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

*Technologies de l'information — Techniques automatiques  
d'identification et de capture des données — Spécification de  
symbologie de code à barre 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. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15420 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This second edition cancels and replaces the first edition (ISO/IEC 15420:2000), which has been technically revised.

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## 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 International Standard serves as a normative reference in the “GS1 General Specifications”. The administration of the numbering system by GS1 ensures that identification codes assigned to particular items are unique world-wide and are defined in a consistent way. The major benefit for the users of the GS1 system 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.

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

## 1 Scope

This International Standard specifies the requirements for the bar code symbology known as EAN/UPC. It 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 International Standard; they are defined in the GS1 General Specifications (see bibliography).

## 2 Normative references

The following referenced documents are indispensable for the application 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 646:1991, *Information technology — ISO 7-bit coded character set for information interchange*

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

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-2, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 2: Optically readable media (ORM)*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1, ISO/IEC 19762-2 and the following apply.

### 3.1

#### add-on symbol

symbol used to encode information supplementary to that in the main symbol which it accompanies

### 3.2

#### auxiliary pattern

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

EXAMPLE guard patterns and inter-character delineators

- 3.3 delineator**  
auxiliary pattern used to separate characters within an add-on symbol
- 3.4 even parity**  
characteristic of the encodation of a symbol character whereby the character contains an even number of dark modules
- 3.5 GS1 member organization**  
agency responsible for the administration of the GS1 system and maintenance of a number bank within a defined territory
- 3.6 GS1 System**  
specifications, standards, and guidelines administered by GS1
- 3.7 GTIN**  
Global Trade Item Number  
number that is used for the unique identification of trade items worldwide and which may be 8, 12, 13 or 14 digits in length
- 3.8 guard pattern**  
auxiliary pattern of bars/spaces corresponding to start or stop patterns in other symbologies, or serving to separate the two halves of a symbol
- 3.9 magnification factor**  
constant multiplier of the nominal dimensions of an EAN/UPC symbol
- 3.10 number set**  
series of ten bar/space patterns of either even or odd parity encoding the digits 0 to 9
- 3.11 odd parity**  
characteristic of the encodation of a symbol character whereby the character contains an odd number of dark modules
- 3.12 variable parity encodation**  
process of encoding additional information in a series of symbol characters by using particular combinations of odd and even parity characters to implicitly encode digits or for checking purposes
- 3.13 zero-suppression**  
process of removing zeroes from specified positions in a GTIN-12 data string in order to encode it in UPC-E format

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## 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 - 57 inclusive, in accordance with 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 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

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### 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

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), B denotes a bar (dark), and the element widths are in modules.

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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.

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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					
		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				

NOTE S denotes a space (light) element, B denotes a bar (dark) element.

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 Annex 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					
	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.

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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 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 Annex A.1. Figure 2 shows an example of an EAN-8 bar code symbol.



Figure 2 — EAN-8 bar code symbol  
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#### 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 Annex A.1. Figure 3 shows an example of a UPC-A bar code symbol.

A UPC-A symbol implicitly encodes a digit zero (0) as a prefix to the GTIN-12 data structure.