
**Information technology — Radio
frequency identification (RFID) for item
management — Software system
infrastructure**

**Part 5:
Device interface**

iTeh STANDARD PREVIEW

*Technologies de l'information — Identification de radio fréquence
(RFID) pour la gestion d'élément — Infrastructure de systèmes logiciels*

Partie 5: Interface de dispositif

ISO/IEC 24791-5:2012

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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 24791-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

ISO/IEC 24791 consists of the following parts, under the general title *Information technology — Radio frequency identification (RFID) for item management — Software system infrastructure*:

- *Part 1: Architecture* [ISO/IEC 24791-5:2012](https://standards.iteh.ai/catalog/standards/sist/f88ec3c7-4098-4a75-9874-3c49117f2793/iso-iec-24791-5-2012)
- *Part 2: Data management*
- *Part 3: Device management*
- *Part 5: Device interface*

Introduction

RFID air interface technology is based on non-contact electro-magnetic communication among interrogators and tags. RFID software systems are composed of RFID interrogators, intermediate software systems, and applications that provide control and coordination of air interface operation, tag information exchange, and health and performance management of system components. RFID technology is expected to increase effectiveness in many aspects of business by further advancing the capabilities of Automatic Identification and Data Capture (AIDC). To achieve this goal through the successful adoption of RFID technology into real business environments, RFID devices, software systems, and business applications shall provide secure and interoperable services, interfaces, and technologies. This is the goal of the standards defined for RFID Software System Infrastructure (SSI), ISO/IEC 24791. The composition and operations of SSI exist in systems that implement other RFID standards including the air interfaces described in the ISO/IEC 18000 series and the data and interface functions defined in ISO/IEC 15962, ISO/IEC 15963, ISO/IEC 24753 and others.

The goal of this part of ISO/IEC 24791 is to define a device interface that provides RFID controlling software with low-level access to RFID air interface hardware. This low-level access gives programmers a degree of control over the sequencing of air protocol commands and direct access to air protocol command parameter. Using this low-level interface, programmers can optimize RFID data access and control operations.

The interface defined by this part of ISO/IEC 24791 supports the following features:

- efficient, binary transfer syntax over TCP/IP
- access to RFID air protocol commands and command parameters
- support for optimized RFID tag access operations whereby multiple operations can be performed on a tag with minimal tag state changes
- direct read/write access to all data on an RFID tag
- read one or more individual tag data items (encoded as defined by ISO/IEC 15962) as specified by their OID using URN notation
- [optional] decode data items (encoded as defined by ISO/IEC 15962) into their Unicode representation (UTF-8 encoded). Encoding data items is not supported
- support for RFID air protocol type defined by Type C of ISO/IEC 18000-6.

The interface defined in this part of ISO/IEC 24791 provides access to RFID air protocol commands and their respective command parameters. Therefore using this interface, tag memory banks can be locked, tags can be killed, and raw-binary RFID tag data can be accessed directly on a tag for both reading and writing. In addition, individual data items (encoded as defined by ISO/IEC 15962) can be read by specifying each data item's OID. Optionally, the interrogator can decode data items read into their character string representation. If the interrogator cannot decode a data item, then it will return the entire encoded package within which the data item resides. In this case, it is the responsibility of higher-level software to further decode the data item. The interface does not support RFID tag data encoding. It is the responsibility of higher-level software (i.e., software outside the interface defined by this part of ISO/IEC 24791 to perform data encoding (i.e., binary tag data representation as defined by ISO/IEC 15962) that is stored on RFID tags.

This part of ISO/IEC 24791 is composed of the EPCglobal™ standard, *Low Level Reader Protocol* [LLRP], in its entirety with extensions that support reading RFID tag data items that are encoded according to ISO/IEC 15962. As does the LLRP standard, this part of ISO/IEC 24791 defines both the abstract functional capabilities of the interrogator interface and the binary transfer syntax between the interrogator and a controlling system device. The transfer syntax is defined to be communicated over TCP/IP.

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Information technology — Radio frequency identification (RFID) for item management — Software system infrastructure

Part 5: Device interface

1 Scope

This part of ISO/IEC 24791 defines an interface within the Software System Infrastructure (SSI) that provides RFID system control components with low-level access to RFID interrogators for the purpose of optimizing RFID data access and control operations. This interface is designed to be modular with the ability to support multiple RFID air protocols. However, in this this part of ISO/IEC 24791, the only RFID air protocol supported is Type C of ISO/IEC 18000-6.

2 Conformance **iTeh STANDARD PREVIEW**

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Conformance for this part of ISO/IEC 24791 shall satisfy the requirements of the EPCglobal LLRP specification and the requirements of the LLRP extensions defined in clause 9 of this part of ISO/IEC 24791. Clause 9 is partitioned into sub-clauses and each sub-clause includes a specific compliance requirement paragraph. Therefore, conformance to clause 9 of this part of ISO/IEC 24791 is defined by the shall statements of the compliance requirement paragraphs found within the sub-clauses of clause 9. The EPCglobal LLRP specification also has specific compliance requirement paragraphs. Therefore, conformance to the EPCglobal LLRP specification is defined by the shall statements of the compliance requirement paragraphs found in the LLRP specification.

3 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 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

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

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

ISO/IEC 24791-1, *Information technology — Radio frequency identification (RFID) for item management — Software system infrastructure — Part 1: Architecture*

EPCglobal™ LLRP, *Low Level Reader Protocol*

4 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.

- 4.1 device interface**
communications interface that provides tag data access and control operations between an RFID Interrogator and an upstream Client
- 4.2 endpoint**
one of two components that either implements and exposes an interface to other components or uses the interface of another component
- 4.3 interrogator endpoint**
component that implements and exposes the interrogator interface defined by this part of ISO/IEC 24791 to other system components
- 4.4 client endpoint**
component that uses the interrogator interface defined by this part of ISO/IEC 24791 to access interrogators
- 4.5 interface**
shared boundary between two functional units, defined by various characteristics pertaining to the functions, physical or software interconnections, signal exchanges, and other characteristics, as appropriate
- 4.6 interrogator controller**
system component, possibly a distinct physical device, which is capable of exercising the data, control, and management of interrogators as described in this part of ISO/IEC 24791
- 4.7 data set**
binary representation of a data element's identifier and its associated data value that is encoded according to the rules defined by ISO/IEC 15962 standard access method
- 4.8 data item**
pairing of a data element's identifier and its associated data value that is encoded according to the rules defined by ISO/IEC 15962, regardless of access method
- 4.9 encoded package**
self-describing binary data from an RFID tag memory bank that, when given the memory bank's DFSID (which defines the ISO/IEC 15962 access method and data format), decoding software can fully decode the individual data item(s) to extract the encapsulated data
- 4.10 protocol data unit**
unit of information communicated between network peers

5 Abbreviated terms

For the purposes of this part of ISO/IEC 24791, the symbols and abbreviated terms given in ISO/IEC 19762-1, ISO/IEC 19762-3, and the following apply.

AIDC

Automatic Identification and Data Capture

DSFID

Data Storage Format Identifier

LLRP

Low Level Reader Protocol

RF

Radio Frequency

SSI

Software System Infrastructure

UML

Unified Modeling Language

6 Software System Infrastructure Architecture Overview

ISO/IEC 24791-1 defines the architecture for the Software System Infrastructure. The basic relationship among the interfaces and implementations of the Software System Infrastructure is depicted in Figure 1 — Architecture Overview including Relationships to other RFID Standards.

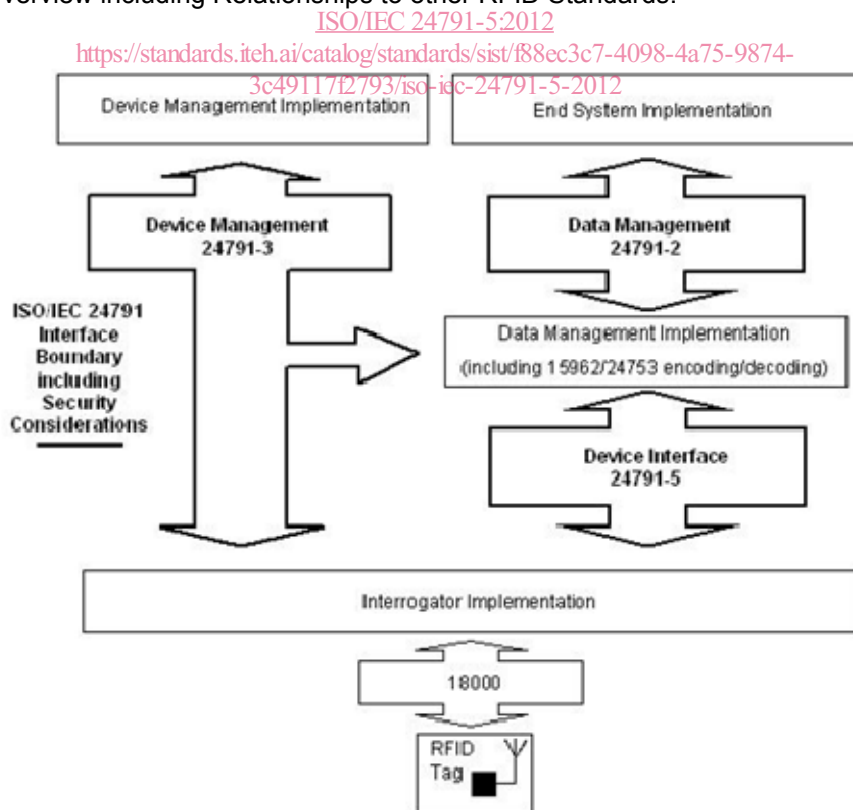


Figure 1 — Architecture Overview including Relationships to other RFID Standards

The Data Interface, Device Interface, and Device Management each provide one or more interfaces that allow a client to communicate with a service-providing implementation, either within the same computing device or across a network. These client and service implementations are consistently referred to as Client Endpoints and Services Endpoints, respectively, and in general, the Client Endpoint accesses the capabilities provided by the Services Endpoint. It is the responsibility of the specific standard to define the formats, procedures, operations, and conformance requirements of each interface.

7 UML Modeling

Although Figure 1 provides a general overview of the relationship between the interfaces and implementations in the SSI, Unified Modeling Language (UML) is used in the remainder of the document to graphically represent the organization and operation of the Device Interface and implementations so that a precise and common understanding of the relationships among the components can be defined.

UML is a very rich language, but for simplicity only the Physical Diagram subset of the language is used to represent the architecture of the Software System Infrastructure. Physical diagrams, comprised of Component Diagrams and Deployment Diagrams, represent the relationships among the functions and the interfaces provided by the SSI architectural elements as well as how these functions might exist in standards compliant solutions, respectively. Refer to ISO/IEC 24791-1 for a more complete description how UML is used in this part of ISO/IEC 24791.

8 Device Interface

8.1 General

This clause describes the device interface defined by this part of ISO/IEC 24791 in terms of the overall software system infrastructure described in ISO/IEC 24791-1. Annex A of this part of ISO/IEC 24791 provides further references to several open sources projects that offer software libraries and utilities supporting this device interface.

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8.2 Architecture

As defined in ISO/IEC 24791-1, the Device Interface defines *data* and *control* operation between the Device Interface Services Endpoint on an RFID interrogator and the Client Endpoint typically on a different physical device. A Device Interface component exposes an interface as represented in Figure 2 — Device Interface Representation whereby a Device Interface Services Endpoint provides services to a Device Interface Client Endpoint over an interface binding as specified in clause 10 of this part of ISO/IEC 24791, ISO/IEC 24791-5. The Client and Services Endpoints may exist in a single device or may be accessed across a network.

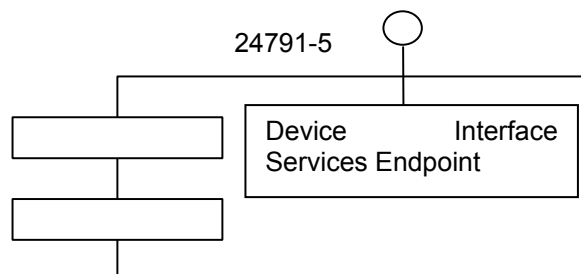


Figure 2 — Device Interface Representation

The Device Interface is responsible for supporting and exercising the capabilities provided by the RFID air protocols to achieve the tag and sensor access goals of an RFID software system. In order to achieve this goal, the standards provided for the data, control, and management functions at this level in the Software System Infrastructure are air-protocol aware and capable of fully exercising specific features of the supported air protocol standards. Equivalently, it is *not* a goal to provide a single, abstract interrogator interface that provides a common interface regardless of the specific air protocol in use. Doing so would reduce the ability of the software systems to access the specific features provided by existing and future air protocols.

The Device Interface supports requests for, and communication of, tag information between the Services Endpoint on RFID interrogators and the Client Endpoint on upstream devices. The data functions include capabilities such as reading, writing, filtering, and the reporting of tag and sensor data. Synchronous, event-based, and externally triggered operation may be supported for access requests.

The control functions in the architecture provide an interface for the Device Interface Client to exercise specific control over the access operations on an interrogator. This control is specific to each air protocol and is intended to provide the necessary capabilities to allow for software system, interrogator, and RF environment optimization. The control function of the Device Interface also supports the delivery of system, interrogator, tag, and RF environment data from the Services Endpoint to the Client Endpoint. This data can be used by implementations to provide the control required to achieve the desired system goals.

9 LLRP Extensions Abstract Definitions

9.1 General

ISO/IEC 24791-5 directly references and therefore utilizes the complete structure, definitions, formats, and procedures of the EPCglobal Low Level Reader Protocol (LLRP) specification [LLRP] with the addition of extensions that provide support for reading and decoding RFID Type C of ISO/IEC 18000-6 tag data formatted and operated upon according to ISO/IEC 15962. If an implementation of this part of ISO/IEC 24791 is unable to decode a tag data object, then it shall transfer to the client endpoint the raw, binary contents of the entire data set (i.e., the data object and its associated header data such as precursor and length fields).

Tag data may be encoded according to ISO/IEC 15962 to represent different character sets (e.g., the default ISO/IEC 8859-1, or UTF-8, or application defined). Tag data encoded as UTF-8 (compaction code 111) is fully compatible with this part of ISO/IEC 24791, and is transferred “as-is”. It is the responsibility of the client application to convert this UTF-8 data to other character sets if needed. Tag data found to be encoded as application defined (compaction code 000) cannot be decoded by an implementation of this part of ISO/IEC 24791 and as such, it shall be transferred as raw, binary data. Tag data that is encoded with no directory, directory, or tag data profile access methods and with the following compaction codes (001, 010, 011, 100, and 101) when decoded have the same single byte value on the tag and in UTF-8 format. If the compaction scheme is declared as Octet encoded (compaction code 110) then the encoding on the tag shall need to be converted to UTF-8 if any byte value is in the range between 80_h to FF_h. An example of the conversion algorithm is given in Appendix B.

The remainder of this part of ISO/IEC 24791 defines the ISO/IEC 24791-5 extensions to LLRP. This clause provides an abstract definition of interface parameters used to request and return decoded tag data. Clause 10 defines the transfer syntax details required to implement these interface parameters.

When referencing the EPCglobal LLRP specification, it will be helpful to understand that there are several EPCglobal terms that are synonymous with ISO/IEC terms. The following list enumerates EPCglobal terms with definitions using ISO/IEC terminology:

- **EPC (Electronic Product Code)**
identifier corresponding to the ISO/IEC unique item identifier (UII) as defined by air protocol interface Type C of ISO/IEC 18000-6 when memory bank 01₂ bit 17_h is zero
- **EPC Memory Bank**
equivalent to the UII memory bank as defined by air protocol interface Type C of ISO/IEC 18000-6