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Information technology — Automatic identification and data capture techniques — Aztec Code bar code symbology specification

Technologies de l'information — Techniques d'identification automatique et de capture des données — Spécification pour la symbologie de code à barres du code Aztec

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Foreword

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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 second edition cancels and replaces the first edition (ISO/IEC 24778:2008), which has been technically revised.

The main changes are as follows:

— introduction of continuous grading for fixed pattern damages (FPDs);

— grading of print growth deleted ~~here~~ and added reference to ISO/IEC 15415.

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

Aztec Code is a two-dimensional matrix symbology whose symbols are nominally square, made up of square modules on a square grid, with a square bullseye pattern at their centre. Aztec Code symbols can encode from small to large amounts of data with user-selected percentages of error correction.

Manufacturers of bar code equipment and users of the technology require publicly available standard symbology specifications to which they can refer when developing equipment and application standards. The publication of standardised symbology specifications is designed to achieve this.

Information technology — Automatic identification and data capture techniques — Aztec Code bar code symbology specification

1 Scope

This document defines the requirements for the symbology known as Aztec Code. It specifies the Aztec Code symbology characteristics, including ~~data character encodation, rules for error control encoding, the graphical symbol structure, symbol dimensions and print quality requirements, a reference decoding algorithm, and user-selectable application parameters.~~:

— data character encodation;

— rules for error control encoding;

— the graphical symbol structure;

— symbol dimensions and print quality requirements;

— a reference decoding algorithm;

— user-selectable application parameters.

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~~:1991~~, *Information technology — ISO 7-bit coded character set for information interchange*

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ISO/IEC 15415, *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Two-dimensional symbols*

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

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

AIM ~~Inc. International Technical Specification:~~ Extended Channel Interpretations (ECI~~)~~

~~—~~), Part 1~~:~~ Identification Schemes and Protocols

~~—~~AIM Extended Channel Interpretations (ECI), Part 2~~,~~: Registration Procedure ~~for Coded Character Sets and Other Data Formats~~

~~—~~ ~~Character Set~~AIM Extended Channel Interpretations (ECI), Part 3: Register

~~ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*~~

~~ISO/IEC 8859-5, *Information technology — 8-bit single-byte coded graphic character sets — Part 5: Latin/Cyrillic alphabet*~~

~~7~~3 Terms, definitions, symbols and functions

~~7.1~~3.1 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/

3.1.1
bullseye
set of concentric square rings used as the finder pattern in Aztec Code

3.1.2
checkword
codeword which is included in a symbol for either error correction ~~and/~~or error detection, or both

3.1.3
dataword
codeword which is part of the data message encoded in a symbol

3.1.4
domino
2-module sub-structure of the symbol character in Aztec Code which is the elemental entity used in graphical encoding of the symbol

3.1.5
mode message
short, fixed-length, error-corrected subsidiary message within an Aztec Code symbol which directly encodes the symbol's size and data message length

~~7.2~~3.2 Symbols and functions

~~7.2.1~~3.2.1 Mathematical symbols

For the purposes of this document, the following mathematical symbols apply.

B	the number of bits in each codeword
C_b	the symbol capacity in number of bits
C_w	the symbol capacity in number of codewords
D	the number of data (message) codewords in the symbol
K	the number of error correction codewords in the symbol, equal to $C_w - D$
L	the number of data layers (1 to 32) in the symbol, defining its size
m	the symbology identifier modifier value
x	a general variable used to express error correction polynomials
(x,y)	Cartesian coordinates within the module grid

7.2.23.2.2 Mathematical functions and operations

For the purposes of this document, the following mathematical functions and operations apply.

abs()	is the absolute value function
div	is the integer division operator
max(a,b)	is the greater of a and b
mod	is the remainder after integer division

84 Symbology characteristics

8.14.1 Basic characteristics

Aztec Code is a two-dimensional matrix symbology with the following basic characteristics:

a) Encodable character set:

1) All 8-bit values can be encoded. The default interpretation shall be:

i) values 0 to 127 in accordance with ISO/IEC 646 International Reference Version (IRV), i.e. all 128 ASCII characters;

ii) values 128 to 255 in accordance with ISO/IEC 8859-1. These are referred to as extended ASCII.

This interpretation corresponds to Extended Channel Interpretation (ECI) ECI 000003.

Additional characters may be encoded using the ECI capabilities.

2) Two non-data characters can be encoded: FNC1 for compatibility with some existing applications and ECI escape sequences for the standardized encoding of message interpretation information.

b) Representation of data: A dark module is a binary one and a light module is a binary zero.

c) Symbol size:

1) The smallest Aztec Code symbol is 15 × 15 modules square, and the largest is 151 × 151.

2.) No quiet zone is required outside the bounds of the symbol.

d.) Data capacity (at recommended error correction level):

1.) The smallest Aztec Code symbol encodes up to 13 numeric or 12 alphabetic characters or 6 bytes of data.

2.) The largest symbol encodes up to 3832 numeric or 3067 alphabetic characters or 1914 bytes of data.

e.) Selectable error correction:

1.) User-selectable, from 5 % to 95 % of the data region, with a minimum of 3 codewords.

2.) Recommended level is 23 % of symbol capacity plus 3 codewords.

f.) Code type: Matrix.

g.) Orientation independent: Yes.

~~8.2~~4.2 Summary of additional features

The following summarizes additional features that are inherent or optional in Aztec Code:

a.) Reflectance Reversal (Inherent): Though Aztec Code symbols are always shown and described in this ~~specification always~~ document with the finder's ~~center~~centre dark and with dark modules encoding binary ~~1s~~1 s throughout, symbols exhibiting the opposite reflectance characteristics are easily autodiscriminated and decoded with the standard reader.

b.) Mirror Image (Inherent): Images which contain an Aztec Code symbol in mirror reversal, either because they are obtained using a reflected optical path, a reversed scan direction, or from behind through a clear substrate, are easily autodiscriminated and decoded with the standard reader.

c.) Extended Channel Interpretation (Optional): The ECI mechanism enables characters from various character sets (e.g. Arabic, Cyrillic, Greek, Hebrew) and other data interpretations or industry-specific requirements to be represented.

d.) Structured Append (Optional): Structured Append allows files of data to be represented logically and continually in up to 26 Aztec Code symbols. The symbols may be scanned in any sequence to enable the original data to be correctly reconstructed.

e.) Reader Initialization Symbols (Optional): A distinct format of Aztec Code symbol is available for use in ~~barcode~~bar code menus for reader initialization. The encoded message in these special symbols is never passed on to an application.

f.) Aztec "Runes" (Optional): a series of 256 small, machine-readable marks compatible with Aztec Code are available for special applications. ~~See~~Normative Annex A. defines Aztec "Runes".

~~9~~5 Symbol description

~~9.1~~5.1 Basic Aztec Code properties

Aztec Code symbols are nominally square, made up of square modules on a square grid, with a square bullseye pattern at their ~~center~~centre. Figure 1 shows two representative Aztec Code symbols, a small 1-

layer symbol on the left which encodes 12 digits with 47 % error correction, and a larger 6-layer symbol on the right which encodes 168 text characters with 30 % error correction.

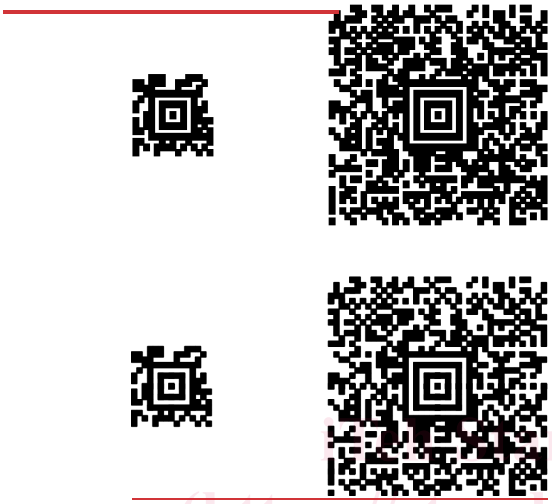


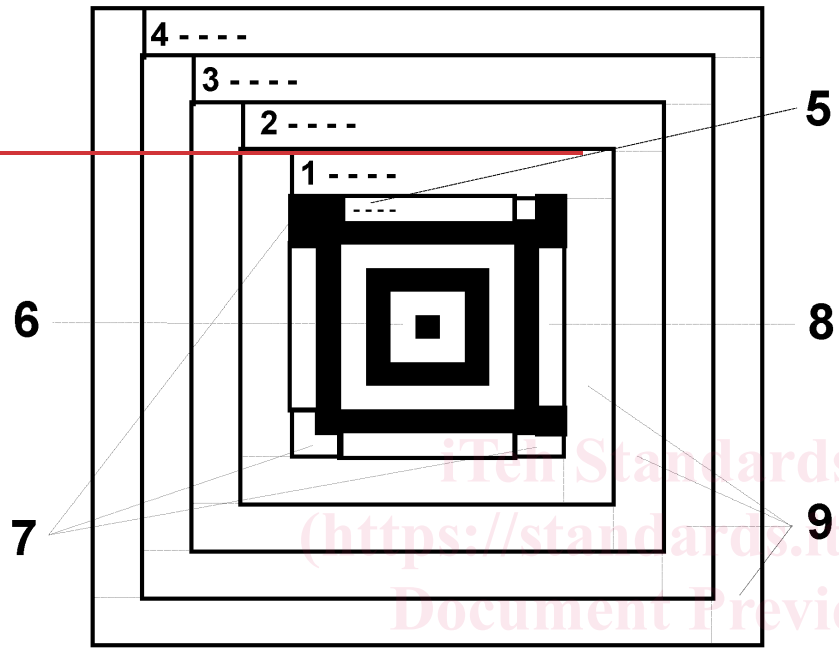
Figure 1 — Representative Aztec Code symbols

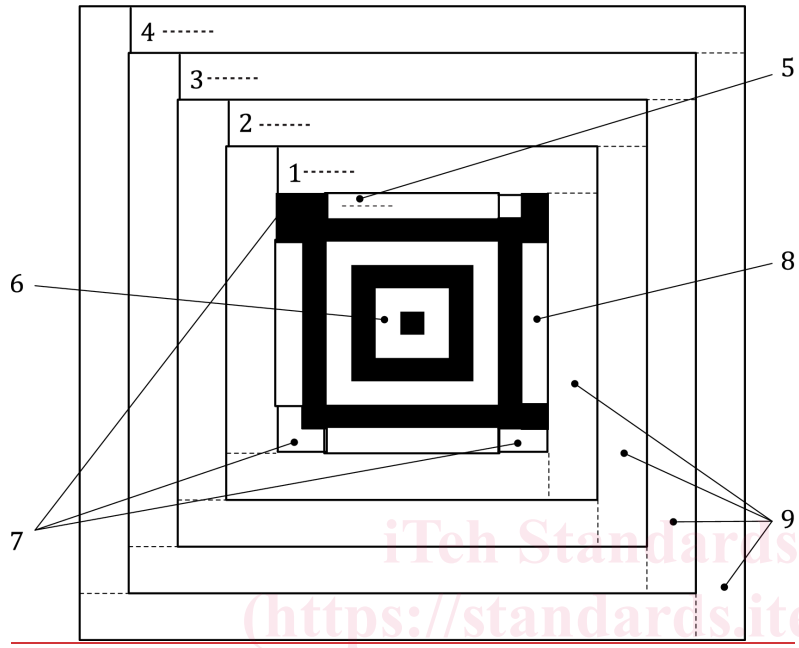
These symbols illustrate the two basic formats of Aztec Code symbols: on the left is a "compact" Aztec Code symbol, visually characterized by a 2-ring bullseye, useful for encoding shorter messages efficiently~~, while~~. On the right is a "full-range" Aztec Code symbol, visually characterized by a 3-ring bullseye, which supports much larger symbols for longer data messages. Since encoders can autoselect and decoders ~~autodiscriminate~~auto discriminate between the two formats, a seamless transition is achieved to cover the full spectrum of applications.

~~9.2~~5.2 Symbol structure

~~9.2.1~~5.2.1 Aztec code layout

The underlying structure of a compact Aztec Code symbol is shown in Figure 2, and that of a full-range Aztec Code symbol is shown in Figure 3. In both cases, the Aztec Code symbol has at its centre a Core Symbol which is then surrounded by data fields on all four sides.





Key

1 layer 1
2 layer 2
3 layer 3
4 layer 4
5 mode bits

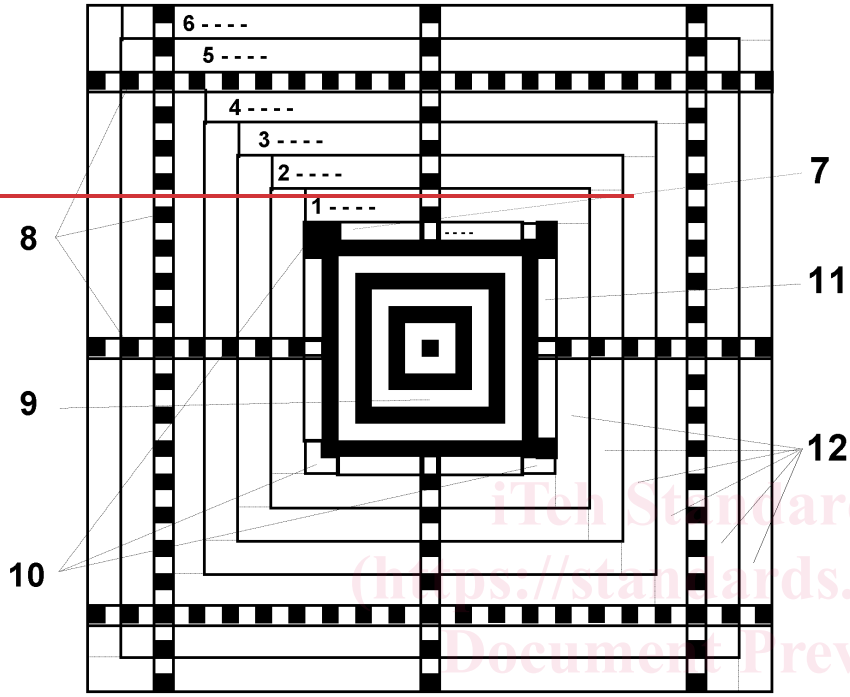
Fixed structures:

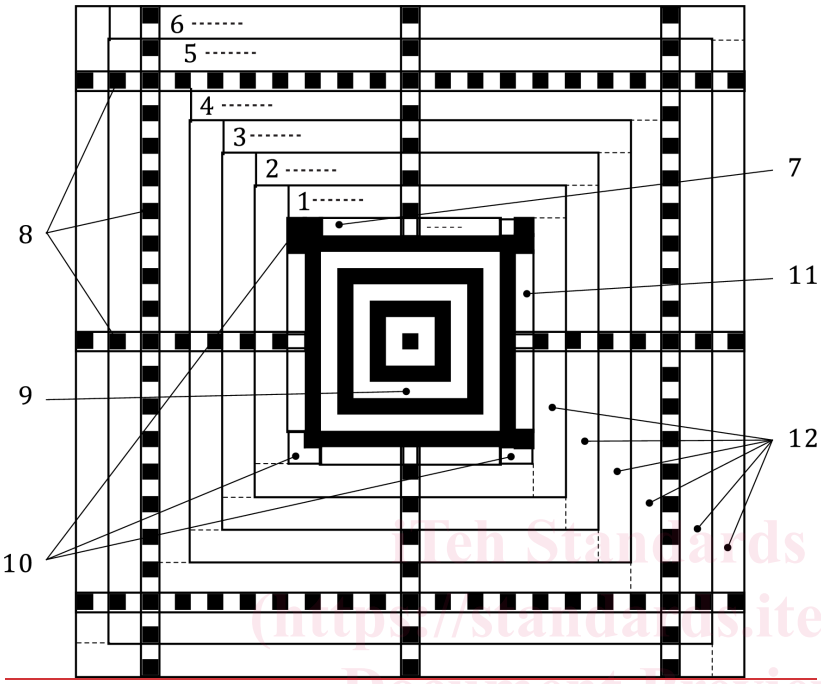
6 finder pattern
7 orientation patterns

Variable structures

8 mode message
9 data layers

Figure 2 — Structure of a "compact" Aztec Code symbol





Key

1 layer 1
2 layer 2
3 layer 3
4 layer 4
5 layer 5
6 layer 6
7 mode bits

Fixed structures

8 reference grid
9 finder pattern
10 orientation patterns

Variable structures

11 mode message
12 data layers

Figure 3 — Structure of a "full-range" Aztec Code symbol

~~9.2.2~~5.2.2 Core Symbol

~~9.2.2.1~~5.2.2.1 Core Symbol position and content

The Core Symbol, always square and at the exact ~~center~~centre of an Aztec Code symbol, consists of a finder pattern, orientation patterns, and a mode message. This core covers an 11~~x~~ × 11 module area in compact symbols and a 15~~x~~ × 15 module area in full-range symbols. It is called the Core "Symbol"