AS ISO 14906:2023
ISO 14906:2022

Australian STANDARD®

STANDARDS Australia

Electronic fee collection — Application interface definition for dedicated short-range communication

Documents
Document Sharing Hub

AS ISO 14906:2023

This Australian Standard ® was prepared by IT-023, Transport Information and Control Systems. It was approved on behalf of the Council of Standards Australia on 23 October 2023.

This Standard was published on 10 November 2023.

The following are represented on Committee IT-023:

ARRB (Australian Road Research Board)
Department of Transport and Main Roads (QLD)
Department of Transport and Planning (VIC)
Engineers Australia
Federal Chamber of Automotive Industries
Intelligent Transport Systems Australia
Transport Certification Australia
Transport for NSW

This Standard was issued in draft form for comment as DR AS ISO 14906:2023.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:
www.standards.org.au

ISBN 978 1 76139 421 8

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

AS ISO 14906:2023
ISO 14906:2022

Electronic fee collection — Application interface definition for dedicated short-range communication

Originated as AS ISO 14906—2005.
Second edition 2023.

COPYRIGHT

Standards Australia Ltd 2023

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

Preface

This Standard was prepared by the Standards Australia Committee IT-023, Transport Information and Control Systems, to supersede AS ISO 14906—2005, *Road transport and traffic telematics — Electronic fee collection — Application interface definition for dedicated short-range communication.*

The objective of this document is to specify the application interface for electronic fee collection (EFC) systems using dedicated short-range communication (DSRC).

This document specifies the following:

(a) EFC attributes (i.e. EFC application information).

(b) Procedures of EFC attributes and (hardware) components (e.g. integrated circuit(s) card).

(c) EFC application functions.

(d) The EFC transaction model.

(e) The behaviour of the interface for interoperability on an EFC-DSRC application interface level.

This document is identical with, and has been reproduced from, ISO 14906:2022, *Electronic fee collection — Application interface definition for dedicated short-range communication*.

As this document has been reproduced from an international document, a full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

Documents
Document Sharing Hub

© Standards Australia Limited 2023

Full document details: AS ISO 14906-2023

Contents

Preface ii
Foreword v
Introduction vi
1 Scope 1
2 Normative references 2
3 Terms and definitions 2
4 Abbreviated terms 4
5 EFC application interface architecture 6
5.1 Relation to the DSRC communication architecture 6
5.2 Usage of DSRC application layer by the EFC application interface 8
5.3 Addressing of EFC attributes 8
5.3.1 Basic mechanism 8
5.3.2 Role of the Element Identifier (EID) 9
5.3.3 Multiple instances of Attributes 9
5.4 Addressing of components 10
6 EFC transaction model 11
6.1 General 11
6.2 Initialisation phase 11
6.2.1 Overview 11
6.2.2 EFC application-specific contents of the BST 12
6.2.3 EFC application-specific contents of the VST 13
6.3 Transaction phase 14
7 EFC functions 16
7.1 Overview and general concepts 16
7.1.1 EFC functions and service primitives 16
7.1.2 Overview of EFC functions 17
7.1.3 Handling of multiple instances 18
7.1.4 Security 19
7.2 EFC functions 22
7.2.1 General 22
7.2.2 GET_STAMPED 23
7.2.3 SET_STAMPED 23
7.2.4 GET_SECURE 24
7.2.5 SET_SECURE 25
7.2.6 GET_INSTANCE 26
7.2.7 SET_INSTANCE 26
7.2.8 GET_NONCE 27
7.2.9 SET_NONCE 28
7.2.10 TRANSFER_CHANNEL 28
7.2.11 COPY 29
7.2.12 SET_MMI 30
7.2.13 SUBTRACT 31
7.2.14 ADD 31
7.2.15 DEBIT 32
7.2.16 CREDIT 33
7.2.17 ECHO 34
8 EFC Attributes 34
8.1 General 34
8.2 Data group contract 36
8.3 Data group receipt 39
8.4 Data group vehicle 44

Documents
Document Sharing Hub
Full document details: AS ISO 14906-2023

8.5 Data group equipment 48
8.6 Data group driver 50
8.7 Data group payment 52

Annex A (normative) **EFC data type specifications** **54**

Annex B (informative) **CARDME transaction** **55**

Annex C (informative) **Examples of EFC transaction types** **86**

Annex D (informative) **Mapping table from LatinAlphabetNo2, LatinCyrillicAlphabet, LatinGreekAlphabet and LatinAlphabetNo10 to LatinAlphabetNo1** **98**

Annex E (informative) **Mapping table between EFC Vehicledata attribute and European registration certificate** **99**

Annex F (normative) **Security calculations for DES** **103**

Annex G (informative) **Security computation examples for DES** **109**

Annex H (normative) **Security calculations for AES** **112**

Annex I (informative) **Security computation examples for AES** **117**

Bibliography **119**

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Intelligent Transport Systems,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 14906:2018), which has been technically revised. It also incorporates the Amendment ISO 14906:2018/Amd 1:2020.

The main changes are as follows:

— updating of terms and definitions, including reference to ISO/TS 17573-2 as the primary source;

— updating of data definitions, including reference to ISO 17573-3:—[1)] as the primary source;

— addition of a second level of the version identifier (i.e. minor version) of the abstract syntax notation one (ASN.1) module to provide enhanced support to standards that import data types from this document;

— introduction of use of imported ASN.1 types with successors (i.e. including all future minor versions).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

1) Under preparation. Stage at the time of publication: ISO/DIS 17573-3:2022.

© Standards Australia Limited 2023

Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

Introduction

This document specifies an application interface for electronic fee collection (EFC) systems, which is based on dedicated short-range communication (DSRC). It supports interoperability between EFC systems on an EFC-DSRC application interface level. This document is intended for DSRC charging applications, but specifically the definition of EFC data elements is valid beyond the use of a DSRC charging interface and can potentially be used for other DSRC applications (e.g. compliance checking communication) and/or on other interfaces (e.g. the application interface of autonomous systems).

This document provides specifications for the EFC transaction model, EFC data elements (referred to as attributes) and functions, from which an EFC transaction can be built. The EFC transaction model provides a mechanism that allows the handling of different versions of EFC transactions and associated contracts. A certain EFC transaction supports a certain set of EFC attributes and EFC functions as defined in this document. It is not envisaged that the complete set of EFC attributes and functions be present in each piece of EFC equipment, on-board equipment (OBE) or roadside equipment (RSE).

This document provides the basis for agreements between operators, which are needed to achieve interoperability. Based on the tools specified in this document, interoperability can be reached by operators recognizing each others' EFC transactions (including the exchange of security algorithms and keys) and implementing the EFC transactions in each others' RSE, or they can reach an agreement to define a new transaction (and contract) that is common to both. Considerations should also be made by each operator so that the RSE has sufficient resources to implement such additional EFC transactions.

In order to achieve interoperability, operators should agree on issues such as:

— which optional features are actually being implemented and used;

— access rights and ownership of EFC application data in the OBE;

— security policy (including encryption algorithms and key management, if applicable);

— operational issues, such as how many receipts may be stored for privacy reasons, how many receipts are necessary for operational reasons (for example as entry tickets or as proof of payment);

— the agreements needed between operators in order to regulate the handling of different EFC transactions.

In this edition of this document, users are faced with issues related to backward compatibility. Such issues can be managed by using the following:

— EfcModule ASN.1 module, including a version number;

— EfcContextMark (incl. the ContextVersion), denoting the implementation version; this provides a means to ensure co-existence of different implementation versions by means of a look-up table and associated appropriate transaction processing. This will enable the software of the RSE to determine the version of the OBE and its capability to accept the new features introduced by this edition of ISO 14906.

This application interface definition can also be used with other DSRC media which do not use layer 7 according to ISO 15628/EN 12834. Any DSRC medium which provides services to read and write data, to initialise communication and to perform actions is suitable to be used as a basis for this application interface. Adaptations are medium-specific and are not further covered here. As Annex B provides a detailed description of a transaction for central account systems, this document can also be used for on-board account systems, in conjunction with ISO 25110, which provides examples of systems based on on-board accounts.

This document also includes:

— Annex A, which provides the normative ASN.1 data type specifications (EFC action parameters and attributes);

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

— Annex B, which presents an example of a transaction based on the CARDME specification, including bit-level specification;

— Annex C, which presents examples of EFC transaction types, using the specified EFC functions and attributes;

— Annex D, which presents a mapping table from LatinAlphabetNo2 & 5 to LatinAlphabetNo1 to facilitate for a service provider the use of LatinAlphabetNo1 to encode an OBE for data available written with non-Latin1 characters;

— Annex E, which presents a mapping table between EFC vehicle data attributes and European registration certificates to facilitate the task of a service provider in OBE-personalization with vehicle data;

— Annex F, which presents the security calculations according to the data encryption standard (DES).

NOTE 1 Annex F is based on EN 15509:2014, Annex B.

— Annex G, which presents security computations examples for DES;

NOTE 2 Annex G is based on EN 15509:2014, Annex E.

— Annex H, which presents the security calculations for advanced encryption standard (AES);

NOTE 3 Annex H is an adaptation of EN 15509:2014, Annex B for the case of AES.

— Annex I, which presents the security computations examples for AES.

NOTE 4 Annex I is an adaptation of EN 15509:2014, Annex E for the case of AES.

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS ISO 14906-2023

NOTES

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

Australian Standard®

Electronic fee collection — Application interface definition for dedicated short-range communication

1 Scope

This document specifies the application interface in the context of electronic fee collection (EFC) systems using dedicated short-range communication (DSRC).

The EFC application interface is the EFC application process interface to the DSRC application layer, as can be seen in Figure 1. This document comprises specifications of:

— EFC attributes (i.e. EFC application information) that can also be used for other applications and/or interfaces;

— the addressing procedures of EFC attributes and (hardware) components (e.g. integrated circuit(s) card);

— EFC application functions, i.e. further qualification of actions by definitions of the concerned services, assignment of associated ActionType values, and content and meaning of action parameters;

— the EFC transaction model, which defines the common elements and steps of any EFC transaction;

— the behaviour of the interface so as to ensure interoperability on an EFC-DSRC application interface level.

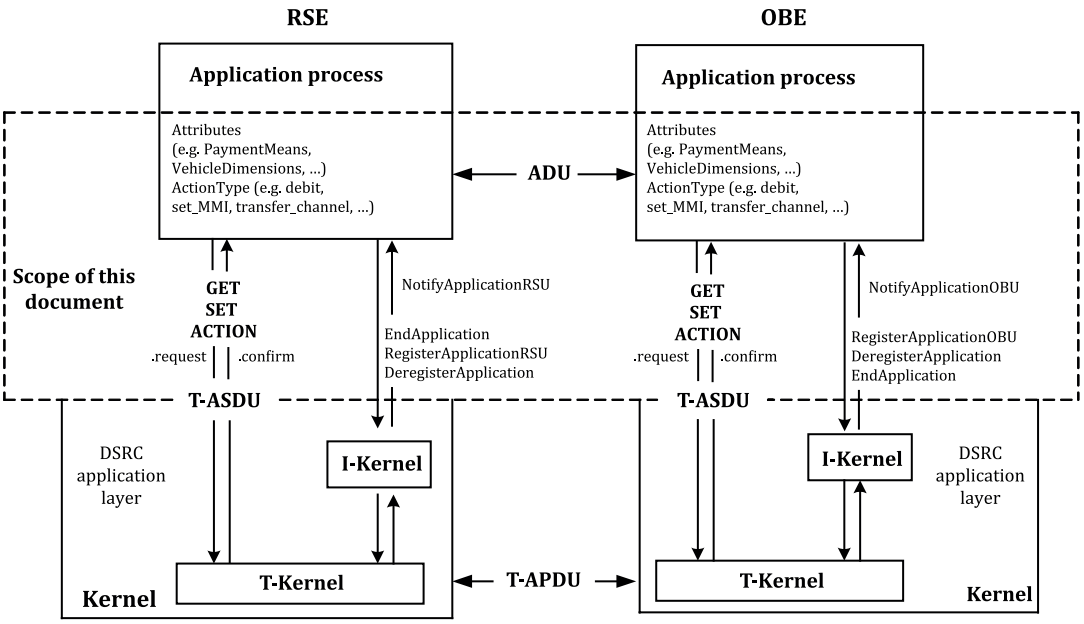


Figure 1 — The EFC application interface

This is an interface standard, adhering to the open systems interconnection (OSI) philosophy (see ISO/IEC 7498-1), and it is as such not primarily concerned with the implementation choices to be realized at either side of the interface.

This document provides security-specific functionality as place holders (data and functions) to enable the implementation of secure EFC transactions. Yet the specification of the security policy (including specific security algorithms and key management) remains at the discretion and under the control of the EFC operator, and hence is outside the scope of this document.

© Standards Australia Limited 2023

Documents
Document Sharing Hub
Full document details: AS ISO 14906-2023

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 612, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country code*

ISO 3779, *Road vehicles — Vehicle identification number (VIN) — Content and structure*

ISO 4217, *Codes for the representation of currencies*

ISO/IEC 7812-1, *Identification cards — Identification of issuers — Part 1: Numbering system*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules — Part 2: Specification of Packed Encoding Rules (PER)*

ISO/IEC 9797-1:2011, *Information technology — Security techniques — Message Authentication Codes (MACs) — Part 1: Mechanisms using a block cipher*

ISO 14816, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ISO 15628:2013, *Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer*

ISO 17573-3:—[2)], *Electronic fee collection — System architecture for vehicle-related tolling — Part 3: Data dictionary*

ISO/IEC 18033-3:2010, *Information technology — Security techniques — Encryption algorithms — Part 3: Block ciphers*

EN 12834, *Road transport and traffic telematics — Dedicated Short Range Communication (DSRC) — DSRC application layer*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
access credentials
trusted attestation or secure module that establishes the claimed identity of an object or application

[SOURCE: ISO/TS 17573-2:2020, 3.4]

2) Under preparation. Stage at the time of publication: ISO/DIS 17573-3:2022.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

3.2
attribute
addressable package of data consisting of a single data element or structured sequences of data elements

[SOURCE: ISO/TS 17573-2:2020, 3.13]

3.3
authenticator
data, possibly encrypted, that is used for authentication

[SOURCE: ISO/TS 17573-2:2020, 3.16]

3.4
channel
information transfer path

[SOURCE: ISO/TS 17573-2:2020, 3.30]

3.5
cryptography
principles, means and methods for the transformation of data in order to hide its information content, prevent its undetected modification or prevent its unauthorized use

[SOURCE: ISO/TS 17573-2:2020, 3.53]

3.6
data group
class of closely related *attributes* (3.2)

[SOURCE: ISO/TS 17573-2:2020, 3.55]

3.7
data integrity
information integrity
property that data has not been altered or destroyed in an unauthorized manner

[SOURCE: ISO/TS 17573-2:2020, 3.56]

3.8
Element
DSRC directory containing application information in the form of *attributes* (3.2)

3.9
on-board equipment
all required equipment on-board a vehicle for performing required EFC functions and communication services

[SOURCE: ISO/TS 17573-2:2020, 3.126]

3.10
on-board unit
single electronic unit on-board a vehicle for performing specific EFC functions and for communication with external systems

[SOURCE: ISO/TS 17573-2:2020, 3.127]

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS ISO 14906-2023

3.11
roadside equipment
fixed or movable electronic fee collection equipment located along or on the road

Note 1 to entry: Roadside equipment (RSE) and roadside unit (RSU) have been used as terms with the same or similar meaning in the standardization of DSRC and DSRC-based EFC within CEN and ETSI. Previously-developed relevant standards used the term "RSU" with the meaning "RSE" as defined in this document.

[SOURCE: ISO/TS 17573-2:2020, 3.161]

3.12
toll charger
entity which levies toll for the use of vehicles in a *toll domain* (3.13)

[SOURCE: ISO/TS 17573-2:2020, 3.194]

3.13
toll domain
area or part of a road network where a toll regime is applied

[SOURCE: ISO/TS 17573-2:2020, 3.201]

3.14
toll service
service enabling users to pay toll

[SOURCE: ISO/TS 17573-2:2020, 3.205]

3.15
toll service provider
entity providing *toll services* (3.14) in one or more *toll domains* (3.13)

[SOURCE: ISO/TS 17573-2:2020, 3.206]

3.16
transaction
whole of the exchange of information between two physically separated communication facilities

[SOURCE: ISO/TS 17573-2:2020, 3.211]

3.17
transaction model
functional model describing the structure of electronic payment *transactions* (3.16)

[SOURCE: ISO/TS 17573-2:2020, 3.213]

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

ADU	application data unit
AES	advanced encryption standard
AP	application process
APDU	application protocol data unit
ASN.1	abstract syntax notation one
BST	beacon service table

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

CCC	compliance check communication
cf	confirm
DES	data encryption standard
DSRC	dedicated short-range communication
EFC	electronic fee collection
EID	Element Identifier
GNSS	global navigation satellite system
ICC	integrated circuit(s) card
IID	invoker identifier
I-Kernel	initialisation kernel
ind	indication
L1	layer 1 of DSRC (physical layer)
L2	layer 2 of DSRC (data link layer)
L7	application layer core of DSRC
LAC	localisation augmentation communication
LID	logical link control identifier
LLC	logical link control
LPDU	LLC protocol data unit
MAC	medium access control
MMI	man-machine interface
n.a.	not applicable
OBE	on-board equipment
OBU	on-board unit
PDU	protocol data unit
PER	packed encoding rules
PPDU	physical protocol data unit
req	request
rs	response
RSE	roadside equipment
RSU	roadside unit
SAM	secure application module

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS ISO 14906-2023

T-APDU	transfer-application protocol data unit
T-ASDU	transfer-application service data unit
T-Kernel	transfer kernel
TC	toll charger
TSP	toll service provider
VST	vehicle service table
XOR	exclusive or (logical operation)

5 EFC application interface architecture

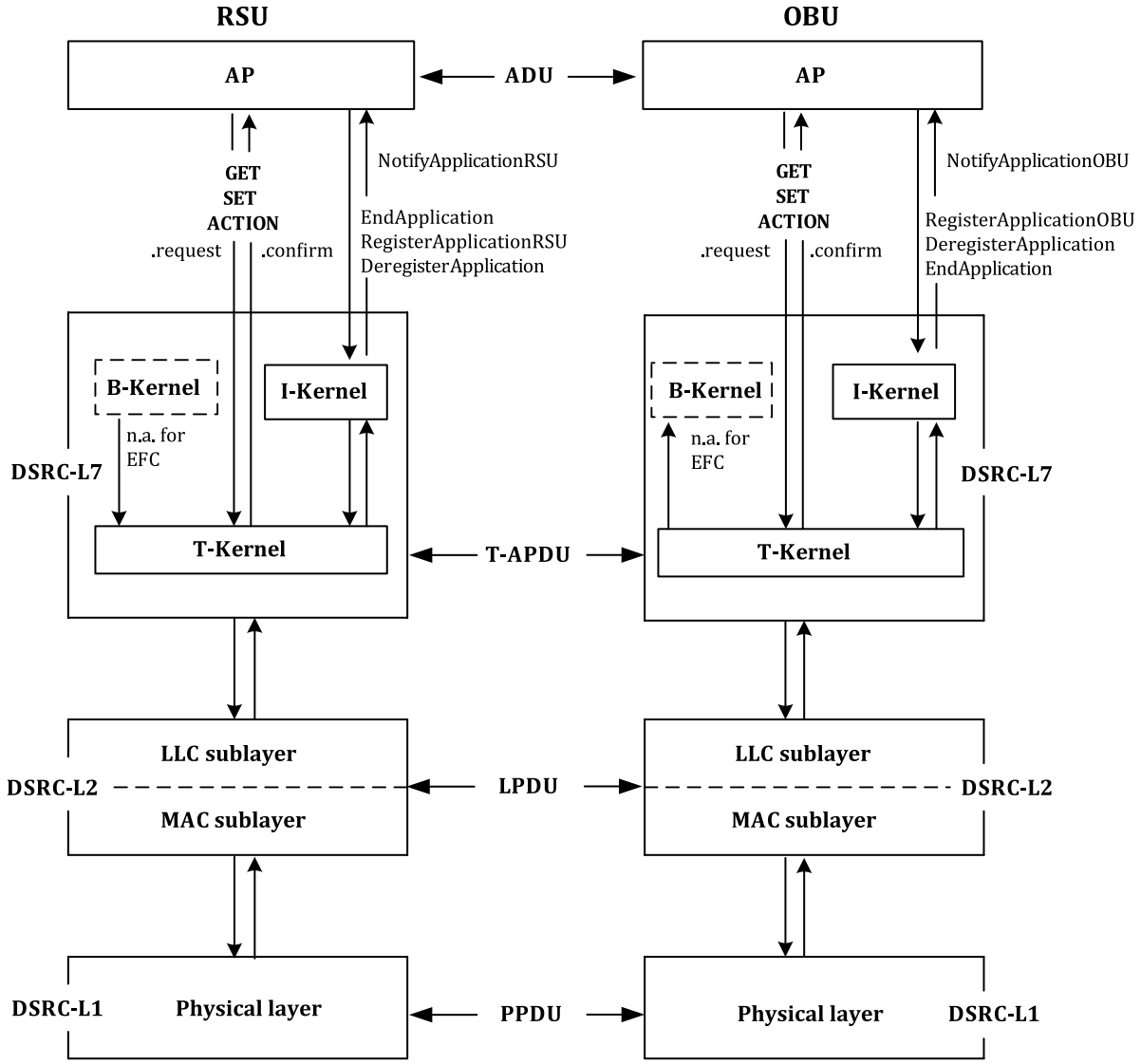
5.1 Relation to the DSRC communication architecture

The DSRC services are provided to an application process (AP) by means of the DSRC application layer service primitives, which are abstract implementation interactions between a communication service user and a provider. The services are offered by the DSRC communication entities by means of its DSRC application layer (EN 12834/ISO 15628) as shown in Figure 2.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023



NOTE The abbreviated terms used in Figure 2 are defined in Clause 4.

Figure 2 — The EFC application process on top of the DSRC communication stack

The transfer kernel (T-Kernel)of DSRC application layer offers the following services to application processes (see Figure 2):

— GET: The invocation of a GET service request results in retrieval (i.e. reading) of application information (i.e. Attributes) from the peer service user (i.e. the OBE application process). A reply is always expected.

— SET: The invocation of a SET service request results in modification (i.e. writing) of application information (i.e. Attributes) of the peer service user (i.e. the OBE application process). This service may be requested in confirmed or non-confirmed mode. A reply is only expected in the former case.

— ACTION: The invocation of an ACTION service request results in a performance of an action by the peer service user (i.e. the OBE application process). An action is further qualified by the value of the ActionType. This service may be requested in confirmed or non-confirmed mode. A reply is only expected in the former case.

— EVENT-REPORT: The invocation of an EVENT-REPORT service request forwards a notification of an event to the peer service user.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

— INITIALISATION: The invocation of an initialisation service request by RSE results in an attempt to initialise communication between an RSE and each OBE that has not yet established communication with the concerned RSE. The initialisation service is only used by the initialisation kernel as defined in EN 12834/ISO 15628.

5.2 Usage of DSRC application layer by the EFC application interface

EFC uses the following services offered by DSRC application layer (as defined in ISO 15628):

— The INITIALISATION services (listed below) are used to realize the EFC-specific initialisation mechanism (see Clause 6):

  — Notify Application RSU (at RSE),

  — End Application (at RSE),

  — Register Application RSU (at RSE),

  — Deregister Application (at RSE and OBE),

  — Notify Application OBU (at OBE),

  — Register Application OBU (at OBE),

— The GET service is used to retrieve EFC attributes (for attribute specifications see Clause 8);

— The SET service is used to set EFC attributes;

— The ACTION services are applied to realize additional EFC specific functionality needed to support EFC application processes, such as TRANSFER_CHANNEL, SET_MMI and ECHO (see 7.2).

In the following subclauses, the EFC-specific usage of the DSRC Layer 7 services is specified in detail.

NOTE The EVENT-REPORT-service can be implicitly used by EFC application processes. For example, it is used indirectly as part of an already defined command to release an application process (see EN 12834/ISO 15628, Ready Application). However, as the EVENT-REPORT-service is not explicitly used by EFC application processes, this service is not further referred to in this document.

5.3 Addressing of EFC attributes

5.3.1 Basic mechanism

EFC Attributes are used to transfer the EFC application-specific information.

EFC Attributes are composed of one or more data elements of specified abstract syntax notation one (ASN.1) types. Each data element is associated with, within the context of this document, an unambiguous name.

To each EFC Attribute, an AttributeID is associated. The AttributeID enables to unambiguously identify and address an EFC Attribute.

EXAMPLE Figure 3 illustrates the basic addressing mechanism.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

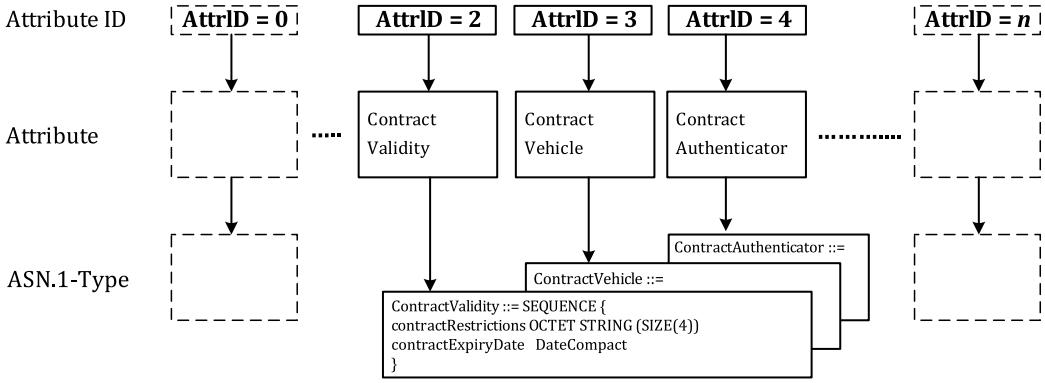


Figure 3 — Basic addressing mechanism

5.3.2 Role of the Element Identifier (EID)

In a given OBE, the DSRC-EID (different from 0) is used to address an EFC context, identified by the EfcContextMark (see 6.2.3), in which Attributes can be addressed unambiguously by AttributeIDs inside an Element of the OBE. In the vehicle service table (VST), the OBE transmits one or several of these EFC contexts, each corresponding to an EFC ContextMark and the EID to be used for addressing the attributes and each using the EFC functions supported by it.

EXAMPLE Figure 4 illustrates the role of the EID.

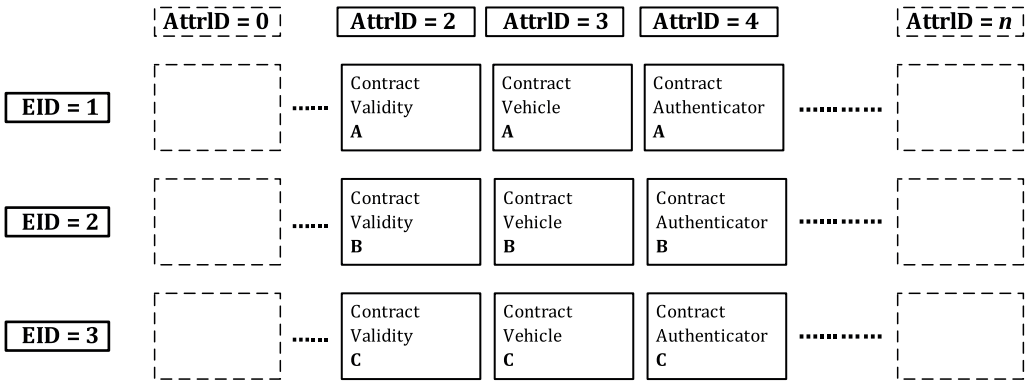


Figure 4 — Role of the EID

EID equals 0 shall be used to address application-independent functions and components, e.g. SET_MMI and TRANSFER_CHANNEL (see 7.2).

5.3.3 Multiple instances of Attributes

There may be *n*, where *n* is an `INTEGER`, instances of an Attribute available in the OBE.

The maximum number of instances, N_{max}, of one Attribute may be limited according to the needs of operators and users. The default maximum number of instances is N_{max} = 1. The value of N_{max} is determined at the time of OBE configuration.

EXAMPLE Figure 5 illustrates multiple instances (0-2) of attribute 5.

© Standards Australia Limited 2023

Full document details: AS ISO 14906-2023

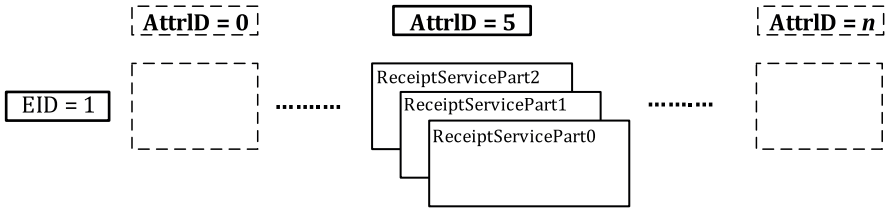


Figure 5 — Multiple instances (0-2) of attribute 5

The handling of multiple instances and the corresponding addressing mechanism are described in detail as part of the behaviour specification of the corresponding functions supporting multiple instances (see 7.2.6 for GET_INSTANCE and 7.2.7 for SET_INSTANCE).

5.4 Addressing of components

Components of an OBE to be addressed via the EFC application interface include for example:

— OBU;

— secure application module (SAM) 1;

— SAM 2;

— ICC;

— display;

— buzzer;

— printer;

— serial interface;

— parallel interface;

— global navigation satellite system (GNSS);

— tachograph;

— bluetooth.

Addressing of these components is enabled on two levels: device-specific and device-independent addressing.

The device-specific transparent addressing mechanism enables the transfer of information, which shall be processed by the addressed device (such as an integrated circuit(s) card (ICC)-command). The addressed device is identified by a channel ID. The EFC function TRANSFER_CHANNEL (see 7.2.10) supports this functionality.

EXAMPLE 1 Transfer of a bit string to an ICC.

The device-independent addressing mechanism uses a set of commands, which describe a certain functionality, which can be performed by various OBE components. In this case, the operating system of the OBE will address the corresponding components. The EFC function SET_MMI supports this functionality (see 7.2.12).

EXAMPLE 2 Invocation of a SET_MMI(EID=0, ContactOperator) function activates an OBE MMI-device, e.g. a buzzer or a display.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

NOTE In a specific implementation, specific attributes or data elements can activate some man-machine interface (MMI) function (e.g. a SET command on the attribute ReceiptText can display the text on a display. A SET command on the attribute ReceiptServicePart with data element SessionResultOperational other than SessionOK can activate an alert beep). Proprietary addressing mechanisms are not defined by this document.

6 EFC transaction model

6.1 General

The EFC transaction model related to the EFC application interface for the DSRC comprises two phases: the initialisation phase and the transaction phase.

NOTE The purpose of the initialisation phase is to set up the communication between the RSE and OBE that have entered the DSRC zone but have not yet established communication with the RSE, and to notify the application processes. It provides, amongst others, a multi-application switching mechanism, allowing for execution of several ITS applications (in parallel) at one RSE station.

The transaction phase can only be reached after completion of the initialisation phase. The EFC functions, as defined in Clause 7, can be performed in the transaction phase. The GET and SET services (DSRC application layer functions) as defined in EN 12834/ISO 15628:2013, 6.2, may also be used in an EFC transaction phase.

6.2 Initialisation phase

6.2.1 Overview

This subclause provides an overview of the functionality of, and the information exchanges in, the initialisation phase.

The initialisation procedures, by means of beacon service table (BST) and vehicle service table (VST) exchanges, are defined in EN 12834/ISO 15628. Subclauses 6.2.2 and 6.2.3 account for the EFC application-specific information that shall be included in the BST and VST, respectively, as shown in Figure 6.

NOTE The OBE evaluates the received BST and selects the applications that it wishes to perform out of the lists of applications supported by the RSE.

If the OBE does not support any of application(s) supported by the RSE, then the OBE should not exchange any information with the RSE. If the OBE supports at least one of the application(s) supported by the RSE, then the OBE should inform the RSE of which application it wishes to execute in its corresponding VST.

© Standards Australia Limited 2023

Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

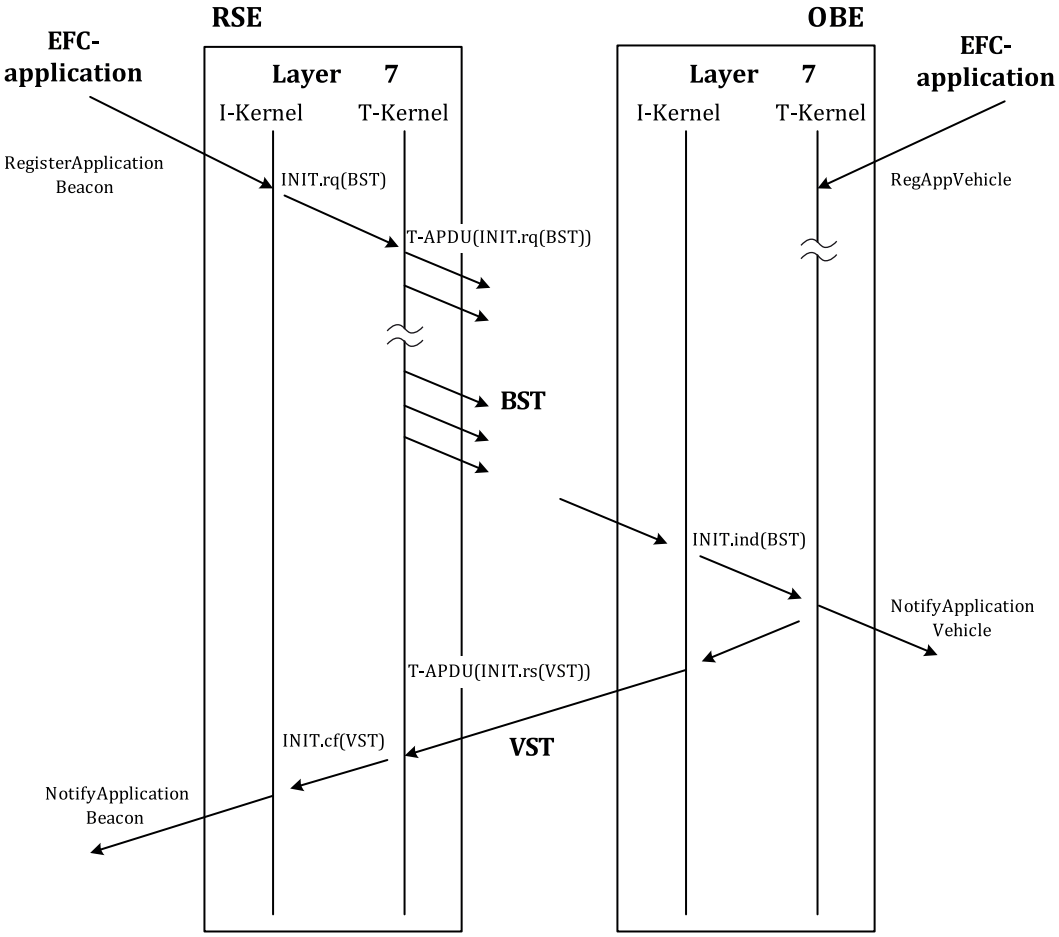


Figure 6 — Initialisation phase: BST - VST exchanges

The initialisation service associated with the initialisation phase is only used by the initialisation kernel (of EN 12834/ISO 15628), which in its turn is configured by the application(s) wishing to execute applications over a DSRC link. The initialisation kernels of the RSE and of the concerned OBE shall have been configured, according to EN 12834/ISO 15628, prior to the invocation of the initialisation service by the RSE.

6.2.2 EFC application-specific contents of the BST

An RSE supporting EFC shall have configured its initialisation kernel to carry the following information related specifically to the EFC application(s):

— the application identifier (AID) shall be equal to 1 (i.e. the value assigned for EFC);

— the EFC application shall be qualified as a mandatory application;

— EID shall not be transmitted in the BST related to the EFC application;

— no parameter shall be transmitted in the BST related to the EFC application.

NOTE 1 AID equal to 14 identifies the multi-purpose payment context. In Japan, this document specifies the application interface for DSRC used for multi-purpose payment (when AID=14 is used in Japan, the EID and parameter fields are defined through the BST).

© Standards Australia Limited 2023

Documents
Document Sharing Hub
Full document details: AS ISO 14906-2023

There shall be only one EFC application present in the BST (i.e. there shall be only one instance of AID=1 in the BST) regardless of whether the RSE supports more than one EfcContextMark (see also 6.2.3).

NOTE 2 The above is the EFC application-specific contents of the BST. The complete BST is defined in EN 12834/ISO 15628 and is given here for readability of this document:

```
BST :: =  SEQUENCE{
          rsu                    BeaconID,
          time                   Time,
          profile                Profile,
          mandApplications       ApplicationList,
          nonmandApplications    ApplicationList  OPTIONAL,
          profileList            SEQUENCE (SIZE(0..127,...)) OF  Profile
          }
```

where

```
ApplicationList ::=  SEQUENCE (SIZE (0..127,...)) OF SEQUENCE {
        aid           DSRCApplicationEntityID,           -- AID = 1
        eid           Dsrc-EID OPTIONAL,                 -- EID = e.g. 2
        parameter     ApplicationContextMark OPTIONAL    -- EfcContextMark
                                                         -- plus any EFC Attribute
        }
```

6.2.3 EFC application-specific contents of the VST

Each EFC application and corresponding contract shall be associated with an EfcContextMark, as defined in this subclause. An OBE may support several EFC applications.

NOTE 1 It is outside the scope of this document to define the presentation order of EfcContextMarks in order to indicate a user's order of preference, in case the user's OBE supports several EFC applications. Such rules for indicating the user's order of preference can be subject to agreements between operators.

An OBE supporting EFC shall have configured its initialisation kernel to carry the following information related specifically to the concerned EFC application:

— the AID shall be equal to 1;

— the EID value shall be logically associated with the corresponding EfcContextMark, contained in the parameter, and shall be unique within the OBE throughout the complete DSRC session;

— the parameter shall be of container choice type `OCTET STRING` and shall comprise the EfcContextMark as defined here, and may also be configured to carry additional EFC attributes (as defined in Clause 8 and in accordance with Annex A).

```
EfcContextMark ::= SEQUENCE{
          ContractProvider     Provider,
          TypeOfContract       OCTET STRING (SIZE(2)),
          ContextVersion       INTEGER(0..127,...)
          }
```

The extensibility of the ContextVersion should not be used. ContextVersion is coded as a single octet.

The EfcContextMark denotes a specific EFC context in the OBE, comprising the organization that issued the contract, the type of contract and the context version. ContractProvider, TypeOfContract and ContextVersion are further defined in Clause 8 as data elements of the Attribute EfcContextMark.

NOTE 2 The above is the EFC application-specific contents of the VST. The complete VST is defined in EN 12834/ISO 15628 and is given here for readability of this document:

```
VST:: = SEQUENCE{
        fill                BIT STRING (SIZE(4)),
        profile             Profile,
        applications        ApplicationList,
        obeConfiguration    ObeConfiguration
        }
```

where

© Standards Australia Limited 2023

Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

```
ApplicationList  ::=  SEQUENCE (SIZE (0..127,...)) OF SEQUENCE {
        aid           DSRCApplicationEntityID,           -- AID = 1
        eid           Dsrc-EID OPTIONAL,                 -- EID = e.g. 2
        parameter     ApplicationContextMark OPTIONAL    -- EfcContextMark
                                                         -- plus any EFC Attribute
        }
```

NOTE 3 Means to ensure backwards compatibility and co-existence are as follows.

— EfcModule ASN.1 module, including a version number.

— EfcContextMark (incl. the ContextVersion), denoting the implementation version, provides a means to ensure co-existence of different implementation versions by means of a look-up table and associated appropriate transaction processing.

NOTE 4 An EFC application provider retains the ultimate control of its security domain, i.e. the security level and the associated security mechanisms to be used within its system.

The data element obeStatus contained in the data element obeConfiguration shall always be present and may indicate the status of the OBE's battery. This information may be used by the RSE to notify the driver (e.g. using the SET_MMI code “contact operator”). Annex A applies.

NOTE 5 Retrofit DSRC OBE are mostly battery powered, and the battery usually has a lifetime that is dependent on the actual usage of the OBE (number of transactions per day, activation of MMI, etc.). In an interoperable environment, toll charger (TCs) can access the OBE via the DSRC interface, check the status of the battery and signal this status to the driver.

6.3 Transaction phase

After completion of the initialisation phase, the appropriate RSE application is informed (by means of the Notify Application RSU service) of the EfcContextMark and associated EID. The RSE shall use the functions defined in Clause 7 to complete the EFC transaction.

The RSE may invoke any sequence of EFC functions to complete the EFC transaction, provided that they are supported by the EfcContextMark. The OBE shall respond to the EFC functions invoked by the RSE and shall not initiate any EFC functions (by usage of a request service primitive, see further Clause 7) on its side.

EXAMPLE A transaction can consist of the following steps:

— GET(EID, ContractValidity, ContractVehicle, ReceiptServicePart, PaymentMeansBalance)

— DEBIT(EID, DebitPaymentFee)

— SET(EID, ReceiptServicePart)

Due to the construction of the EFC part of the VST, each EID identifies a certain EfcContextMark and shall be used by the RSE as a parameter of every function to unambiguously address data elements within the context given by the EfcContextMark. More than one EID may be used in one session.

The attributes to be implemented and the maximum number of instances of an attribute are defined at time of configuration of the OBE, which is outside the scope of this document. These implementation-dependent aspects are referenced unambiguously by the EfcContextMark (for each element present in the OBE) shown in Figure 7.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

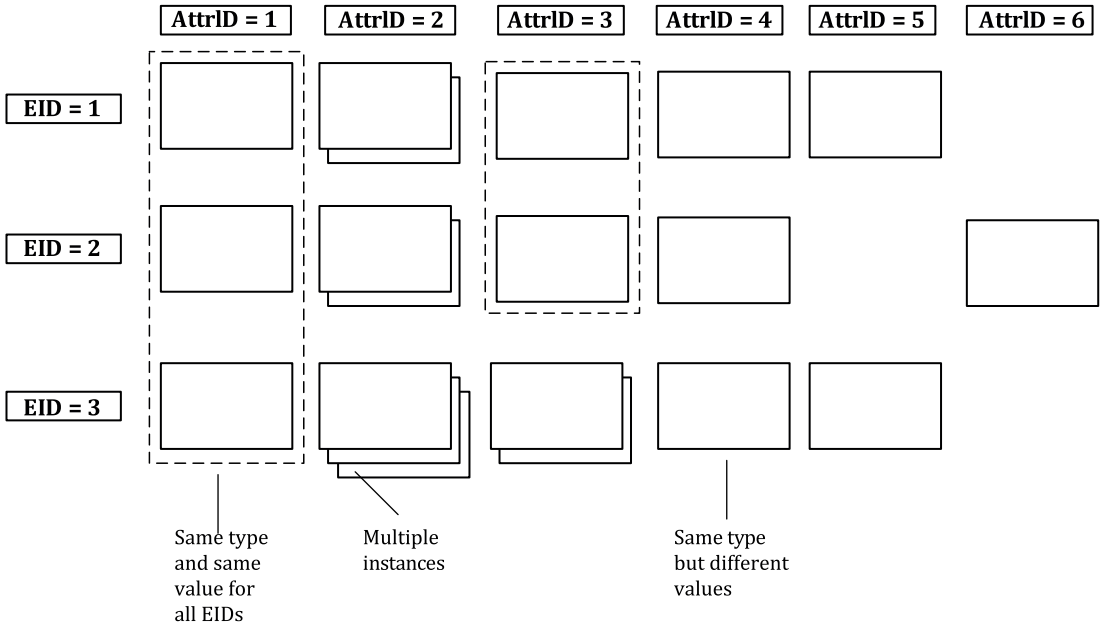


Figure 7 — Context of attributes given by EfcContextMark and identified by the EID

NOTE 1 This construction of contexts being identified by EIDs allows amongst others to implement the following transactions.

— Booking from two contracts in one transaction. There is sometimes the need to book from two contracts in one session, e.g. when a customer has a contract with a reduced price (e.g. a commuter contract) for part of the route being tolled, plus an ordinary (not reduced) contract for the rest of the route. This can be implemented by having all data groups identical between two EIDs, except for the data group contract.

— Having either two instances of the data group Vehicle to accommodate a pulling vehicle plus a trailer, or having two Elements containing same Attribute, one for the pulling vehicle and one for the trailer (and probably also separate Contract).

NOTE 2 This EFC transaction model and associated procedures allow for different levels of co-existence and interoperability between operators.

— No agreement between operators: each operator has a completely separate application domain, i.e. there are no common data groups. Each operator uses the attributes associated with "its" EFC-Context Mark.

— Agreement to share some data groups, but not others, e.g. the data groups Vehicle, Receipt and Payment are shared, but not Contract. Different security measures (algorithms) are used by the two operators or more, or all data groups are shared, except for Payment: each operator books from an account issued by itself.

— Agreement between operators (TCs and ETS Provider): each TC has the possibility to select only the attributes needed for a given toll context (principle of "Pick what you need") amongst common data group.

© Standards Australia Limited 2023

Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

7 EFC functions

7.1 Overview and general concepts

7.1.1 EFC functions and service primitives

This clause describes the EFC functions invoked by transfer-application service data units (T-ASDU) exchanged between peer applications communicating via a DSRC link. The T-ASDUs are exchanged by means of service primitives of the DSRC Application Layer (EN 12834/ISO 15628). Exchanges of service primitives (and the corresponding T-ASDUs) associated with EFC functions adhere to the following basic pattern:

— `xxx.rq` (request) service primitive invoked by the RSE application to DSRC Application Layer;

— `xxx.ind` (indication) service primitive issued by the DSRC Application Layer to the OBE application;

— `xxx.rs` (response) service primitive invoked by the OBE application to DSRC Application Layer;

— `xxx.cf` (confirmation) service primitive issued by the DSRC Application Layer to RSE application.

The last two steps are either mandatory or optional, depending on the nature of the service primitive and on the setting of the Mode parameter (see EN 12834:2003, 6.2.4/ISO 15628:2013, 6.2.4).

The logical sequence of a successful service primitives exchange (for Mode = TRUE) is illustrated in Figure 8. Service primitives that occur earlier in time, and are connected by dotted lines in the figure, are the logical antecedents of subsequent service primitives.

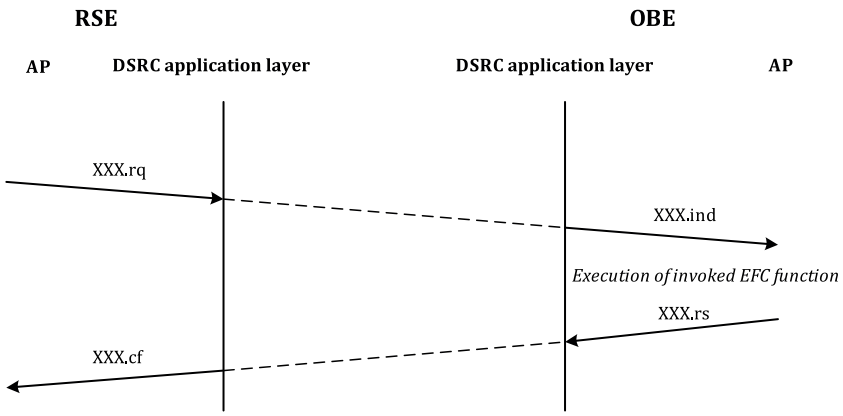


Figure 8 — Logical sequencing of service primitive exchanges

For the purposes of this document, the DSRC link is seen as completely transparent, i.e. in the absence of exceptions the `XXX.ind` is identical in content and meaning to the `XXX.rq`, and the `XXX.cf` is identical in content and meaning to the `XXX.rs`. For the purpose of conciseness there will be:

— one description for request, i.e. `XXX.rq`, covering both request and indication service primitives;

— one description for response, i.e. `XXX.rs`, covering both response and confirmation service primitives.

The format and the parameters of the service primitives of the DSRC application layer are defined in EN 12834/ISO 15628:2013, 6.2.2 (T Kernel Services).

© Standards Australia Limited 2023

Documents
Document Sharing Hub
Full document details: AS ISO 14906-2023

7.1.2 Overview of EFC functions

This subclause provides an overview of the EFC functions as shown in Table 1 (based on the ACTION service primitive of EN 12834/ISO 15628) that are defined in 7.2. Each EFC function comprises a pair of service primitives, a request and its associated response service primitive, which are accounted for in 7.2.

Table 1 — Overview of EFC functions

Function name	Action type	Action parameter	Response parameter	Remarks
GET_STAMPED	0	`GetStampedRq`	`GetStampedRs`	retrieves data with an authenticator from the OBE
SET_STAMPED	1	`SetStampedRq`	`OCTET STRING`	sets data in the OBE, which generates an authenticator
GET_SECURE	2	`OCTET STRING`	`OCTET STRING`	gets data securely from the OBE
SET_SECURE	3	`OCTET STRING`	`OCTET STRING`	sets data securely in the OBE
GET_INSTANCE	4	`GetInstanceRq`	`GetInstanceRs`	retrieves a number of entries out of an attribute's multiple instances
SET_INSTANCE	5	`SetInstanceRq`	n.a.	sets one entry at a specified position in an attribute's multiple instances
GET_NONCE	6	n.a.	`OCTET STRING`	retrieves a nonce; typically used against replay attacks
SET_NONCE	7	`OCTET STRING`	n.a.	sets a nonce; typically used against replay attacks
TRANSFER_CHANNEL	8	`ChannelRq`	`ChannelRs`	sets and/or retrieves data from the addressed OBE component (e.g. an ICC)
COPY	9	`CopyRq`	n.a.	copies data from a source EID to a destination EID
SET_MMI	10	`SetMMIRq`	n.a.	invokes an MMI function (e.g. signal OK via buzzer)
SUBTRACT	11	`SubRq`	n.a.	subtracts the given value to the addressed value
ADD	12	`AddRq`	n.a	adds the given value to the addressed value
DEBIT	13	`DebitRq`	`DebitRs`	debits purse
CREDIT	14	`CreditRq`	`CreditRs`	credits purse
ECHO	15	`OCTET STRING`	`OCTET STRING`	OBE echoes received data

The GET and SET services (DSRC application layer functions) as defined in EN 12834/ISO 15628:2013, 6.2, may also be used in an EFC transaction phase.

NOTE GET is used to retrieve (i.e. read) value(s) of the addressed attribute(s). A reply is always expected. SET is used to set (i.e. write) value(s) of the addressed attribute(s).

© Standards Australia Limited 2023

Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

7.1.3 Handling of multiple instances

For the purpose of description, the number of instances is denoted by n. In general, the EFC functions operating on multiple instances of OBE Attributes can be divided into the following groups:

— GET, GET_STAMPED: These functions shall always access the last instance (i.e. instance at position 0). If no instance is available, the result is undefined but may lead to the return of an error code.

— GET_INSTANCE: This function carries parameters N_1 and N_2, both ≥ 0. It shall return the following:

  — if $N_2 < N_1$, or $N_1 > n$, then the empty list;

  — if $N_2 \geq N_1$, then the values of the instances numbered N_1, N_1+1, ... up to and including min. (N_2, n).

  The case that zero instance is returned is permissible. In this case the response carries an empty list.

— SET, SET_STAMPED: These functions shall always set the value of instance at position 0. In addition, the previous instance number p (where p is an `INTEGER` between 0 and N_{max}–1) shall become instance number p+1, and instance number N_{max} shall no longer be available.

NOTE 1 A cyclic buffer is as acceptable as a dynamic memory allocation scheme.

NOTE 2 The description above also covers the common case for N_{max} =1. In this case it leads to overwriting the old value of the single instance.

— SET_INSTANCE: This function carries a parameter $N \geq 0$, and a value for the addressed attribute. It shall always set the value of instance number N.

EXAMPLE 1 Behaviour for a static memory allocation scheme - a cyclic buffer.

Assume N_{max} = 3. Table 2 shows the effects of a certain sequence of functions.

Table 2 — Behaviour for a static memory allocation scheme

Function	N	Buffer content instance position 0	1	2	Result
GET	3	X	X	X	returns X
GET_INSTANCE(1,0)	3	X	X	X	returns empty list
SET (A)	3	A	X	X	
GET	3	A	X	X	returns value A
SET(B)	3	B	A	X	
GET	3	B	A	X	returns value B
GET_INSTANCE(0,7)	3	B	A	X	returns list (B, A, X)
SET(C)	3	C	B	A	
GET	3	C	B	A	returns value C
GET_INSTANCE(1,2)	3	C	B	A	returns list (B, A)
SET(D)	3	D	C	B	value A is no longer available
SET_INSTANCE(1,E)	3	D	E	B	value C is no longer available

EXAMPLE 2 Behaviour for a dynamic memory allocation scheme.

Assume N_{max} = 3. Let n = 0 initially. Table 3 shows the effects of a certain sequence of functions.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

Table 3 — Behaviour for a dynamic memory allocation scheme

Function	*N*	Buffer content Instance position 0	1	2	Result
GET	0				undefined (implementation dependent)
GET_INSTANCE(1,0)	0				returns empty list
SET (A)	1	A			
GET	1	A			returns value A
SET(B)	2	B	A		
GET	2	B	A		returns value B
GET_INSTANCE(0,6)	2	B	A		returns list (B, A)
SET(C)	3	C	B	A	
GET	3	C	B	A	returns value C
GET_INSTANCE(1,2)	3	C	B	A	returns list (B, A)
SET(D)	3	D	C	B	value A is no longer available
SET_INSTANCE(1,E)	3	D	E	B	value C is no longer available

7.1.4 Security

7.1.4.1 General

Security is an essential part of EFC applications. The actual mechanisms used by an application provider are outside the scope of this document. It is generally recognized that security mechanisms involve many parameters, e.g. encryption algorithm and keys (if the security mechanism is encryption based), hash function, key length, padding method, redundancy data, etc. It is assumed that the EFC application communicating parties know everything they need, either by implementation or by deriving information from the VST. This information should suffice for the RSE to determine how to proceed. The OBE, in general, supports only a limited number of security mechanisms.

In this document, for calculation of access credentials using DES, a framework is defined permitting security mechanisms to be specified unambiguously at the discretion of the application provider. It includes the access credentials defined in EN 12834/ISO 15628. In addition, security values, like authenticators, will often be needed for additional protection. This document describes security mechanisms for access credentials and authenticators, based on data encryption standard (DES) and advanced encryption standard (AES) primitives.

The security mechanisms to be applied and the exact role of access credentials and authenticators are outside the scope of this document.

NOTE ISO/TS 17574 provides guidelines for the preparation and evaluation of appropriate security measures.

7.1.4.2 Use of access credentials and authenticators

Access credentials and authenticators are defined as being of ASN.1 type `OCTET STRING`. This only pertains to the ASN.1 syntax; the semantics are implicit in the context given by the EFC-context mark as specified in the VST, and as selected by the EID.

Access credentials shall be used to manage access to attributes. Different access conditions can apply for different attributes, and if so, different access credentials should be associated with these access conditions. Access credentials are used in transactions, in order to protect against non-authorized access to sensitive user data and against (commercial) use of the OBU by non-authorized RSE.

Documents Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS ISO 14906-2023

EXAMPLE The VehicleDimensions EFC attribute can be associated with no access conditions whilst the ContractSerialNumber and ContractValidity EFC attributes can be subject to access conditions (e.g. requiring the correct password to be presented).

Authenticators shall primarily pertain to values, and prove the source and/or the integrity of the data unit and protect against forgery. Authenticators are used in cryptography-related EFC functions such as GET_STAMPED and SET_STAMPED. Authenticators can be transmitted from the RSE to the OBE as access credentials to prove the authenticity of the RSE, or from the OBE to the RSE to prove the source and/or integrity of the data unit.

7.1.4.3 Principle of access credentials

The principle of access credentials to the OBU information is shown in Figure 9. When an OBU, having entered the communication zone, responds to a polling message (BST) from the RSE, it returns a VST that for each available contract contains information about an access credential reference (AC_CR-KeyReference) and a random number (RndOBE). Access credential reference contains the diversifier and a reference to a secret master key (MAcK) that shall be used for the computation of the secret key (AcK). This key shall be used for the computation of the access credentials (AC_CR) using the RndOBE number as input. The RSE returns the access credential calculated and the OBU compares the access credential with its own calculation. If they are equal, the OBU accepts the RSE as a genuine RSE and reading data from the OBU is allowed.

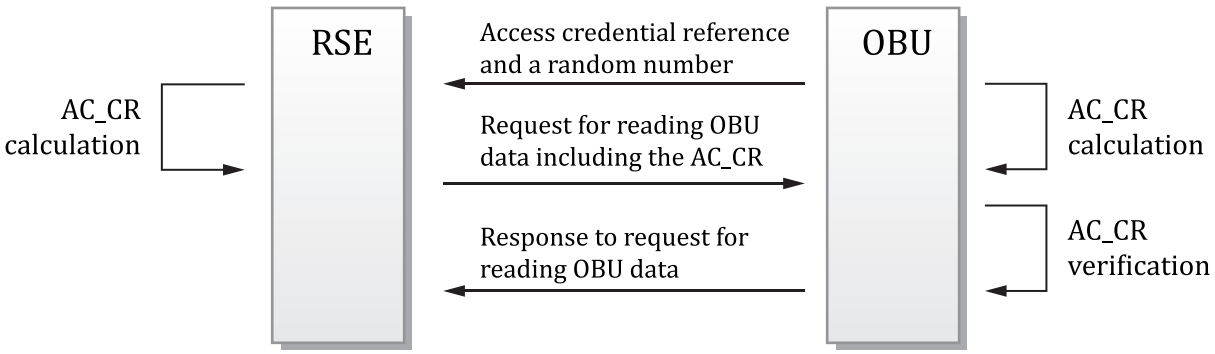


Figure 9 — Principle of access control to the OBU data

Parameters needed (AC_CR-KeyReference and RndOBE) shall be included in the VST application parameter. The encoding of the EfcContextMark and the security parameters into `OCTET STRING` is done with an ASN.1 data type defintion equivalent to:

```
ApplicationContextMark ::= SEQUENCE {
    efcContextMark      EfcContextMark,
    ac-cr-keyReference  EfcContainer (WITH COMPONENTS {octetstring PRESENT}),
    rndOBE              EfcContainer (WITH COMPONENTS {octetstring PRESENT})
}
```

The size of the RndOBE may vary with the requirements of the Access credential method and the application.

7.1.4.4 Access credentials with DES

If the OBU supports calculation of access credentials for protection of user related data on the OBU based on DES, these calculations shall be performed according to F.3.

The security related data elements listed in Table 4 shall be implemented in the OBU.

© Standards Australia Limited 2023

Documents
Document Sharing Hub
Full document details: AS ISO 14906-2023

Table 4 — OBU security related data for handling of access credentials

Name	Length (octets)	Remarks
AccessKey	**8**	Private.
AC_CR	**4**	Access credentials calculated by the RSE and the OBU using RndOBE and the access key AC_CRKey.
AC_CR-KeyReference	**2**	Reference to the key generation and the diversifier for the computation of AC_CRKey.
RndOBE	**4**	Random number (nonce) used together with the access key (referenced through AC_CR-KeyReference) to calculate the access credentials.

7.1.4.5 Access credentials with AES

If the OBU supports calculation of access credentials for the protection of user-related data on the OBU based on AES, these calculations shall be performed according to H.3.

The security-related data elements listed in Table 5 shall be implemented in the OBU.

Table 5 — Overview of the OBU security related data

Name	Length (octets)	Remarks
AccessKey	**16**	Private.
AC_CR	**8**	Access credentials calculated by the RSE and the OBU using RndOBE and the access key AC_CRKey.
AC_CR-KeyReference	**2**	Reference to the key generation and the diversifier for the computation of AC_CRKey.
RndOBE	**8**	Random number (nonce) used together with the access key (referenced through AC_CR-KeyReference) to calculate the access credentials.

7.1.4.6 Authenticator with DES

The security-related data elements listed in Table 6 shall be implemented in the OBU.

Table 6 — Overview of the OBU security related DES data

Name	Length (octets)	Remarks
AuthenticationKey1	**8**	Private.
AuthenticationKey2	**8**	Private.
AuthenticationKey3	**8**	Private.
AuthenticationKey4	**8**	Private.
AuthenticationKey5	**8**	Private.
AuthenticationKey6	**8**	Private.
AuthenticationKey7	**8**	Private.
AuthenticationKey8	**8**	Private.
KeyRef	**1**	Reference to AuKey used for the computation of the authenticators, e.g. toll service provider (TSP) and TC authenticators. The TSP decides which keys are shared with (MoU) TCs (referenced through AuKey_Op), and which are only known by the TSP (referenced through AuKey_Iss).

Documents Document Sharing Hub
© Standards Australia Limited 2023

Full document details: AS ISO 14906-2023

Table 6 *(continued)*

Name	Length (octets)	Remarks
RndRSE	**4**	Random number, containing SessionTime, from RSE used for the computation of authenticator.

If the OBU supports calculation of an authenticator (i.e. supports the GET_STAMPED function operating on one attribute list considering that the response shall fit into one Layer 2 frame) to validate data integrity and origin of the application data, these calculations shall be performed according to F.2.

7.1.4.7 Authenticator with AES

The security-related data elements listed in Table 7 shall be implemented in the OBU.

Table 7 — Overview of the OBU security related AES data

Name	Length (octets)	Remarks
AuthenticationKey1	**16**	Private.
AuthenticationKey2	**16**	Private.
AuthenticationKey3	**16**	Private.
AuthenticationKey4	**16**	Private.
AuthenticationKey5	**16**	Private.
AuthenticationKey6	**16**	Private.
AuthenticationKey7	**16**	Private.
AuthenticationKey8	**16**	Private.
KeyRef	**1**	Reference to AuKey used for the computation of the authenticators, e.g. TSP and TC authenticators. The TSP decides which keys are shared with (MoU) TCs (referenced through AuKey_Op), and which are only known to the TSP (referenced through AuKey_Iss).
RndRSE	**8**	Random number from RSE used for the computation of authenticator.
RndOBE2	**8**	Random number (nonce) used together with AttributeList and RndRSE to calculate the authenticator.

If the OBU supports calculation of an authenticator (i.e. support the GET_STAMPED function operating on one attribute list considering that the response shall fit into one Layer 2 frame) to validate data integrity and origin of the application data, these calculations shall be performed according to H.2.

7.2 EFC functions

7.2.1 General

In this subclause, the EFC functions are specified in detail. The format and the parameters of the EFC functions shall adhere to the Action service primitives of the DSRC application layer as defined in EN 12834:2003, 6.2.2 (Transfer Kernel Services)/ISO 15628:2013, 6.2.2. Not all parameters associated with the EFC functions are accounted for in this subclause, as they are either not specifically needed for the EFC applications or have the same meaning for all functions.

The return codes (RET) are explicitly specified whenever additional precision is needed on top of the specifications given in EN 12834/ISO 15628:2013, 6.2.4.

The ASN.1 type specifications of the ActionParameters and ResponseParameters are provided in Annex A.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

7.2.2 GET_STAMPED

GET_STAMPED is used to retrieve the value(s) of the addressed attribute(s), with an authenticator appended to the retrieved data. The authenticator generation involves transformations (notably encryption) that may include a nonce value (e.g. a random number or a sequence number).

GET_STAMPED.request shall request the retrieval of the value(s) of the attributes addressed by the attributeIdList, with an authenticator given in the response. A response shall always be expected (Mode = TRUE). The parameter keyRef shall contain a reference to the key to be used for the calculation of the authenticator in the response. See Table 8.

Table 8 — GET_STAMPED.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	0	
AccessCredentials	`OCTET STRING`		optional use

ActionParameter	`GetStampedRq ::= SEQUENCE {`
	`  attributeIdList AttributeIdList,`
	`  nonce OCTET STRING,`
	`  keyRef Int1Unsigned`
	`}`
			always to be present

Mode	`BOOLEAN`	TRUE	

NOTE 1 The AccessCredentials are only needed if the data attributes addressed by EID and attributeIdList require authentication of the RSE.

GET_STAMPED.response shall carry the retrieved value(s) of the addressed attribute(s) in the attributeList, as the result of the corresponding GET_STAMPED.request command. An authenticator over the retrieved values shall be carried in the authenticator parameter, with the keyRef parameter of the GET_STAMPED.request being used as a reference to the (cryptographic) key to be used. When a nonce of non-zero length is given in the request, the nonce value shall be included in the cryptographic transformation. See Table 9.

Table 9 — GET_STAMPED.response

Parameter name	ASN.1 type	Value	Remark/constraints

ResponseParameter	`GetStampedRs ::= SEQUENCE {`
	`  attributeList AttributeList,`
	`  authenticator OCTET STRING`
	`}`
			always to be present when Return Code is present and its value is 0

Return Code (Ret)	`ReturnStatus`		optional use

NOTE 2 GET_STAMPED can be used with an empty attributeIdList to request an authenticator from the OBE to authenticate the OBE EFC application.

7.2.3 SET_STAMPED

SET_STAMPED is used to set the value(s) of the addressed attribute(s), with the OBE returning an authenticator as a proof that the data has been set. The authenticator generation involves transformations (notably encryption) which may include a nonce value (e.g. a random number or a sequence number).

Documents
Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS ISO 14906-2023

SET_STAMPED.request shall request the setting of the value(s) of the attributes addressed by the attributeList, with an authenticator given in the response. A response shall always be expected (Mode = TRUE). See Table 10.

Table 10 — SET_STAMPED.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	1	
AccessCredentials	`OCTET STRING`		optional use

ActionParameter	`SetStampedRq ::= SEQUENCE {`
	`attributeList AttributeList,`
	`nonce OCTET STRING,`
	`keyRef Int1Unsigned }`
			always to be present

Mode	`BOOLEAN`	TRUE	

SET_STAMPED.response shall carry an authenticator as the response parameter (being of ASN.1 type `OCTET STRING`) to the corresponding request to convey that the data in the attribute list of the request have been set. The authenticator shall be calculated over the values given in the request attributeList, with the keyRef parameter of the request being used as a reference to the (cryptographic) key to be used. When a nonce of non-zero length is given in the request, the nonce value shall be included in the cryptographic transformation. See Table 11.

Table 11 — SET_STAMPED.response

Parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	`OCTET STRING`		always to be present
Return Code (Ret)	`ReturnStatus`		optional use

7.2.4 GET_SECURE

GET_SECURE is used to retrieve the value(s) of attribute(s) subject to security measures defined implicitly by the context identification set in the initialisation phase. These measures may involve any kind of transformations (notably encryption).

GET_SECURE.request shall request the retrieval of attributes subject to security measures implicit in the context set in the VST, amongst others by explicit reference given in the action parameter. The ActionParameter (being of ASN.1 type `OCTET STRING`) shall carry the AttributeIds of the requested attributes plus any information (nonce, key reference) required by the algorithm providing the security measures. A reply is always expected (Mode = TRUE). See Table 12.

Table 12 — GET_SECURE.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	2	
AccessCredentials	`OCTET STRING`		optional use
ActionParameter	`OCTET STRING`		always to be present
Mode	`BOOLEAN`	TRUE	

NOTE 1 The accessCredentials are only needed if the data attributes addressed by EID and AttributeIdList require them.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

NOTE 2 The interpretation of the actionParameter is defined by the security mechanism in effect, which is implicit in the context identification in the initialisation phase. The parameter includes an AttrIDList (possibly encrypted), and it can, for example, also contain an authenticator for non-repudiation purposes.

GET_SECURE.response shall carry as the responseParameter (being of ASN.1 type `OCTET STRING`) to the corresponding request the requested value(s) of the addressed attribute(s) in the form (e.g. encrypted) implicitly defined in the context set in the VST, amongst others by explicit reference given in the action parameter. See Table 13.

Table 13 — GET_SECURE.response

parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	`OCTET STRING`		always to be present when Return Code is present and its value is 0
Return Code (Ret)	`ReturnStatus`		optional use

NOTE 3 The interpretation of the responseParameter is defined by the security mechanism that is in effect. The parameter includes an (possibly encrypted, or otherwise transformed) AttributeList. It can in addition contain, for example, an authenticator for non-repudiation purposes.

7.2.5 SET_SECURE

SET_SECURE is used to set the value(s) of attribute(s) subject to security measures defined implicitly by the context identification set in the initialisation phase. These measures may involve any kind of transformations and additions (e.g. checking of authenticators).

SET_SECURE.request shall request the setting of attributes subject to security measures implicit in the context set in the VST, amongst others by explicit reference given in the action parameter. The ActionParameter (being of ASN.1 type `OCTET STRING`) shall carry the attributes to be set plus any information (authenticator, nonce, key reference) required by the algorithm providing the security measures. SET_SECURE.request can be used in confirmed or non-confirmed mode; a reply shall always be expected in the former case. See Table 14.

Table 14 — SET_SECURE.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	3	
AccessCredentials	`OCTET STRING`		optional use
ActionParameter	`OCTET STRING`		always to be present
Mode	`BOOLEAN`		

NOTE 1 The interpretation of the ActionParameter is defined by the security mechanism in effect, which is implicit in the context identification in the initialisation phase. The parameter includes an attrList (possibly encrypted), and it can, for example, also contain an authenticator for non-repudiation purposes.

SET_SECURE.response shall, if used in the confirmed mode, carry as the ResponseParameter (being of ASN.1 type `OCTET STRING`) the confirmation of the corresponding request. The confirmation shall be in the form implicitly defined in the context set in the VST, amongst others, by explicit reference given in the action parameter. See Table 15.

Table 15 — SET_SECURE.response

Parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	`OCTET STRING`		optional use

© Standards Australia Limited 2023

Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

Table 15 *(continued)*

Parameter name	ASN.1 type	Value	Remark/constraints
Return Code (Ret)	`ReturnStatus`		optional use

NOTE 2 The interpretation of the ResponseParameter is entirely defined by the security mechanism that is in effect, which is implicit in the context identification in the initialisation phase. It can, for example, be empty or contain an authenticator to be used for non-repudiation of receipt.

7.2.6 GET_INSTANCE

GET_INSTANCE is used to retrieve a number of values from multiple instances of the addressed attributes (see 7.1.3 for the handling of multiple instances).

GET_INSTANCE.request shall request the retrieval of a number of instances of the value(s) of the addressed attribute(s). The ActionParameter contains the position of the first instance and the last instance of the instances of the specified attribute(s) to be retrieved. GET_INSTANCE.request can only be used in confirmed mode; a reply shall always be expected. See Table 16.

Table 16 — GET_INSTANCE.request

Parameter name	ASN.1 type	Value	Remark/ constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	4	
AccessCredentials	`OCTET STRING`		optional use

ActionParameter	`GetInstanceRq ::= SEQUENCE {`
	`posOfFirstInstance Int1Unsigned,`
	`posOfLastInstance Int1Unsigned,`
	`attributeIdList AttributeIdList}`
			always to be present

Mode	`BOOLEAN`	TRUE	

GET_INSTANCE.response shall, as a response to the corresponding request, contain all available values of the requested attributes, starting from the value at the first position (posOfFirstInstance) up to the value at the last position (posOfLastInstance), as asked for in the request. The ResponseParameter shall for each requested attribute in turn contain first the attribute ID of the requested attribute, followed by the values of the attribute. The value(s) of an attribute at the first position shall be transferred first in the parameter attributeValues. See Table 17.

Table 17 — GET_INSTANCE.response

Parameter name	ASN.1 type	Value	Remark/constraints

ResponseParameter	`GetInstanceRs ::= SEQUENCE (0..127,...) OF`
	`SEQUENCE {`
	`attributeId INTEGER(0..127,...),`
	`attributeValues Container::=OCTET STRING } }`
			always to be present when Return Code is present and its value is 0

Return Code (Ret)	`ReturnStatus`		optional use

7.2.7 SET_INSTANCE

SET _INSTANCE is used to set the value of a specified entry from multiple instances of the addressed attribute (see 7.1.3 for the handling of multiple instances).

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023

SET_INSTANCE.request shall request the replacement of a selected instance of the addressed attribute. The ActionParameter contains the value (posOfInstance) attempted to be replaced and the attribute ID. SET_INSTANCE.request can be used in confirmed or non-confirmed mode (i.e. Mode equal to TRUE or FALSE, respectively); a reply shall always be expected in the former case. See Table 18.

Table 18 — SET_INSTANCE.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	5	
AccessCredentials	`OCTET STRING`		optional use

ActionParameter	`SetInstanceRq ::= SEQUENCE {`
	`posOfInstance Int1Unsigned,`
	`attribute Attr }`
			always to be present

Mode	`BOOLEAN`		

SET_INSTANCE.response shall explicitly convey the result of the corresponding SET_INSTANCE.request. If the addressed value could not be replaced, the Return Code shall indicate a failure. See Table 19.

Table 19 — SET_INSTANCE.response

Parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	`None`		
Return Code (Ret)	`ReturnStatus`		optional use

7.2.8 GET_NONCE

GET_NONCE is used by the RSE to obtain a nonce value (e.g. a random number, a sequencing number or a time stamp) to be used for guaranteeing a unique relationship between a number of related data items. The retrieved value shall remain "active" throughout the session or until a new GET_NONCE service has been successfully completed within the same session.

EXAMPLE GET_NONCE can be used to get a challenge value, which is used as an input parameter when computing the applicable access credentials (e.g. an authenticator). The resulting data can subsequently be included as access credentials in another request command.

Guaranteeing uniqueness implies certain requirements on the value to be produced, e.g. sequencing numbers and random numbers need to have a sufficiently large period, time stamps need to have sufficiently high resolution. In addition, random numbers may have to be generated by a cryptographic algorithm to be sufficiently "unpredictable". These additional requirements are outside the scope of this document.

GET_NONCE.request shall request the retrieval of a value to be used for guaranteeing a unique relationship between a number of related data items. GET_NONCE.request shall always be used in confirmed mode; a reply shall always be expected. See Table 20.

Table 20 — GET_NONCE.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	6	
AccessCredentials	`OCTET STRING`		not to be used
ActionParameter	`n.a.`		not to be used
Mode	`BOOLEAN`	TRUE	

Documents Document Sharing Hub
© Standards Australia Limited 2023
Full document details: AS ISO 14906-2023

GET_NONCE.response shall, as response to the corresponding request, carry as the ResponseParameter (being of ASN.1 type `OCTET STRING`) a value to be used for guaranteeing a unique relationship between a number of related data items. The retrieved value shall remain "active" throughout the session or until a new GET_NONCE service has been successfully completed within the same session. See Table 21.

Table 21 — GET_NONCE.response

Parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	`OCTET STRING`		always to be present when Return Code is present and its value is 0
Return Code (Ret)	`ReturnStatus`		optional use

When the GET_NONCE.request is not supported by the OBE EFC application, then the Return Code shall indicate complexityLimitation, and ResponseParameter shall be empty.

7.2.9 SET_NONCE

SET_NONCE is used by the RSE to present a value (e.g. a sequencing number, a random number or a time stamp) to the OBE, to be used for guaranteeing a unique relationship between a number of related data items. The set value remains ”active” throughout the session or until a new SET_NONCE service has been successfully completed within the same session.

SET_NONCE.request shall request setting a nonce value to be used for guaranteeing a unique relationship between a number of related data items. The ActionParameter (being of ASN.1 type `OCTET STRING`) shall carry the nonce value. SET_NONCE.request can be used in confirmed or non-confirmed mode (i.e. Mode equal to TRUE or FALSE, respectively); a reply shall always be expected in the former case. See Table 22.

Table 22 — SET_NONCE.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	7	
AccessCredentials	`OCTET STRING`		n.a.
ActionParameter	`OCTET STRING`		always to be present
Mode	`BOOLEAN`		

SET_NONCE.response shall be issued as a response to the corresponding request to convey the result of the request. A receiving peer entity supporting no nonce shall return a Return Code indicating the Complexity Limitation. See Table 23.

Table 23 — SET_NONCE.response

Parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	n.a.		n.a.
Return Code (Ret)	`ReturnStatus`		optional use

7.2.10 TRANSFER_CHANNEL

TRANSFER_CHANNEL is used to send and/or retrieve data from a dedicated channel of the OBE.

TRANSFER_CHANNEL.request shall request data transfer from and/or to a dedicated channel of the OBE. The channel shall be addressed by the parameter channelled. Data to be transferred to the OBE channel shall be contained in the parameter application protocol data unit (APDU) in a format recognized by the addressed component. In case no data is to be set to the OBE channel, the APDU can

© Standards Australia Limited 2023

AVA Documents Document Sharing Hub

Full document details: AS ISO 14906-2023

be empty. The direction(s) of transfer is either implicitly given by the context of the addressed channel within the context given in the VST, or is to be conveyed as part of the parameter APDU in a format appropriate for the addressed channel. See Table 24.

Table 24 — TRANSFER_CHANNEL.request

parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`	0	
ActionType	`INTEGER(0..127,...)`	8	
AccessCredentials	`OCTET STRING`		not to be used

ActionParameter	`ChannelRq ::= SEQUENCE {`
	`channelId ChannelId,`
	`apdu OCTET STRING }`		

Mode	`BOOLEAN`		

NOTE TRANSFER_CHANNEL allows addressing of data residing in components of the OBE using a transparent application layer protocol bridge. The command can, for example, be used to address a serial interface, or an electronic purse that requires a protocol that is not covered by the DEBIT command.

TRANSFER_CHANNEL.response shall carry the response to the requested data transfer from and/or to a dedicated channel of the OBE. The parameter channelled shall contain the channel ID of the request. Data requested to be transferred from the OBE channel shall be contained in the parameter apdu in a format specific to the addressed component. In case no data is to be returned from the OBE channel, the APDU can be empty. See Table 25.

Table 25 — TRANSFER_CHANNEL.response

Parameter name	ASN.1 type	Value	Remark/constraints

ResponseParameter	`ChannelRs ::= SEQUENCE {`
	`channelId ChannelId,`
	`apdu OCTET STRING }`		

Return Code (Ret)	`ReturnStatus`		optional use

7.2.11 COPY

Copy is used to copy the values of the addressed attribute(s) to another EID (i.e. the destination ID).

EXAMPLE 1 When not implemented in the OBE itself, “sharing” of data attributes for common use between two operators (between two different contexts addressed by two different EIDs) can be performed with a copy command. Note that operators can protect the data under “their” EID by requiring certain Access Credentials only known to parties with whom they have an agreement.

EXAMPLE 2 The RSE sets (i.e. writes) the last event into the Receipt data group in the OBE, which only stores a limited number of events. The RSE invokes a copy command requesting the OBE to copy the value of the last event to the event log of the ICC.

COPY.request shall request the copying of the value(s) of the addressed attribute(s) to the same attribute(s) in a destination EID. COPY.request can be used in confirmed or unconfirmed mode; a reply shall always be expected in the former case. See Table 26.

Table 26 — COPY.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`		
ActionType	`INTEGER(0..127,...)`	9	
AccessCredentials	`OCTET STRING`		optional use

© Standards Australia Limited 2023

Full document details: AS ISO 14906-2023

Table 26 *(continued)*

Parameter name	ASN.1 type	Value	Remark/constraints

ActionParameter	`CopyRq ::= SEQUENCE {`
	`destinationEID INTEGER(0..127,...),`
	`attributeIdList AttributeIdList`
	`}`
			always to be present

Mode	`BOOLEAN`		

COPY.response shall be used to explicitly convey the result of the corresponding COPY.request command. See Table 27.

Table 27 — COPY.response

Parameter name	ASN.1 type	Value	Remark/constraints
ResponseParameter	n.a.		n.a.
Return Code (Ret)	`ReturnStatus`		optional use

7.2.12 SET_MMI

SET_MMI is used to perform device-independent MMI functions.

SET_MMI.request shall request to control the MMI in a device-independent way. The ActionParameter shall contain the MMI function that is to be invoked, e.g. signalling of a successful operation (such as a successful EFC transaction), a non-successful operation or signalling to contact the operator (e.g. due to low balance). SET_MMI.request can be used in confirmed or non-confirmed mode; a reply shall always be expected in the former case. See Table 28.

Table 28 — SET_MMI.request

Parameter name	ASN.1 type	Value	Remark/constraints
Element Identifier EID	`Dsrc-EID`	0	
ActionType	`INTEGER(0..127,...)`	10	
AccessCredentials	`OCTET STRING`		not to be used

ActionParameter	`SetMMIRq ::= INTEGER {`
	`ok (0),`
	`nok (1),`
	`contactOperator (2),`
	`reservedForFutureCENUse (3-127),`
	`reservedForPrivateUse (128-254),`
	`noSignalling (255)`
	`} (0..255)`
			always to be present

Mode	`BOOLEAN`		

SET_MMI.response shall be used to explicitly convey the result of the corresponding SET_MMI.request command. If Mode was set to TRUE in the corresponding request and the operation was successfully executed, then the response shall indicate no error. If an error occurred at an attempt to execute the command, then the Return Code shall take the appropriate value. See Table 29.

© Standards Australia Limited 2023

Documents
Document Sharing Hub

Full document details: AS ISO 14906-2023