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Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure

Télématique de la circulation et du transport routier — Identification automatique des véhicules et équipements — Codification et structure des données

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Foreword

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

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14816 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with Technical Committee CEN/TC 278, *Road transport and traffic telematics*.

This first edition cancels and replaces (ISO/TS 14816:2000).

Introduction

This International Standard specifies a data structure that enables upwards integration and expansion from the simplest low-cost AVI/AEI system to more complex functions. The structure is designed to be flexible and enabling rather than prescriptive.

This International Standard has been designed to provide for the differing requirements of AVI and AEI by the use of separate application specifics. By retaining these differing requirements within one supervisory document, the interoperability is maximized, particularly in the case where both AVI and AEI are required at the same time in the road environment.

In order to support systems using both active and passive On Board Equipment (OBE), the basic data structures have been minimized. This enables any manufacturer/operator with an OBE with a user addressable memory of only 56 bits to be able to conform to a full core identification according to this International Standard.

Abstract Syntax Notation One (ASN.1) is widely applied. Its usage provides maximum interoperability and conformance to existing International Standards, and meets the specifically defined requirements for a generic standard model for RTTT in that it:

— Uses existing standard Syntax Notation and Encoding Rules,

— Is adaptable and expandable,

— Does not include unnecessary information for a specific system, and

— Incurs a minimum of overhead in storage and transmission.

Readers who are unfamiliar with ASN.1 are advised to read ANNEX C before reading the main body of this International Standard. Readers are also advised to read ISO/IEC 8824, ISO/IEC 8825-1, ISO/IEC 8825-2 and ISO/IEC 8825-3 and other published work on ASN.1 before reading the main body of this International Standard.

ISO 14814 provides a reference architecture model for AVI/AEI systems.

Sections 4.1-4.6 of ISO 14816 provide a standardized yet flexible and interoperable framework for numbering schemes. A structure for AVI/AEI unambiguous identification and several numbering schemes associated with AVI/AEI systems are determined in this International Standard.

The core AVI/AEI numbering scheme, central to the effective use of many of the constructs, is a structure to provide unambiguous identification. 4.7 of this International Standard provides a data element coding for Automatic Vehicle and Equipment Identification (AVI/AEI) in RTTT applications. This coding provides a structure with the possibility of 2^{56} (in excess of 72 million billions) unique identifiers, provided within a 56-bit code structure when ISO/IEC 8825-2 (PER) is used, i.e. no overhead is incurred.

Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure

1 Scope

1.1 Overall numbering scheme

This International Standard establishes a common framework data structure for unambiguous identification in RTTT/ITS systems. It excludes any physical aspects such as interfaces. It is neither frequency- nor air interface protocol-specific.

Data elements that form part of transmission or storage protocols such as headers, frame markers and checksums are thus excluded.

The specifications for protecting against changes, classifying and qualifying security aspects of the data structure elements are not included within this International Standard.

The principles of data element structure and description determined in ISO/IEC 8824, ISO/IEC 8825-1 and ISO/IEC 8825-2 have been adopted to provide an interoperable architecture within a standard framework according to guidelines from ISO/TC 204 and CEN/TC 278.

This International Standard defines data structures based on the ISO/IEC 8824-1 ASN.1 `UNIVERSAL CLASS` types that may be directly `IMPORTED` to other application standards that would need only subsets of the full `APPLICATION CLASS` types. These `UNIVERSAL CLASS` and `APPLICATION CLASS` types are uniquely defined as an ASN.1 module in Annex B. This module may be directly linked into an application data definition.

This International Standard defines default encoding for simple AVI/AEI applications where no other relevant application standard exists. This definition forms Clause 4.

1.2 AVI/AEI numbering scheme

The principal registered schemes for AVI/AEI are determined in 4.7 and 4.8 of this International Standard. Other relevant and interoperable schemes are detailed in subsequent clauses and subclauses.

The structures defined in this International Standard provide interoperability, not only between simple AVI/AEI and more complex RTTT/ITS functions, but also with pre-existing International Standards (e.g. ISO 10374).

There is one Central Registration Authority that administers the AVI numbering scheme according to the rules of CEN and ISO (see Annex A).

The choices available to the issuer to operate its structure include, amongst others:

— simple identification, in which case the separate identities may be openly available, at the discretion of the issuer or nation state;

— an alias basis, in which case the “identities” are known, but secured under provisions of data protection to maintain privacy and therefore not available; and

— dynamically encrypted identities in an anonymous system.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

ISO 3780, *Road vehicles — World manufacturer identifier (WMI) code*

ISO 6346, *Freight containers — Coding, identification and marking*

ISO/IEC 8824-1, *Information technology — Abstract Syntax Notation One (ASN.1) — Part 1: Specification of basic notation*

ISO/IEC 8825-1, *Information technology — ASN.1 encoding rules — Part 1: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

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

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

ISO/IEC 8859-2, *Information technology — 8-bit single-byte coded graphic character sets — Part 2: Latin alphabet No. 2*

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

ISO/IEC 8859-4, *Information technology — 8-bit single-byte coded graphic character sets — Part 4: Latin alphabet No. 4*

ISO/IEC 8859-5, *Information technology — 8-bit single-byte coded graphic character sets — Part 5: Latin/Cyrillic alphabet*

ISO/IEC 8859-6, *Information technology — 8-bit single-byte coded graphic character sets — Part 6: Latin/Arabic alphabet*

ISO/IEC 8859-7, *Information technology — 8-bit single-byte coded graphic character sets — Part 7: Latin/Greek alphabet*

ISO/IEC 8859-8, *Information technology — 8-bit single-byte coded graphic character sets — Part 8: Latin/Hebrew alphabet*

ISO/IEC 8859-9, *Information technology — 8-bit single-byte coded graphic character sets — Part 9: Latin alphabet No. 5*

ISO/IEC 8859-10, *Information technology — 8-bit single-byte coded graphic character sets — Part 10: Latin alphabet No. 6*

ISO 10374, *Freight containers — Automatic identification*

ISO/IEC 10646-1, *Information technology — Universal Multiple-Octet Coded Character Set (UCS) — Part 1: Architecture and Basic Multilingual Plane*

ISO/TR 14813-3, *Transport information and control systems — Reference model architecture(s) for the TICS sector — Part 3: Example elaboration*

ISO 14814, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Reference architecture and terminology*

3 Terms, definitions and notations

For the purposes of this document, the terms and definitions given in ISO 14814 apply.

The term “Issuer” applies to any of the coding schemes CS1, CS2 and CS8.

Numerical notations are represented as follows:

— Decimal (“normal”) notation has no subscript.

EXAMPLE 127.

— Hexadecimal numbers are noted by subscript 16.

EXAMPLE Example: $7F_{16}$.

— Binary numbers are noted by subscript 2.

EXAMPLE Example: 01111111_2.

Characters are represented as follows:

— Characters have no subscript or quotes.

EXAMPLE ABC5EFD.

4 Requirements

4.1 Overall coding structure

The AVI/AEI coding structure determined in this International Standard:

— is unambiguous and flexible enough to include relevant transport related numbering schemes,

— follows relevant International Standards, available at the time of writing,

— provides an exact coding of the data elements,

— is extendible to enable future expansion, and

— is able to accommodate private structures.

4.2 General requirements

The coding structure determined in this International Standard is an “enabling” structure. It is designed to accommodate, within its framework, coding structures for a variety of RTTT/ITS systems from simple AVI/AEI to more complex transactions with a wide variety of uses, and to allow combinations of data elements to be used in a composite data construct. It is designed to allow as much interoperability of the data elements within

an EDI/EDT environment as is possible, and provide capability for a significant expansion of the number of RTTT/ITS applications in the future.

This International Standard recognizes and accommodates the operation of systems of different capabilities. It shall enable, within its structure, the interoperability of one OBE in any country so long as there is a common air interface and protocol, even though the operator systems themselves may be significantly different. Even where information has to be collected by a separate interrogator because air interface compatibility does not exist, the data, once collected, is in a commonly interoperable format, and may thus be used accurately and effectively within an EDI/EDT environment.

The data structures defined in this International Standard enable “tree and branch” or “cascade” structures, with the ability to build complex data element constructs.

This International Standard has been optimized for ISO/IEC 8825-2 as recommended by ISO/TS 14813-3.

It uses ISO/IEC 8824-1 in all its syntax descriptions.

By adopting the ISO/IEC 8824, ISO/IEC 8825-1, ISO/IEC 8825-2 and ISO/IEC 8825-3 Abstract Syntax Notation (ASN.1), the flexibility is provided for data elements of any length and combination to be supported. Also, this data structure standard is itself given a migration path so that, as technological developments allow further capabilities, subsequent International Standards may provide additional data fields for use in all, or some, sector-specific applications, whilst maintaining the upwards compatibility from and to this document.

The ASN.1 encoding rules enable the chaining of multiple data elements from different application sectors to build complex data element constructs. (See examples in Annex C.)

4.3 Data structure

The data structuring requirements as defined in ISO/IEC 8824, ISO/IEC 8825-1, ISO/IEC 8825-2 and ISO/IEC 8825-3 apply, and in particular ISO/TS 14813-3.

4.4 Residency of data

The data construct is designed to be free-standing and independent of the media. It therefore normally resides in the OBE.

In specific cases, such as the standardized European DSRC 5.8 GHz link, where part of the message is already known because of L7 services, the use of ASN.1Packed Encoding Rules (PER) proposed within this International Standard enables only the unknown part of the message to be transferred, thus achieving minimum redundancy.

The examples given in the remainder of this International Standard assume the use of ASN.1 PER. Where Basic Encoding Rules (BER) are used, there is additional overhead as defined in ISO/IEC 8825-1. See Annex C for implementation examples.

4.5 Table of coding structure identifiers

Table 1 — Coding structure identifiers

Coding Structure Identifier (CSI) Number	RTTT/ITS Coding Structure
0	Reserved for CEN/ISO
1	AVI/AEI for use in RTTT applications
2	RTTT Manufacturer Serial Number
3	RTTT Validity Limitation (Time and Place)
4	Licence Plate
5	Vehicle (VIN) Chassis Number
6	Reserved for CEN/ISO
7	Freight Container Numbering
8	Tax Authority Code
9	Reserved for CEN/ISO
...	...
30	Reserved for CEN/ISO
31	Reserved for CEN/ISO (Extension)

4.6 Coding structure data elements (AVI/AEI applications)

Table 2 shows the seven defined CS in a short form table detailing the primitive elements (`UNIVERSAL TYPES`). The definitions are given in 4.7 and Annex C.

Table 2 — Minimum size of data elements

CSI	Length	Coding Structure Data Field			
1	7 Octets / 56 bits	Country Code	Issuer Identifier	Service Number	
		10	14	32	
2	6 Octets / 48 bits	Manufacturer Identifier	Service Number		
		16	32		
3	22 Octets / 176 bits	Start Time	Stop Time	Geographic Limit	Application Limit
		80	80	8	8
4	Variable	Country Code	Alphabet Indicator	Licence Plate Number	
		10	6	Not defined	
5	17 Octets / 136 bits	Vehicle Identification (Chassis) Number			
		136			
6	Variable	Reserved for CEN/ISO			
		Not defined			
7	93 bits	Freight Container Numbering			
		93			
8	Variable	Country Code	Tax Code		
		10	Not defined		

NOTE 1 The overhead of each coding structure data field is excluded from the table. The numbers of bits in the data fields are only indications when using PER as the coding rules.

NOTE 2 When the term “Service Number” is used in this International Standard, it indicates both “Service Code” and “Unique Number”.

4.7 CS1- AVI/AEI Numbering scheme

4.7.1 General requirements

This AVI/AEI numbering scheme provides an unambiguous identification element of 56 bits (PER encoding) to be held on the OBE. This data structure is designed to be used for simple AVI/AEI, and may also be used to form the AVI/AEI element of RTTT messages where AVI/AEI is a component.

Registration procedures including the structures that are with National Issuing Authorities are mandatory for this structure. Provisions for registration can be found in Annex A.

4.7.2 Data structure

4.7.2.1 Data structure elements

The format provides a “read only” On Board Equipment Permanent Code Mandatory Field providing specific adaptation to the requirements for AVI/AEI in the RTTT/ITS environment.

Operators who wish to provide additional data fields, of read only or read/write nature, can do so by adding additional ASN.1 identifier sets as described in Annex C.

4.7.2.2 ASN.1 Data type definitions

4.7.2.2.1 CS1 Definition

```
CS1::= SEQUENCE {
        countryCode             CountryCode,
        issuerIdentifier        IssuerIdentifier,
        serviceNumber           ServiceNumber
        }
```

4.7.2.2.2 CountryCode definition

```
CountryCode::= BIT STRING(Size(10))
```

Value assignment is done in accordance with ISO 3166-1 and by using the ITA.2 alphabet. For value assignment, please refer to: http://www.nen.nl/cen278/14816_NRAI_register_by_country.html.

4.7.2.2.3 IssuerIdentifier definition

```
IssuerIdentifier::= INTEGER(0 .. 16383)
```

See Annex A for registration.

4.7.2.2.4 ServiceNumber definition

```
ServiceNumber::= BIT STRING(Size(32))
```


4.8 CS2-Manufacturers numbering

4.8.1 General requirements

Manufacturers numbering enables manufacturers to provide, if they so choose, a numbering system that is independent of a particular country. It is expected that this numbering scheme will primarily be used as an electronic serial number in systems requiring direct knowledge of manufacturer and equipment versions (e.g. for QA/QC purposes). This number may also be used as a cryptographic hidden identity in systems with a combination of anonymity and strong security requirements.

The following structure details the content of the manufacturers numbering data “primitive” and is to be read in conjunction with the notes shown below the structure.

Registration procedures are similar to the procedures of CS1, with the exception that the structures are not registered with any National Issuing Authority. Provisions for registration can be found in Clause 5.

4.8.2 Data structure

4.8.2.1 Data structure elements

Operators who wish to provide additional data fields, of read only or read/write nature, can do so by adding additional ASN.1 identifier sets as described in Annex C.

4.8.2.2 Detailed data structure

The numbering scheme views the ID as a data element, and the common basic data structure is only a data identifier code.

The framework of this data structure, into which the manufacturers numbering data field fits, follows the principles defined in CS1 (AVI/AEI numbering scheme), and is applied in this structure as follows:

4.8.2.2.1 CS2 Definition

```
CS2::= SEQUENCE {
               issuerIdentifier    ManufacturerIdentifier,
               serviceNumber    ServiceNumber
       }
```

4.8.2.2.2 ManufacturerIdentifier definition

```
ManufacturerIdentifier::= INTEGER(0 .. 65535)
```

4.8.2.2.3 ServiceNumber definition

`ServiceNumber` is defined in 4.7.2.2.4.

4.9 CS3 – Validity limitation

4.9.1 General requirements

The validity limitation structure is a data element structure that specifies value(s) to provide limits, either in time, geography or application.