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Information technology — Automatic identification and data capture techniques — MicroPDF417 bar code symbology specification

Technologies de l'information — Techniques d'identification automatique et de capture des données — Spécifications pour la symbologie de code à barres MicroPDF417

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Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
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Contents

Page

Foreword vi

Introduction vii

1 Scope 1

2 Normative references 1

3 Terms and definitions 2

4 Symbols, operations and abbreviated terms 4
4.1 Symbols 4
4.2 Mathematical operations 5
4.3 Abbreviated terms 5

5 Requirements 5
5.1 Symbology characteristics 5
5.1.1 Basic characteristics 5
5.1.2 Summary of additional features 6
5.2 Symbol structure 7
5.2.1 MicroPDF417 symbol parameters 7
5.2.2 Row and column combinations 9
5.2.3 Row parameters 10
5.2.4 Codeword sequence 10
5.2.5 MicroPDF417 Row Address Patterns 12
5.3 Basic encodation 14
5.3.1 Symbol character structure 14
5.3.2 Start and Stop Patterns 15
5.4 High level (data) encodation 15
5.4.1 Function codewords 15
5.4.2 Text Compaction mode 21
5.4.3 Byte Compaction mode 25
5.4.4 Numeric Compaction mode 27
5.4.5 Advice to select the appropriate compaction mode 28
5.4.6 Treatment of MicroPDF417 reserved codewords 29
5.5 Extended Channel Interpretation 29
5.5.1 Encoding the ECI assignment number 30
5.5.2 Pre-assigned and default Extended Channel Interpretations 31
5.5.3 Encoding ECI sequences within compaction modes 31
5.5.4 Post-decode protocol 33
5.6 Determining the codeword sequence 33
5.7 Error detection and correction 34
5.7.1 Number of error correction codewords 34
5.7.2 Error correction capacity 34
5.7.3 Defining the error correction codewords 35
5.8 Dimensions 35
5.8.1 Minimum width of a module (*X*) 35
5.8.2 Row height (*Y*) 35
5.8.3 Quiet zones 35
5.9 Defining the symbol format 35
5.9.1 Defining the aspect ratio of the module 36
5.9.2 Defining the symbol matrix of rows and columns 36
5.10 Generating the error correction codewords 37
5.11 Low level encodation 39
5.11.1 Clusters 40

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ISO/IEC 24728:2006
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5.11.2 Determining the symbol matrix 40
5.11.3 Determining the values of the Row Address Patterns 40
5.11.4 Row encoding 46
5.12 Printing Row Address Patterns 46
5.13 Structured Append 47
5.13.1 Compaction modes and Structured Append 47
5.13.2 ECIs and Structured Append 47
5.14 User guidelines 47
5.14.1 Human readable interpretation 47
5.14.2 Autodiscrimination capability 47
5.14.3 User-defined application parameters 48
5.14.4 MicroPDF417 symbol quality 48
5.14.5 Separation of multiple symbols 49
5.15 Reference decode algorithm 49
5.16 Error detection and error correction procedure 49
5.17 Transmitted data 49
5.17.1 Transmitted data in the basic (default) interpretation 49
5.17.2 Transmission protocol for Extended Channel Interpretation (ECI) 49
5.17.3 Transmitted data for Structured Append 51
5.17.4 Transmission of reserved codewords using the ECI protocol 51
5.17.5 Symbology identifier 51
5.17.6 Transmission using older protocols 51

Annex A (normative) **Encoding/decoding table of PDF417 symbol character bar-space sequences** 52

Annex B (normative) **The default character set for Byte Compaction mode** 67

Annex C (normative) **Byte Compaction mode encoding algorithm** 68

Annex D (normative) **Numeric Compaction mode encoding algorithm** 70

Annex E (normative) **Error correction** 72

Annex F (normative) **Tables of coefficients for calculating MicroPDF417 error correction codewords** 73

Annex G (normative) **Text Compaction mode encoding algorithm** 77

Annex H (normative) **Structured Append MicroPDF417 symbols** 78
H.1 Structured Append overview 78
H.2 Structured Append syntax 78
H.3 High level encoding considerations 81
H.4 Encodation example 81
H.5 Structured Append and the Extended Channel Interpretation protocol 82
H.6 Structured Append data transmission 83

Annex I (normative) **Testing MicroPDF417 symbol quality** 86
I.1 Overview of methodology 86
I.2 Test scans for scan reflectance profile 86

Annex J (normative) **Reference decode algorithm for MicroPDF417** 88
J.1 Phase 1: Initialization 88
J.2 Phase 2: Filling the matrix 89
J.3 Phase 3: Interpretation 90
J.4 Reference line-decode algorithm 91

Annex K (normative) **Error correction procedures** 95

Annex L (normative) **Symbology identifier** 97

Annex M (normative) **Transmission protocol for decoders conforming with original PDF417 standards** 98
M.1 Basic Channel Mode 98
M.2 GLI encoded symbols 98
M.3 Structured Append symbols 100
M.4 Transmission of reserved codewords using the original PDF417 protocol 101

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ISO/IEC 24728:2006
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M.5 Achieving compatibility between old and new PDF417 equipment **101**

Annex N (informative) **Algorithm to minimise the number of codewords** **104**

Annex O (informative) **Guidelines to determine the symbol matrix** **106**

Annex P (informative) **Calculating the coefficients for generating the error correction codewords — worked example** **107**

Annex Q (informative) **Generating the error correction codewords — worked example** **109**

Annex R (informative) **Division circuit procedure for generating error correction codewords** **112**

Annex S (informative) **Additional guidelines for the use of MicroPDF417** **113**
S.1 Autodiscrimination compatibility **113**
S.2 Pixel-based printing **113**

Bibliography **115**

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ISO/IEC 24728:2006
https://standards.iteh.ai/catalog/standards/sist/a9e8384a-39c2-425b-bc54-effc41b2f22e/iso-iec-24728-2006

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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 24728 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic Identification and data capture techniques*.

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This International Standard contains many provisions which are identical with those of ISO/IEC 15438.

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Introduction

MicroPDF417 is a multi-row symbology, derived from and closely based on PDF417. MicroPDF417 is designed for applications with a need for improved area efficiency but without the requirement for PDF417's maximum data capacity. A limited set of symbol sizes is available, together with a fixed level of error correction for each symbol size. Module dimensions are user-specified to enable symbol production and reading by a wide variety of techniques.

Since MicroPDF417's data character encodation, its error correction method, and many of its other symbol characteristics are, and are intended to remain, identical to those of PDF417, descriptions of these characteristics are quoted verbatim from the PDF417 symbology specification (ISO/IEC 15438) wherever appropriate, or with the appropriate modifications. For ease of cross-reference, this International Standard follows a similar document structure, with minor differences in clause/subclause numbering, to ISO/IEC 15438.

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Information technology — Automatic identification and data capture techniques — MicroPDF417 bar code symbology specification

1 Scope

This International Standard specifies the requirements for the bar code symbology known as MicroPDF417. It specifies the MicroPDF417 symbology characteristics, data character encodation, symbol formats, dimensions, error correction rules, decoding algorithm, and a number of application parameters.

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/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*

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

ISO/IEC 15417, *Information technology — Automatic identification and data capture techniques — Bar code symbology specification — Code 128*

ISO/IEC 15418, *Information technology — EAN/UCC Application Identifiers and Fact Data Identifiers and Maintenance*

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

ISO/IEC 24723, *Information technology — Automatic identification and data capture techniques — EAN.UCC Composite bar code symbology specification*

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)*

AIM Inc. International Technical Standard: ITS/04-001, *Extended Channel Interpretations — Part 1: Identification Schemes and Protocols* [1]

GS1 General Specification [2]

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1 Published by AIM Global, 125 Warrendale-Bayne Road, Suite 100, Warrendale, PA 15086, USA.

2 Published by GS1, Blue Tower, Avenue Louise 326, bte 10, B-1050 Brussels, Belgium.

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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
application identifier
sequence of 2 to 4 digits, used to define the nature or use of the subsequent data characters, in accordance with ISO/IEC 15418 and the GS1 General Specification

3.2
bar-space sequence
sequence which represents the module widths of the elements of a symbol character

3.3
basic channel mode
standard system for encoding and transmitting bar code data where data message bytes are output from the decoder but no control information about the message is transmitted

3.4
cluster
any of three mutually exclusive subsets of PDF417 symbol characters, also used in MicroPDF417; the symbol characters in a given cluster conform with particular structural rules which are used in decoding the symbology

3.5
compaction mode
any of three data compaction algorithms in PDF417 (Text, Numeric and Byte Compaction modes), also used in MicroPDF417, which are used to map 8-bit data bytes efficiently to PDF417 codewords

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3.6
e-distance
measurement from the leading edge of one element to the leading edge of the next element, or from the trailing edge of an element to the trailing edge of the next element, in a symbol character or Row Address Pattern

3.7
error correction codeword
codeword which encodes a value derived from the error correction codeword algorithm to enable decode errors to be detected and, depending on the number of error correction codewords, to be corrected

3.8
Extended Channel Interpretation
ECI
procedure within some symbologies, including MicroPDF417, to replace the default interpretation with another interpretation in a reliable manner

NOTE The interpretation intended prior to producing the symbol can be retrieved after decoding the scanned symbol to recreate the data message in its original format.

3.9
extended channel model
system for encoding and transmitting both data message bytes and control information about the message, the control information being communicated using Extended Channel Interpretation (ECI) escape sequences

3.10
family
set of MicroPDF417 symbol versions sharing the same number of columns and the same RAP rotation

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3.11
function codeword
codeword which initiates a particular operation within a symbology, for example to switch between data encoding sets, to invoke a compaction scheme, to program the reader, or to invoke Extended Channel Interpretations

3.12
Global Label Identifier
GLI
procedure in the PDF417 symbology which behaves in a similar manner to Extended Channel Interpretation

NOTE The GLI system was the symbology-dependent precursor to the symbology-independent ECI system.

3.13
macro character
character representing a predefined sequence of data characters (e.g. an industry-specific message header) used to reduce the number of symbol characters needed to encode data in a symbol using certain structured formats

3.14
Mode Latch codeword
codeword which is used to switch from one mode to another mode, which stays in effect until another latch or shift codeword is implicitly or explicitly brought into use, or until the end of the symbol is reached

3.15
Mode Shift codeword
codeword which is used to switch from one mode to another for one codeword, after which encoding returns to the original mode

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3.16
RAP rotation
difference between the number designating a Center or Right Row Address Pattern and the number designating the nearest Row Address Pattern to the left, in the same row of a symbol

3.17
Row Address Patterns
special patterns made up of three bars and three spaces occupying ten modules that serve both as start or (with the stop bar) stop patterns and as row indicators in MicroPDF417 symbols

3.18
stop bar
single-module bar, adjoining the rightmost Row Address Pattern, which forms the right boundary of the symbol

3.19
Structured Append
procedure within the MicroPDF417 symbology to distribute data logically from a computer file across a number of related symbols

NOTE 1 This procedure is identical to the Macro PDF417 feature of PDF417.

NOTE 2 The procedure considerably extends the data capacity beyond that of a single symbol.

3.20
UCC/EAN-128
subset of Code 128 symbols as defined in ISO/IEC 15417, reserved for use in accordance with GS1 General Specification

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4 Symbols, operations and abbreviated terms

4.1 Symbols

For the purposes of this document, the following mathematical symbols apply. There are some cases where the symbols below have been used in a different manner in an equation. This has been done for consistency with a more general use of the notation and is always clearly defined in the text.

b the element width in a symbol character

c number of columns in the symbol in the data region (excluding Row Address Patterns)

d data codeword including ECI Descriptor and all function codewords

E error correction codeword

e an edge to similar edge dimension in a symbol character

f number of substitution errors

F row number

H height of symbol including quiet zone

K cluster number

k number of error correction codewords

L number of erasures

m number of source data codewords (including the codeword in the ECI Descriptor position but prior to the addition of any pad codewords)

n total number of data codewords (including ECI Descriptor and pad codewords)

p pitch or width of a symbol character

Q_H horizontal quiet zone

Q_V vertical quiet zone

r number of rows in the symbol

W width of symbol including quiet zone

X *X*-dimension or module width

Y module height (also called row height)

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4.2 Mathematical operations

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

div is the integer division operator, rounding down

INT is the integer value i.e. where a number is rounded down to its whole number component, ignoring its decimal fractions

mod is the positive integer remainder after division. If the remainder is negative, then add the value of the divisor in order to make the result positive. For example, the remainder of –29 160 divided by 929 is –361, which when added to 929 yields 568

4.3 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

AI Application Identifier

EC Error Correction

ECI Extended Channel Interpretation

GLI Global Label Identifier

RAP Row Address Pattern

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5 Requirements

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5.1 Symbology characteristics

5.1.1 Basic characteristics

MicroPDF417 is a multi-row symbology which may be utilized by applications needing to encode a moderate amount of data in a two-dimensional symbol (up to 150 bytes, 250 alphanumeric characters, or 366 numeric digits), and when minimizing symbol size is a primary concern. MicroPDF417 is identical to PDF417 in terms of its encodation modes, error correction method, and symbol character sets. However, MicroPDF417 replaces PDF417's 17-module-wide start/stop patterns and left/right row indicators with a unique set of 10-module-wide Row Address Patterns, which were designed both to reduce overall symbol width and to facilitate linear scanning at row heights as low as 2*X*. MicroPDF417, unlike PDF417, may only be printed in certain defined combinations of *r* (number of rows), *c* (number of columns), and *k* (number of error correction codewords), up to a maximum of four data columns by 44 rows (see 5.2.2).

MicroPDF417 has the following basic characteristics:

a) Encodable character set:

   1) Text Compaction mode (see 5.4.2) permits all printable ASCII characters to be encoded, i.e. values 32 to 126 inclusive in accordance with ISO/IEC 646, as well as selected control characters.

   2) Byte Compaction mode (see 5.4.3) permits all 256 possible 8-bit byte values to be encoded. This includes all ASCII characters value 0 to 127 inclusive and provides for international character set support.

   3) Numeric Compaction mode (see 5.4.4) permits efficient encoding of numeric data strings.

   4) Up to 811 800 different character sets or data interpretations.

   5) Various function codewords for control purposes.

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b) Symbol character structure: (*n, k, m*) characters of 17 modules (*n*), 4 bar and 4 space elements (*k*), with the largest element 6 modules wide (*m*).

c) Maximum possible number of data characters per symbol (for a maximum size MicroPDF417 symbol): 125 data codewords which can encode

   1) Text Compaction Mode: 250 characters (2 data characters per codeword).

   2) Byte Compaction mode: 150 characters (1,2 data characters per codeword).

   3) Numeric Compaction mode: 366 characters (2,93 data characters per codeword).

d) Symbol Size:

   1) Number of rows: 4 to 44 (available in defined combinations with number of columns).

   2) Number of data columns: either one, two, three, or four

   3) Width in modules: 40*X*, 57*X*, 84*X*, or 101*X* including quiet zones

   4) Maximum codeword capacity: 176 codewords.

   5) Maximum data codeword capacity: 125 codewords.

e) Number of error correction codewords: fixed for each available row/column combination, ranging from 7 to 50 codewords per symbol and reserving from 28% to 67% of codewords for error detection and correction, depending on symbol size.

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f) Non-data overhead: per row: 23 modules for the one- and two-column versions; 33 modules for the three- or four-column version, including quiet zones.

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g) Code type: continuous, multi-row bar code symbology

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h) Character self-checking: Yes.

i) Bi-directionally decodable: Yes.

5.1.2 Summary of additional features

The following are additional features in MicroPDF417:

a) **Data compaction**: Three schemes are defined to compact a number of data characters into codewords. Generally data is not directly represented on a one character for one codeword basis (see 5.4.2 to 5.4.4).

b) **Extended Channel Interpretations**: These mechanisms allow up to 811 800 different data character sets or interpretations to be encoded (see 5.5).

c) **Structured Append**: MicroPDF417 uses the Macro PDF417 mechanism for Structured Append. This mechanism allows files of data to be represented logically and consecutively in a number of MicroPDF417 symbols. Up to 99 999 different MicroPDF417 symbols can be so linked or concatenated and be scanned in any sequence to enable the original data file to be correctly reconstructed (see 5.13).

d) **Edge to edge decodable**: MicroPDF417 can be decoded by measuring elements from edge to similar edge (see 5.3.1).

e) **Cross-row scanning**: The combination of three characteristics in MicroPDF417 facilitates cross-row scanning:

- being synchronised horizontally, or self clocking
- row identification
- being vertically synchronised, by using the cluster values to achieve local row discrimination.

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This combination allows a single linear scan to cross a number of rows and achieve a partial decode of the data so long as at least one complete symbol character per row is decoded into its codeword. The decoding algorithm can then place the individual codewords into a meaningful matrix.

f) **Code 128 emulation codewords**: special codewords may be used at the start of a MicroPDF417 symbol as a signal to the decoder to transmit the symbol's data as if it were encoded in a Code 128 symbol. The Symbology Identifier of the resulting transmission can thus signal the presence of an implied FNC1 flag, for special applications (see 5.4.1.5).

5.2 Symbol structure

5.2.1 MicroPDF417 symbol parameters

Each MicroPDF417 symbol consists of a stack of vertically-aligned rows (with a minimum of 4 and maximum of 44 rows); the allowable numbers of rows are specified separately for each of the one-, two-, three- or four-column versions. Each row shall include a minimum of 1 symbol character and a maximum of 4 symbol characters, excluding the Row Address Pattern columns. The symbol shall include a quiet zone on all four sides.

Figure 1 shows sample one-, two-, three-, and four-column MicroPDF417 symbols, each with twenty rows.

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