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Information technology — Automatic identification and data capture techniques — Interleaved 2 of 5 bar code symbology specification

Technologies de l'information — Techniques d'identification automatique et de capture des données — Spécifications des symbologies des codes à barres, code 2 parmi 5 entrelacé

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Foreword

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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 16390 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 16390:1999), 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. Interleaved 2 of 5 is one such symbology. The rules defining the translation of characters into bar and space patterns and other essential features are known as the symbology specification.

In the past, symbology specifications were developed and published by a number of organizations, resulting in certain instances in conflicting requirements for certain symbologies.

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 application standards.

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Information technology — Automatic identification and data capture techniques — Interleaved 2 of 5 bar code symbology specification

1 Scope

This International Standard specifies the requirements for the bar code symbology known as Interleaved 2 of 5; it specifies Interleaved 2 of 5 symbology characteristics, data character encodation, dimensions, tolerances, decoding algorithms and parameters to be defined by applications. It specifies the Symbology Identifier prefix strings for Interleaved 2 of 5 symbols.

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.

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ISO 646, *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*

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ISO/IEC 15424, *Information technology — Automatic identification and data capture techniques — Data carrier identifiers (including Symbology Identifiers)*

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 and ISO/IEC 19762-2 apply.

4 Requirements

4.1 Symbology characteristics

The characteristics of Interleaved 2 of 5 are:

a) Encodable character set: numeric 0 to 9 (ASCII characters 48 - 57 inclusive, in accordance with ISO/IEC 646);

b) Code type: continuous;

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c) Elements per symbol character: 5, of which 2 wide and 3 narrow, encoded as either five bars or five spaces;

d) Character self-checking: yes;

e) Data string length encodable: variable (even number of digits);

f) Bidirectionally decodable: yes;

g) Symbol check character: one, optional (see annex A);

h) Symbol character density: 14 to 18 modules per symbol character pair, depending on wide/narrow ratio;

i) Non-data overhead: 8 to 9 modules, depending on wide/narrow ratio.

4.2 Symbol structure

Interleaved 2 of 5 symbols shall comprise:

a) leading quiet zone;

b) start pattern;

c) one or more pairs of symbol characters representing data (inclusive of optional symbol check character);

d) stop pattern;

e) trailing quiet zone.

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4.3 Character encodation

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4.3.1 Symbol character structure

Data is encoded as interleaved pairs of symbol characters, the first of which comprises two wide and three narrow bars and the second of which comprises two wide and three narrow spaces, the first bar of the first character being followed by the first space of the second character, then the second bar of the first character and the second space of the second character, and so on until the last space of the second character, which is directly followed by the first bar of the next symbol character pair (or stop pattern).

4.3.2 Data character encodation

Table 1 defines the Interleaved 2 of 5 character encodation. In the columns headed "Binary representation" the character 1 is used to represent a wide element and 0 a narrow element.

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Table 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

Table 1 uses a modified binary coded decimal encoding scheme. The four left-most 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 the data character 0, where the weights 4 and 7 are applied. The parity bit ensures that there are always two '1' bits per character.

The following algorithm defines the rules to convert numeric data into the symbol characters of an Interleaved 2 of 5 symbol:

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Step in Algorithm	Example
1) Calculate check character if required by the application standard. See 4.7; 2) If the data string, including check characters, has an odd number of digits, add a leading zero; which becomes	367 0367
3) Subdivide the numeric string into digit pairs; which becomes	0367 03 and 67
4) Encode each digit pair in turn as follows: a) Encode the leading digit of the pair into a pattern of bars as shown in Table 1; b) Encode the second digit of the pair into a pattern of spaces as shown in Table 1;	 0 (binary pattern 00110) 3 (binary pattern 11000)
5) Form each symbol character pair by taking the bar and space elements alternately from the patterns derived from steps 4 a) and 4 b), commencing with the first bar of the pattern for the first digit, followed by the first space of the pattern for the second digit.	Binary pattern 0101101000

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Figure 1 illustrates the sequence of bar and space elements corresponding to the data character pairs "03 67".

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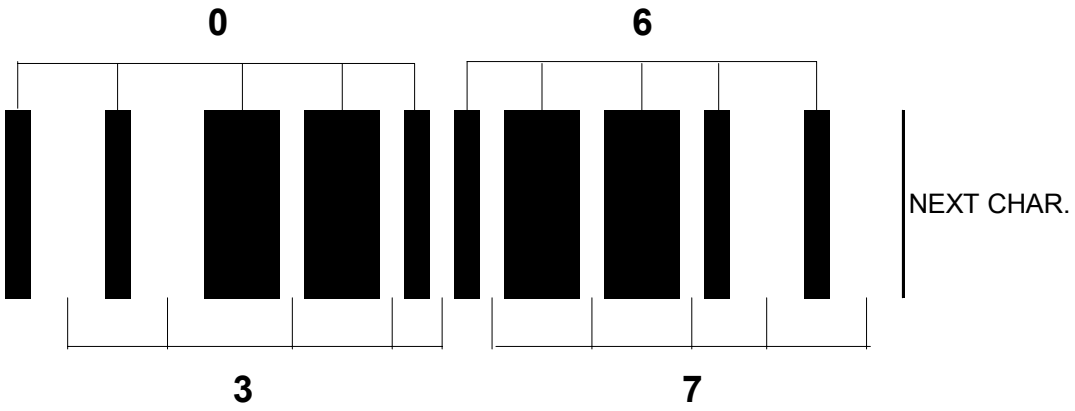


Figure 1 — Interleaved 2 of 5 character pairs, encoding "03 67"

4.3.3 Start and stop patterns

The start pattern shall consist of four narrow elements in the sequence bar - space - bar - space. The stop pattern shall consist of a wide bar - narrow space - narrow bar sequence.

The start pattern shall be positioned at the normal left end of the data symbol characters adjacent to the first bar of the most significant digit. The stop pattern shall be positioned at the normal right end of the data symbol characters adjacent to the final space 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 2 illustrates the start and stop patterns and their relationship to the symbol data characters.

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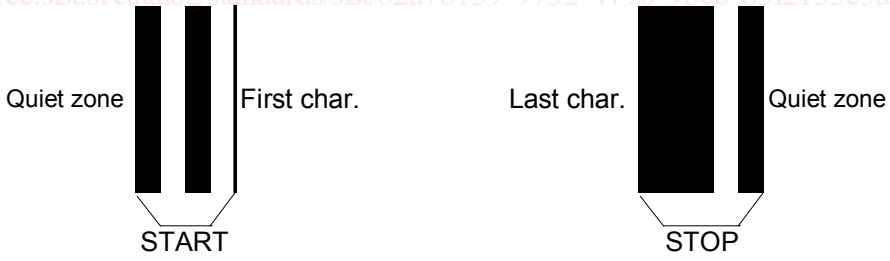


Figure 2 — Start and stop patterns

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Figure 3 illustrates a complete Interleaved 2 of 5 bar code symbol for the data "1234" showing the necessary quiet zones.

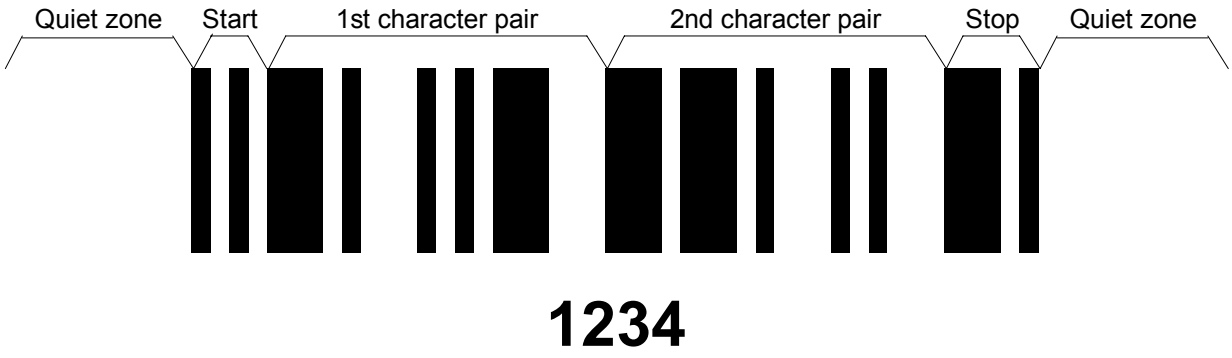


Figure 3 — Interleaved 2 of 5 symbol inclusive of quiet zones

4.3.4 Optional symbol check character

Annex A defines the check character position and calculation.

4.4 Dimensions

Interleaved 2 of 5 symbols shall use the following nominal dimensions:

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— width of narrow element (*X*): the *X* dimension of Interleaved 2 of 5 symbols should be defined by the application specification in accordance with the needs of the application in question. See 4.7.1;

— wide/narrow ratio (*N*): 2,0:1 to 3,0:1;

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— minimum width of quiet zone: 10*X*;

— recommended minimum bar code height for manual scanning: 5,0 mm or 15 % of symbol width excluding quiet zones, whichever is greater.

The width, *W* (in millimetres) of an Interleaved 2 of 5 symbol, including quiet zones, can be calculated from the following expression:

$$W = \left[P\left(4N + 6\right) + N + 6\right]X + 2Q$$

where:

W is the symbol width;

P is the number of symbol character pairs;

N is the wide/narrow ratio;

X is the width of a narrow element in millimetres;

Q is the width of the quiet zone in millimetres.

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