INTERNATIONAL STANDARD

ISO 28560-3

First edition
2011-04-01

Information and documentation — RFID in libraries —

Part 3: Fixed length encoding

Information et documentation — RFID dans les bibliothèques —

Partie 3: Encodage de longueur fixe

Reference number
ISO 28560-3:2011(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member 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 shall not be held responsible for identifying any or all such patent rights.

ISO 28560-3 was prepared by Technical Committee ISO/TC 46, *Information and documentation*, Subcommittee SC 4, *Technical interoperability*.

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*

Introduction

Libraries are implementing RFID (radio frequency identification) 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.

ISO 28560 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 ISO 28560.

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 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 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 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*

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

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 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 A byte can represent one **character** (3.3) or be part of a representation of a character.

3.3
character
one or more **byte**s (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 may 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 This is measured in **byte**s (3.2).

3.12
string
sequence of **character**s (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 whilst 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 may 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) may 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 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 may 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.