formed both user and technical committees to address this issue. The committees evaluated the EAN-8 Composite Symbology and UCC/EAN-128 Composite Symbology along with two-dimensional (2D) stacked and matrix symbologies. The committees determined that a new compact linear symbology, RSS, with an associated stacked two-dimensional symbol, versions of MicroPDF417, provided the most efficient and general solution. The combination of a linear symbol and associated 2D symbol is known as a composite symbol. It is the only EAN.UCC System standard 2D symbology. The linear component encodes the item identification and can be read by most scanners.

The RSS family has a higher data density than other linear bar codes because it has a larger symbol character. The RSS Limited™ Bar Code Symbol encodes 2,013,571 values in one symbol character with 26 modules.



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Figure 5.5.1 – 1: Data Density Comparison

| Symbology | Modules per Digit |
|---|---|
| | |
| ITF-14 | 8.0 |
| EAN/UPC | 7.0 |
| UCC/EAN-128 | 5.5 |
| RSS Limited | 4.1 |
| | |

To allow for broad functionality, the RSS linear component of the composite symbol has been designed in several formats. They include:

- RSS-14™
- RSS-14 Truncated
- RSS Limited
- RSS Stacked
- RSS Stacked Omnidirectional
- RSS Expanded™
- RSS Expanded Stacked

RSS-14, RSS-14 Truncated, RSS Stacked, and RSS Stacked Omnidirectional enable the full 14-digit numbering of items. They are smaller than EAN-13 or UPC-A Bar Code Symbols. Each provides a linkage flag to indicate the existence of a 2D Composite Component. RSS-14 and RSS Stacked Omnidirectional have omnidirectional scanning capability.

RSS Limited is designed for very small item identification. It encodes 14-digit item identification using indicator digits 0 or 1 and provides a linkage flag for the 2D Composite Component.

RSS Expanded and RSS Expanded Stacked encode all EAN.UCC System Application Identifier (AI) Element Strings. Each symbol has a variable length with a capacity of up to 74 characters. Each provides a linkage flag to indicate the existence of a 2D Composite Component. Unlike the UCC/EAN-128 Bar Code Symbol, the RSS Expanded Symbologies are designed to be read in an omnidirectional scanning environment.

The Composite Component (CC) family of symbologies consists of new 2D symbologies that will be used by EAN International and the UCC as an add-on to their linear symbologies in new applications. The family is in the public domain. A symbol that combines a linear symbol with a 2D component is known as a composite symbol.



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The 2D component adds supplementary Application Identifier Element String data to EAN.UCC System linear symbologies. It provides the following benefits:

- The composite symbol is the only one with an easily scannable item identification.
- The composite symbols are comparable in size to the matrix symbols but can be scanned with a wider range of scanner technologies.
- The composite symbols are smaller than other laser scannable 2D symbols.

2D components can be added to the RSS family, UCC/EAN-128, and EAN/UPC Bar Code Symbols. There are three versions of the 2D symbol: CC-A, CC-B, and CC-C. The Composite Components increase in size and capacity. CC-C composites have greater capacity than CC-B composites, and CC-B composites have greater capacity than CC-A. The three versions of the Composite Component are based on new versions of MicroPDF417 and PDF417: CC-A (new version of MicroPDF417) up to 56 characters, CC-B (MicroPDF417 variant) up to 338 characters, and CC-C (PDF417 variant) up to 2361 characters.

RSS and composite symbols can encode new features beyond the structure of the standard Element String carried by a UCC/EAN-128 Symbol. The symbol separator allows new structures such as nesting/looping to be used for logistics applications.

A new Symbology Identifier of “]e0” is used to differentiate the data transmission from UCC/EAN-128 Bar Code Symbols because the data may easily exceed the 48-character limit for UCC/EAN-128.

Figure 5.5.1 – 2: Symbology Identifiers

| | **Message Content** | **Separator** |
|---|---|---|
| | | |
| ]e0 | Standard AI Element Strings | none |
| ]e1 | New ISO 646 structures | “symbol separator” |
| ]e2 | ISO 8859-1 8-bit data | codeword > 899 |
| ]e3 | ECI escapes and 8/16-bit data | codeword > 899 |



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#### 5.5.1.1 Composite Symbol Features

The primary identification is encoded in the linear symbol that is easily scanned with a low cost scanner. Supplementary AI Element Strings may be encoded in the two-dimensional (2D) component where they take up less space. Specific application guidelines will provide full details.

Composite symbols are designed to be scanned with hand-held laser, linear CCD, or 2D imaging scanners.

Within the EAN.UCC System, there are several possible linear/composite formats:

- RSS-14™ Composite
- RSS-14 Stacked Composite
- RSS Limited™ Composite
- RSS Expanded™ Composite
- UPC-A Composite
- UPC-E Composite
- EAN-8 Composite
- EAN-13 Composite

UCC/EAN-128 Composite (note that the linkage flag is an extra code set character between the last data character and the Symbol Check Character)

Composite Symbols can be selected to provide the best fit to a specific area. For example, the same data can be encoded in RSS-14 Truncated/CC-A, RSS Limited/CC-A, or RSS-14 Stacked/CC-A. Each of the three composites can be used to fit a different maximum height and width space requirement.

To provide assistance for rapid implementation, EAN International and the Uniform Code Council (UCC™) have:

- Patents granted and placed in the public domain
- Reduced Space Symbology® (RSS)and Composite Symbology® specifications issued by AIM, Inc.;
- Encoder and decoder models freely available to interested developers
- A verification model available to interested developers
- RSS verifiers available
- Two-dimensional 2D composite symbol verifiers in development.
- Active user application groups
- Completed pilot tests with additional tests underway



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The specifications for RSS and Composite Symbologies contained within this publication are provided for EAN International staff, UCC staff, and technical users of the EAN.UCC System. The information provides a template for implementation of RSS/Composite Symbology. Technical specifications are referenced in this document for those needing more detailed information.

## 5.5.2 Reduced Space Symbology® (RSS)

### 5.5.2.1 Introduction

Reduced Space Symbology® (RSS) is a family of linear symbologies used within the EAN.UCC System. There are three types of RSS symbols, two of which have a number of versions optimised for different application requirements.

RSS-14™ encodes AI (01) in a linear symbol that can be scanned omnidirectionally by suitably programmed slot scanners. RSS Limited™ encodes AI (01) in a linear symbol for use on small items that will not be scanned in an omnidirectional scanning environment. RSS Expanded™ encodes EAN.UCC System primary item identification plus supplementary AI Element Strings, such as weight and "best before" date, in a linear symbol that can be scanned omnidirectionally by suitably programmed slot scanners.

RSS-14 Stacked is a variation of the RSS-14 Symbology that is stacked in two rows and used when the normal symbol would be too wide for the application. It comes in two versions: a truncated version used for small item marking applications and a taller version that is designed to be read by omnidirectional scanners. RSS Expanded can also be printed in multiple rows as a stacked symbol.

Any member of the RSS family can be printed as a stand-alone linear symbol or as a component of an EAN.UCC composite symbol with an accompanying two-dimensional (2D) Composite Component™ printed above the RSS linear component.

The RSS family is fully described in the Automatic Identification Manufacturers, Inc. document *AIM ITS 99-001 - International Symbology Specification - Reduced Space Symbology (RSS).*

#### 5.5.2.1.1 Symbology Characteristics

The Reduced Space Symbology® (RSS) family consists of the following versions:

- RSS-14™
- RSS-14 Truncated
- RSS-14 Stacked
- RSS-14 Stacked Omnidirectional
- RSS Limited™
- RSS Expanded™
- RSS Expanded Stacked



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The characteristics of the RSS family are:

- Encodable character set:
  - RSS-14 versions and RSS Limited: digits 0 through 9 (with the restriction of RSS Limited to 0 or 1 in the first digit)
  - RSS Expanded: a subset of Table 1 of the *International Standard ISO/IEC 646*, consisting of the uppercase and lowercase letters, digits, spaces, and 20 selected punctuation characters in addition to the Function 1 Character (FNC1)
- Symbol character structure: Different (n,k) symbol characters are used for each member of the family, where each symbol character is n modules in width and is composed of k bars and k spaces.
- Code type: continuous, linear bar code symbology
- Maximum numeric data capacity (including implied Application Identifiers (AIs) where appropriate, but not including any encoded FNC1 characters):
  - RSS-14 versions and RSS Limited: AI (01) plus a 14-digit numeric item identification
  - RSS Expanded: 74 numeric or 41 alphabetic characters
- Error detection:
  - RSS-14 versions: mod 79 checksum
  - RSS Limited: mod 89 checksum
  - RSS Expanded: mod 211 checksum
- Character self-checking
- Bidirectionally decodable
- Quiet Zones: none required



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### 5.5.2.1.2 Additional Features

Additional Reduced Space Symbology® (RSS) features include:

- Data compaction: Each member of the RSS family has data compaction methods optimised for the data strings that it will encode. RSS Expanded™ is also optimised for specific sequences of Application Identifiers (AIs) that are commonly used.

- Component linkage: All RSS symbols include a linkage flag. If the linkage flag is 0, then the RSS symbol stands alone. If the linkage flag is 1, then a 2D Composite Component™ and its separator pattern is printed above the RSS symbol with the separator pattern aligned and contiguous to the RSS symbol.

- Edge to similar edge decoding: All RSS family data characters, finder patterns, and check characters can be decoded using edge-to-edge measurements.

- Large data characters: Unlike EAN/UPC Symbols, an RSS symbol's data characters do not directly correspond to the encoded data character. The symbol's data characters encode thousands of possible combinations to increase the encoding efficiency. They are then combined mathematically to form the encoded data string.

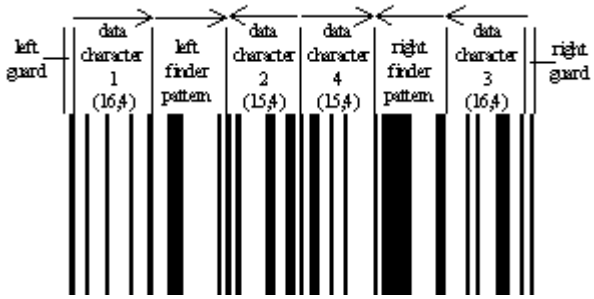
- UCC/EAN-128 Symbol emulation: Readers set to the UCC/EAN-128 Symbol emulation mode transmit the data encoded within the RSS family symbol as if the data were encoded in one or more UCC/EAN-128 Symbols.

## 5.5.2.2 RSS-14™ Versions

RSS-14™ encodes the Element String AI (01). It has four versions: RSS-14, RSS-14 Truncated, RSS-14 Stacked, and RSS-14 Stacked Omnidirectional. All four versions encode data in an identical manner.

Figure 5.5.2.2 – 1 shows the structure of RSS-14. An RSS-14 Symbol contains four data characters and two finder patterns. The RSS-14 family is capable of being scanned in four separate segments, each consisting of a data character and an adjacent finder pattern. The two finder patterns together encode a modulo 79 check value for data security.

Figure 5.5.2.2 – 1: RSS-14 Structure




The left and right Guard Bar Patterns consist of a narrow bar and narrow space. RSS-14 does not require a Quiet Zone.



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### 5.5.2.2.1 RSS-14™

The RSS-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 RSS-14 Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 24 mm (0.96 in.) wide and 8.25 mm (0.33 in.) high.

Figure 5.5.2.2.1 – 1: RSS-14 Bar Code Symbol

(01)20012345678909

### 5.5.2.2.2 RSS-14 Truncated

The RSS-14 Truncated Bar Code Symbol is a reduced height version of the RSS-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 RSS-14 Truncated Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 24 mm (0.96 in.) wide by 3.25 mm (0.13 in.) high.

Figure 5.5.2.2.2 – 1: RSS-14 Truncated Bar Code Symbol

(01)00012345678905

### 5.5.2.2.3 RSS-14 Stacked

The RSS-14 Stacked Bar Code Symbol is a reduced height two-row version of the RSS-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 RSS-14 Stacked Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 12.5 mm (0.50 in.) wide by 3.25 mm (0.13 in.) high. Its structure includes a 1X high separator pattern between the two rows.

Figure 5.5.2.2.3 – 1: RSS-14 Stacked Bar Code Symbol

(01)00012345678905

### 5.5.2.2.4 RSS-14 Stacked Omnidirectional

The RSS-14 Stacked Omnidirectional Bar Code Symbol is a full height two-row version of the RSS-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 RSS-14 Stacked Omnidirectional Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 12.5 mm (0.50 in.) wide by 17.25 mm (0.69 in.) high. The height of 69X includes a 3X high separator pattern between two rows of 33X each.



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Figure 5.5.2.2.4 – 1: RSS-14 Stacked Omnidirectional Bar Code Symbol

(01)00034567890125

### 5.5.2.3 RSS Limited™

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

The RSS 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 RSS Limited Bar Code Symbol with an X-dimension of 0.25 mm (0.010 in.) would be 18.5 mm (0.74 in.) wide by 2.5 mm (0.10 in.) high.

Figure 5.5.2.3 – 1: RSS Limited Bar Code Symbol

(01)15012345678907



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Figure 5.5.2.3 – 2 shows the structure of the RSS Limited Bar Code Symbol. An RSS Limited Symbol contains two data characters and a check character. The check character encodes a modulo 89 check value for data security.

Figure 5.5.2.3 – 2: RSS Limited Bar Code Symbol Structure

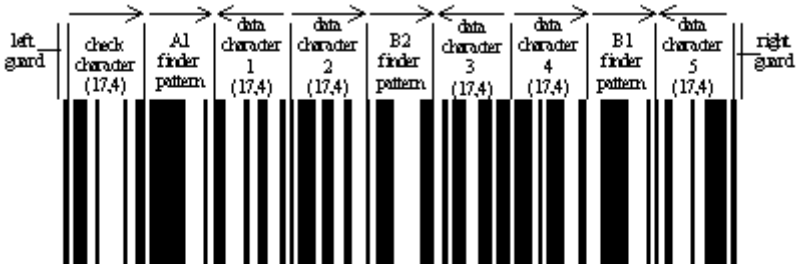
The left and right Guard Bar Patterns consist of a narrow bar and narrow space. The RSS Limited Bar Code Symbol does not require a Quiet Zone.

### 5.5.2.4 RSS Expanded™ Versions

RSS Expanded™ is a variable length linear symbology capable of encoding up to 74 numeric or 41 alphabetic characters of AI Element String data. RSS 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 an UCC/EAN-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.

Figure 5.5.2.4 – 1 shows the structure of a six-segment RSS Expanded Symbol. RSS Expanded Symbols contain a check character, 3 to 21 data characters and 2 to 11 finder patterns, depending on the symbol length. RSS Expanded is capable of being scanned in separate segments, each segment consisting of a data character or check character and the adjacent finder pattern. The check character encodes a modulo 211 check value for data security.

Figure 5.5.2.4 – 1: RSS Expanded Structure




The left and right Guard Bar Patterns consist of a narrow bar and narrow space. RSS Expanded does not require a Quiet Zone.

#### 5.5.2.4.1 RSS Expanded™

The RSS 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 RSS Expanded Symbol shown in Figure 5.5.2.4.1 – 1 with an X-dimension of 0.25 mm (0.010 in.) would be 37.75 mm (1.51 in.) wide by 8.5 mm (0.34 in.) high.



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Figure 5.5.2.4.1 – 1: RSS Expanded Bar Code Symbol

(01)90614141000015(3202)000150

### 5.5.2.4.2 RSS Expanded Stacked

The RSS Expanded Stacked Bar Code Symbol is a multi-row stacked version of RSS 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 RSS Expanded Stacked Symbol shown in Figure 5.5.2.4.2 – 1 with an X-dimension of 0.25 mm (0.010 in.) would be 25.5 mm (1.02 in.) wide by 17.75 mm (0.71 in.) high.

The white space at the end of the second row of the symbol shown in Figure 5.5.2.4.2 – 1 is not part of the symbol and can be used for other purposes, such as text.

Figure 5.5.2.4.2 – 1: RSS Expanded Stacked Bar Code Symbol

(01)90614141000015(3202)000150

RSS Expanded Stacked is used when the symbol area or print mechanism is not wide enough to accommodate the full single-row RSS Expanded Symbol. It is designed for variable weight products, perishable products, traceable retail products, and coupons.

### 5.5.2.4.3 Compressed Element String Sequences

While RSS Expanded™ Symbols can encode any sequence of Application Identifier (AI) data up to the maximum capacity of the symbol, certain sequences of AI Element Strings have been selected for special compression in RSS Expanded versions. If the application requires the use of the AI Element Strings in one of these sequences and they are used in the predefined sequence, a smaller symbol will result.

The selected sequences are two types: fixed length, where the sequence of selected AI Element Strings is the only data encoded, and open-ended, where the sequence occurs at the start of the symbol's data, and other AI Element Strings may be added following the sequence. If the data to be encoded in an RSS Expanded Symbol starts with a sequence defined as fixed length but is followed by additional AI Element Strings, all the data will be encoded normally without special compression.



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#### 5.5.2.4.3.1 Fixed-Length Sequences

##### 5.5.2.4.3.1.1 AI (01) and Weight with Limited Range

This sequence consists of the two Application Identifier (AI) Element Strings AI (01), followed by AI (3103), AI (3202), or AI (3203) for weight. The AI (01) Element String must start with an indicator value of 9 for variable measure. Using AI (3103) (weight in grams), the special compression can only be applied up to a maximum weight of 32.767 kg. Using AI (3202) (weight in 0.01 lbs.) the special compression can only be applied up to a maximum weight of 99.99 lbs. Using AI (3203) (weight in 0.001 lbs.) the special compression can only be applied up to a maximum weight of 22.767 lbs. If the weight is in excess of these values, the sequence defined in Section 5.5.2.4.3.1.2 still enables special compression to be performed.

##### 5.5.2.4.3.1.2 AI (01): Weight and Optional Date

This sequence consists of the two or three Application Identifier (AI) Element Strings AI (01), AI (310n), or (320n) for weight (n ranging from 0 to 9) and optionally AI (11), AI (13), AI (15), or AI (17) for date. The AI (01) Element String must start with an indicator value of 9 for variable measure. If the date is not needed, this sequence still gives additional compression when the weight is outside the ranges required by the AI (01) and weight with limited range sequence above.

#### 5.5.2.4.3.2 Open-Ended Sequences

##### 5.5.2.4.3.2.1 AI (01) and Price

This sequence consists of the two Application Identifier (AI) Element Strings, AI (01), followed by AI (392x) for price or AI (393x) for price with ISO currency code (where x is in the range of 0 to 3). The AI (01) Element String must start with an indicator value of 9 for variable measure. For example, this sequence is used for an AI (01) Element String, price and weight, because the fixed-length sequence AI (01) and weight does not give additional compression if the AI Element String for price is added to the end since the length of the sequence is fixed.

##### 5.5.2.4.3.2.2 AI (01)

Any sequence that starts with Application Identifier (AI) (01) will have special compression applied to the AI (01). So when the data includes AI (01), it should always be the first Element String encoded.

### 5.5.2.5 Human Readable Interpretation in RSS Symbols

The Human Readable Interpretation of data in a bar code must be shown below the bar code symbol.

The precise location of the human readable characters and the font used to represent them are not specified for the Reduced Space Symbology® (RSS) Symbol. However, characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol.

Application Identifiers (AIs) should be clearly recognisable to facilitate key entry. This is achieved by putting the AI between parentheses in the Human Readable Interpretation.

Note: The parentheses are not part of the data and are not encoded in the bar code symbol, following the same principle that applies to UCC/EAN-128 Symbols.



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As an option, the data title (see Section 3.A.4) may be associated with the data instead of using the AI numbers.

Figure 5.5.2.5 – 1 shows the weight and price identified with text.

Figure 5.5.2.5 – 1: The Human Readable Interpretation

### 5.5.2.6 Data Transmission and Symbology Identifier Prefixes

#### 5.5.2.6.1 Default Transmission Mode

The EAN.UCC System requires the use of Symbology Identifiers. Reduced Space Symbology® (RSS) family symbols are normally transmitted using Symbology Identifier prefix "]e0" (see Section 5.0.3). For example, an RSS Symbol encoding AI (01) Element String 10012345678902 produces the transmitted data string "]e001l0012345678902." Data transmission follows the same principles that apply to the concatenation of AI Element Strings from UCC/EAN-128 Symbols.

If a 2D Composite Component™ accompanies a RSS family linear symbol, the AI Element String data from the 2D Composite Component immediately follows the linear component's data. However, readers have an option to transmit only the linear component data and ignore the 2D Composite Component.

#### 5.5.2.6.2 UCC/EAN-128 Symbol Emulation Mode

Readers also have an option for UCC/EAN-128 Symbol emulation mode. This mode emulates the UCC/EAN-128 Symbology for data transmission. This mode is used for applications programmed for UCC/EAN-128 but not yet programmed to recognise the Symbology Identifier prefix "]e0." The Symbology Identifier for UCC/EAN-128 emulation mode is "]C1." RSS Expanded™ Symbols that exceed 48 data characters are transmitted as two messages so as not to exceed the maximum UCC/EAN-128 Symbol message length. Each of the two messages has a Symbology Identifier prefix of "]C1" and does not exceed 48 data characters. The two messages are split at a boundary between two Element Strings. This mode is inferior to the normal transmission mode as message integrity may be lost when a message is split.



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### 5.5.2.7 Width of a Module (X)

The range of the X-dimension will be defined by the application specification, having due regard to the availability of equipment for the production and reading of symbols and complying with the general requirements of the application.

The X-dimension shall be constant throughout a given symbol.

### 5.5.2.8 Print Quality Grade

The International Standard *ISO/IEC 15416 Automatic identification and data capture techniques – Bar code print quality test specification – Linear symbols* methodology should be used for measuring and grading the Reduced Space Symbology® (RSS) family of symbols. The *ISO/IEC 15416* print quality specification is functionally identical to the older ANSI and CEN print quality specifications. The print quality grade is measured by verifiers that comply with the standard. The grade includes a grade level, measuring aperture, and the wavelength of light used for the measurement.

The minimum quality grade for RSS Symbols is:

1.5 / 6 / 670

where

- 1.5 is the overall symbol quality grade.
- 6 is the measuring aperture reference number (corresponding to an 0.15 mm or 0.006 in. diameter aperture).
- 670 is the peak response wavelength in nanometres.

In addition to the minimum print quality grade, all elements in the row separator patterns should be visually distinguishable.

### 5.5.2.9 Advice for Selecting the Symbology

Any use of Reduced Space Symbology® (RSS) should comply with EAN.UCC System global application guidelines. RSS is not meant to replace other EAN.UCC System Symbologies. Existing applications that are satisfactorily utilising EAN/UPC Symbols, ITF-14 Symbols, or UCC/EAN-128 Symbols should continue to use them.

Note: Scanning systems that need to read RSS Symbols must be appropriately programmed.

If RSS is used on items that will be read by omnidirectional slot scanners, then RSS-14™, RSS-14 Stacked Omnidirectional, RSS Expanded™, or RSS Expanded Stacked should be used. If only an AI (01) is to be encoded, then RSS-14 or RSS-14 Stacked Omnidirectional should be used. The selection of one or the other depends on the aspect ratio of the area available for the symbol.

If supplementary Application Identifier (AI) Element Strings are required or the primary identification has an AI other than AI (01), then RSS Expanded or RSS Expanded Stacked must be used. The selection of one or the other depends on the width of the print head or the area available for the symbol.



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If RSS is used on small items that do not need omnidirectional scanning capability, then RSS-14 Stacked, RSS Limited™, or RSS-14 Truncated should be used. RSS Limited cannot be used to encode an EAN/UCC-14 number structure with an indicator value greater than 1. Otherwise RSS-14 or RSS-14 Stacked must be used. RSS-14 Stacked is the smallest symbol; however as the heights of both rows are very low, it is harder to scan and cannot be used with wand scanners. If space is available, RSS Limited can be used for number structures that it can encode. Otherwise RSS-14 Truncated should be used for EAN/UCC-14 Data Structures with an indicator value greater than 1.

If the symbol is an RSS Composite Symbol, then using a wider RSS Symbol such as RSS-14 Truncated instead of RSS Limited may be preferable because the wider companion 2D Composite Component™ may result in an RSS Composite Symbol of lower overall height even though the RSS component itself is slightly taller.

If the data capacity in a two-column or three-column CC-B 2D Composite Component is inadequate to encode the required 2D component's data message, then the linear component can be changed to increase the number of columns of the companion CC-B component. This will increase the maximum data capacity of the CC-B component as shown in Figure 5.5.2.9 – 1.

Figure 5.5.2.9 – 1: Data Capacity of CC-B

| Number of CC-B Columns | Used with | Maximum Numeric Characters | Maximum Alpha Characters |
|---|---|---|---|
| 2 | RSS-14 Stacked<br>RSS-14 Stacked Omnidirectional | 95 | 55 |
| 3 | RSS Limited | 219 | 127 |
| 4 | RSS-14<br>RSS Expanded<br>RSS Expanded Stacked | 338 | 196 |

## 5.5.3 EAN.UCC Composite Symbology®

### 5.5.3.1 EAN.UCC Composite Symbology® Introduction

The EAN.UCC Composite Symbology® integrates both an EAN.UCC System linear symbol and a 2D Composite Component™ as a single symbology. There are three types of EAN.UCC Composite Symbols A, B and C, each with different encoding rules. The encoder model is designed to automatically select the appropriate type and optimise.

The linear component encodes the item's primary identification. The adjacent 2D Composite Component encodes supplementary data, such as a batch number and expiration date. The EAN.UCC Composite Symbol always includes a linear component so that the primary identification is readable by all scanning technologies. The EAN.UCC Composite Symbol always includes a multi-row 2D Composite Component that can be read with linear- and area-CCD scanners, and with linear and rastering laser scanners.

The EAN.UCC Composite Symbology is described in the Automatic Identification Manufacturers, Inc. *AIM ITS 99-002 - International Symbology Specification - EAN.UCC Composite Symbology*.



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#### 5.5.3.1.1 EAN.UCC Composite Symbology® Characteristics

The characteristics of the EAN.UCC Composite Symbology® are:

- Encodable character set:
  - Linear components:
    - EAN/UPC Symbol, RSS-14™ Symbol versions, and RSS Limited™ Symbol: digits 0 through 9
    - UCC/EAN-128 Symbol and RSS Expanded™ Symbol: a subset of Table 1 of the *International Standard ISO/IEC 646*, consisting of the uppercase and lowercase letters, digits, spaces, and 20 selected punctuation characters in addition to the Function 1 Character (FNC1)
  - 2D Composite Components™:
    - All types: UCC/EAN-128 Symbols and RSS Expanded Symbols together with the symbol separator character
    - Additionally, for CC-B and CC-C: 2D Composite Component escape character
- Symbol character structure: Various (n,k) symbol characters are used in accordance with the underlying symbology of the selected linear and 2D Composite Components of the symbol.
- Code type:
  - Linear component: continuous, linear bar code symbology
  - 2D Composite Component: continuous, multi-row bar code symbology
- Maximum numeric data capacity:
  - Linear component:
    - UCC/EAN-128 Symbol: up to 48 digits
    - EAN/UPC Symbol: 8, 12, or 13 digits
    - RSS Expanded Symbol: up to 74 digits
    - Other RSS Symbols: 16 digits
  - 2D Composite Component:
    - CC-A: up to 56 digits
    - CC-B: up to 338 digits
    - CC-C: up to 2,361 digits



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- Error detection and correction:
  - Linear component: a modulo check value for error detection
  - 2D Composite Component: a fixed or variable number of Reed-Solomon error correction codewords, depending upon the specific 2D Composite Component
- Character self-checking
- Bi-directionally decodable

#### 5.5.3.1.2 Additional Features

The following is a summary of additional EAN.UCC Composite Symbology® features:

- Data compaction: The 2D Composite Components™ utilise a bit-oriented compaction mode designed to encode data efficiently using Application Identifiers (AIs).
- Component linkage: The 2D Composite Component of each EAN.UCC Composite Symbol contains a linkage flag, which indicates to the reader that no data shall be transmitted unless the associated linear component is also scanned and decoded. All linear components except EAN/UPC Symbols also contain an explicit linkage flag.
- UCC/EAN-128 Symbol emulation: Readers set to the UCC/EAN-128 Symbol emulation mode transmit the data encoded within the EAN.UCC Composite Symbol as if the data were encoded in one or more UCC/EAN-128 Symbols.
- A symbol separator character: a flag character to support future applications that instructs the reader to terminate transmission of the message at that point and to transmit the remaining data as a separate message
- 2D Composite Component escape mechanism: a mechanism to support future applications that require data content beyond the ISO 646 subset encodable in the standard form of the EAN.UCC Composite Symbology

### 5.5.3.2 Symbol Structure

Each EAN.UCC Composite Symbol consists of a linear component and a multi-row 2D Composite Component™. The 2D Composite Component is printed above the linear component. The two components are separated by a separator pattern. Up to 3X of light space is permitted between the separator pattern and 2D Composite Component to facilitate printing the two components separately; however, if the two components are printed at one time, the nominal alignment should be followed as shown in Figure 5.5.3.2 – 1.

Figure 5.5.3.2 – 1: RSS Limited Composite Symbol with CC-A

(01)13112345678906(17)010615(10)A123456

In Figure 5.5.3.2 – 1, the AI (01) Global Trade Item Number™ (GTIN™) is encoded in the RSS Limited™ linear component. The AI (17) expiration date and the AI (10) lot number are encoded in the CC-A 2D Composite Component.



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The linear component is one of the following:

- A member of the EAN/UPC Symbology (EAN-13, EAN-8, UPC-A, or UPC-E)
- A member of the Reduced Space Symbology® (RSS) family
- A UCC/EAN-128 Symbol

The choice of linear component determines the name of the EAN.UCC Composite Symbol, such as an EAN-13 Composite Symbol, or a UCC/EAN-128 Composite Symbol.

The 2D Composite Component (abbreviated as CC) is chosen based on the selected linear component and on the amount of supplementary data to be encoded. The three 2D Composite Components, listed in order of increasing maximum data capacity, are:

- CC-A: a variant of MicroPDF417
- CC-B: a MicroPDF417 symbol with new encoding rules
- CC-C: a PDF417 symbol with new encoding rules

Figure 5.5.3.2 – 2: UCC/EAN-128 Composite Symbol with CC-C

(01)03812345678908(10)ABCD123456(410)3898765432108

In Figure 5.5.3.2 – 2, the AI (01) GTIN is encoded in the UCC/EAN-128 Symbol linear component. The AI (10) lot number and the AI (410) ship-to location are encoded in the CC-C 2D Composite Component.

Based upon the width of the linear component, a choice of “best-fit” 2D Composite Component is specified. Figure 5.5.3.2 – 3 lists all of the permissible combinations.

Figure 5.5.3.2 – 3: Permissible Combinations of Linear and 2D Composite Components

| Linear Component | CC-A/CC-B | CC-C |
|---|---|---|
| UPC-A and EAN-13 | Yes (4-columns) | No |
| EAN-8 | Yes (3-columns) | No |
| UPC-E | Yes (2-columns) | No |
| UCC/EAN-128 | Yes (4-columns) | Yes (variable width) |
| RSS-14™ and RSS-14 Truncated | Yes (4-columns) | No |
| RSS-14 Stacked and RSS-14 Stacked Omnidirectional | Yes (2-columns) | No |
| RSS Limited | Yes (3-columns) | No |
| RSS Expanded™ and RSS Expanded Stacked | Yes (4-columns) | No |



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### 5.5.3.2.1 CC-A Structure

CC-A is a variant of MicroPDF417 with a unique combination of row address patterns (RAP). It is the smallest of the 2D Composite Components™ and can encode up to 56 digits. It has from 3 to 12 rows and 2 to 4 columns.

Each row is a minimum of 2X high (where X is the width of a module, narrow bar or space). A 1X high minimum separator pattern is positioned between the linear component and 2D Composite Component. (A different separator pattern, 6X high, is used in EAN.UCC Composite Symbols with EAN/UPC linear components).

Each column contains one n,k = 17,4 data or error correction character (codeword) per row (n is the number of modules, and k is the number of bars and also the number of spaces). So the width of a codeword is 17X.

In addition to the codeword columns, CC-A has two or three n,k = 10,3 RAP columns that encode the row numbers (each 10X wide). The rightmost RAP column is terminated on the right by a 1X bar so it is 11X instead of 10X wide.

Each row also requires a 1X Quiet Zone at each end. There is no Quiet Zone required above CC-A. The separator pattern is printed directly above the linear component and no Quiet Zone is required below the CC-A.

The two-column and three-column CC-A versions have two RAP columns, and the four-column CC-A version has three RAP columns, as shown in Figure 5.5.3.2.1 – 1.

Figure 5.5.3.2.1 – 1: CC-A Column Structures

Two-Column CC-A Structure

| Quite Zone | RAP Column | Codeword Column | Codeword Column | RAP Column | Quiet Zone |
|---|---|---|---|---|---|

Three-Column CC-A Structure

| Quiet Zone | Codeword Column | RAP Column | Codeword Column | Codeword Column | RAP Column | Quiet Zone |
|---|---|---|---|---|---|---|

Four-Column CC-A Structure

| Quiet Zone | RAP Column | Codeword Column | Codeword Column | RAP Column | Codeword Column | Codeword Column | RAP Column | Quiet Zone |
|---|---|---|---|---|---|---|---|---|

Figure 5.5.3.2.1 – 2 lists all possible column and row combinations for CC-A. It also shows the capacity and size of the 2D Composite Components. For example, a two-column, five-row CC-A would be 57X wide (including 1X for the extra right-most guard bar) by 10X high (not including the separator pattern). With an X-dimension of 0.25 mm (0.010 in.), it would be 14.25 mm (0.57 in.) wide by 2.50 mm (0.10 in.) high.



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Figure 5.5.3.2.1 – 2: CC-A Row and Column Sizes

| Number of Data Columns (c) | Number of Rows (r) | Total CWs in Data Region | Number of EC CWs (k) | Percent of CWs for EC | Number of CWs for Data | Max Alpha Chars | Max Digits | Component Width, in X (see Note 1) | Component Height, in X (see Note 2) |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 5 | 10 | 4 | 40.00% | 6 | 8 | 16 | 57 | 10 |
| 2 | 6 | 12 | 4 | 33.33% | 8 | 12 | 22 | 57 | 12 |
| 2 | 7 | 14 | 5 | 35.71% | 9 | 13 | 24 | 57 | 14 |
| 2 | 8 | 16 | 5 | 31.25% | 11 | 17 | 30 | 57 | 16 |
| 2 | 9 | 18 | 6 | 33.33% | 12 | 18 | 33 | 57 | 18 |
| 2 | 10 | 20 | 6 | 30.00% | 14 | 22 | 39 | 57 | 20 |
| 2 | 12 | 24 | 7 | 29.17% | 17 | 26 | 47 | 57 | 24 |
| 3 | 4 | 12 | 4 | 33.33% | 8 | 12 | 22 | 74 | 8 |
| 3 | 5 | 15 | 5 | 33.33% | 10 | 15 | 27 | 74 | 10 |
| 3 | 6 | 18 | 6 | 33.33% | 12 | 18 | 33 | 74 | 12 |
| 3 | 7 | 21 | 7 | 33.33% | 14 | 22 | 39 | 74 | 14 |
| 3 | 8 | 24 | 7 | 29.17% | 17 | 26 | 47 | 74 | 16 |
| 4 | 3 | 12 | 4 | 33.33% | 8 | 12 | 22 | 101 | 6 |
| 4 | 4 | 16 | 5 | 31.25% | 11 | 17 | 30 | 101 | 8 |
| 4 | 5 | 20 | 6 | 30.00% | 14 | 22 | 39 | 101 | 10 |
| 4 | 6 | 24 | 7 | 29.17% | 17 | 26 | 47 | 101 | 12 |
| 4 | 7 | 28 | 8 | 28.57% | 20 | 31 | 56 | 101 | 14 |

CW = Codeword; EC = Error Correction

Note 1: Includes a 1X Quiet Zone on each side
Note 2: Assumes row height = 2X; does not include separator pattern

### 5.5.3.2.2 CC-B Structure

CC-B is a MicroPDF417 symbol uniquely identified by the codeword 920 as the first codeword in the symbol. Encoding systems normally automatically select CC-B when the data to be encoded exceeds the capacity of CC-A. CC-B can encode up to 338 digits. It has from 10 to 44 rows and 2 to 4 columns.

Each row is a minimum of 2X high (where X is the width of a module, narrow bar or space). A 1X high minimum separator pattern is positioned between the linear component and 2D Composite Component™. (A different separator pattern, 6X high, is used in EAN.UCC Composite Symbols with EAN/UPC linear components).

Each column contains one n,k = 17,4 data or error correction character (codeword) per row (where n is the number of modules, and k is the number of bars and also the number of spaces). So the width of a codeword is 17X.

In addition to the codeword columns, CC-B has two or three n,k = 10,3 row address pattern (RAP) columns that encode the row numbers (each 10X wide). The rightmost RAP column is terminated on the right by a 1X bar, so it is 11X instead of 10X wide.



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Each row also requires a 1X Quiet Zone on each end. There is no Quiet Zone required above CC-B. The separator pattern is printed directly above the linear component and no Quiet Zone is required below the CC-B.

The two-column CC-B version has two RAP columns and the three- and four-column CC-B versions have three RAP columns, as shown in Figure 5.5.3.2.2 – 1.

Figure 5.5.3.2.2 – 1: CC-B Column Structures

Two-Column CC-B Structure

| Quiet Zone | RAP Column | Codeword Column | Codeword Column | RAP Column | Quiet Zone |
|---|---|---|---|---|---|

Three-Column CC-B Structure

| Quiet Zone | RAP Column | Codeword Column | RAP Column | Codeword Column | Codeword Column | RAP Column | Quiet Zone |
|---|---|---|---|---|---|---|---|

Four-Column CC-B Structure

| Quiet Zone | RAP Column | Codeword Column | Codeword Column | RAP Column | Codeword Column | Codeword Column | RAP Column | Quiet Zone |
|---|---|---|---|---|---|---|---|---|

CC-B differs from CC-A in the three-column structure in that CC-B has a third RAP column on the left end that is missing in CC-A.

Figure 5.5.3.2.2 – 2 lists all the possible column and row combinations for CC-B. It also shows the capacity and size of the 2D Composite Components. For example a four-column, 10-row CC-B would be 101X wide by 20X high (not including the separator pattern). With an X-dimension of 0.25 mm (0.010 in.), it would be 25.25 mm (1.01 in.) wide by 5.00 mm (0.20 in.) high.



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Figure 5.5.3.2.2 – 2: CC-B Row and Column Sizes

| Number of Data Columns (c) | Number of Rows (r) | Total CWs in Data Region | Number of EC CWs (k) | Percent of CWs for EC | Number of non-EC CWs | Number of CWs for Data (Note 1) | Max Alpha chars | Max Digits | CC-B Width, in X (see Note 2) | CC-B Height, in X (see Note 3) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 17 | 34 | 10 | 29 | 24 | 22 | 34 | 59 | 57 | 34 |
| 2 | 20 | 40 | 11 | 28 | 29 | 27 | 42 | 73 | 57 | 40 |
| 2 | 23 | 46 | 13 | 28 | 33 | 31 | 48 | 84 | 57 | 46 |
| 2 | 26 | 52 | 15 | 29 | 37 | 35 | 55 | 96 | 57 | 52 |
| 3 | 15 | 45 | 21 | 47 | 24 | 22 | 34 | 59 | 84 | 30 |
| 3 | 20 | 60 | 26 | 43 | 34 | 32 | 50 | 86 | 84 | 40 |
| 3 | 26 | 78 | 32 | 41 | 46 | 44 | 68 | 118 | 84 | 52 |
| 3 | 32 | 96 | 38 | 40 | 58 | 56 | 88 | 153 | 84 | 64 |
| 3 | 38 | 114 | 44 | 39 | 70 | 68 | 107 | 185 | 84 | 76 |
| 3 | 44 | 132 | 50 | 38 | 82 | 80 | 127 | 219 | 84 | 88 |
| 4 | 10 | 40 | 16 | 40 | 24 | 22 | 34 | 59 | 101 | 20 |
| 4 | 12 | 48 | 18 | 38 | 30 | 28 | 43 | 75 | 101 | 24 |
| 4 | 15 | 60 | 21 | 35 | 39 | 37 | 58 | 100 | 101 | 30 |
| 4 | 20 | 80 | 26 | 33 | 54 | 52 | 82 | 141 | 101 | 40 |
| 4 | 26 | 104 | 32 | 31 | 72 | 70 | 111 | 192 | 101 | 52 |
| 4 | 32 | 128 | 38 | 30 | 90 | 88 | 139 | 240 | 101 | 64 |
| 4 | 38 | 152 | 44 | 29 | 108 | 106 | 168 | 290 | 101 | 76 |
| 4 | 44 | 176 | 50 | 28 | 126 | 124 | 196 | 338 | 101 | 88 |

CW = Codeword; EC = Error correction

Note 1: Excludes EC codewords and 2 codewords to define CC-B encodation
Note 2: Including 1X Quiet Zones on either side
Note 3: Assumes Y = 2X; does not include separator pattern

### 5.5.3.2.3 CC-C Structure

CC-C is a PDF417 symbol uniquely identified by the codeword 920 as the first codeword in the symbol following the symbol length descriptor. CC-C can be used as a 2D Composite Component™ within a UCC/EAN-128 Composite Symbol. It has the greatest data capacity of the EAN.UCC Composite Symbols, encoding up to 2,361 digits. It has from 3 to 30 rows and 1 to 30 data/EC codeword columns.

Each row is a minimum of 3X high (where X is the width of a module, narrow bar or space). A 1X high minimum separator pattern is positioned between the linear component and 2D Composite Component.

Each column contains one n,k = 17,4 data or error correction character (codeword) per row (where n is the number of modules, and k is the number of bars and also the number of spaces). So the width of a data/EC codeword is 17X.

In addition to the codeword columns, CC-C has two 17,4 row indicator columns, a 17X wide start pattern, and a 18X wide stop pattern as illustrated in Figure 5.5.3.2.3 – 1.

Each row also requires a 2X Quiet Zone on each end. There is no Quiet Zone required above CC-C. The separator pattern is printed directly above the linear component, and no Quiet Zone is required below the CC-C.



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Figure 5.5.3.2.3 – 1: CC-C Row Structure

| Quiet Zone | Start Pattern | Left Row Indicator Column | 1 to 30 Data/EC Codeword Columns | Right Row Indicator Column | Stop Pattern | Quiet Zone |
|---|---|---|---|---|---|---|

CC-C is normally printed with the number of columns that will result in a width nearly matching the width of the UCC/EAN-128 Symbol linear component. However, as an option, the user may specify a wider CC-C to be printed. This reduces the height of the 2D Composite Component. A lower EAN.UCC Composite Symbol may be needed to fit in a height-restricted application. A wider CC-C may also be required if the amount of data would not fit in the default width CC-C.

### 5.5.3.2.4 Special Compressed Element String Sequences

While 2D Composite Components™ can encode any sequence of Application Identifier (AI) Element Strings up to the maximum capacity of the component, certain sequences of AI Element Strings have been selected for special compression in 2D Composite Component Symbols. If the application requires the use of the AI Element Strings in one of these sequences, and they are used in the predefined sequence, a smaller symbol will result.

For special compression to be performed, the AI Element String sequence must occur at the start of the 2D Composite Component's data. Other AI Element Strings may be added following the sequence.

The AI Element Strings selected for special compression are:

- Production date and lot number: AI (11) production date followed by AI (10) lot number
- Expiration date and lot number: AI (17) expiration date followed by AI (10) lot number
- AI (90): AI (90) followed by the Element String data starting with an alphabetic character and a digit; AI (90) may be used to encode data identifier data; the AI (90) followed by data in the data identifier format has special compression applied only if it is the start of the first Element String.

### 5.5.3.3 Human Readable Interpretation in Composite Symbols

The Human Readable Interpretation of the linear component of the EAN.UCC Composite Symbol must be shown below the linear component. If there is a Human Readable Interpretation of the 2D Composite Component™, there is no required location, but it should be close to the EAN.UCC Composite Symbol.

The precise location of the human readable characters and the font used to represent them are not specified for EAN.UCC Composite Symbols. However, the characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol.

Application Identifiers (AIs) should be clearly recognisable to facilitate key entry. This is achieved by putting the AI between parentheses in the Human Readable Interpretation.

Note: The parentheses are not part of the data and are not encoded in the bar code symbol, following exactly the same principle that applies to UCC/EAN 128 Symbols.



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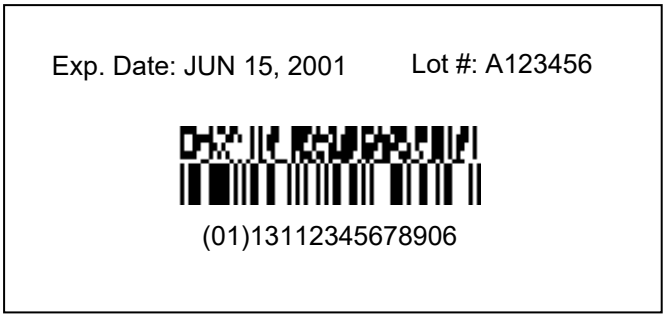
As an option, the data title (see Section 3.A.4) may be associated with the data instead of using AIs. Figure 5.5.3.3. – 1 shows the expiration date and lot number identified with text. This can be compared with Figure 5.5.3.2 – 1, where the same data is shown using the all-AI format.

Figure 5.5.3.3. –1: The Human Readable Interpretation




For EAN.UCC Composite Symbols encoding a large amount of data, it may not be practical to display all the data in Human Readable Interpretation form or, even if there is space to show it in this form, it may not be practical to key enter that much data. In these instances, some of the data may be omitted from the Human Readable Interpretation. However, primary identification data such as the Global Trade Item Number™ (GTIN™) and Serial Shipping Container Code (SSCC)must always be shown. Application specifications provide guidance on Human Readable Interpretation.

### 5.5.3.4 Data Transmission and Symbology Identifier Prefixes

#### 5.5.3.4.1 Default Transmission Mode

The EAN.UCC System requires the use of Symbology Identifiers. EAN.UCC Composite Symbols are normally transmitted using Symbology Identifier prefix "]e0," with the data from the 2D Composite Component™ directly appended to that of the linear component. For example, an EAN.UCC Composite Symbol encoding (01)10012345678902(10)ABC123 produces the data string "]e0011001234567890210ABC123" (note that the Symbology Identifier prefix "]e0" is different from the Symbology Identifier prefix "]E0," which has an uppercase "E" and is used for standard EAN/UPC Symbols). However, readers have an option to transmit only the linear component data and ignore the 2D Composite Component.

Data transmission follows the same principles that apply to the concatenation of Application Identifier (AI) Element Strings from UCC/EAN-128 Symbols. If the linear component data ends with a variable length AI Element String, an ASCII 29 character ($^{G}_{S}$) is inserted between it and the first character of the data from the 2D Composite Component.

#### 5.5.3.4.2 UCC/EAN-128 Symbol Transmission Mode

Readers also have an option for UCC/EAN-128 Symbol emulation mode. This mode emulates the UCC/EAN-128 Symbology for data transmission. It can be used for applications programmed for UCC/EAN-128 Symbols but not yet programmed to recognise the Symbology Identifier prefix "]e0." The Symbology Identifier for UCC/EAN-128 Symbol emulation mode is "]C1." EAN.UCC Composite Symbols that exceed 48 data characters are transmitted as two or more messages so as not to exceed the maximum UCC/EAN-128 Symbol message length. Each of the messages has a Symbology Identifier prefix of "]C1" and does not exceed 48 data characters. The messages are split at boundaries between Element Strings. This mode is inferior to the normal transmission mode as message integrity may be lost when a message is split into multiple messages.



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#### 5.5.3.4.3 Symbol Separator Character

The 2D Composite Component™ can encode symbol separator characters as defined in the decoder. This character instructs the reader to terminate the current EAN.UCC Composite Symbol's data message and transmit the data following the symbol separator as a separate message. This new message will have the Symbology Identifier prefix of "]e1." This feature will be used for future EAN.UCC System applications such as encoding the mixed contents of a logistical container.

#### 5.5.3.4.4 2D Composite Component™ Escape Mechanism

The CC-B and CC-C also can encode 2D Composite Component™ escape mechanism codewords. These instruct the reader to terminate the current EAN.UCC Composite Symbol's data message and transmit the data following the escape mechanism codeword as a separate message. This new message has the Symbology Identifier prefix of "]e2" for standard data message or "]e3" if the data message includes an ECI codeword. The codewords following the escape mechanism codeword are encoded and decoded using the standard PDF417 encoding defined in *ISO/IEC 15438 – Automatic identification and data capture techniques - Symbology specification - PDF417*. This feature is used for future EAN.UCC System applications that require characters beyond the ISO 646 character subset defined for Application Identifier (AI) Element String data.

### 5.5.3.5 Width of a Module (X)

The X-dimension of the 2D Composite Component™ must be the same as that of the associated linear component. Refer to the linear component's X-dimension requirements.



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### 5.5.3.6 Print Quality

The print quality assessment methodology defined in the International Standard *ISO/IEC 15416* should be used for measuring and grading the linear components. The ISO print quality specification is functionally identical to the older ANSI and CEN print quality specifications. The print quality grade is measured by verifiers that apply the standard. The print quality grade reported includes a grade level, measuring aperture, and the wavelength of light used for the measurement.

*AIM ITS 99-002 – International Symbology Specification - MicroPDF417* and *ISO/IEC 15438 – Automatic identification and data capture techniques - Symbology specification - PDF417* specify the methods for determining the print quality grade of the 2D Composite Components™ CC-A/B and CC-C respectively. An additional grading parameter unused error correction (UEC) is defined in these specifications.

The minimum quality grade for EAN.UCC Composite Symbols is:

1.5 / 6 / 670

where

- 1.5 is the overall symbol quality grade.
- 6 is the measuring aperture reference number (corresponding to an 0.15 mm or 0.006 in. diameter aperture).
- 670 is the peak response wavelength in nanometres. In addition to the print quality grade, all elements in the separator patterns should be visually distinguishable.

Both the linear component and the 2D Composite Component must independently achieve the minimum print quality grade.

Note: An international standard methodology for quality grading two-dimensional symbologies is under development and may eventually supersede the method defined in the above specifications.

### 5.5.3.7 Advice for Selecting the Symbology

Any use of the 2D Composite Component™ should comply with EAN.UCC System global application guidelines. The linear component of an EAN.UCC Composite Symbol should be selected according to the application rules defined in the *General EAN.UCC Specifications*, but where a choice of linear components is available for the application, consideration should also be given to the 2D Composite Component options available. A wider linear component will result in a shorter 2D Composite Component and, particularly for CC-B, a higher capacity symbol.

For CC-A and CC-B, the selection of the linear component automatically determines the number of columns of the 2D Composite Component. The selection of CC-A or CC-B is automatically determined by the amount of data to be encoded. CC-A is always used unless the data exceeds its capacity.

When the linear component is a UCC/EAN-128 Symbol, the user may specify CC-A/B or CC-C. CC-A/B will produce a smaller 2D Composite Component. However, CC-C can increase in width to match the width of the UCC/EAN-128 Symbol or be selected to be even wider. This may produce an EAN.UCC Composite Symbol of lower height. CC-C also has a larger data capacity, so it is suitable for applications such as logistics.



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### 5.5.3.8 Sample EAN.UCC Composite Symbols

Figure 5.5.3.8 – 1: EAN-13 Symbol with a Four-Column CC-A Component

(99)1234-abcd



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Figure 5.5.3.8 – 2: UPC-A Symbol with a Four-Column CC-B Component

Figure 5.5.3.8 – 3: EAN-8 Symbol with a Three-Column CC-A

Ser. #: A12345678

Figure 5.5.3.8 – 4: UPC-E Symbol with a Two-Column CC-A

(15)021231



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Figure 5.5.3.8 – 5: RSS-14™ Symbol with a Four-Column CC-A:

(01)03612345678904(11)990102

Figure 5.5.3.8 – 6: RSS-14 Stacked Symbol with a Two-Column CC-A

(01)03412345678900(17)010200

Figure 5.5.3.8 – 7: RSS Limited™ Symbol with a Three-Column CC-B

(01)03512345678907

Note: The three-column CC-B is wider than the three-column CC-A shown in Figure 5.5.3.2 – 1.

Figure 5.5.3.8 – 8: RSS Expanded™ Symbol with a Four-Column CC-A

(01)93712345678904(3103)001234
(91)1A2B3C4D5E



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Figure 5.5.3.8 – 9: UCC/EAN-128 Symbol with a Four-Column CC-A

(01)03212345678906
(21)A1B2C3D4E5F6G7H8



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# Section 5.6:

# Data Matrix Symbology

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### 5.6.1 Introduction

This section of the *General EAN.UCC Specifications* addresses some of the technical aspects of the two-dimensional bar code symbology called Data Matrix. Data Matrix is a standalone, two-dimensional matrix symbology that is made up of square modules arranged within a perimeter finder pattern. Unlike a Composite Component® symbol (~~Reference~~ see Section 5.5), Data Matrix does not require a linear symbol. Data Matrix has been ~~in use~~used in the public domain since 1994.

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This section provides only a brief technical description and overview of the Data Matrix symbology. A more detailed technical specification can be found in the International Standard *ISO/IEC 16022 Information technology - International Symbology Specification - Data Matrix*. The EAN.UCC System has adopted Data Matrix partly because it can encode EAN.UCC System data structures and offers other technical advantages. Its compact design and the existence of various production methods that accommodate placing the symbology onto various substrates offer certain advantages over other symbologies currently in the EAN.UCC System.

Data Matrix ISO version ECC 200 is the only version that supports EAN.UCC System data structures, including Function Code 1. The ECC 200 version of Data Matrix uses Reed-Solomon error correction, and this feature helps correct for partially damaged symbols. In the remainder of this section, the ECC 200 version of Data Matrix is assumed when the symbology is described as Data Matrix or DM. This version of Data Matrix is ~~, a stable version of the symbology,~~ similar in stability to ISO versions of current EAN.UCC System symbologies.

Implementation of Data Matrix shall be done per approved EAN.UCC System application guidelines. This section will not describe the specific applications. The user needs to refer to specific application standards and guidelines ~~that will be added to~~in other sections of the *General EAN.UCC Specifications* as they are approved for use. However, some of the production processes that can be used to produce Data Matrix S~~s~~ymbols are as follows:

- Direct part marking, such as is done by dot peening on items, such as~~,~~ automotive, aircraft metal parts, medical instruments, and surgical implants~~.~~
- Laser or chemically etched parts with low contrast or light marked elements on a dark background (~~,~~ e.g.~~,~~ circuit boards and electronic components, medical instruments, and surgical implants)~~.~~
- High-speed ink jet printed parts and components where the marked dots cannot form a scannable linear symbol~~.~~
- Very small items that require a symbology with a square aspect ratio and/or cannot be marked within the allocated packaging space by existing Reduced Space Symbology® (RSS) and EAN.UCC Composite Symbols~~.~~

Data Matrix Symbols are read by two-dimensional imaging scanners or vision systems. Most other scanners that are not two-dimensional imagers cannot read Data Matrix. ~~Use of Data Matrix needs to be restricted to new, niche applications that are prepared to use imaging scanners throughout the supply chain for that application.~~Data Matrix Symbols are restricted for use with new niche applications that will involve imaging scanners throughout the supply chain.



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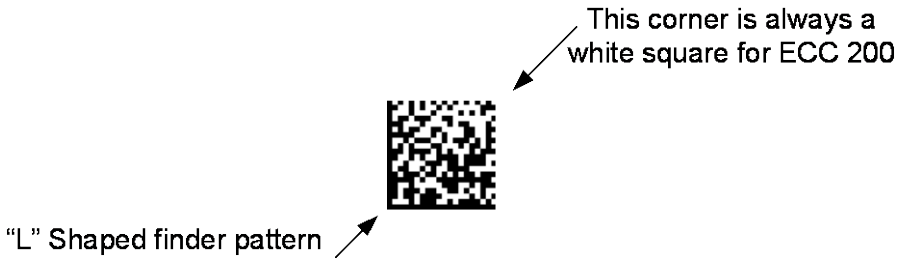
### 5.6.2 Data Matrix Features and Symbol Basics

**Figure 5.6.2 – 1: Data Matrix Symbol**




- The above symbolFigure 5.6.2 – 1 represents a Data Matrix Ssymbol with 20 rows and 20 columns (including the perimeter finder pattern but not including Quiet Zones).
- Data Matrix solid "L" shaped finder or alignment pattern is one module wide.
- Data Matrix Quiet Zone is one module wide on all four sides. As with other bar code Quiet Zones, do not print in this area.
- ECC 200 symbols can always be recognized from older versions of Data Matrix since because the corner opposite the middle of the finder pattern is a zero module or white in normal print.
- For Square Data Matrix symbols, only an even number of rows and columns exist. Depending on data requirements, symbols can range from 10 row by 10 columns (10 x10) to 144x144 (including finder pattern but not the Quiet Zone)
- For normal printing, a module is one X by one X in dimension. Representation of data: A dark module is a binary one and a light module is a zero (or a light module is a binary one and a dark module is a zero for a symbol with reflectance reversal).
- ECC 200 (ECC = Error Checking and& Correction) that uses Reed-Solomon error correction. Table Figure 5.6.3.2-1: 5.6.3.2 – 1: ECC 200 Square Symbol Attributes shows the fixed amounts of error correction associated for each allowable Data Matrix Ssymbol size.
- FNC1 for EAN.UCC System compatibility can be encoded at the beginning of the data string and as a group separator. When a FNC1 is used as a group separator, it shall be represented in the transmitted message by the ASCII character <GS> (ASCII value 29).
- Encodable character set:
  - Values 0 - 127 in accordance with ANSI X3.4 (, i.e.e.g., all 128 ASCII characters) (equivalent to the U.S. national version of ISO 646).
  - Values 128 - 255 in accordance with ISO 8859-1; Latin alphabet No. 1. These are referred to as extended ASCII.
  - The EAN.UCC System requires that only the subset of ISO 646 defined in the *General EAN.UCC Specifications* be used for Application Identifier (AI) Element Strings.



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- Data characters per symbol (for the maximum symbol size):
  - Alphanumeric data: up to 2335 characters
  - Eight8-bit byte data: 1556 characters
  - Numeric data: 3116 digits
- Large, square ECC symbols (at least 32 X32) will include alignment patterns to separate the data regions.
- Code type: matrix (Composite Component® is a stacked type)
- Orientation independence: Yes (requires a two2-dimensional imaging scanner).
- Summary of aAdditional fFeatures inherent or optional in Data Matrix:
  - Reflectance reversal: (Inherent) Symbols can be read when marked so that the image is either dark on light or light on dark.
  - Rectangular symbols: Six symbol formats are specified in a rectangular form.
  - ECI (Extended Channel Interpretation) (ECI) capability allows Data Matrix to encode data from other alphabets.

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### 5.6.3 Data Matrix Symbology

The technical description of Data Matrix contained within this section provides additional information based on ISO technical specification 16022, and it is provided as a further aid in the development of specific applications. Data Matrix Ssymbols shown in the following subsections, have been magnified to show detail; otherwise, they might now show clearlynot be seen clearly.

#### 5.6.3.1 Square and Rectangular Formats

Data Matrix may be printed in a square format or a rectangular format. The square format is usually used as it has a larger range of sizes and is the only format available for symbols encoding a large amount of data. The largest rectangular symbol can encode 98 digits, while the largest square symbol can encode 3,116 digits. Enlarged An enlarged rectangular symbol and an equivalent square symbol are shown in Figure 5.6.3.1 – 1.

**Figure 5.6.3.1 – 1: Rectangular and Square Data Matrix Symbols**

(Specific applications are not used in the data encodation. Both symbols contain the same data)

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### 5.6.3.2 Data Matrix Symbol Sizes

Data Matrix Symbology has multiple sizes to match various data content~~,~~ (see ~~Table~~ Figure 5.6.3.2 – 1). ~~It has~~ Data Matrix Symbols have 24 sizes of the square format ranging from 10 by 10 modules up to 144 by 144 modules, not including the 1-X surrounding Quiet Zone. The rectangular format has 6 sizes from 8 by 18 modules up to 16 by 48 modules not including the 1-X surrounding Quiet Zone. Data Matrix sizes of 52 by 52 or larger have ~~two~~ 2 to ~~ten~~ 10 interleaved blocks of Reed-Solomon error correction codewords.

The term~~,~~ "codeword" is used often to describe attributes concerning the encodation of data into Data Matrix Symbols. *ISO 16022* defines codeword as "A symbol character value. An intermediate level of coding between source data and the graphical encodation in the symbol."~~"~~ Codewords are typically eight~~8~~ bits of data. FNC1, two numerics, ~~or~~ and one alpha all take up one codeword each.

**~~Table~~ Figure 5.6.3.2 – 1: ECC 200 Square Symbol Attributes*****

| Symbol Size* | | Data Region | | Mapping | Total | | Reed-Solomon | | Inter- | Data Capacity | | | Error | Max. Correctable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Matrix | Codewords | | Block | | leaved | Num. | Alphanum. | Byte | Correction | Codeword |
| Row | Col | Size | No. | Size | Data | Error | Data | Error | Blocks | Cap. | Cap. | Cap. | Overhead % | Error/Erasure |
| 10 | 10 | 8x8 | 1 | 8x8 | 3 | 5 | 3 | 5 | 1 | 6 | 3 | 1 | 62.5 | 2/0 |
| 12 | 12 | 10x10 | 1 | 10x10 | 5 | 7 | 5 | 7 | 1 | 10 | 6 | 3 | 58.3 | 3/0 |
| 14 | 14 | 12x12 | 1 | 12x12 | 8 | 10 | 8 | 10 | 1 | 16 | 10 | 6 | 55.6 | 5/7 |
| 16 | 16 | 14x14 | 1 | 14x14 | 12 | 12 | 12 | 12 | 1 | 24 | 16 | 10 | 50 | 6/9 |
| 18 | 18 | 16x16 | 1 | 16x16 | 18 | 14 | 18 | 14 | 1 | 36 | 25 | 16 | 43.8 | 7/11 |
| 20 | 20 | 18x18 | 1 | 18x18 | 22 | 18 | 22 | 18 | 1 | 44 | 31 | 20 | 45 | 9/15 |
| 22 | 22 | 20x20 | 1 | 20x20 | 30 | 20 | 30 | 20 | 1 | 60 | 43 | 28 | 40 | 10/17 |
| 24 | 24 | 22x22 | 1 | 22x22 | 36 | 24 | 36 | 24 | 1 | 72 | 52 | 34 | 40 | 12/21 |
| 26 | 26 | 24x24 | 1 | 24x24 | 44 | 28 | 44 | 28 | 1 | 88 | 64 | 42 | 38.9 | 14/25 |
| 32 | 32 | 14x14 | 4 | 28x28 | 62 | 36 | 62 | 36 | 1 | 124 | 91 | 60 | 36.7 | 18/33 |
| 36 | 36 | 16x16 | 4 | 32x32 | 86 | 42 | 86 | 42 | 1 | 172 | 127 | 84 | 32.8 | 21/39 |
| 40 | 40 | 18x18 | 4 | 36x36 | 114 | 48 | 114 | 48 | 1 | 228 | 169 | 112 | 29.6 | 24/45 |
| 44 | 44 | 20x20 | 4 | 40x40 | 144 | 56 | 144 | 56 | 1 | 288 | 214 | 142 | 28 | 28/53 |
| 48 | 48 | 22x22 | 4 | 44x44 | 174 | 68 | 174 | 68 | 1 | 348 | 259 | 172 | 28.1 | 34/65 |
| 52 | 52 | 24x24 | 4 | 48x48 | 204 | 84 | 102 | 42 | 2 | 408 | 304 | 202 | 29.2 | 42/78 |
| 64 | 64 | 14x14 | 16 | 56x56 | 280 | 112 | 140 | 56 | 2 | 560 | 418 | 277 | 28.6 | 56/106 |
| 72 | 72 | 16x16 | 16 | 64x64 | 368 | 144 | 92 | 36 | 4 | 736 | 550 | 365 | 28.1 | 72/132 |
| 80 | 80 | 18x18 | 16 | 72x72 | 456 | 192 | 114 | 48 | 4 | 912 | 682 | 453 | 29.6 | 96/180 |
| 88 | 88 | 20x20 | 16 | 80x80 | 576 | 224 | 144 | 56 | 4 | 1152 | 862 | 573 | 28 | 112/212 |


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| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96 | 96 | 22x22 | 16 | 88x88 | 696 | 272 | 174 | 68 | 4 | 1392 | 1042 | 693 | 28.1 | 136/260 |
| 104 | 104 | 24x24 | 16 | 96x96 | 816 | 336 | 136 | 56 | 6 | 1632 | 1222 | 813 | 29.2 | 168/318 |
| 120 | 120 | 18x18 | 36 | 108x108 | 1050 | 408 | 175 | 68 | 6 | 2100 | 1573 | 1047 | 28 | 204/390 |
| 132 | 132 | 20x20 | 36 | 120x120 | 1304 | 496 | 163 | 62 | 8 | 2608 | 1954 | 1301 | 27.6 | 248/472 |
| 144 | 144 | 22x22 | 36 | 132x132 | 1558 | 620 | 156 | 62 | 8** | 3116 | 2335 | 1556 | 28.5 | 310/590 |
| | | | | | | | 155 | 62 | 2** | | | | | |

**~~Table~~ Figure 5.6.3.2 – 2: ECC 200 Rectangular Symbol Attributes*****

| Symbol Size* | | Data Region | | Mapping | Total | | Reed-Solomon | | Inter- | Data Capacity | | | Error | Max. Correctable |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Matrix | Codewords | | Block | | leaved | Num. | Alphanum. | Byte | Correction | Codeword |
| Row | Col | Size | No. | Size | Blocks | Cap. | Cap. | Cap. | Blocks | Cap. | Cap. | Cap. | Overhead % | Error/Erasure |
| 8 | 18 | 6x16 | 1 | 6x16 | 5 | 7 | 5 | 7 | 1 | 10 | 6 | 3 | 58.3 | 3/+ |
| 8 | 32 | 6x14 | 2 | 6x28 | 10 | 11 | 10 | 11 | 1 | 20 | 13 | 8 | 52.4 | 5/+ |
| 12 | 26 | 10x24 | 1 | 10x24 | 16 | 14 | 16 | 14 | 1 | 32 | 22 | 14 | 46.7 | 7/11 |
| 12 | 36 | 10x16 | 2 | 10x32 | 22 | 18 | 22 | 18 | 1 | 44 | 31 | 20 | 45.0 | 9/15 |
| 16 | 36 | 14x16 | 2 | 14x32 | 32 | 24 | 32 | 24 | 1 | 64 | 46 | 30 | 42.9 | 12/21 |
| 16 | 48 | 14x22 | 2 | 14x44 | 49 | 28 | 49 | 28 | 1 | 98 | 72 | 47 | 36.4 | 14/25 |

* Note: Symbol size does not include Quiet Zones.

** Note: In the largest symbol (144x144), the first eight Reed-Solomon blocks shall be 218 codewords long encoding 156 data codewords. The last two blocks shall encode 217 codewords (155 data codewords). All the blocks have 62 error correction codewords.

*** Equivalent to Table 11 ~~as printed~~ in the ~~i~~International sStandard *ISO-16022*, fFirst edition, 2000-05-01.

The square format is divided into 4 to 36 data regions for symbols sized 32 by 32 modules and larger. The rectangular format symbols may also be divided into two data regions. Each data region is separated from the other regions by alignment patterns that consist of an alternating pattern of ones and zeroes and a solid line of ones (a dark line when there is no reflectance reversal). Figure 5.6.3.2-3 shows a four-segment square symbol on the left and a two-segment rectangular symbol on the right, each with hypothetical data shown to create the effect.

**Figure 5.6.3.2 – 3: Segmented Data Matrix Symbols: Square and Rectangular Formats**

(Sizes of these Data Matrix Symbols are larger than what would be used in a typical application so that typical alignment patterns can be easily seen.)

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### 5.6.3.3 Data Transmission and Symbology Identifier Prefixes

The EAN.UCC System requires the use of Symbology Identifiers. Data Matrix uses the Symbology Identifier of "]d2" (see ~~Table~~ Figure 5.6.3.~~3~~2 - 1) for EAN.UCC System compliant symbols ~~which~~ that have a leading FNC1 character. This indicates that Application Identifier (AI) data is encoded equivalent to the Symbology Identifier "]C1" for UCC/EAN-128 Symbols and "]e0" for Reduced Space Symbology® (RSS) and Composite Symbols. For more information on Symbology Identifiers, see the International standard *ISO/IEC 15424 Information technology — Automatic identification and data capture techniques — Data Carrier Identifiers* and the maintenance document *Data Carrier/Symbology Identifiers Maintenance Document - AIM Inc. ITS 02-2002.*

For example, a Data Matrix S~~s~~ymbol encoding AI (01) Element String 10012345678902 produces the transmitted data string "]d20110012345678902." Data transmission follows the same principles that apply to the concatenation of AI Element Strings from UCC/EAN-128 Symbols or RSS Expanded®.

**Figure 5.6.3.3 – 1: Symbology Identifier for Data Matrix ECC 200**

| | Message Content | Separator |
|---|---|---|
| ]d2 | Standard AI Element Strings | None |

### 5.6.3.4 Width and Height of a Module (X)

The range of the X-dimensions will be defined by the application specification, having due regard to the availability of equipment for the production and reading of symbols and complying with the general requirements of the application.

The X-dimension shall be constant throughout a given symbol. The X-dimension should apply to both the width and height of the modules.

### 5.6.3.5 Symbol Quality Grade

The International Standard *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols* methodology shall be used for measuring and grading Data Matrix. The print quality grade is measured by verifiers that comply with the standard. The grade includes a grade level, measuring aperture, the wavelength of light used for the measurement, and the illumination angle relative to the symbol.

A symbol grade is only meaningful if it is reported in conjunction with the illumination and aperture used. It should be shown in the format *grade/aperture/light/angle*, where:

- "grade" is the overall symbol grade as defined in *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols*~~, i.e.~~ (e.g., the arithmetic mean to one decimal place of the S~~s~~can R~~r~~eflectance P~~p~~rofile or scan grades)~~.~~.
- "aperture" is the diameter in thousandths of an inch (to the nearest thousandth) of the synthetic aperture defined in *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols*.

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- "light" defines the illumination: A~~a~~ numeric value indicates the peak light wavelength in nanometres (for narrow band illumination); the alphabetic character W indicates that the symbol has been measured with broadband illumination ("white light") the spectral response characteristics of which must imperatively be defined or have their source specification clearly referenced.~~,~~

- "angle" is an additional parameter defining the angle of incidence (relative to the plane of the symbol) of the illumination. It shall be included in the reporting of the overall symbol grade when the angle of incidence is other than 45 degrees°. Its absence indicates that the angle of incidence is 45° degrees.

Note: This i~~I~~nternational s~~S~~tandard provides for 30 degrees° and 90 degrees° illumination in addition to the default 45 degrees°.

An asterisk following the value for "grade", in the case of a two-dimensional matrix symbol, indicates that the surroundings of the symbol contain extremes of reflectance that may interfere with reading (– see *ISO/IEC 15415 Information technology - Automatic identification and data capture techniques - Bar code symbol print quality test specification - Two-dimensional symbols*).

Examples:

- 2,8/05/660 would indicate that the average of the grades of the S~~s~~can R~~r~~eflectance P~~p~~rofiles, or of the scan grades, was 2,8 when these were obtained with the use of a 0,125 mm aperture (ref. no. 05) and a 660 nm light source, incident at 45° degrees.

- 2,8/10/W/30 would indicate the grade of a symbol intended to be read in broadband light, measured with light incident at 30 degrees° and using a 0,250 mm aperture (ref. no. 10), but would need to be accompanied either by a reference to the application specification defining the reference spectral characteristics used for measurement or a definition of the spectral characteristics themselves.

- 2,8/10/670 would indicate the grade of a symbol measured using a 0,250 mm aperture (ref. no. 10), and a 670 nm light source, and indicates the presence of a potentially interfering extreme reflectance value in the surroundings of the symbol.

~~Actual, r~~Recommended symbol grades for Data Matrix ~~will be~~are identified in individual applications ~~and~~ in Section 5.4.

### 5.6.3.6 Advice for Selecting the Symbology

Any use of Data Matrix should comply with EAN.UCC System global application guidelines and be restricted to those applications defined by the EAN.UCC System for Data Matrix. Data Matrix will not replace other EAN.UCC System Symbologies. Existing applications that are satisfactorily utilising EAN/UPC Symbols, ITF-14 Symbols, UCC/EAN-128 Symbols, Reduced Space Symbology® (RSS) Symbols, or Composite Symbols should continue to use them.

Note: Scanning systems that need to read Data Matrix Symbols must be 2D imaging scanners and be appropriately programmed to read the EAN.UCC System version of Data Matrix or ECC 200.

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### 5.6.3.7 Human Readable Interpretation of Data Matrix Symbols

The Human Readable Interpretation of the primary Application Identifier (AI) Element String encoded in the Data Matrix Symbol should be shown with the symbol. How the human readable data will be shown ~~specifically~~ shall be determined by the specific application guidelines. Typical conventions, as used for Reduced Space Symbology® (RSS) and Composite Component® Symbols, ~~has been to~~ place the key information, such as the Global Trade Item Number™ (GTIN™), in the human readable data underneath the bar code symbol, while secondary information ~~has been~~is placed above. The characters should be clearly legible (such as OCR-B) and must be obviously associated with the symbol.

~~Application Identifiers (AIs)~~AIs should be clearly recognisable to facilitate key entry. This is achieved by putting the AI between parentheses in the Human Readable Interpretation. Note: The parentheses are not part of the data and are not encoded in the bar code symbol, following ~~exactly~~ the same principles that apply to UCC/EAN-128 Symbols ~~or~~ and RSS Expanded® Symbols.

For Data Matrix Symbols encoding large amounts of data, it may not be practical to display all the data in Human Readable Interpretation form. Even if there is space to show it in this form, it may not be practical to key enter that much data. In these instances, some of the data may be omitted from the Human Readable Interpretation. However, primary identification data (EAN.UCC System keys), such as the ~~Global Trade Item Number™~~GTIN, must always be shown. Application specifications may provide additional guidance on Human Readable Interpretation.

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# Section 7.0:

# System Processing in EDP Applications

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## 7.1 Introduction

The purpose of entering data transmitted from a reading device into a system is to record a transaction. In the EAN.UCC System, a transaction is an electronic message to be processed according to the meaning and content of the data fields contained in the message. This should be possible without requiring any human intervention to determine the data's meaning and content.

The standardised Element Strings of the EAN.UCC System are the basis for the identification of items of every kind. They identify a particular item in an unambiguous manner and supply relevant attribute information.

When these Element Strings are printed on items, the scanned and transmitted data refers to that item and identifies its physical presence at a given location. When the message read from the scanned data carrier is coupled with an internally assigned designation of the type of item movement (e.g., warehouse entry, stock taking, sales), it is possible to automatically record data related to each movement of items. This provides security in two ways. First, an item must be physically present in order to produce a bar code reader message about the item, and, second, only the data in the bar code on the item and, therefore, relevant to it, can be recorded. False notification of movements is thereby largely eliminated.

When Element Strings are used in administrative areas (e.g., in order entry) they also can be used for automatic, error-free data capture. Because of the considerable length of many EAN.UCC System ID numbers, automatic reading has great significance. By using a Check Digit, a digit that ensures the data has been correctly ~~composed,~~composed; the accuracy of the reading can be verified.


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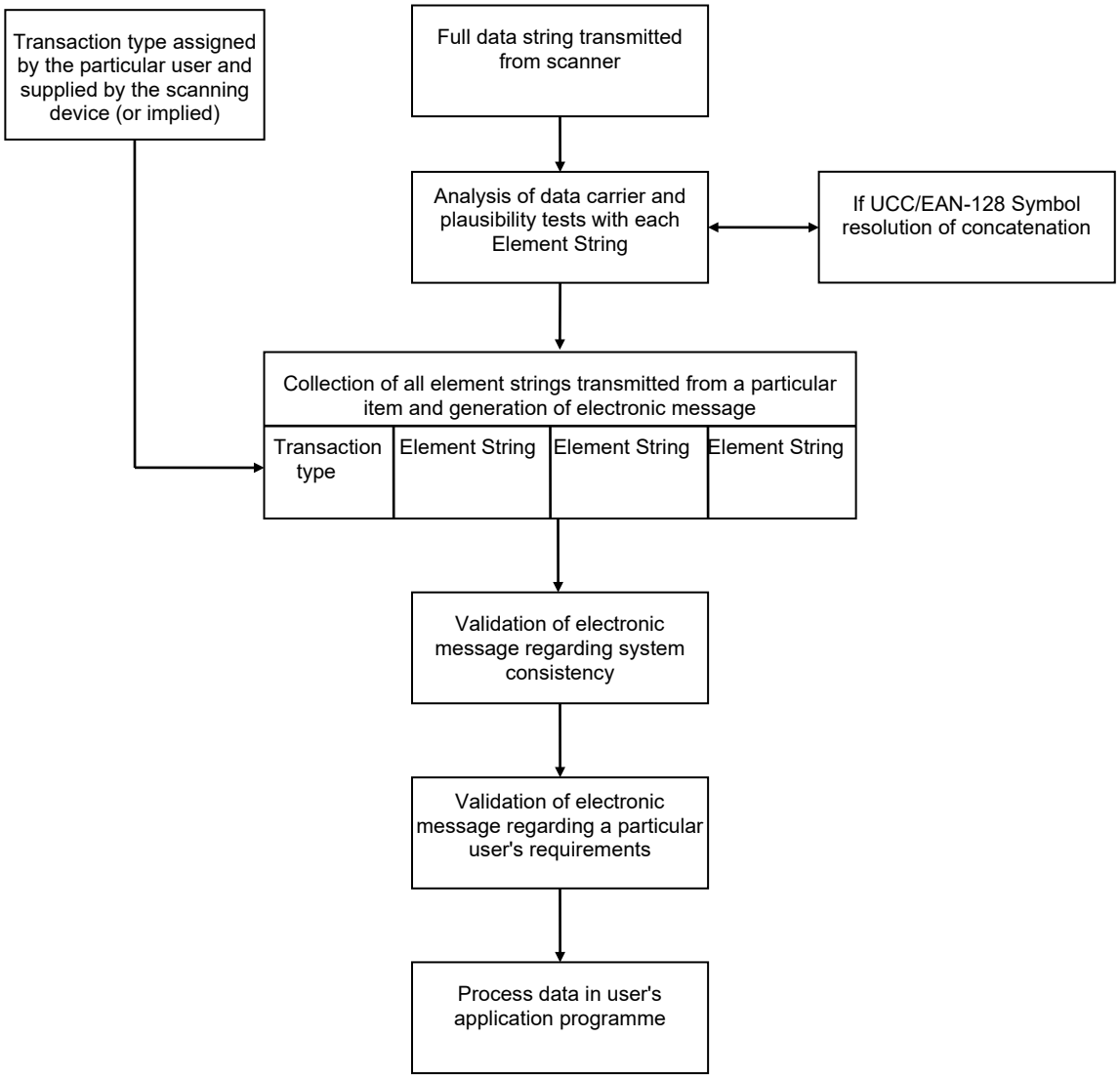
## 7.2 Synopsis of Message Processing

Figure 7.2 – 1




For details on any of the actions in Figure 7.2 – 1, see the following subsections.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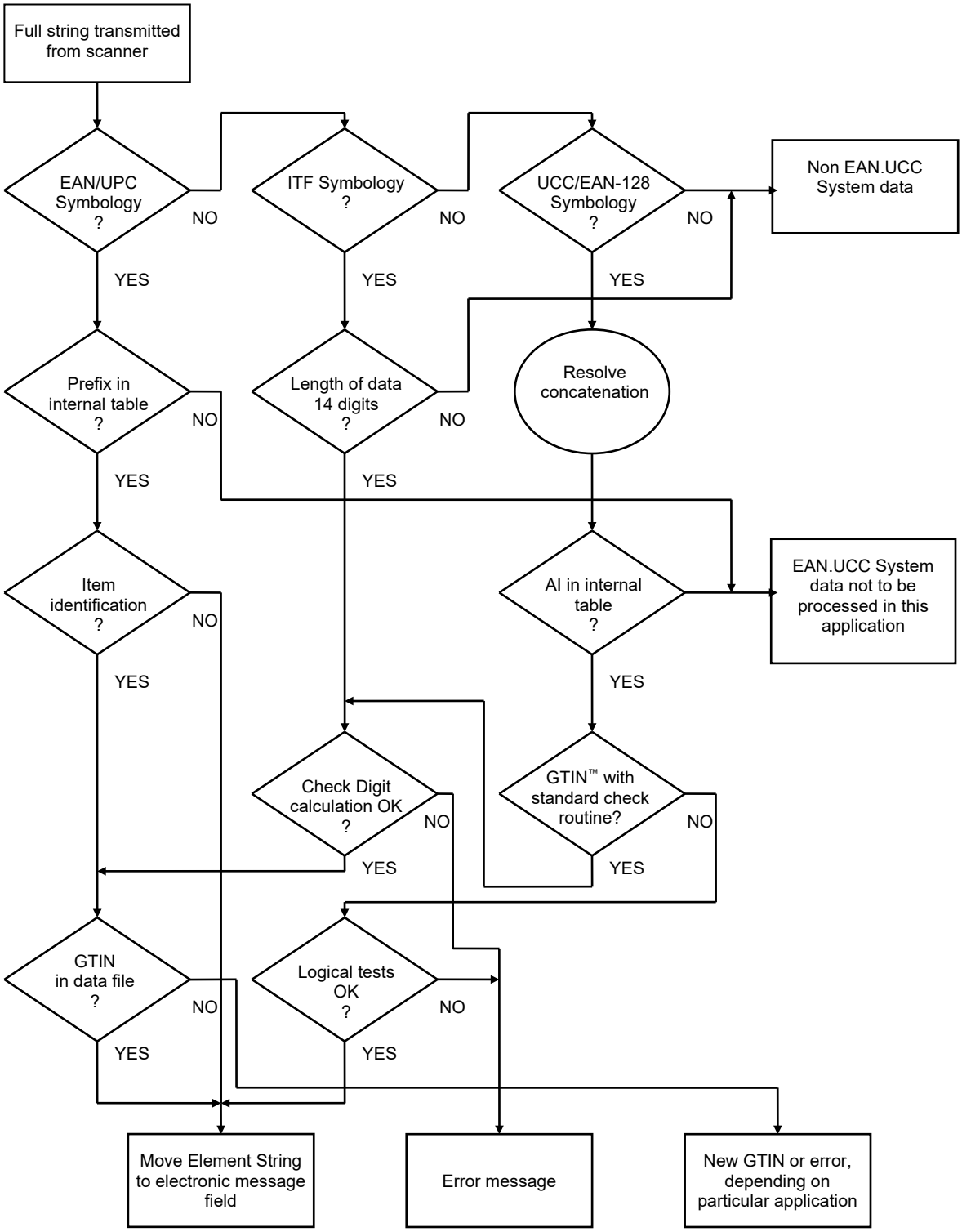
## 7.2.1 Analysis of the Data Carrier and Plausibility Tests for Element Strings

Figure 7.2.1 – 1




For details on any of the actions in Figure 7.2.1 – 1, see the following subsections.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### 7.2.1.1 Symbology Identification

Each transmitted full string consists of a symbology identifier and one or more Element Strings (see Section 3.0). The identifiers of bar code symbologies are stated in Section 5.0.

### 7.2.1.2 Prefix in Internal Table

System users may generate an internal table showing the EAN.UCC Prefixes of Element Strings they wish to process. This table also serves to sort out the Element Strings representing item identification numbers in order to check their presence in the data file. Details on the respective prefixes are stated in Section 3.0.

### 7.2.1.3 Item Identification

The symbols in the EAN/UPC Symbology family contain identification data for trade items and special data structures (e.g., coupons). Whether an Element String contains the identification of a trade item is determined by the EAN.UCC Prefix. System users must determine the specific structure and meaning of prefixes 20 to 29 as defined by their EAN Member Organisation.

### 7.2.1.4 Application Identifier (AI) in Internal Table

The Element Strings using Application Identifiers cover a wide range of applications. In order to keep the amount of programming on a reasonable level, it is possible to ignore processing of unwanted Element Strings. This is achieved by establishing an internal table with only the Application Identifiers intended for processing.

### 7.2.1.5 Length of Data 14 Digits

ITF-14 Bar Code Symbols are used to represent trade item identification numbers. They have 14 Human Readable Interpretation characters, which can be printed above or below the symbol. In the EAN.UCC System, Global Trade Item Numbers™ (GTINs™) are stored in the GTIN Format, a 14-digit reference field in computer files that is used to ensure the uniqueness of the identification numbers.

### 7.2.1.6 Check Digit Calculation

In EAN/UPC Symbology, the Check Digit verifies reading and decoding of bar code symbols as well as Global Trade Item Numbers™ (GTINs™). This is performed automatically by the bar code reader.

Bar code readers processing ITF-14 Symbols may be programmed to verify the Check Digit as well. If this recommended verification has been performed, it is indicated by the symbology identifier ] I 1 (see Section 5.0). Data transmitted from ITF-14 Symbols with symbology identifier ] I 0 must be verified.

UCC/EAN-128 Bar Code Symbols have an integral Symbol Check Character that verifies correct decoding of scanned data. If an Element String encoded in UCC/EAN-128 includes a Check Digit, the Check Digit will not be verified by the bar code reader. While the data security provided by the UCC/EAN-128 Symbol Check Character guarantees proper decoding of the entire Element String, correctness of the contained identification number is achieved by having the application software verify the ID number's Check Digit. Logical Tests

Logical tests check for reasonable data content, such as verifying:

- Data field ranges (e.g., month < 13 and > 00)
- The maximum length of a variable length Element String
- Alphanumeric characters in numeric-only fields
- Correct EAN.UCC Prefixes in given applications


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### 7.2.1.7 Move Element String to Message Field

Several Element Strings may be scanned in a single transaction. In order to verify the correctness and completeness of the transmitted data, each Element String is transferred to a message record. If an Element String does not include an Application Identifier, verification of the message is simplified if an Application Identifier is internally assigned. Global Trade Item Numbers™ (GTINs™) that are carried by EAN-13, UPC-A, UPC-E or ITF-14 bar code symbols may be denoted with an internally assigned AI (01). Other Element Strings may be assigned "ghost" Application Identifiers


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## 7.3 Validation of the Electronic Message Regarding System Consistency

The EAN.UCC System enables system users to process scanned data without human intervention. This implies that the electronic message generated from data scanned and transmitted from data carriers needs to substitute all human activities during a particular transaction. In other words, the transmitted data must provide all information required for its correct processing.

The EAN.UCC System is designed to fulfil these requirements. Section 4.0 describes the association of Element Strings to form valid messages.

Validation of system consistency refers to the verification of the correct composition of the electronic message by a system processing the transaction messages. Whether the message is adequate in business application terms is dealt with by the application software.

Only messages containing a valid set of Element Strings defined in the EAN.UCC System can be unambiguously processed. The processing of invalid messages may lead to data file errors because the meaning and relationship of the Element Strings are not defined. This is illustrated in Figures 7.3 – 1 and 7.3 – 2.

Figure 7.3 – 1

| **Examples of Valid Messages** | | | |
|---|---|---|---|
| Element Strings in Message | | | Comment |
| AI 00 | AI 33nn | | Identification of a logistic unit + logistic weight |
| AI 00 | AI 01 | | Identification of an entity as a logistic unit and as a Fixed Measure Trade Item |
| AI 00 | AI 01 '9' | AI 31nn | Identification of an entity as a logistic unit and as a Variable Measure Trade Item |
| AI 00 | AI 02 | AI 37 | Identification of a logistic unit and its contained Fixed Measure Trade Items |
| AI 01 | AI 10 | AI 15 | Identification of a trade item + lot number + best before date |
| AI 00 | AI 401 | | Identification of a logistic unit as part of a consignment |
| AI 01 '9' | AI 31nn | AI 33nn | Identification of a Variable Measure Trade Item + logistic weight |
| AI 00 | AI 01 | AI 33nn | Identification of an entity as a logistic unit and a Fixed Measure Trade Item; the logistic weight is associated with the identification number of the logistic unit |


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Figure 7.3 – 2

| Examples of Invalid Messages | | | |
|---|---|---|---|
| Element Strings in Message | | | Comment |
| AI 00 | AI 01 | AI 37 | Invalid identification of an entity as a logistic unit and as a Fixed Measure Trade Item; AI 37 (quantity of items contained) must be used with AI 02 only |
| AI 01 | AI 10 | AI 33nn | Invalid identification of a Fixed Measure Trade Item + lot number; AI 33nn is incorrect because logistic measures of a Fixed Measure Trade Item are fixed attributes stored in the data file |
| AI 01'9' | AI 33nn | | Invalid identification of a Variable Measure Trade Item + logistic weight; the mandatory Element String with a trade measure is missing |
| AI 00 | AI 11 | | Invalid identification of a logistic unit; AI 11 is incorrect because a production date must be associated with the identification number of a trade item |
| AI 00 | AI 01 | AI 02/37 | Invalid identification of an entity as a logistic unit and as a Fixed Measure Trade Item; AI 02/37 must not be associated with AI 01 |
| AI 01 | AI 30 | | Invalid identification of a Fixed Measure Trade Item; AI 30 must only be associated with the identification number of a Variable Measure Trade Item |
| AI 02 | AI 37 | | Invalid identification of the fixed measure trade units contained in an unidentified logistic unit; AI 00 is missing |
| AI 00 | AI 02 | | Invalid identification of a logistic unit and of the contained Fixed Measure Trade Items; AI 02 requires the mandatory presence of AI 37 to complete the identification of the content |


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## 7.4 Validation of the Electronic Message Regarding User Requirements

Some industry groups and organisations specify the use of particular Element Strings for attributes and other information not directly identifying the item. Contrary to the validation of messages for system conformity, the Uniform Code Council (UCC™) and EAN International do not define the rules for the validation and application of these particular Element Strings. Validation of messages containing these Element Strings in these environments (e.g., trade item identification with best before date and batch number) is left to the discretion of the particular system user community.

Validation of the correctness of a message may be performed differently for each Global Trade Item Number™ (GTIN™), and instructions must be stored in the data file. System users should include the Application Identifiers and their specific application rules in the stored instructions.

Validation of the user requirements must be performed after validation of system consistency. Missing elements in consistent messages may be by-passed or completed in given instances. Inconsistent messages can never be processed properly.


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## 7.5 Conversion of Weights and Measures in User Applications

All weights and measures that are encoded in the Element Strings with the Application Identifiers (31nn) to (36nn) are structured according to the same mathematical rules. The determination of basic units of measurement and the freedom to choose the number of decimal positions will lead to variations in data representation. Suppliers will choose the value that best suits the respective trade item in terms of weight/size and the degree of accuracy required (e.g., grams) for the representation of weights and measures in the six-position data field.

The recipient of such goods also may want to store these details in a standardised form in his data file. This requirement is easily fulfilled through programming with the conversion formula shown below.

As described in Section 3.0, the Application Identifier in position $A_4$ denotes the position of the implied decimal point, called the Inverse Exponent.

The three-step formula to convert weights and measures is as follows:

1. Define the company's internal Inverse Exponent in accordance with the basic unit of measure of the company's internal field structure (e.g., for an AI expressing weight in kilograms, Inverse Exponent 0 could signify kilograms and Inverse Exponent 3 could signify grams).

2. Subtract the company's internal Inverse Exponent from the value of the position $A_4$ of the Application Identifier in the decoded Element String. Call the result X.

3. Divide the amount of the six-digit applicable value field from the decoded data string by $10^X$. The result is the value required in the company's data structure.

In the examples in Figure 7.5 – 1, the company's system uses internal weight fields eight digits in length (format: nnnnnnn.n) with a unit of measure equal to grams. Thus, the company uses the internal Inverse Exponent of 3.

Figure 7.5 – 1

| **Decoded Data String** | | | | | **Conversion** | **Internal Weight Field** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Application Identifier $A_1$ | $A_2$ | $A_3$ | $A_4$ | Weight | | Eight-Digit Data Field Defined as Grams with One Decimal Position | | | | | | | |
| 3 | 1 | 0 | 0 | 005097 (= 5097 kg) | Step 2: X = 0 minus 3 = -3<br>Step 3: 005097 divided by $10^{-3}$ (.001) = | 5 | 0 | 9 | 7 | 0 | 0 | 0 | |
| 3 | 1 | 0 | 2 | 005097 (= 50.97 kg) | Step 2: X = 2 minus 3 = -1<br>Step 3: 005097 divided by $10^{-1}$ (.1) = | 0 | 0 | 5 | 0 | 9 | 7 | 0 | |
| 3 | 1 | 0 | 3 | 045250 (= 45.250 kg) | Step 2: X = 3 minus 3 = 0<br>Step 3: 045250 divided by $10^{0}$ (1) = | 0 | 0 | 4 | 5 | 2 | 5 | 0 | |
| 3 | 1 | 0 | 4 | 012347 (= 1234.7 g) | Step 2: X = 4 minus 3 = 1<br>Step 3: 012347 divided by $10^{1}$ (10) = | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 7 |

Decimal point


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In the examples in Figure 7.5 – 2, the company's system uses internal weight fields eight digits in length (format: nnnnn.nnn) with a unit of measure equal to kilograms. Thus the company uses an internal Inverse Exponent of 0.

Figure 7.5 – 2

| **Decoded Data String** | | | | | **Conversion** | **Internal Weight Field** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Application Identifier $A_1$ $A_2$ $A_3$ $A_4$ | | | | Weight | | Eight-Digit Data Field Defined as Kilograms with Three Decimal Position | | | | | | | |
| 3 | 1 | 0 | 0 | 005097 (= 5097 kg) | Step 2: X = 0 minus 0 = 0<br>Step 3: 005097 divided by $10^0$ (1) = | 0 | 5 | 0 | 9 | 7 | | | |
| 3 | 1 | 0 | 2 | 005097 (= 50.97 kg) | Step 2: X = 2 minus 0 = 2<br>Step 3: 005097 divided by $10^2$ (100) = | 0 | 0 | 0 | 5 | 0 | 9 | 7 | |
| 3 | 1 | 0 | 3 | 045250 (= 45.250 kg) | Step 2: X = 3 minus 0 = 3<br>Step 3: 045250 divided by $10^3$ (1000) = | 0 | 0 | 0 | 4 | 5 | 2 | 5 | |
| 3 | 1 | 0 | 4 | 012347 (= 1234.7 g) | Step 2: X = 4 minus 0 = 4<br>Step 3: 012347 divided by $10^4$ (10000) = | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 5 |

Decimal point

Position rounded


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## 7.6 Linkage of GTINs™ in a Database

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. Trade items may be a single item, part, unit, product, or service, or a pre-defined multiple or grouping or combination of such items. A separate Global Trade Item Number™ (GTIN™) identifies each of these items unambiguously, irrespective of the applied data structure. This also applies to identification numbers for restricted distribution in a closed environment.

Information about the hierarchical structure of trade items is an important issue in a business. Section 7.6.1 illustrates an example of how the required links can be established by using a relational database.

### 7.6.1 The Principle

The hierarchy for the example in Figure 7.6.1 – 1 is basic product = A; 10 x A = product B; 5 x B = product C.

Figure 7.6.1 – 1

**Trade Item Database**

| GTIN™ (14 digits) | Item Characteristics | Relation Up | Relation Down |
|---|---|---|---|
| A | (as applicable) | YES | NO |
| B | | YES | YES |
| C | | NO | YES |

**Upper Relations**

| GTIN in Database | GTIN of Relation |
|---|---|
| A | B |
| B | C |

**Lower Relations**

| GTIN in Database | GTIN of Relation |
|---|---|
| B | A |
| C | B |

See Figure 7.6.2 – 1 for the mechanism of linkage for the various types of trade items.


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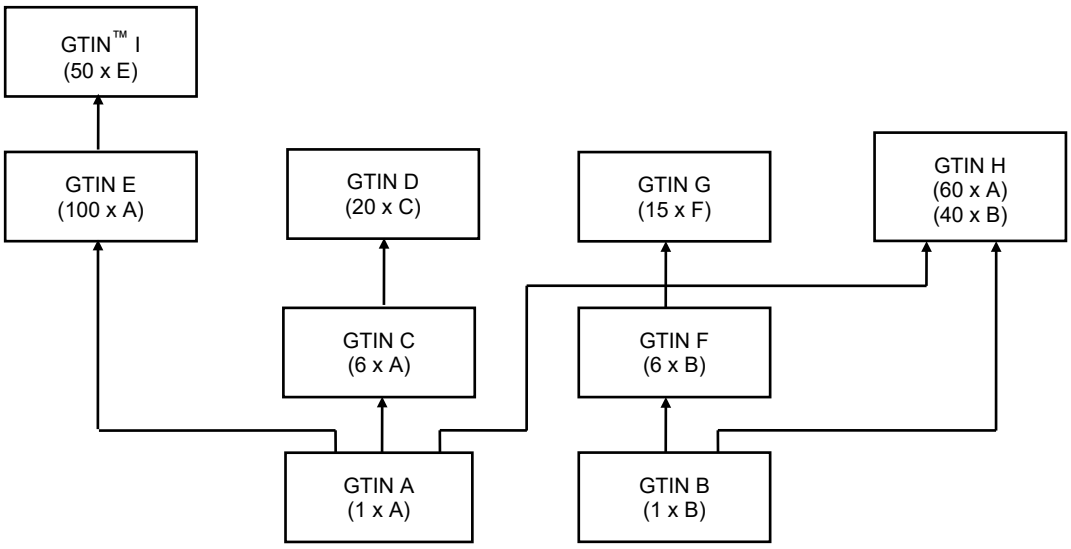
## 7.6.2 Extended Example of a Trade Item Hierarchy

Figure 7.6.2 – 1




Note: For reasons of simplicity, Global Trade Item Numbers™ (GTINs) are expressed in letters in this example, signifying that they may be of any standardised structure.

Figure 7.6.2 – 2

| **Trade Item Database** | | | |
|---|---|---|---|
| GTIN™ (14 digits) | Item Characteristics | Relation Up | Relation Down |
| A | (as applicable) | YES | NO |
| B | | YES | NO |
| C | | YES | YES |
| D | | NO | YES |
| E | | YES | YES |
| F | | YES | YES |
| G | | NO | YES |
| H | | NO | YES |
| I | | NO | YES |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| Upper Relations | | | |
|---|---|---|---|
| GTIN in Database | GTIN of Relation | Quantity of Items Contained | Relation is Mixed Trade Item |
| A | C | 6* | NO |
| A | E | 100 | NO |
| A | H | 60 | YES |
| B | F | 6 | NO |
| B | H | 40 | YES |
| C | D | 20 | NO |
| E | I | 50 | NO |
| F | G | 15 | NO |

| Lower Relations | | | |
|---|---|---|---|
| GTIN in Database | GTIN of Relation | Quantity of Items Contained | Relation is Mixed Trade Item |
| C | A | 6** | NO |
| D | C | 20 | NO |
| E | A | 100 | NO |
| F | B | 6 | NO |
| G | F | 15 | NO |
| H | A | 60 | NO |
| H | B | 40 | NO |
| I | E | 50 | NO |

*Quantity of items numbered A contained in item C

**Quantity of items numbered A contained in item C

Note: The columns "GTIN in Database" and "GTIN of Relation" are sufficient to establish the links between the different items. The column "Quantity of Items Contained" provides additional information, which may be useful in particular business applications. The column "Relation is Mixed Trade Item" provides the relations pointing to all trade items contained in a mixed trade item.

### 7.6.3 Linkage of GTINs™ in a Non-Relational Database by Trade Item Manufacturer

Many types of items are produced and distributed in fixed measure standard nested packaging configurations (e.g., consumer unit, carton, case, pallet) with fixed quantity relationships. The various packaging configurations are often broken into lower levels at various points in the supply chain, and, therefore, each level of the packaging may be a trade item. Computer systems must be capable of understanding the relationships of the units or trade items in the configuration and treating inventory of all levels of the configuration as one SKU (Stock Keeping Unit).

Use of the first digit Indicator (values 1 to 8) of the EAN/UCC-14 Data Structure can be used to identify levels of a standard packaging configuration. This allows digits 2 to 13 to remain constant for all levels of the standard packaging configurations for an item. If this method of numbering item


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configurations is used when necessary to support business processes or when driven by system constraints, the non-relational database construct defined below may be appropriate.

The item database is constructed with a base item record (table) and segments (tables) for each level of the item packaging configuration. Properly designed, this type of system can support pricing, ordering, and shipping of any level of the packaging configuration (trade item) with appropriate dimension and weight information. It enables inventories to be maintained by packaging level and in total for the base item. It also provides channel partners or customers the choice of ordering and invoicing units. Meeting these requirements often makes this approach a good business solution for manufacturers, because it meets the most critical needs in the supply chain and is practical to implement, particularly in distributed and small systems where performance is critical.

Using the EAN/UCC-14 Data Structure, the base item record contains the base EAN/UCC-8, UCC-12, or EAN/UCC-13 ID Number (digits 2 to 13) as a key, with all information relating to the base unit and the item in total (including total inventory balance). Each of the packaging segments contains information unique to the respective packaging configuration (e.g., Indicator, Check Digit, quantity relationship to next lower level of the configuration, dimensions, weight, prices). After accessing the item record using the GTIN of the base item (digits 2 to 13), the packaging segments are accessed using the Indicator (first digit).

This construct demands that:

- the trade item must be fixed in measure
- there must be a single Global Trade Item Number™ (GTIN™) for the base item of the related packaging configurations that is an EAN/UCC-8, UCC-12, or EAN/UCC-13 ID Number
- each related packaging configuration is limited to eight levels of packaging for the base item using Indicator values 1 to 8

When storing EAN/UCC-8, UCC-12, or EAN/UCC-13 ID Numbers in a 14-digit reference field or 14-digit data carrier, they must be stored based on rules that ensure their uniqueness. When a GTIN is stored in the GTIN Format, a 14-digit reference field represented in computer files, the uniqueness of the ID number is ensured.

The GTIN Format is intended to support the uniqueness management process for the construction of GTINs and not for the receiving process. Companies that receive trade items with GTINs must be able to process the complete GTIN without regard to how it was constructed.

## 7.7 Element Strings Represented in Data Carriers

Scanned Element Strings are decoded as a full string by the reading device and are then transmitted for processing in the application software. The full string is composed of a symbology identifier and one or more Element Strings. The meaning of an Element String is also determined by the data carrier in which it is represented.

A synopsis by data carrier of the Element Strings described in these specifications is shown in Figure 7.7.1 – 1, which also provides an overview of the sequential number range of trade items by data carrier.


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## 7.7.1 GTINs™ Represented in EAN.UCC System Data Carriers

Figure 7.7.1 – 1

| | ITF-14 or UCC/EAN-128 Bar Code Symbol | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EAN-13 Bar Code Symbol | | | | | | | | | | | | |
| | | | UPC-A or UPC-E Bar Code Symbol | | | | | | | | | | | |
| | | | | | | | EAN-8 Bar Code Symbol | | | | | | | |
| 2. | * | * | * | * | * | * | 00 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | * | * | * | * | * | * | 11 | 03 | 09 | 09 | 09 | 09 | 09 | CC |
| 2. | * | * | * | * | * | * | 22 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | * | * | * | * | * | * | 39 | 06 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | 00 | 00 | 00 | 00 | 00 | 19 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 2. | * | * | 00 | 00 | 17 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | 00 | 00 | 01 | 09 | 89 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 4. | * | 00 | 22 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | 00 | 00 | 33 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 2. | * | 00 | 44 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 5. | * | 00 | 55 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | 00 | 00 | 69 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 8. | 00 | 11 | 03 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 2. 4. | 00 | 22 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 8. | 00 | 39 | 06 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 7. | * | 99 | 77 | 79 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 5. 6. | * | 99 | 88 | 02 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 5. | * | 99 | 99 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | 18 | 00 | 00 | 00 | 00 | 00 | 11 | 03 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. | 18 | 00 | 00 | 00 | 00 | 00 | 39 | 06 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 3. | 19 | 00 | 00 | 00 | 00 | 19 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 3. | 19 | 00 | 01 | 09 | 99 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 3. | 19 | 00 | 33 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 3. | 19 | 00 | 69 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 3. | 19 | 11 | 03 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |
| 1. 3. | 19 | 39 | 06 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | CC |

1. Fixed measure


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2. Fixed measure restricted distribution

3. Variable measure

4. Variable measure restricted distribution

5. Coupons (not a GTIN)

6. Refund Receipts (not a GTIN)

7. ISBN, ISMN, and ISSN

8. GRAI


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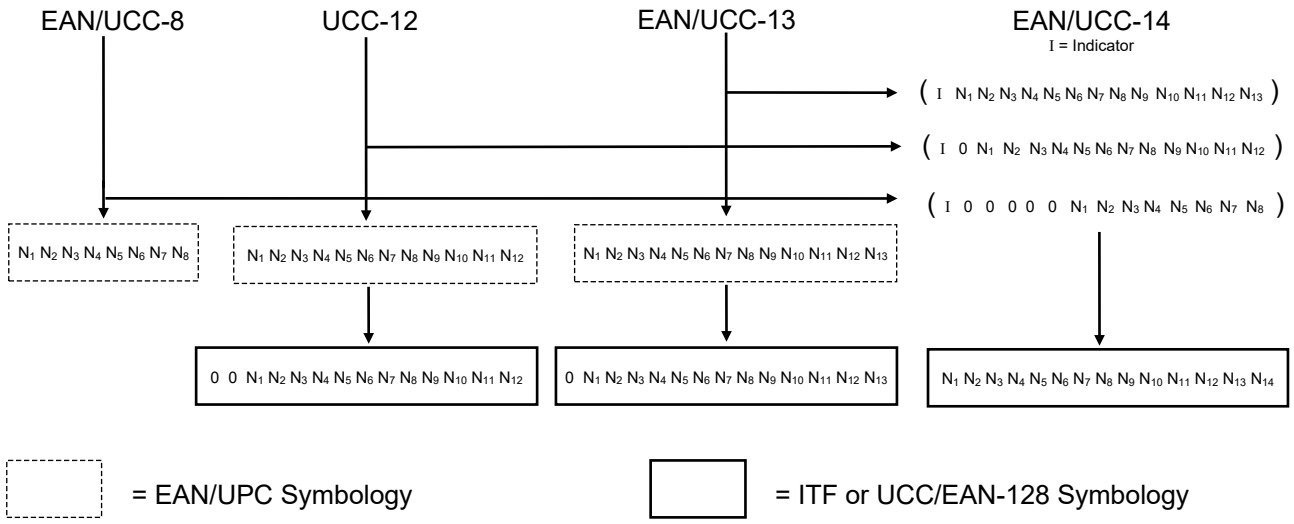
## 7.7.2 Handling of Global Trade Item Numbers™ to Conform with the System

Figure 7.7.2 – 1

GTINs™ in EAN.UCC System Bar Code Symbols




As shown in Figure 7.7.2 – 1, the EAN.UCC System uses Global Trade Item Numbers™ (GTINs™) that vary in length. To avoid duplication in the GTIN Format in a computer file, it is necessary to observe some rules regarding GTIN arrangement.

Currently, the longest identification number for Fixed Measure Trade Items consists of 14 digits, which necessitates the creation of a 14-digit field. Figure 7.7.2 – 2 shows how GTINs transmitted in Element Strings are positioned in the GTIN Format.

Figure 7.7.2 – 2

| Data Structure | **Positions in the GTIN Format** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | $T_6$ | $T_7$ | $T_8$ | $T_9$ | $T_{10}$ | $T_{11}$ | $T_{12}$ | $T_{13}$ | $T_{14}$ |
| EAN/UCC-8 | 0 | 0 | 0 | 0 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ |
| UCC-12 | 0 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ |
| EAN/UCC-13 | 0 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ |
| EAN/UCC-14 | $N_1$ | $N_2$ | $N_3$ | $N_4$ | $N_5$ | $N_6$ | $N_7$ | $N_8$ | $N_9$ | $N_{10}$ | $N_{11}$ | $N_{12}$ | $N_{13}$ | $N_{14}$ |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### 7.7.3 Element Strings Represented in UCC/EAN-128 Symbology

The Element Strings encoded in the UCC/EAN-128 Symbology are composed of an Application Identifier and one or several data fields. The Application Identifier denotes the contents and structure of the respective data fields. Full details are contained in Section 3.0.


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## 7.8 Secondary Data for Specific Health Industry Products

Figures 7.8 – 1 and 7.8 – 2 show the correct data formats for secondary data for specific health industry products. If a column in Figure 7.8 – 3 is left blank, then that data format information is not used.

Figure 7.8 – 1

| | |
|---|---|
| MM | two-digit expiration date month indicator (fixed length of two numeric digits) |
| YY | two-digit expiration date year indicator (fixed length of two numeric digits) |
| DD | two-digit expiration date day indicator (fixed length of two numeric digits) |
| HH | two-digit expiration date hour indicator (fixed length of two, G.M.T. format) |
| JJJ | three-digit expiration date Julian day indicator (fixed length of three numeric digits |
| LOT | up to 13-digit alphanumeric lot number |
| L | 1-digit link character ~~( GTIN~~(GTIN Check Digit) |
| QQ | two-digit quantity (fixed length of two numeric digits) |
| QQQQQ | five-digit quantity (fixed length of five numeric digits) |

The data in Figure 7.8 - 2 is used in the example in Figure 7.8 - 3.

Figure 7.8 – 2

| | |
|---|---|
| GTIN™ | 10312345678903 |
| Lot number | 3C001 |
| Link character | 3 |
| Expiration date | September 28, 1995, at 10 p.m. |
| Two-digit quantity | 24 |
| Five-digit quantity | 00100 |

Quantity represents the quantity of items contained within the trade item where the inside item is assigned the GTIN™ 00312345678906.


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The data formats in Figure 7.8 – 3 show all combinations of the sub-fields possible within the Element String.

Figure 7.8 – 3

| Row | Application Identifier | Quantity Format Digit | Quantity Format | Expiration Date Format Digit | Expiration Date Format | Lot Field | Link Digit | Example Data |
|---|---|---|---|---|---|---|---|---|
| 1 | 22 | | | | MMYY | LOT | L | 2209953C0013 |
| 2 | 22 | | | 2 | MMDDYY | LOT | L | 2220928953C0013 |
| 3 | 22 | | | 3 | YYMMDD | LOT | L | 2239509283C0013 |
| 4 | 22 | | | 4 | YYMMDDHH | LOT | L | 224950928223C0013 |
| 5 | 22 | | | 5 | YYJJJ | LOT | L | 225952713C0013 |
| 6 | 22 | | | 6 | YYJJJHH | LOT | L | 22695271223C0013 |
| 7 | 22 | | | 7 | | LOT | L | 2273C0013 |
| 8 | 22 | 8 | QQ | | MMYY | LOT | L | 2282409953C0013 |
| 9 | 22 | 8 | QQ | 2 | MMDDYY | LOT | L | 2282420928953C0013 |
| 10 | 22 | 8 | QQ | 3 | YYMMDD | LOT | L | 2282439509283C0013 |
| 11 | 22 | 8 | QQ | 4 | YYMMDDHH | LOT | L | 228244950928223C0013 |
| 12 | 22 | 8 | QQ | 5 | YYJJJ | LOT | L | 228245952713C0013 |
| 13 | 22 | 8 | QQ | 6 | YYJJJHH | LOT | L | 22824695271223C0013 |
| 14 | 22 | 8 | QQ | 7 | | LOT | L | 2282473C0013 |
| 15 | 22 | 8 | QQ | | | LOT | L | 228243 |
| 16 | 22 | 9 | QQQQQ | | MMYY | LOT | L | 2290010009953C0013 |
| 17 | 22 | 9 | QQQQQ | 2 | MMDDYY | LOT | L | 2290010020928953C0013 |
| 18 | 22 | 9 | QQQQQ | 3 | YYMMDD | LOT | L | 2290010039509283C0013 |
| 19 | 22 | 9 | QQQQQ | 4 | YYMMDDHH | LOT | L | 22900100 4950928223C0013 |
| 20 | 22 | 9 | QQQQQ | 5 | YYJJJ | LOT | L | 229001005952713C0013 |
| 21 | 22 | 9 | QQQQQ | 6 | YYJJJHH | LOT | L | 22900100695271223C0013 |
| 22 | 22 | 9 | QQQQQ | 7 | | LOT | L | 2290010073C0013 |
| 23 | 22 | 9 | QQQQQ | | | LOT | L | 229001003 |

As an example, row 8 in Figure 7.8 – 3, using the required AI (01) and AI (22), would create the full string ]C1 01 10312345678903 22 82409953C0013.


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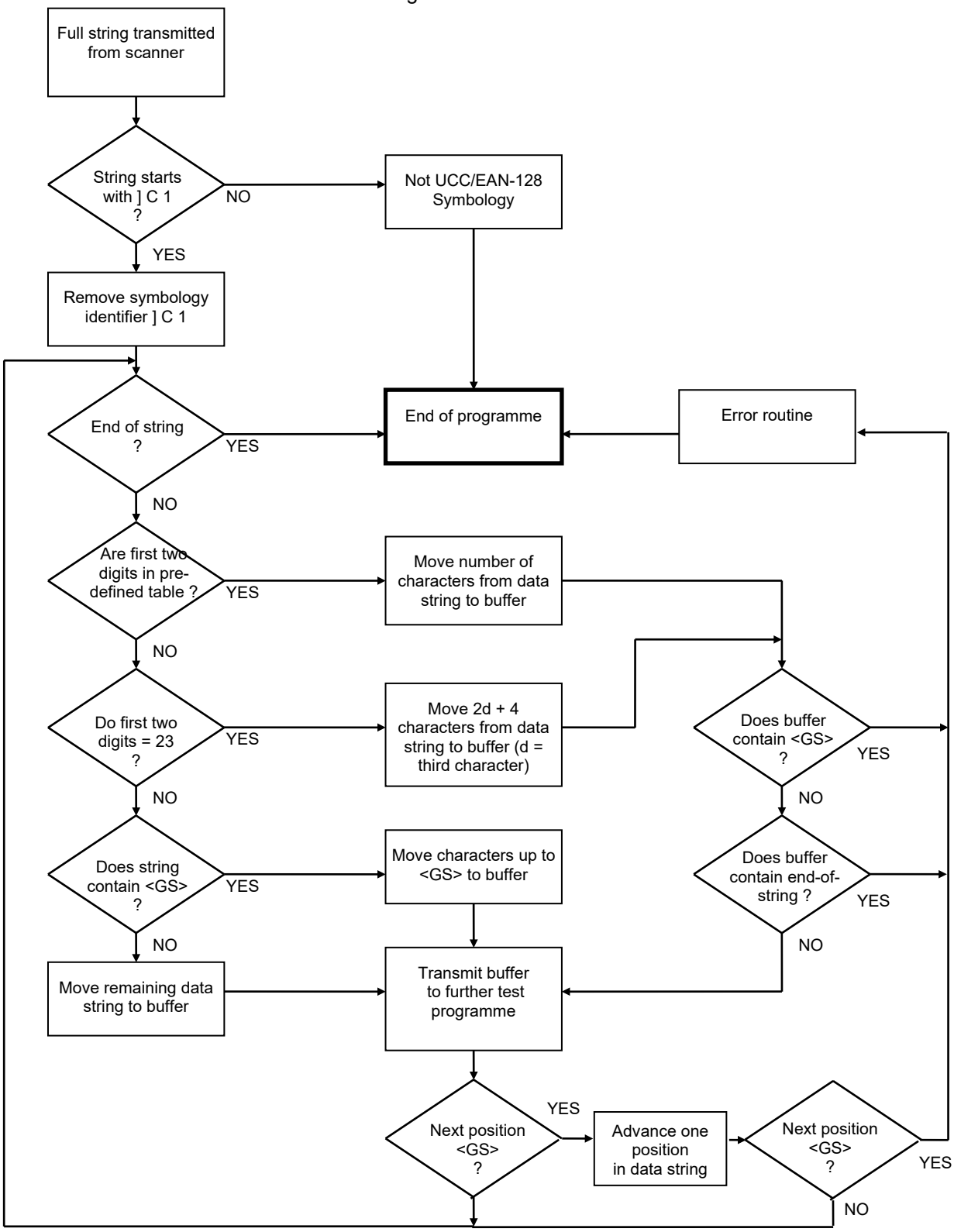
## 7.9 Processing of Data from UCC/EAN-128 Bar Code Symbols

Figure 7.9 – 1





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### 7.9.1 General

UCC/EAN-128 Bar Code Symbols may represent several Element Strings in concatenated form (see Section 5.0). For processing as shown in Figure 7.3 – 1, it is necessary to separate each Element String, which is performed by the processing routine illustrated in Figure 7.9 – 1.

### 7.9.2 Element Strings with Pre-Defined Lengths using Application Identifiers

Representation of more than one Element String in a UCC/EAN-128 Bar Code Symbol requires the use of a separator character between the different Element Strings to mark their end. In UCC/EAN-128 Symbology, this is the ~~Function 1 Character~~Function Code 1 (FNC1). For details, see Section 5.0.

However, in order to enable printing of shorter bar code symbols, some Element Strings have been pre-defined in length, so that their end may be determined, and the FNC1 is not needed. These Element Strings, are shown in Figure 5.3.8.2.1

### 7.9.3 The ~~Function 1 Character~~Function Code 1 (FNC1)

Only when used as a separator character is the ~~Function 1 Character~~Function Code 1 (FNC1) transmitted in the decoded data string as <GS> (ASCII character 29, seven-bit character set ISO 646). All Element Strings of variable length and those of fixed length not stated in Figure 5.3.8.2.1 – 1 must be followed by an FNC1 when followed by another Element String in a single bar code symbol. An FNC1 is not required at the end of the last Element String represented in a bar code symbol.


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# Section 8.0:
# Glossary of Terms

| | |
|---|---|
| Add-On Symbol | A bar code symbol used to encode information supplementary to that in the main bar code symbol. |
| AI | Abbreviation for Application Identifier. |
| AIDC | Abbreviation for Automatic Identification and Data Capture. |
| alphanumeric (an) | Describes a character set that contains alphabetic characters (letters), numeric digits (numbers), and other characters, such as punctuation marks. |
| ANSI | Abbreviation for American National Standards Institute. |
| aperture | A physical opening that is part of the optical path in a device such as a scanner, photometer, or camera. Most apertures are circular, but they may be rectangular or elliptical. |
| Application Identifier | The field of two or more characters at the beginning of an Element String that uniquely defines its format and meaning. |
| ASC X12 | Accredited Standards Committee X12. ASC X12 is responsible for developing American National Standards for Electronic Data Interchange (EDI). |
| Asset Type | A number assigned by the owner of an asset to uniquely identify a type of asset. |
| attribute | A piece of information reflecting a characteristic related to an identification number (e.g., Global Trade Item Number™ (GTIN™), SSCC). |
| autodiscrimination | The capability of a reader to automatically recognise and decode multiple bar code symbologies. |
| auxiliary guard patterns | Components of the EAN/UPC Symbology. The centre guard bar pattern, the left guard bar pattern, and the right bar patterns that are represented in some of the symbols are specific types of auxiliary guard pattern. |
| auxiliary pattern | See auxiliary guard pattern |
| bar gain/loss | The increase/decrease in bar width due to effects of the reproduction and printing processes. |
| Bearer Bars | Bars surrounding a bar code symbol to prevent misreads or to improve print quality of the bar code symbol. |
| billing unit | An item that is priced and invoiced in trade between two parties at any point in the supply chain. |


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| | |
|---|---|
| brand owner | The party that is responsible for allocating EAN.UCC System numbering and bar code symbols on a given trade item. The administrator of an EAN.UCC Company Prefix. |
| carrier | The party that provides freight transportation services or a physical or electronic mechanism that carries data. |
| Check Digit | A digit calculated from the other digits of an Element String, used to check that the data has been correctly composed. (See EAN.UCC Check Digit Calculation.) |
| Clear Area | See Quiet Zone. |
| Company Number | A component of the EAN.UCC Company Prefix. EAN Member Organisations and the Uniform Code Council (UCC™) assign EAN.UCC Company Prefixes to entities that administer the allocation of EAN.UCC System identification numbers. These entities may be, for example, commercial companies, not for profit organisations, governmental agencies, and business units within organisations. Criteria to qualify for the assignment of an EAN.UCC Company Prefix are set by the EAN Member Organisations and the UCC. |
| Composite Component™ ® | This term is used to refer to either a linear or 2D symbol component within a composite symbol. |
| Composite Symbology™ ® | An EAN.UCC System composite symbol consists of a linear component (encoding the item's primary identification) associated with an adjacent 2D Composite Component™ (encoding supplementary data, such as a batch number or expiration date). The composite symbol always includes a linear component so that the primary identification is readable by all scanning technologies, and so that 2D imager scanners can use the linear component as a finder pattern for the adjacent 2D Composite Component™. The composite symbol always includes one of three multi-row 2D Composite Component™ versions (e.g., CC-A, CC-B, CC-C) for compatibility with linear- and area-CCD scanners and with linear and rastering laser scanners. |
| concatenation | The representation of several Element Strings in one bar code symbol. |
| contrast | See Symbol Contrast. |
| coupon | A voucher that can be redeemed at the Point-of-Sale for a cash value or free item. |
| customer | The party that receives, buys, or consumes an item or service. |
| data carrier | A means to represent data in a machine readable form; used to enable automatic reading of the Element Strings. |
| data character | A letter, digit, or other symbol represented in the data field(s) of an element string. |
| data field | The smallest part of the data part of an Element String that needs to be distinguished. |

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| | |
|---|---|
| Data Standard | The entirety of all EAN.UCC System data standardised in meaning and structure. |
| data structure | The Uniform Code Council (UC~~C~~™®) and EAN International data structures defined in the various lengths required for the different identification purposes, which all share a hierarchical composition. Their composition blends the needs of international control with the needs of the user. |
| data titles | A standard abbreviated description of a data field; used to denote the Human Readable Interpretation of encoded data. |
| Default Front | The side of a consumer trade item that is used to capture dimensional attributes for the purpose of data alignment. |
| direct print | A process in which the printing apparatus prints the symbol by making physical contact with a substrate (e.g., flexography, ink jet, dot peening). |
| DUN-14 (Despatch Unit Number) | See EAN/UCC-14 Identification Number. |
| EAN | Abbreviation of EAN International. |
| EAN International | EAN International, based in Brussels, Belgium, is an organisation of EAN Member Organisations that jointly manages the EAN.UCC System with the Uniform Code Council (UCC™®). |
| EAN Member Organisation | A member of EAN International that is responsible for administering the EAN.UCC System in its country (or assigned area) and for managing the correct use of the EAN.UCC System by its member companies. |
| EAN.UCC Check Digit Calculation | An EAN.UCC System algorithm for the calculation of a Check Digit to verify accuracy of data decoded from a bar code symbol. |
| EAN.UCC Common Currency Coupon Code | An identification number for coupons issued in a common currency area (e.g., the euro currency) that uses the EAN/UCC-13 Data Structure. |
| EAN.UCC Company Prefix | Part of the international EAN.UCC System data structures consisting of an EAN.UCC Prefix and a Company Number, both of which are allocated by either the Uniform Code Council (UCC™) or an EAN International Member Organisation. |
| EAN.UCC Coupon Code | An identification number for coupons issued in a national currency that uses the EAN/UCC-13 Data Structure. |
| EAN.UCC Prefix | A number with two or more digits, co-administered by EAN International and the Uniform Code Council (UCC™®), denoting the format and meaning of a particular Element String. |
| EAN.UCC System | The specifications, standards, and guidelines co-administered by EAN International and the Uniform Code Council (UCC™®). |


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| | |
|---|---|
| EAN/UCC-13 Data Structure | The 13-digit EAN.UCC System data structure composed of an EAN.UCC Company Prefix and Check Digit as well as an Item Reference, Location Reference, or Asset Type. |
| EAN/UCC-13 Identification Number | The EAN.UCC System identification number comprising 13 digits; used to identify trade items, locations, and special applications (e.g., coupons). |
| EAN/UCC-14 Data Structure | The 14-digit EAN.UCC System data structure composed of an Indicator, EAN.UCC Company Prefix, Item Reference, and a Check Digit. |
| EAN/UCC-14 Identification Number | The EAN.UCC System identification number comprising 14 digits; used to identify trade items. |
| EAN/UCC-8 Data Structure | The eight-digit EAN.UCC System data structure composed of an EAN/UCC-8 Prefix, Item Reference, and Check Digit. |
| EAN/UCC-8 Identification Number | The EAN.UCC System identification number comprising eight digits used to identify trade items and special applications. |
| EAN/UCC-8 Prefix | A one-, two-, or three-digit index number, co-administered by EAN International and the Uniform Code Council (UCC™), denoting the area of distribution of trade items identified by an EAN/UCC-8 Identification Number. |
| EAN/UPC Composite Symbology™® Family | A family of bar code symbols comprised of the UPC-A Composite Symbology™®, UPC-E Composite Symbology™®, EAN-8 Composite Symbology™®, and EAN-13 Composite Symbology™®. |
| EAN/UPC Symbology | A family of bar code symbols including EAN-8, EAN-13, UPC-A, and UPC-E Bar Code Symbols. Although UPC-E Bar Code Symbols do not have a separate Symbology Identifier, they act like a separate symbology through the scanning application software. See also EAN-8 Bar Code Symbol, EAN-13 Bar Code Symbol, UPC-A Bar Code Symbol, and UPC-E Bar Code Symbol. |
| EAN-13 Bar Code Symbol | A bar code symbol of the EAN/UPC Symbology that encodes EAN/UCC-13 Identification Numbers. |
| EAN-13 Composite Symbology™® | The Composite Symbology™® that utilises an EAN-13 Bar Code Symbol as the linear component. |
| EAN-8 Bar Code Symbol | A bar code symbol of the EAN/UPC Symbology that encodes EAN/UCC-8 Identification Numbers. |
| EAN-8 Composite Symbology™® | The Composite Symbology™® that utilises an EAN-8 Bar Code Symbol as the linear component. |
| EANCOM® | The international Electronic Data Interchange (EDI) standard provided by EAN International, conforming to the UN/EDIFACT standard. |
| EDI | Abbreviation for Electronic Data Interchange. |


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| | |
|---|---|
| Electronic Commerce | The conduct of business communications and management through electronic methods, such as Electronic Data Interchange (EDI) and automated data collection systems. |
| Electronic Message | A composition of Element Strings from scanned data and transaction information assembled for data validation and unambiguous processing in a user application. |
| Element String | A piece of data defined in structure and meaning, comprising an identification part (prefix or Application Identifier) and a data part, represented in an EAN.UCC System endorsed data carrier. |
| even parity | A characteristic of the encodation of a symbol character whereby the symbol character contains an even number of dark modules. |
| Extension digit | A digit, allocated by the user, used to increase the capacity of the Serial Reference within the SSCC (Serial Shipping Container Code). |
| fixed length | Term used to describe a data field in an Element String with an established number of characters. |
| Fixed Measure Trade Item | An item always produced in the same pre-defined version (e.g., type, size, weight, contents, design) that may be sold at any point in the supply chain. |
| FNC1 | Abbreviation for Function ~~1 Character~~Code 1. |
| Full String | The data transmitted by the bar code reader from reading a data carrier, including Symbology Identifier and Element String(s). |
| Function ~~1 Character~~Code 1 (FNC1) | A symbology element used to form the double start pattern of ~~a~~an UCC/EAN-128 Bar Code Symbol. It is also used to separate certain concatenated Element Strings, dependent on their positioning in the bar code symbol. |
| General Distribution Scanning | Scanning environments that include bar coded trade items packaged for transport, logistic units, assets and location tags. |
| GIAI | Abbreviation for the Global Individual Asset Identifier. |
| GLN | Abbreviation for the Global Location Number. |
| Global Individual Asset Identifier | A number that uniquely identifies an individual asset. |
| Global Location Number | A number that uses the EAN/UCC-13 Data Structure to identify physical, functional, or legal entities. |
| Global Returnable Asset Identifier | A number that uses the EAN/UCC-13 or UCC-12 Data Structure to identify Asset Type combined with an optional serial number. |
| Global Service Relation Number | A number that uses a defined structure and is used to identify a database entry for recording recurring services. |
| Global Trade Item Number™® | A Global Trade Item Number™® may use the EAN/UCC-8, UCC-12, EAN/UCC-13, or EAN/UCC-14 Data Structure. |


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| | |
|---|---|
| GRAI | Abbreviation for the Global Returnable Asset Identifier. |
| GSRN | Abbreviation for the Global Service Relation Number. |
| GTIN™® | Abbreviation for the Global Trade Item Number™®. |
| GTIN™® Format | The format in which Global Trade Item Numbers™® (GTINs™®) must be represented in a 14-digit reference field (key) in computer files to ensure uniqueness of the identification numbers. |
| Guard Bar Pattern | An auxiliary pattern of bars/spaces corresponding to start or stop patterns in bar code symbologies, and serving to separate the two halves of EAN-8, EAN-13, and UPC-A Symbols. |
| Hanging Item | Any consumer trade item that is normally presented in the store in a hanging position. |
| House Way Bill Number | A freight forwarder's document used mainly as a control for the goods within the freight forwarder's own service system. |
| Human Readable Interpretation | Characters that can be read by persons, such as letters and numbers, as opposed to symbol characters within bar code symbols, which are read by machines. |
| human translation | Text designed to support manual operations and to facilitate key entry in menu driven systems. Data titles and data content are included. |
| Indicator | A digit to complete a particular identification number or to add some sort of significance to a particular Element String. |
| Individual Asset | An entity that is part of the inventory of a given company.<br>(See also Returnable Asset.) |
| Interleaved 2 of 5 | See ITF-14 Symbol. |
| Inverse Exponent | The Application Identifier digit that denotes the implied decimal point position in an Element String. |
| ISO | Abbreviation for International Organisation for Standardisation. |
| Item Number | See Item Reference. |
| Item Reference | The part of the data structure allocated by the user to identify a trade item for a given EAN.UCC Company Prefix. |
| Item Reference Number | See Item Reference. |
| ITF Symb~~ol~~ology | The Interleaved 2 of 5 Symbology. |
| ITF-14 Bar Code Symbol | An ITF Symbol used by the EAN.UCC System to carry EAN/UCC-14 Identification Numbers. |
| LAC | Abbreviation for Local Assigned Code. |


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|---|---|
| Light Margin | See Quiet Zone. |
| Light Margin Indicator | See Quiet Zone Indicator. |
| Local Assigned Code | A particular use of the UPC-E Bar Code Symbol for restricted distribution. |
| Location Number | See Global Location Number. |
| Location Reference | A number within an Global Location Number (GLN) assigned by various parties to identify a different entity. |
| logistic measures | Measures indicating the outside dimensions, total weight, or volume inclusive of packing material of a logistic unit. Also known as gross-measures. |
| logistic unit | An item of any composition established for transport and/or storage that needs to be managed through the supply chain. It is identified with SSCC. |
| magnification | Different sizes of bar code symbols based on a nominal size and a fixed aspect ratio; stated as a percent or decimal equivalent of a nominal size. |
| Manufacturer's ID | See EAN.UCC Company Prefix. |
| Manufacturer's Number | See EAN.UCC Company Prefix. |
| measure check-digit | A digit calculated from the measure field of an Element String encoded using the EAN/UPC Symbology. Used to check that the data has been correctly composed. |
| module | The narrowest nominal width unit of measure in a bar code symbol. In certain symbologies, element widths may be specified as multiples of one module. Equivalent to X-dimension. |
| modulo | An arithmetic scheme in which the result is the remainder after division. |
| Modulo 10 | Modulo 10 creates a Check Digit according to the Modulo 10 algorithm specified in the General EAN.UCC Specifications. The following EAN.UCC Data Structures use the Modulo 10 based Check Digit: GTINs: EAN/UCC-8, UCC-12, EAN/UCC-13, and EAN/UCC-14; GLNs: UCC-12 or EAN/UCC-13; SSCCs: see AI (00) definition; GSRNs: see AI (8018) definition; Shipment Identification Number (Bill of Lading): see AI (402) definition; and GRAI: see AI (8003) definition~~; and GIST see AI (252) definition~~. |
| Modulo 103 UCC/EAN-128 Symbol Check Character | A number that results from a modulo calculation that is encoded in the UCC/EAN-128 Bar Code Symbol as a self-checking symbol character. It is created automatically by software as a symbol overhead character and is not expressed in the Human Readable Interpretation. |
| Natural Base | The side of a non-consumer trade item package that is used as a reference point for capturing dimensional attributes for the purpose of data alignment. |


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|---|---|
| Non-GTIN® Packs | A packaging level for trade items where there is no trading partner requirement for GTIN identification. If a GTIN is required, then this item becomes a retail consumer trade item or standard trade item grouping. |
| Number System Character | See UCC Prefix. |
| Numbering Organisation (NO) | See EAN Member Organisation. |
| odd parity | A characteristic of the encodation of a symbol character whereby the symbol character contains an odd number of dark modules. |
| Packaging Indicator | See Indicator. |
| Packaging Type | See Extension digit. |
| payment slip | The end customer's notification of a demand for payment for a billable service (e.g., utility bill) comprising an amount payable and payment conditions. |
| Point-of-Sale (POS) | Refers to the retail type checkout where bar code symbols are normally scanned. |
| price check-digit | A digit calculated from the price field of an Element String encoded using the EAN/UPC Symbology. Used to check that the data has been correctly composed. |
| Primary bar code | The bar code containing the identification number of the item (e.g. GTIN®, SSCC, etc.). Used to determine the placement of any additional bar code information. |
| Print Gain Gauge | A printed test pattern used to determine the print gain mean and the range of print gain (press variance) as it relates to bar widths. It may also be used throughout the print run to indicate whether the anticipated range of print gain is experienced. |
| print gain/loss | See bar gain/loss. |
| printability gauge | See Print Gain Gauge. |
| Quiet Zone | A clear space containing no ~~machine readable~~machine-readable marks, which precedes the Start Character of a bar code symbol and follows the Stop Character. Formerly referred to as "Clear Area" or "Light Margin." |
| Quiet Zone Indicator | A greater than (>) or less than (<) character, printed in the human readable field of the bar code symbol, with the tip aligned with the outer edge of the Quiet Zone. |
| Reduced Space Symbology® (RSS) | A family of bar code symbols, including RSS-14™®, RSS Limited™®, RSS Expanded™®, and RSS-14™® Stacked. Any member of the RSS family can be printed as a stand-alone linear symbol or as a composite symbol with an accompanying 2D Composite Component™® printed directly above the RSS linear component. |

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| | |
|---|---|
| Refund Receipt | A voucher produced by equipment handling empty containers (bottles and crates). |
| restricted distribution | Signifies that such system data may be applied on goods to be processed only in certain environments, defined by the Uniform Code Council (UCC™®) or the appropriate EAN International Member Organisation (e.g., a country, company, industry). |
| retail consumer trade item | The trade item intended to be sold to the end consumer at retail Point-of-Sale. They are identified with a unique EAN/UCC-13, UCC-12, or EAN/UCC-8 GTIN. |
| Retailer Zero-Suppression Code | A group of 4,500 ID numbers (separate from Local Assigned Codes), that enable the use of UPC-E Bar Codes in a closed system environment (not for open supply chain applications). |
| Returnable Asset | A reusable entity owned by a company that is used for transport and storage of goods. |
| RSS Composite Symbology™® Family | A family of symbols comprised of the RSS-14™® Composite Symbology™®, RSS-14™® Stacked Composite Symbology™®, RSS Limited™® Composite Symbology™®, and RSS Expanded™® Composite Symbology™®. |
| RSS Expanded™® Bar Code Symbol | A bar code symbol that encodes an EAN/UCC-14 Identification Number plus supplementary AI Element Strings, such as weight and "best before" date, in a linear symbol that can be scanned omnidirectionally by suitably programmed Point-of-Sale scanners. |
| RSS Expanded™® Composite Symbology™® | The RSS Composite Symbology™® that utilises an RSS Expanded™® Bar Code Symbol as the linear component. |
| RSS Expanded™® Stacked Bar Code Symbol | A bar code symbol that is a variation of the RSS Expanded™® Bar Code Symbol that is stacked in multiple rows and is used when the normal symbol would be too wide for the application. |
| RSS Expanded™® Stacked Composite Bar Code Symbol | The RSS Composite Symbology™® that utilises an RSS Expanded™® Stacked Bar Code Symbol as the linear component. |
| RSS Limited™® Bar Code Symbol | A bar code symbol that encodes an EAN/UCC-14 Identification Number with Indicators of zero or one in a linear symbol; for use on small items that will not be scanned at the Point-of-Sale. |
| RSS Limited™® Composite Symbology™® | The RSS Composite Symbology™® that utilises an RSS Limited™® Bar Code Symbol as the linear component. |
| RSS-14™® Bar Code Symbol | A bar code symbol that encodes an EAN/UCC-14 Identification Number in a linear symbol that can be scanned omnidirectionally by suitably programmed Point-of-Sale scanners. |


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|---|---|
| RSS-14™® Composite Symbology™® | The RSS Composite Symbology™® that utilises an RSS-14™® Bar Code Symbol as the linear component. |
| RSS-14™® Stacked Bar Code Symbol | A bar code symbol that is a variation of the RSS-14™® Symbology that is stacked in two rows and is used when the normal symbol would be too wide for the application. It comes in two versions: a truncated version used for small item marking applications and a taller omnidirectional version that is designed to be read by omnidirectional scanners. RSS Expanded™® can also be printed in multiple rows as a stacked symbol. |
| RSS-14™® Stacked Composite Symbology™® | The RSS Composite Symbology®™ that utilises an RSS-14™® Stacked Bar Code Symbol as the linear component. |
| RZSC | Abbreviation for Retailer Zero-Suppression Code. |
| scanner | An electronic device to read bar code symbols and convert them into electrical signals understandable by a computer device. |
| Separator Character | Function ~~1 Character~~Code 1 used to separate certain concatenated Element Strings, dependent on their positioning in the UCC/EAN-128 Bar Code Symbol. |
| Serial Reference | The part of the data structure allocated by the user that, in conjunction with the Extension digit, establishes a unique SSCC for a given EAN.UCC Company Prefix. |
| Serial Shipping Container Code | See SSCC. |
| special characters | Special characters are designated by the symbology specification. For UCC/EAN-128 symbology the special characters are the last 7 characters of codes sets A and B or the last 3 characters for code set C. |
| SSCC | Term used for the Serial Shipping Container Code. The unique identification of a logistic unit using an 18-digit data structure. |
| SSCC Serial Number | See Serial Reference. |
| standard numbering structures | See data structure. |
| standard trade item grouping | A standard composition for a trade item(s) that is not intended for Point-of-Sale scanning. They are identified with a unique EAN/UCC-14, EAN/UCC-13, or UCC-12 GTIN. |
| substrate | The material on which a bar code symbol is printed. |
| supplier | The party that produces, provides, or furnishes an item or service. |
| symbol | The combination of symbol characters and features required by a particular symbology, including Quiet Zone, Start and Stop Characters, data characters, and other auxiliary patterns, which together form a complete scannable entity; an instance of a symbology and a data structure. |



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| | |
|---|---|
| symbol character | A group of bars and spaces in a symbol that is decoded as a single unit. It may represent an individual digit, letter, punctuation mark, control indicator, or multiple data characters. |
| Symbol Check Character | A symbol character or set of bar/space patterns included within a UCC/EAN-128 or RSS Symbol, the value of which is used by the bar code reader for the purpose of performing a mathematical check to ensure the accuracy of the scanned data. It is not shown in Human Readable Interpretation. It is not input to the bar code printer and is not transmitted by the bar code reader. |
| Symbol Contrast | An ISO 15416 parameter that measures the difference between the largest and smallest reflectance values in a Scan Reflectance Profile (SRP). |
| Symbol Control Character | See symbology element. |
| symbology | A defined method of representing numeric or alphabetic characters in a bar code; a type of bar code. |
| symbology element | A character or characters in a bar code symbol used to define the integrity and processing of the symbol itself (e.g., start and stop patterns). These elements are symbology overhead and are not part of the data conveyed by the bar code symbol. |
| Symbology identifier | A sequence of characters transmitted with the decoded data that identifies the data carrier from which the data has been decoded. |
| 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. |
| trade measures | Net measures of Variable Measure Trade Items as used for invoicing (billing) the trade item. |
| transaction type | Information (not part of the EAN.UCC System) denoting the particular operation in connection with which the scanned data has been captured. |
| 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 Uniform Code Council (UCC™®). |
| UCC Coupon Code | An identification number for coupons issued in a national currency that uses the UCC-12 Data Structure. |
| UCC Prefix | A one-digit index number administered by the Uniform Code Council (UCC™®), denoting the format and meaning of a particular Element String contained within the UCC-12 Data Structure. |
| UCC/EAN-128 Bar Code Symbol | A subset of the Code 128 that is utilised exclusively for UCC.EAN System data structures. |


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| UCC/EAN-128 Composite Symbology™® | A Composite Symbology® ™ that utilises aan UCC/EAN-128 Bar Code Symbol as the linear component. |
| UCC/EAN-128 Coupon Extended Code | A supplemental bar code that can be printed on a coupon next to the primary UCC Coupon Code to provide additional information, such as Offer Codes, expiration dates, and household identification numbers. |
| UCC-12 Data Structure | The 12-digit EAN.UCC System data structure composed of a UCC Company Prefix, Item Reference, and Check Digit. |
| UCC-12 Identification Number | The EAN.UCC System identification number comprising 12 digits; used to identify trade items, locations, and special applications (e.g., coupons). |
| UCC™® | Abbreviation for the Uniform Code Council. |
| Uniform Code Council, Inc.® | The Uniform Code Council (UCC™®), based in the United States, is a membership organisation that jointly manages the EAN.UCC System with EAN International. The UCC also administers the EAN.UCC System in the United States and Canada. |
| unrestricted distribution | Signifies that such system data may be applied on goods to be processed anywhere in the world without restraint as to such things as country, company, and industry. |
| UPC-A Bar Code Symbol | A bar code symbol of the EAN/UPC Symbology that encodes UCC-12 Identification Numbers. |
| UPC-A Composite Symbology™® | The EAN.UCC Composite Symbology™® that utilises a UPC-A Bar Code Symbol as the linear component. |
| UPC-E Bar Code Symbol | A bar code symbol of the EAN/UPC Symbology representing a UCC-12 Identification Number in six explicitly encoded digits using zero-suppression techniques. |
| UPC-E Composite Symbology™® | The EAN.UCC Composite Symbology™® that utilises a UPC-E Bar Code Symbol as the linear component. |
| validation of data | Verification of scanned data to determine whether it meets the application rules for system logic and consistency and/or a particular user's requirements, prior to processing in EDP applications. |
| Variable Measure Trade Item | An item always produced in the same pre-defined version (e.g., type, design, packaging) 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. |
| wide-to-narrow ratio | The ratio between the wide elements and the narrow elements in a bar code symbology, such as ITF-14, which has two different element widths. |
| X-dimension | The specified width of the narrow element in a bar code symbol. |

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