



BSI Standards Publication

**Information technology — Automatic
identification and data capture techniques —
EAN/UPC bar code symbology specification**

National foreword

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**Information technology —
Automatic identification and data
capture techniques — EAN/UPC bar
code symbology specification**

*Technologies de l'information — Techniques automatiques
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symbologie de code à barres EAN/UPC*

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This third edition cancels and replaces the second edition (ISO/IEC 15420:2009), which has been technically revised.

The main changes are as follows:

- terminology and dimensions have been updated to align with latest GS1 General Specifications;
- clarification on what is defined in this document compared to an application standard has been added;
- example barcodes have been revised to use GS1 company prefixes reserved for examples;
- verification lighting has been changed from 670 nm to 660 nm to align with GS1 General Specifications.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

The technology of bar coding is based on the recognition of patterns encoded in bars and spaces of defined dimensions. There are numerous methods of encoding information in bar code form, known as symbologies. EAN/UPC is one such symbology. The rules defining the translation of characters into bar and space patterns, and other essential features of each symbology, are known as the symbology specification.

This document is intended to be used alongside the GS1 General Specifications. The administration of the numbering system by GS1 ensures that identification codes assigned to particular items are unique worldwide and are defined in a consistent way. The major benefit for the users of the GS1 system¹⁾ is the availability of uniquely defined identification codes for use in their trading transactions. [Annex C](#) gives an overview of the GS1 system.

NOTE GS1 is the worldwide association encompassing the organizations formerly known as EAN International and Uniform Code Council (UCC).

Manufacturers of bar code equipment and users of bar code technology require publicly available standard symbology specifications to which they can refer when developing equipment and software.

1) The GS1 system are specifications, standards, and guidelines administered by GS1.

Information technology — Automatic identification and data capture techniques — EAN/UPC bar code symbology specification

1 Scope

This document specifies the requirements for the bar code symbology known as EAN/UPC. This document specifies EAN/UPC symbology characteristics, data character encodation, dimensions, tolerances, decoding algorithms and parameters to be defined by applications. It specifies the symbology identifier prefix strings for EAN/UPC symbols.

Data content and the rules governing the use of this symbology are outside the scope of this document; they are defined in GS1 General Specifications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

ISO/IEC 15416, *Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols*

ISO/IEC 19762, *Information technology — Automatic identification and data capture (AIDC) techniques — Vocabulary*

GS1 General Specifications (GS1, Brussels, Belgium)²⁾

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 auxiliary pattern

pattern of bars and spaces representing non-data components of the symbol

EXAMPLE Guard patterns and inter-character delineators.

3.2 GTIN Global Trade Item Number

GS1 identification key that is used for the unique identification of trade items worldwide and which may be 8, 12, 13 or 14 digits in length

²⁾ Available at www.gs1.org.

3.3

number set

series of ten bar and space patterns of either even or odd parity encoding the digits 0 to 9

4 Requirements

4.1 Symbology characteristics

The characteristics of EAN/UPC are:

- a) encodable character set: numeric (0 to 9) i.e. ASCII characters 48 to 57 inclusive, according to ISO/IEC 646;
- b) symbology type: continuous;
- c) elements per symbol character: 4, comprising 2 bars and 2 spaces, each of 1, 2, 3 or 4 modules in width (auxiliary patterns have differing numbers of elements);
- d) character self-checking: yes;
- e) data string length encodable: fixed (8, 12 or 13 characters including check digit depending on specific symbol type);
- f) omni-directionally decodable: yes;
- g) symbol check digit: one, mandatory (see [Clause A.1](#));
- h) symbol character density: 7 modules per symbol character;
- i) non-data overhead not including the check digit or quiet zones:
 - 11 modules for EAN-13, EAN-8 and UPC-A symbols;
 - 9 modules for UPC-E symbols.

4.2 Symbol structure

4.2.1 Symbol types

There are four types of the EAN/UPC symbol:

- EAN-13, UPC-A and UPC-E, all of which may be accompanied by an add-on symbol;
- EAN-8.

The four symbol types are described in [4.2.3.1](#) to [4.2.3.4](#) and the optional add-on symbols are described in [4.2.3.5](#).

4.2.2 Symbol encodation

4.2.2.1 Symbol characters

Symbol characters shall encode digit values in 7-module characters selected from different number sets known as A, B and C, as in [Table 1](#).

Table 1 — Number sets A, B and C^a

Digit value	Set A element widths ^a				Set B element widths ^a				Set C element widths ^a			
	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
Key S space (light) B bar (dark) ^a The element widths are in modules.												

[Annex D](#) illustrates [Table 1](#) graphically. The sum of the 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.

Symbol characters in number sets A and B always begin on the left with a light 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 below (see [4.2.3.1](#), [4.2.3.4](#) and [4.2.3.5](#)), the combination of number sets in a symbol may itself represent either data or a check value. This technique is referred to as variable parity encodation.

4.2.2.2 Auxiliary pattern encodation

Auxiliary patterns shall be composed as shown in [Table 2](#).

Table 2 — Auxiliary patterns

Auxiliary pattern	Number of modules	Element widths in modules ^a					
		S	B	S	B	S	B
Normal guard pattern	3		1	1	1		
Centre guard pattern	5	1	1	1	1	1	
Special guard pattern	6	1	1	1	1	1	1
Add-on guard pattern	4		1	1	2		
Add-on delineator	2	1	1				
Key S space (light) B bar (dark) ^a The element widths are in modules.							

[Annex D](#) illustrates these patterns graphically.

The normal guard pattern corresponds to the start and stop patterns in other symbologies. The special guard pattern is used as a stop pattern in UPC-E symbols.

4.2.3 Symbol formats

4.2.3.1 EAN-13 symbols

The EAN-13 symbol shall be made up as follows, reading from left to right:

- a left quiet zone;
- a normal guard pattern;
- 6 symbol characters from number sets A and B in accordance with [Table 3](#);
- a centre guard pattern;
- 6 symbol characters from number set C;
- a normal guard pattern;
- a right quiet zone.

The rightmost symbol character shall encode the check digit calculated in accordance with [Clause A.1](#).

Since the EAN-13 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 6 symbol characters in the left half of the symbol. The coding system for values of the leading digit is specified in [Table 3](#). [Figure 1](#) is an example of an EAN-13 bar code symbol.

NOTE UPC-A bar patterns (see [4.2.3.3](#)) are a subset of EAN-13, although the human-readable information, the symbol layout and the quiet zone requirements (see [4.3.4](#)) differ.

Table 3 — Left half of EAN-13 symbol

Leading digit, implicitly encoded	Number sets used for coding left half of EAN-13 symbol for the symbol character position					
	1	2	3	4	5	6
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
9	A	B	B	A	B	A

NOTE 13-digit strings printed in EAN-13 begin with a number from 1 to 9. 13-digit strings that begin with 0 (e.g., GTIN-12) are printed using UPC-A or UPC-E.



Figure 1 — EAN-13 bar code symbol

4.2.3.2 EAN-8 symbols

The EAN-8 symbol shall be made up as follows, reading from left to right:

- a left quiet zone;
- a normal guard pattern;
- 4 symbol characters from number set A;
- a centre guard pattern;
- 4 symbol characters from number set C;
- a normal guard pattern;
- a right quiet zone.

The rightmost symbol character shall encode the check digit calculated in accordance with [Clause A.1](#). [Figure 2](#) shows an example of an EAN-8 bar code symbol.



Figure 2 — EAN-8 bar code symbol

4.2.3.3 UPC-A symbols

The UPC-A symbol shall be made up as follows, reading from left to right:

- a left quiet zone;

- a normal guard pattern;
- 6 symbol characters from number set A;
- a centre pattern;
- 6 symbol characters from number set C;
- a normal guard pattern;
- a right quiet zone.

The rightmost symbol character shall encode the check digit calculated in accordance with [Clause A.1](#). [Figure 3](#) shows an example of a UPC-A bar code symbol.

A UPC-A encodes a GTIN-12 data structure.



Figure 3 — UPC-A bar code symbol

4.2.3.4 UPC-E symbols

4.2.3.4.1 UPC-E symbol structure

The UPC-E symbol shall be made up as follows, reading from left to right:

- a left quiet zone;
- a normal guard pattern;
- 6 symbol characters from number sets A and B in accordance with [Table 8](#);
- a special guard pattern;
- a right quiet zone.

The UPC-E symbol shall only be used to encode GTIN-12 data structures which commence with a zero and contain a sequence of four or five zeroes in defined positions, as shown in [Table 9](#). These zeros are removed from the data during encoding by the process of zero suppression described in [4.2.3.4.2](#). [Figure 4](#) shows an example of a UPC-E bar code symbol.