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

**Part 1:
Application interface**

iTeh STANDARD PREVIEW
*Technologies de l'information — Identification par radiofréquence
(RFID) pour la gestion d'objets: Protocole de données —
Partie 1: Interface d'application*
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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 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*

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.

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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*

3 Terms, definitions and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1, ISO/IEC 19762-3 and the following apply.

3.1.1 application

software component that issues commands and receives responses to the commands within a system

3.1.2 Data Processor

implementation of the processes defined in ISO/IEC 15962, including the Data Compactor, Formatter, Logical Memory, and Command/Response Unit

NOTE This was called the Data Protocol Processor in ISO/IEC 15691:2004.

3.1.3 Relative-OID

particular Object Identifier where a common Root-OID (for the first and subsequent arcs) is implied, and remaining arcs after the Root-OID are defined by the Relative-OID

3.2 Conventions

Conventionally in International Standards, long numbers are separated by a space character as a “thousands separator”. This convention has not been followed in this part of ISO/IEC 15961 because the arcs of an Object Identifier are defined by a space separator (according to ISO/IEC 8824 and ISO/IEC 8825). As the correct representation of these arcs is vital to this part of ISO/IEC 15961, all numeric values have no space separators except to denote a node between two arcs of an Object Identifier.

4 Compliance

4.1 General

The commands and responses in this part of ISO/IEC 15961 are only expressed in an abstract syntax, and transfer encoding is no longer required. As such, compliance to this part of ISO/IEC 15961 for a particular system is specifically indicated by the resultant proper encoding of RFID tags according to ISO/IEC 15962 by the system.

The arguments and fields contained in individual commands and responses identify what needs to be taken into account for correct input to the Data Processor to achieve a valid encoding. Also, they identify what an application expects to have returned following access to an RFID tag. Because of the way the Data Protocol is structured, the commands and responses specified in this part of ISO/IEC 15961 are, to a large extent, independent of particular RFID tag types that are only known to the Data Processor through the Tag Driver. The effect of this is that ISO/IEC 15962 can specify conformance requirements for valid encoding, which this part of ISO/IEC 15961 cannot.

The following sub-clauses provide compliance advice as best practice to achieve an integrated data communication channel between the application and the RFID tag.

4.2 Application compliance

An application is expected to support the commands and responses that are meaningful to the application. For every command considered relevant for an application, all the constituent components need to be taken into account in transfers between the application and the Data Processor.

In particular, application standards need to take into consideration the various arguments in the command as defined in Clause 7 (e.g. **Object-Lock**, **Compact-Parameter**). These determine the requirements of what is encoded on the RFID tag, and the necessary processes that the Data Processor has to invoke to achieve a valid encoding.

4.3 Conformance of the Data Processor

The Data Processor is, effectively, the implementation of ISO/IEC 15962. Depending on the scope of the Data Processor (ranging from being specific to an industry to being generic to the entire RFID Data Protocol) various arguments included in the commands can be processed in different manners (e.g. data can be identified with a full **Object-Identifier** or a **Relative-OID**). This part of ISO/IEC 15961 imposes no constraints on the design of the Data Processor, other than a requirement to support all the functionality specified by the arguments in the commands that are necessary to achieve proper encoding.

5 Protocol model

5.1 Overview

RFID supports bit encodation in the RFID tag memory. Unlike other data carrier standards prepared by ISO/IEC JTC1 SC31 which require encodation schemes that are specific to the individual data carrier technology, ISO/IEC 18000 does not specify the interpretation of bits or bytes encoded on the RFID tag memory. However, as an RFID tag is a relay in a communication system, each tag used for open systems item management needs to have data encoded in a consistent manner. The prime function of this part of ISO/IEC 15961 is to specify a common interface between the application programs and the RFID interrogator. The prime function of ISO/IEC 15962 is to specify the common encoding rules and logical memory functions.

RFID tags utilise electronic memory, which is typically capable of increasing data capacity as new generations of product are introduced. Differences in data capacity of each RFID tag type, whether similar or dissimilar, are recognised by the data protocol defined in these two International Standards.

Different application standards may have their own particular data sets or data dictionaries. Each major application standard for item management needs to have its data treated in an unambiguous manner, avoiding confusion with data from other applications and even with data from closed systems. The data protocol specified in these International Standards ensures the unambiguous identification of data.

5.2 Layered protocol

The protocol layers of an implementation of RFID for item management are illustrated schematically in Figure 1 — Schematic of protocol layers for an implementation of RFID for item management.

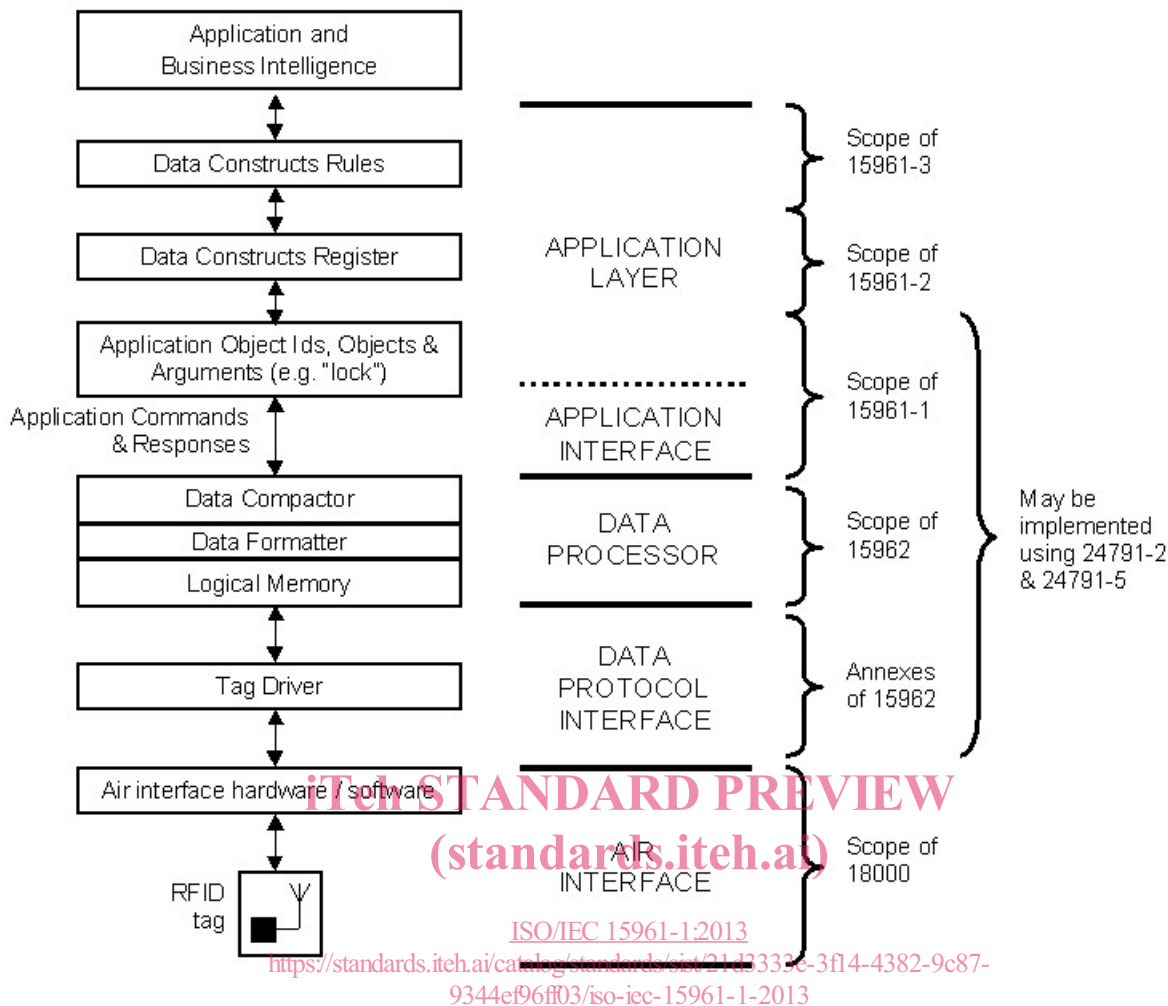


Figure 1 — Schematic of protocol layers for an implementation of RFID for item management

The data protocol specified in ISO/IEC 15961-1, ISO/IEC 15961-2, ISO/IEC 15961-3, and ISO/IEC 15962 is independent of the different RFID tag technologies specified in ISO/IEC 18000, which is concerned with different air interface protocols that function between the interrogator and the RFID tag. This independence is achieved by implementing the standards at different levels in the protocol hierarchy. The RFID data protocol defined in this part of ISO/IEC 15961 is primarily concerned with the upper layers as described below:

5.2.1 Application layer - as defined in the various parts of ISO/IEC 15961

The RFID data protocol specifies how data is presented as objects, each uniquely identified with an Object Identifier, which are meaningful to the application and can be encoded on the RFID tag. ISO/IEC 15961-3 specifies the data construct rules for the AFI, DSFID, Object Identifier for the Unique Item Identifier, and Object Identifier structure for other item-related data. This ensures that each piece of data can be uniquely identified, both within the scope of a particular application and between applications.

Each application needs to be registered according to the rules of ISO/IEC 15961-2 so that the data constructs can be declared and used in an unambiguous manner.

The RFID data protocol in this part of ISO/IEC 15961 defines functions and arguments used to construct application commands and responses. This is so that application programs can specify what data to transfer to and from the RFID tag and to append, update, selectively lock, delete data, or perform other functions on the RFID tag.

To illustrate how the functions and arguments are assembled into a structured format, a number of commands and responses have been constructed using an abstract syntax. This is independent of the host application,

operating system, and program language and also independent of the specific command structures between the interrogator and tag driver. The abstract syntax used in this part of ISO/IEC 15961 is similar to that used in ISO/IEC 24791-5, and is intended to enable closer integration with that standard. The original version of ISO/IEC 15961:2004 included commands defined using ASN.1 abstract syntax. For backward compatibility the commands that were originally defined in this manner have been included in an annex in this part of ISO/IEC 15961.

This RFID data protocol also defines arguments and codes to support responses of data that is read from an RFID tag, including error messages, which are returned to the application.

The abstract syntax may be used as a basis to prepare commands in different programme languages, supporting the functionality and arguments of the abstract commands.

5.2.2 Application interface - as defined in ISO/IEC 15961-1

The application interface may be implemented in a number of different ways that are not explicitly defined in this part of ISO/IEC 15961, nor in ISO/IEC 15962. The basic requirement is to identify data objects distinctly from all others using Object Identifiers, even to enable different data formats to be intermixed on the same RFID tag. The application interface also needs to define command and response arguments unambiguously, so that they can be intermixed with data on the same wired or wireless network.

One major class of implementation, described as a *straight-through process*, is appropriate where the functions and arguments used to construct commands and the arguments and codes used to construct responses, as specified in this part of ISO/IEC 15961, are directly input to the encoding processes of ISO/IEC 15962. Such input can be from computer screens or forms, or more direct transfers from host systems. The advantage of this process is that it avoids the creation of the transfer encoding (see below), but requires more rigorous adherence to the functional requirements of the commands and responses. This part of ISO/IEC 15961 imposes no constraints on the particular application interface process to be adopted, other than the requirement that it be integrated with the encoding rules of ISO/IEC 15962.

An alternative process, consistent with the first edition of ISO/IEC 15961, is to use the abstract syntax for defining the commands and responses in a structured, consistent and verifiable manner, and to generate the transfer encoding that defines the byte stream transferred between the processes of this International Standard and those of ISO/IEC 15962.

Whichever approach is used, the encoding rules of ISO/IEC 15962 shall be followed, and the encoding on the RFID tag has to be compliant with all the arguments in the commands specified in this part of ISO/IEC 15961.

5.2.3 Data Protocol Processing - as defined in ISO/IEC 15962

The RFID data protocol specifies how data is encoded, compacted and formatted on the RFID tag and how this data is retrieved from the RFID tag to be meaningful to the application.

This RFID data protocol provides for a set of schemes that compact the data to make more efficient use of the memory space.

This RFID data protocol also supports various storage formats to enable efficient use of memory and efficient access procedures.

5.2.4 Data Protocol Interface - as defined in ISO/IEC 15962

Each air interface protocol standard in ISO/IEC 18000 has its own specific rules for defining commands and responses. Furthermore, one air interface protocol can support different tag architectures with different memory sizes, and possibly support optional commands. The data protocol provides a mechanism to interface with these rules through specific tag drivers. These allow the basic application commands and responses of this part of ISO/IEC 15961 to be applied independently of the air interface protocol and specific tag architecture.