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Information and documentation — RFID in libraries —

Part 3: Fixed length encoding

Information et documentation — RFID dans les bibliothèques —

Partie 3: Encodage de longueur fixe

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Foreword

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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 ISO documents 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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 46, *Information and documentation*, Subcommittee SC 4, *Technical interoperability*.

This second edition cancels and replaces the first edition (ISO 28560-3:2011), of which it constitutes a minor revision.

ISO 28560 consists of the following parts, under the general title *Information and documentation — RFID in libraries*:

— *Part 1: Data elements and general guidelines for implementation*

— *Part 2: Encoding of RFID data elements based on rules from ISO/IEC 15962*

— *Part 3: Fixed length encoding*

The following parts are under preparation:

— *Part 4: Encoding of data elements based on rules from ISO/IEC 15962 in an RFID tag with partitioned memory* [Technical Specification]

Introduction

Libraries are implementing radio frequency identification (RFID) as item identification to replace bar codes. RFID streamlines applications like user self-service, security, and materials handling. A standard data model for encoding information on RFID tags could increase the cost-effectiveness of the technology within libraries, particularly through greater interoperability of RFID tags and equipment, and enhance support for resource sharing between libraries.

Several countries have undertaken preliminary work on standardization. The Netherlands developed a data model for public libraries and in Denmark "RFID Data Model for Libraries" has been published (DS/INF 163-1). Finland has adopted the Danish model, but with a few changes. There is a French data model that differs from the Danish and Dutch models. Other libraries in different parts of the world have installations based on various proprietary systems offered by technology and library system suppliers. All of these constitute the installed base of RFID systems, but only account for a small minority of the total of libraries globally.

There is an opportunity to develop a standard data model, taking into account the lessons learned from the national schemes and vendor solutions, and provide migration options for those libraries that have already invested in the technology. Because new items are continually being purchased, a number of migration options can be adopted based on factors relevant to each library.

This part of ISO 28560 deals with the encoding of a basic set of data elements in a fixed length format and the rest of the data elements in optional extension blocks. ISO 28560-1 defines the set of mandatory and optional data elements.

ISO 28560-2 and this part of ISO 28560 are mutually exclusive with respect to an RFID tag being applied to a loan item. In other words, the RFID tag is encoded according to the rules of this part of ISO 28560, or to the rules of ISO 28560-2, or to some proprietary rules. Depending on the technologies being used, and other features of tags that are claiming compliance with ISO 28560-2, the reading system might achieve a degree of interoperability.

This International Standard provides essential standards-based information about RFID in libraries. Ongoing advice needs to be provided because of the evolving nature of RFID technology, and the opportunities to migrate between different types of legacy system and encoding rules of this International Standard.

Information and documentation — RFID in libraries —

Part 3:
Fixed length encoding

1 Scope

This part of ISO 28560 provides a data model and encoding rules for the use of radio frequency identification (RFID) tags for items appropriate for the needs of all types of libraries (including national, academic, public, corporate, special, and school libraries).

This part of ISO 28560 specifies the rules for encoding

— a subset of data elements taken from the total set of data elements listed in ISO 28560-1 into a basic block, and

— other data elements into extension blocks onto the RFID tag.

A source of additional information about implementation issues is provided in Annex A.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 28560-1, *Information and documentation — RFID in libraries — Data elements and general guidelines for implementation*

ISO/IEC 10646, *Information technology — Universal Coded Character Set (UCS)*

ISO/IEC 18000-3, *Information technology — Radio frequency identification for item management — Part 3: Parameters for air interface communications at 13,56 MHz*

ISO/IEC 18046-3, *Information technology — Radio frequency identification device performance test methods — Part 3: Test methods for tag performance*

ISO/IEC TR 18047-3, *Information technology — Radio frequency identification device conformance test methods — Part 3: Test methods for air interface communications at 13,56 MHz*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 28560-1 and the following apply.

3.1
basic block
data block occupying the first 272 bits of the RFID tag

Note 1 to entry: If the RFID tag is limited to 256 bits (i.e. 32 bytes), the basic block is truncated.

3.2
byte
8-bit byte
group of eight consecutive bits

Note 1 to entry: A byte can represent one *character* (3.3) or be part of a representation of a character.

3.3
character
one or more *bytes* (3.2)

3.4
CRC
cyclic redundancy check
value calculated from the data on the tag

3.5
data block
container for encoding data elements, *CRC* (3.4), filler, and end mark

3.6
end block
data block (3.5) containing the end mark terminating the information on the RFID tag

3.7
extension block
optional *data block* (3.5) following the *basic block* (3.1)

3.8
field
entry in a *data block* (3.5)

3.9
filler data block
optional *data block* (3.5) that can be inserted to align other data blocks on *page* (3.11) boundaries

3.10
fixed length field
field (3.8) of prescribed size in a *data block* (3.5)

3.11
page
minimum data unit that can be read from or written to a tag

Note 1 to entry: This is measured in *bytes* (3.2).

3.12
string
sequence of *characters* (3.3)

3.13
unsigned integer
binary value of a number of consecutive bits

3.14
variable length field
field (3.8) of variable size in a *data block* (3.5)

4 Requirements

4.1 Data elements

The data elements shall be as defined and compliant with those listed in ISO 28560-1.

NOTE There is a degree of flexibility in using locally defined codes that enable enhancements and variations to be implemented while still complying with the basic set of data elements.

4.2 RFID air interface

4.2.1 Air interface conformance

The air interface for compliant tags shall be in accordance with the specification for Mode 1.

For migration purposes, additional non-compliant air interfaces used in legacy systems can be supported during a transition period, which is permitted to remain in place for years, as necessary.

The air interface conformance shall be tested in accordance with ISO/IEC TR 18047-3.

4.2.2 Tag performance

Where there are requirements for test tag performance, these shall be performed in accordance with ISO/IEC 18046-3.

4.3 Data protocol

The fixed length encoding described in this part of ISO 28560 does not require a separate data protocol.

5 General encoding rules

5.1 Distinguishing from other applications and encodings

The value of the application family identifier (AFI) is used to distinguish tags for library applications from other applications. The values of AFI for library applications are defined in ISO 28560-1.

ISO 28560-1 describes how the data storage format identifier (DSFID), if present in the system memory as a programmable register, is used to distinguish tags in the library application area, i.e. with the same AFI.

Tags encoded according to this part of ISO 28560 shall be programmed with the value $3E_{HEX}$ in the DSFID register if the tag contains a programmable DSFID register.

This part of ISO 28560 is not able to encode the DSFID if the tag does not contain a programmable DSFID register. In this case, ISO 28560-2 encodes the DSFID in the first byte of the working area of the tag. To take this situation into account, the content parameter (see Table 1) shall not take the value 6 on RFID tags encoded according to this part of ISO 28560.

If and only if the tag does not contain a programmable DSFID register, it is permissible to distinguish tags encoded according to this part of ISO 28560 from other encodings by verifying the cyclic redundancy check (CRC) encoded in the basic block (see 7.2).

5.2 Writing/reading direction

Data shall be written to and read from the tag as specified in ISO/IEC 18000-3, Mode 1, such that the first bit transmitted to or from the tag is the least significant bit of the first field of the basic block. This field contains the content parameter (see Table 1). From that starting point, bytes are transmitted to or from

the tag in order from left to right, with byte 0 to the left of bytes 1, 2, and 3, as shown in the memory map in Annex B.

5.3 Memory area layout

5.3.1 Specifications

The memory area shall be encoded starting with a basic block with fixed length encoding of a basic set of data elements for use in the library.

If the size of the RFID tag is limited to 256 bits (32 bytes), the RFID tag can only contain a truncated basic block.

If the size of the RFID tag is greater than 256 bits, extension blocks (structured or unstructured) can be inserted after the basic block up to the capacity of the chip. If extension blocks are inserted, the order of these is optional. The length of an extension block is determined by the first byte of the block. The type of extension block is defined in the following two bytes.

Filler data blocks may be inserted between blocks to align to page boundaries.

An end block shall terminate the encoding, unless the basic block and possible extension blocks take up the whole space on the RFID tag, in which case an end block is not needed.

5.3.2 Layout for tags greater than 32 bytes

The layout for tags greater than 32 bytes (256 bits) shall be as follows:

<basic block>[(<filler data block>)*<extension block>]*(<filler data block>)*(<end block>)

The end block is mandatory if the tag is not full (see 5.3.1). Basic block, filler data block, structured extension blocks, unstructured extension blocks, and end block are specified in Clause 7.

An example is given in Annex B.

5.3.3 Layout for 32-byte tags

The layout for 32-byte tags shall be as follows:

<truncated basic block>

The truncated basic block is specified in Clause 7.

An example is given in Annex B.

5.4 Strings and integers

5.4.1 String encoding

All strings shall be encoded in UTF-8 in accordance with ISO/IEC 10646, with the first character of the string stored in the lowest memory location. Note that UTF-8 encoding implies that a character can occupy more than one byte.

The end of a string can be defined in the following different ways:

— with one byte 00_{HEX};

— with the length of a fixed length field;

— with the end of a structured extension block.

For fixed length fields, all unused bytes shall be 00_{HEX}.

For variable length fields, one byte 00_{HEX} shall be used between each field.

5.4.2 Integer encoding

Integer-encoded fields shall use 4, 8, or 16 bits unsigned integers.

5.5 Writing the tag

5.5.1 Cyclic redundancy check (CRC)

For RFID tags with only 32 bytes (256 bits) user data space of the basic block is truncated two bytes, but the CRC shall be calculated for a full-length basic block with the two missing bytes assumed to be 00_{HEX}.

See 7.2 and Annex C for a description of CRC.

5.5.2 Unused space

Any unused space in blocks shall be filled with 00_{HEX}, i.e. a 6-byte primary item identifier encoded in the basic block (see 7.2) shall be written as the 6-byte primary item identifier followed by 10 bytes 00_{HEX}. It is very important for reading optimization that this rule be followed.

5.5.3 End of tag

If a data block ends on the last user byte of a tag, no "end block" is required. The length specified in the last data block shall not indicate a size larger than the tag.

5.6 Reading optimization

Guidelines for reading optimization are given in Annex D.

5.7 Profiling

Guidelines for regional profiling are given in Annex E.

5.8 Locking

It is technically possible to lock parts of the tag, but this part of ISO 28560 does not prescribe any strategy for locking. Such a strategy is left for regional profiling.

5.9 Migration

The decision to migrate from a legacy implementation to a data model based on this part of ISO 28560 depends on economic and operational considerations that are beyond the scope of this part of ISO 28560.

6 Data elements

Table 1 shows for each data element defined in ISO 28560-1 the data block where it is encoded, how it is encoded, and the values it can take. Note that some data elements can be encoded in different data blocks. The data blocks are described in Clause 7.

Table 1 — Data elements

N[a]	Name of data element[b]	Data block[c]	Encoding[d]	Values[e]	Requirements and remarks[f]
1	Primary item identifier	Basic block or library extension block	If the primary item identifier is maximum 16 bytes, it shall be encoded in the basic block as a string. Otherwise, it shall be encoded as a string in the library extension block.	Any string	If a primary identifier is not assigned yet, the string is empty.
2	Content parameter	Basic block	4-bit unsigned integer	1 (14 values are reserved for future use: 0, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15. To be able to distinguish from tags encoded according to ISO 28560-2, the value 6 shall not be used.)	The value defines a version number. A new version number shall be applied if and only if it refers to a new version of this part of ISO 28560, which is not backward compatible.
3	Owner institution (ISIL)	Basic block or library extension block	If the ISIL prefix is one or two characters and the ISIL unit identifier is less than or equal to 11 bytes (or 9 bytes for 32 bytes tags), the string can be encoded in the basic block. In this case, the string shall be formed as the concatenation of the prefix and the unit identifier. If the prefix is only one character, a blank is added between the prefix and the unit identifier. If the prefix is more than two characters or the unit identifier is longer than 11 bytes, the string can be encoded in the library extension block. In this case, the string shall be the ISIL code, including the hyphen.	If the tag is limited to 32 bytes, only ISIL codes with a prefix of a maximum of two characters and a unit identifier less than 9 bytes can be encoded. If the size of the tag is more than 32 bytes, any ISIL code can, in theory, be encoded.	The ISIL code is defined in ISO 15511 as <prefix><hyphen><unit identifier>, where <prefix> shall be either an alpha-2 country code (two upper-case letters), or another registered string (non-country code), and where <unit identifier> can be up to 11 characters long.
4	Set information	Basic block	Two 8-bit unsigned integers, the first specifying <number of parts in item> and the second <ordinal part number>.	<numbers of parts in item> can take the values 0 to 255, where 0 indicates an unspecified number. <ordinal part number> can take the values 0 to 255, where 0 indicates the first item in a set, where not all items have an RFID tag.	Set information consists of two parts: <number of parts in item> and <ordinal part number> See examples in ISO 28560-1.
5	Type of usage	Basic block or library extension block	Main qualifier shall be encoded in basic block as a 4-bit unsigned integer. As a supplement, the whole data element can be encoded in the library extension block as an 8-bit unsigned integer.	The set of code values is specified in ISO 28560-1.	The data element consists of two parts: <main qualifier> and <sub-qualifier>.
6	Shelf location	Library supplement block	String	Any string specifying the location of the item	See ISO 28560-1.