STANDARD

ISO/IEC 15961-1

First edition
2013-03-15

Information technology — Radio frequency identification (RFID) for item management: Data protocol —

Part 1: Application interface

Technologies de l'information — Identification par radiofréquence (RFID) pour la gestion d'objets: Protocole de données —

Partie 1: Interface d'application

Reference number
ISO/IEC 15961-1:2013(E)

© ISO/IEC 2013

COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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 viii

Introduction ix

1 Scope 1

2 Normative references 1

3 Terms, definitions and conventions 2
3.1 Terms and definitions 2
3.2 Conventions 2

4 Compliance 2
4.1 General 2
4.2 Application compliance 3
4.3 Conformance of the Data Processor 3

5 Protocol model 3
5.1 Overview 3
5.2 Layered protocol 3
5.2.1 Application layer - as defined in the various parts of ISO/IEC 15961 4
5.2.2 Application interface - as defined in ISO/IEC 15961-1 5
5.2.3 Data Protocol Processing - as defined in ISO/IEC 15962 5
5.2.4 Data Protocol Interface - as defined in ISO/IEC 15962 5
5.3 Flexible implementation configurations 6
5.4 Functional processes – interrogator implementation 6
5.4.1 Functional processes - application interface 7
5.4.2 Functional processes – interrogator 7
5.4.3 RFID tag 8
5.5 ISO/IEC 15962 and the Data Processor 9

6 Presentation conventions 9
6.1 Presentation of commands, responses and arguments 9
6.1.1 Commands and responses 9
6.1.2 Arguments 9
6.1.3 Data types 10
6.2 Object Identifier presentation in the application interface 10
6.2.1 Object identifier structure to ISO/IEC 8824-1 10
6.2.2 Presenting the Object-Identifier in the style of ISO/IEC 8824-1 11
6.2.3 Presenting the Object-Identifier as a Uniform Resource Name (URN) 12
6.3 Byte Notation 12
6.3.1 The byte: the basic unit for 8-bit coding 12
6.3.2 Bit ordering 12
6.3.3 Byte conversion 12

7 Processing application commands and responses 12
7.1 General 12
7.2 Encoding system related information in commands 13
7.2.1 Singulation-Id 13
7.2.2 AFI 13
7.2.3 DSFID 14
7.2.4 Access-Method 14
7.2.5 Data-Format 16
7.3 Preparing the basic Objects and other application-based arguments 17
7.3.1 General model 17
7.3.2 Object-Identifier 17

© ISO/IEC 2013 – All rights reserved

7.3.3 Relating Object-Identifiers 18
7.3.4 Object 18
7.3.5 Compact-Parameter 18
7.3.6 Object-Lock 20
7.4 Other command arguments 20
7.4.1 Access-Password 20
7.4.2 Additional-App-Bits 21
7.4.3 AFI-Lock 21
7.4.4 Append-To-Existing-Multiple-Record 21
7.4.5 Application-Defined-Record-Capacity 21
7.4.6 Avoid-Duplicate 21
7.4.7 Battery-Assist-Indicator 21
7.4.8 Block-Align 21
7.4.9 Block-Align-Packed-Object 21
7.4.10 Check-Duplicate 22
7.4.11 Data-CRC-Indicator 22
7.4.12 Data-Length-Of-Record 22
7.4.13 Delete-MR-Method 22
7.4.14 Directory-Length-EBV8-Indicator 22
7.4.15 DSFID-Lock 22
7.4.16 DSFID-Pad-Bytes 23
7.4.17 Editable-Pointer-Size 23
7.4.18 Encoded-Memory-Capacity 23
7.4.19 EPC-Code 23
7.4.20 Full-Function-Sensor-Indicator 23
7.4.21 Hierarchical-Identifier-Arc 23
7.4.22 Identifier-Of-My-Parent 23
7.4.23 Identify-Method 23
7.4.24 ID-Type 24
7.4.25 Instance-Of-Arc 24
7.4.26 Kill-Password 24
7.4.27 Length-Of-Mask 24
7.4.28 Lock-Directory-Entry 24
7.4.29 Lock-Multiple-Records-Header 24
7.4.30 Lock-Record-Preamble 25
7.4.31 Lock-UII-Segment-Arguments 25
7.4.32 Max-App-Length 25
7.4.33 Memory-Bank 25
7.4.34 Memory-Bank-Lock 25
7.4.35 Memory-Length-Encoding 25
7.4.36 Memory-Segment 25
7.4.37 Memory-Type 25
7.4.38 Multiple-Records-Directory-Length 25
7.4.39 Multiple-Records-Features-Indicator 26
7.4.40 NSI-Bits 26
7.4.41 Number-In-Data-Element-List 26
7.4.42 Number-Of-Records 26
7.4.43 Number-Of-Tags 26
7.4.44 Objects-Offsets-Multiplier 27
7.4.45 Packed-Object-Directory-Type 27
7.4.46 Password 27
7.4.47 Password-Type 27
7.4.48 PO-Directory-Size 27
7.4.49 PO-Index-Length 27
7.4.50 Pointer 27
7.4.51 Pointer-To-Multiple-Records-Directory 27
7.4.52 Read-Record-Type 28
7.4.53 Read-Type 29
7.4.54 Record-Memory-Capacity 30
7.4.55 Record-Type-Arc 30

 © ISO/IEC 2013 – All rights reserved

7.4.56 Record-Type-Classification 30
7.4.57 Sector-Identifier 30
7.4.58 Simple-Sensor-Indicator 31
7.4.59 Start-Address-Of-Record 31
7.4.60 Tag-Data-Profile-ID-Table 31
7.4.61 Tag-Mask 31
7.4.62 Update-Multiple-Records-Directory 31
7.4.63 Word-Count 31
7.4.64 Word-Pointer 31
7.5 Command-related field names 31
7.5.1 Data-Set 32
7.5.2 Identities 32
7.5.3 Length-Lock Byte 32
7.5.4 Length-Of-Encoded-Data 32
7.5.5 Lock-Status 32
7.5.6 Logical-Memory-Map 32
7.5.7 Memory-Capacity 32
7.5.8 Module-OID 32
7.5.9 Number-Of-Tags-Found 32
7.5.10 PO-ID-Table 32
7.5.11 Protocol-Control-Word 32
7.5.12 Read-Data 33
7.6 Data security 33

8 Data flows and processes to the air interface 33
8.1 Establishing communications between the application and the RFID tag 33
8.1.1 Air interface services 33
8.1.2 System information 34
8.2 Application system services 34

9 Command-Codes, Completion-Codes, and Execution-Codes 34
9.1 Final arc values of the command and response modules 35
9.2 Completion-Code 36
9.3 Execution-Code 39

10 Commands and responses 40
10.1 Configure-AFI 40
10.1.1 Configure-AFI command 40
10.1.2 Configure-AFI response 40
10.2 Configure-DSFID 41
10.2.1 Configure-DSFID command 41
10.2.2 Configure-DSFID response 42
10.3 Inventory-Tags 42
10.3.1 Inventory-Tags command 42
10.3.2 Inventory-Tags response 44
10.4 Delete-Object 44
10.4.1 Delete-Object command 44
10.4.2 Delete-Object response 45
10.5 Modify-Object 46
10.5.1 Modify-Object command 46
10.5.2 Modify-Object response 47
10.6 Read-Object-Identifiers 48
10.6.1 Read-Object-Identifiers command 48
10.6.2 Read-Object-Identifiers response 49
10.7 Read-Logical-Memory-Map 49
10.7.1 Read-Logical-Memory-Map command 49
10.7.2 Read-Logical-Memory-Map response 50
10.8 Erase-Memory 50
10.8.1 Erase-Memory command 50
10.8.2 Erase-Memory response 51
10.9 Get-App-Based-System-Info 51

© ISO/IEC 2013 – All rights reserved

10.9.1 Get-App-Based-System-Info command 51
10.9.2 Get-App-Based-System-Info response 51
10.10 Write-Objects 52
10.10.1 Write-Objects command 52
10.10.2 Write-Objects response 54
10.11 Read-Objects 55
10.11.1 Read-Objects command 55
10.11.2 Read-Objects response 56
10.12 Write-Objects-Segmented-Memory-Tag 56
10.12.1 Write-Objects-Segmented-Memory-Tag command 56
10.12.2 Write-Objects-Segmented-Memory-Tag response 58
10.13 Write-EPC-UII 59
10.13.1 Write-EPC-UII command 59
10.13.2 Write-EPC-UII response 60
10.14 Inventory-ISO-UIImemory 60
10.14.1 Inventory-ISO-UIImemory command 60
10.14.2 Inventory-ISO-UIImemory response 61
10.15 Inventory-EPC-UIImemory 62
10.15.1 Inventory-EPC-UIImemory command 62
10.15.2 Inventory-EPC-UIImemory response 62
10.16 Write-Password-Segmented-Memory-Tag 63
10.16.1 Write-Password-Segmented-Memory-Tag command 63
10.16.2 Write-Password-Segmented-Memory-Tag response 63
10.17 Read-Words-Segmented-Memory-Tag 64
10.17.1 Read-Words-Segmented-Memory-Tag command 64
10.17.2 Read-Words-Segmented-Memory-Tag response 64
10.18 Kill-Segmented-Memory-Tag 65
10.18.1 Kill-Segmented-Memory-Tag command 65
10.18.2 Kill-Segmented-Memory-Tag response 65
10.19 Delete-Packed-Object 65
10.19.1 Delete-Packed-Object command 65
10.19.2 Delete-Packed-Object response 66
10.20 Modify-Packed-Object-Structure 67
10.20.1 Modify-Packed-Object-Structure command 67
10.20.2 Modify-Packed-Object-Structure response 68
10.21 Write-Segments-6TypeD-Tag 69
10.21.1 Write-Segments-6TypeD-Tag command 69
10.21.2 Write-Segments-6TypeD-Tag response 70
10.22 Read-Segments-6TypeD-Tag 71
10.22.1 Read-Segments-6TypeD-Tag command 71
10.22.2 Read-Segments-6TypeD-Tag response 73
10.23 Write-Monomorphic-UII 73
10.23.1 Write-Monomorphic-UII command 73
10.23.2 Write-Monomorphic-UII response 75
10.24 Configure-Extended-DSFID 76
10.24.1 Configure-Extended-DSFID command 76
10.24.2 Configure-Extended-DSFID response 77
10.25 Configure-Multiple-Records-Header 77
10.25.1 Configure-Multiple-Records-Header command 77
10.25.2 Configure-Multiple-Records-Header response 80
10.26 Read-Multiple-Records 80
10.26.1 Read-Multiple-Records command 80
10.26.2 Read-Multiple-Records response 81
10.27 Delete-Multiple-Record 82
10.27.1 Delete-Multiple-Record command 82
10.27.2 Delete-Multiple-Record response 83

11 Arguments 84
11.1 Add-Objects 84
11.2 DSFID-Constructs 85

 © ISO/IEC 2013 – All rights reserved

11.3 EPC-UIImemory **85**
11.4 Ext-DSFID-Constructs **85**
11.5 ISO-UIImemory **87**
11.6 Item-Related-Add-Objects **87**
11.7 Item-Related-DSFID-Constructs **87**
11.8 Multiple-Records-Constructs **87**
11.9 Multiple-Records-Directory-Structure **89**
11.10 Multiple-Records-Header-Structure **89**
11.11 Multiple-Records-Preamble-Structure **90**
11.12 Packed-Object-Constructs **91**
11.13 Read-Objects **93**
11.14 Read-Objects-Response **93**
11.15 Read-OIDs-Response **93**
11.16 UII-Add-Objects **93**
11.17 UII-DSFID-Constructs **94**
11.18 Write-Responses **94**

Annex A (informative) **Abstract syntax and transfer encoding rules** **95**

Annex B (informative) **Accommodating established data formats** **104**

Annex C (informative) **Relating data Objects** **106**

Annex D (informative) **Data security issues** **108**

Annex E (informative) **Original commands and responses using ASN.1 abstract syntax** **110**

Annex F (informative) **Example of a transfer encoding to ISO/IEC 15961:2004** **139**

Bibliography **142**

© ISO/IEC 2013 – All rights reserved

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 15961-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

This first edition of ISO/IEC 15961-1, together with ISO/IEC 15961-2, ISO/IEC 15961-3 and ISO/IEC 15961-4, cancels and replaces ISO/IEC 15961:2004, which has been technically revised.

ISO/IEC 15961 consists of the following parts, under the general title *Information technology — Radio frequency identification (RFID) for item management: Data protocol*:

— *Part 1: Application interface*

— *Part 2: Registration of RFID data constructs*

— *Part 3: RFID data constructs*

The following part is under preparation:

— *Part 4: Application interface commands for battery assist and sensor functionality*

© ISO/IEC 2013 – All rights reserved

Introduction

The technology of radio frequency identification (RFID) is based on non-contact electronic communication across an air interface. The structure of the bits stored on the memory of the RFID tag is invisible and accessible between the RFID tag and the interrogator only by the use of an air interface protocol, as specified in the appropriate part of ISO/IEC 18000. The result of the transfer of data between an application and an interrogator in open systems requires data to be encoded in a consistent manner on any RFID tag that is part of that open system. This is not only to allow equipment to be interoperable, but in the special case of data carriers, for the data to be encoded on the RFID tag in one systems implementation and to be read at a later time in a completely different and unknown systems implementation. The data bits stored on each RFID tag must be formatted in such a way as to be reliably read at the point of use if the RFID tag is to fulfil its basic objective. This reliability is achieved through the specification of a data protocol in this part of ISO/IEC 15961 and the data encoding rules of ISO/IEC 15962. Additionally, ISO/IEC 24791-1 specifies a software system infrastructure architecture that enables RFID system operations between business applications and RFID interrogators. Specific parts of the infrastructure standards address data management requirements (ISO/IEC 24791-2) and device interface requirements (ISO/IEC 24791-5). These support defined implementations that incorporate the encoding rules of ISO/IEC 15962 and the functional rules of the commands and responses in this part of ISO/IEC 15961.

Manufacturers of RFID equipment (interrogators, RFID tags, etc.) and users of RFID technology require standards-based data protocols for RFID for item management. This part of ISO/IEC 15961, ISO/IEC 15962, and ISO/IEC 24791 specify these protocols, which are layered above the air interface standards defined in ISO/IEC 18000.

The transfer of data to and from an application, supported by appropriate application commands, is the subject of this part of ISO/IEC 15961. The companion International Standard, ISO/IEC 15962, specifies the overall process and the methodologies developed to format the application data into a structure to store on the RFID tag.

© ISO/IEC 2013 – All rights reserved

Information technology — Radio frequency identification (RFID) for item management: Data protocol —

Part 1: Application interface

1 Scope

This part of ISO/IEC 15961 focuses on the abstract interface between an application and the data processor, and includes the specification and definition of application commands and responses. It allows data and commands to be specified in a standardised way, independent of the particular air interface of ISO/IEC 18000.

This part of ISO/IEC 15961

- provides guidelines on how data shall be presented as objects;
- defines the structure of Object Identifiers, based on ISO/IEC 9834-1;
- specifies the commands that are supported for transferring data between an application and the radio frequency identification (RFID) tag;
- specifies the responses that are supported for transferring data between the RFID tag and the application;
- does not specify any required transfer syntax with ISO/IEC 15962, but provides the non-normative information in Annex A to provide backward compatibility with ISO/IEC 15961:2004.

It is expected that this part of ISO/IEC 15961 will be used as a reference to develop software appropriate for particular applications, or for particular RFID equipment.

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 9834-1, *Information technology — Open Systems Interconnection — Procedures for the operation of OSI Registration Authorities: General procedures and top arcs of the International Object Identifier tree* (equivalent to ITU-T Recommendation X.660)

ISO/IEC 15961-3, *Information technology — Radio frequency identification (RFID) for item management: Data protocol — Part 3: RFID data constructs*

ISO/IEC 15962:2013, *Information technology — Radio frequency identification (RFID) for item management — Data protocol: data encoding rules and logical memory functions*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

© ISO/IEC 2013 – All rights reserved

ISO/IEC 19762-3, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 3: Radio frequency identification (RFID)*

© ISO/IEC 2013 – All rights reserved