DRAFT INTERNATIONAL STANDARD

ISO/DIS 17215-3

ISO/TC **22**/SC **31**

Secretariat: **DIN**

Voting begins on:
2020-06-10

Voting terminates on:
2020-09-02

Road vehicles — Video communication interface for cameras (VCIC) —

Part 3:
Camera message dictionary

Véhicules routiers — Interface de communication vidéo pour caméras (ICVC) —

Partie 3: Dictionnaire de message de caméra

ICS: 43.040.15

This document is circulated as received from the committee secretariat.

Reference number
ISO/DIS 17215-3:2020(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 17215-3:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Corrections of equations and scaling in clause 7.6.8;

— Editorial adoptions and corrections.

A list of all parts in the ISO 17215 series can be found on the ISO website.

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.

Introduction

Driver assistance systems are more and more common in road vehicles. From the beginning, cameras were part of this trend. Analogue cameras were used in the beginning because of lower complexity of the first systems. With increasing demand for more advanced functionality, digital image processing has been introduced. So-called one box design cameras (combining a digital image sensor and a processing unit) appeared in the vehicles.

Currently, the market demands such systems with multiple functions. Even different viewing directions are in use. It seems to be common sense that 6 up to 12 cameras in a single vehicle will be seen in the next future. Out of this and the limitation in size, power consumption, etc. it will lead to designs where the cameras are separated from the processing unit. Therefore, a high-performance digital interface between camera and processing unit is necessary.

This Document has been established in order to define the use cases, the communication protocol, and the physical layer requirements of a video communication interface for cameras, which covers the needs of driver assistance applications.

The video communication interface for cameras

— incorporates the needs of the whole life cycle of an automotive grade digital camera,

— utilizes existing standards to define a long-term stable state-of-art video communication interface for cameras usable for operating and diagnosis purpose,

— can be easily adapted to new physical data link layers including wired and wireless connections by using existing adaption layers, and

— is compatible with AUTOSAR.

This part of ISO 17215 is related to the general information and use case definition. This is a general overview Document which is not related to the OSI model.

To achieve this, it is based on the Open Systems Interconnection (OSI) basic reference model specified in ISO/IEC 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the protocol and physical layer requirements specified by this Document, in accordance with Table 1 are broken into following layers:

— application (layer 7), specified in ISO 17215-3;

— presentation layer (layer 6), specified in ISO 17215-2;

— session layer (layer 5), specified in ISO 17215-2;

— transport protocol (layer 4), specified in ISO 17215-4, ISO 13400-2;

— network layer (layer 3), specified in ISO 17215-4, ISO 13400-2;

— data link layer (layer 2), specified in ISO 17215-4, ISO 13400-3;

— physical layer (layer 1), specified in ISO 17215-4, ISO 13400-3.

Table 1 — Specifications applicable to the OSI layers

Applicability	OSI 7 layers	Video communication interface for cameras		Camera diagnostics
Seven layers according to ISO 7498–1 and ISO/IEC 10731	Application (layer 7)	ISO 17215-3		
	Presentation (layer 6)	ISO 17215-2		
	Session (layer 5)	ISO 17215-2		
	Transport (layer 4)	ISO 17215-4	Other future interface standards	ISO 13400-2
	Network (layer 3)			
	Data link (layer 2)	ISO 17215-4		ISO 13400-3
	Physical (layer 1)			

ISO 17215-1 has been established in order to define the use cases for vehicle communication systems implemented on a video communication interface for cameras; it is an overall Document not related to the OSI model.

ISO 17215-3 covers the application layer implementation of the video communication interface for cameras; it includes the API.

ISO 17215-2 covers the presentation layer implementation of the video communication interface for cameras.

ISO 17215-4 is the common standard for the OSI layers 1 to 4 for video communication interface for cameras. It complements ISO 13400 2 and ISO 13400 3 and adds the requirement for video transmission over Ethernet.

ISO 17215-2 and ISO 7215-3 (OSI layer 5 to 7) services have been defined to be independent of the ISO 17215-4 (OSI layer 1 to 4) implementation. Therefore, ISO 17215-4 could be replaced by other future communication Document.

Road vehicles — Video communication interface for cameras (VCIC) —

Part 3:
Camera message dictionary

1 Scope

This document specifies the standardized camera messages and data types used by a VCIC camera (OSI Layer 7).

The scope of the camera application interface (API) and its context are shown in Figure 1.

Applications hosted on ECUs want to communicate with one or more cameras (e.g. “Ask camera for parameters.”). If the applications can use standardized services supported by the cameras (API layer 7), the development of a vision application should be independent of the camera used. The services can be implemented by general libraries.

The definition of streaming data is not an issue of this API.

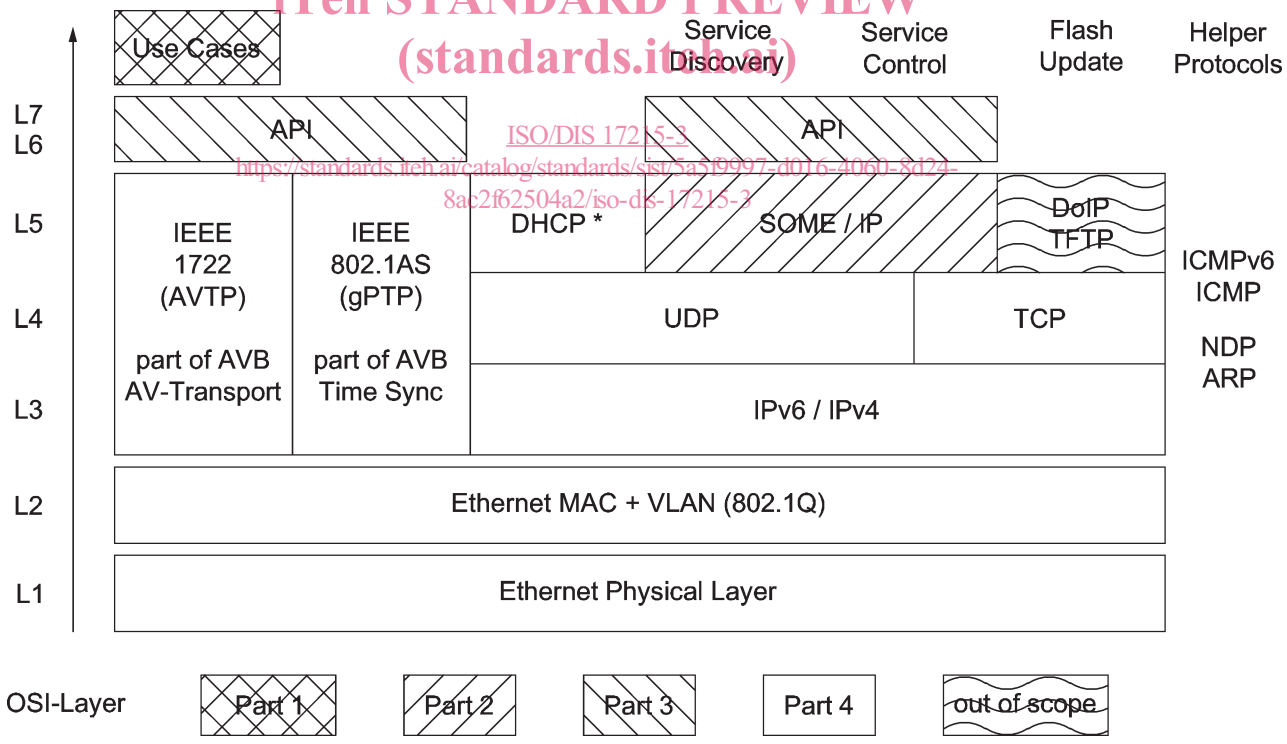

Figure 1 — Overview of ISO 17215

The general terminology defined in ISO 17215-1 is also used in this part of ISO 17215.

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°7498-1, *Information processing systems — Open systems interconnection — Basic reference model*

ISO/IEC 10731, *Information technology — Open Systems Interconnection — Basic Reference Model — Conventions for the definition of OSI services*

ISO 13400-2, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 2: Transport protocol and network layer services*

ISO 13400-3, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 3: Wired vehicle interface based on IEEE 802.3*

ISO 17215-1, *Road vehicles — Video communication interface for cameras (VCIC) — Part 1: General information and use case definition*

ISO 17215-2, *Road vehicles — Video communication interface for cameras (VCIC) — Part 2: Service discovery and control*

ISO 17215-4, *Road vehicles — Video communication interface for cameras (VCIC) — Part 4: Implementation of communication requirements*

3 Terms and definitions

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

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

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

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

3.1
camera identification number
individual camera identification number that identifies the supplier, camera type, and individual camera (e.g. MEE-32140-194565432-DD2RT supplier, camera type, serial number)

3.2
camera register
internal HW registers of the camera

3.3
extrinsic parameters
denotes the coordinate system transformations from 3D world (vehicle) coordinates (m,°) to 3D-camera coordinates (m,°)

3.4
focal length
distance over which initially collimated rays are brought to a focus

3.5
frame rate
update rate per time of camera images

3.6
global shutter
exposure that exposes all pixels at the same time

3.7
histogram
type of histogram that acts as a graphical representation of the tonal distribution in a digital image

3.8
intrinsic camera parameters
denote the coordinate system transformations from 3D camera (m) to 2D pixel coordinates (pixel)

4 Abbreviations

API	Application Programming Interface
AEC	Automatic Exposure Control
AGC	Automatic Gain Control
DAS	Driver Assistance System
ECU	Electronic Control Unit
HDR	High Dynamic Range
HMI	Human Machine Interface
ISO	International Organization for Standardization
LDR	Low Dynamic Range
MAC	Media Access Control
OSI	Open Systems Interconnection
PSE	Persistent storage entry
ROI	Region of Interest, i.e. sub-part of overall image
RPC	Remote Procedure Call

5 Conventions

This document is based on the conventions as specified in the OSI service conventions ISO/IEC°10731 as they apply for physical layer, protocol, network, and transport protocol and diagnostic services.

6 Overview of ISO 17215

6.1 General

This document has been established in order to implement a standardized video communication interface for cameras on a communication data link.

The focus of this document is using existing protocols.

— Figure 1 specifies the relation to the other parts of this document;

— Figure 2 specifies the relation of this document to existing protocols.

6.2 Document overview and structure

This document consists of a set of four sub-documents, which provide all references and requirements to support the implementation of a standardized video communication interface for cameras according to the standard at hand.

— ISO 17215-1 provides an overview of the document set and structure along with use case definitions and a common set of resources (definitions, references) for use by all subsequent parts;

— ISO 17215-2 specifies the discovery and control of services provided by a VCIC camera;

— ISO 17215-3 specifies the standardized camera messages and data types used by a VCIC camera (OSI Layer 7);

— ISO 17215-4 specifies standardized low-level communication requirements for implementation of the physical layer, data link layer, network layer, and transport layer (OSI Layers 1 to 4).

6.3 Open Systems Interconnection (OSI) model

This Document is based on the Open Systems Interconnection (OSI) basic reference model as specified in ISO/IEC 7498 which structures communication systems into seven layers.

All parts of this Document are guided by the OSI service conventions as specified in ISO/IEC 10731 to the extent that they are applicable to diagnostic services. These conventions define the interaction between the service user and the service provider through service primitives.

The aim of this subclause is to give an overview of the OSI model and show how it has been used as a guideline for this part of ISO 17215. It also shows how the OSI service conventions have been applied to this Document.

The OSI model structures data communication into seven layers called (from top to bottom) the application layer (layer 7), presentation layer, session layer, transport layer, network layer, data link layer, and physical layer (layer 1). A subset of these layers is used in this Document.

The purpose of each layer is to provide services to the layer above. The active parts of each layer, implemented in software, hardware, or any combination of software and hardware, are called entities. In the OSI model, communication takes place between entities of the same layer in different nodes. Such communicating entities of the same layer are called peer entities.

The services provided by one layer are available at the Service Access Point (SAP) of that layer. The layer above can use them by exchanging data parameters

This Document distinguishes between the services provided by a layer to the layer above it and the protocol used by the layer to send a message between the peer entities of that layer. The reason for this distinction is to make the services, especially the application layer services, and the transport layer services, reusable also for other types of networks than the video communication interface for cameras. In this way, the protocol is hidden from the service user and it is possible to change the protocol if demanded by special system requirements.

6.4 Document reference according to OSI model

Figure 2 illustrates the document references.

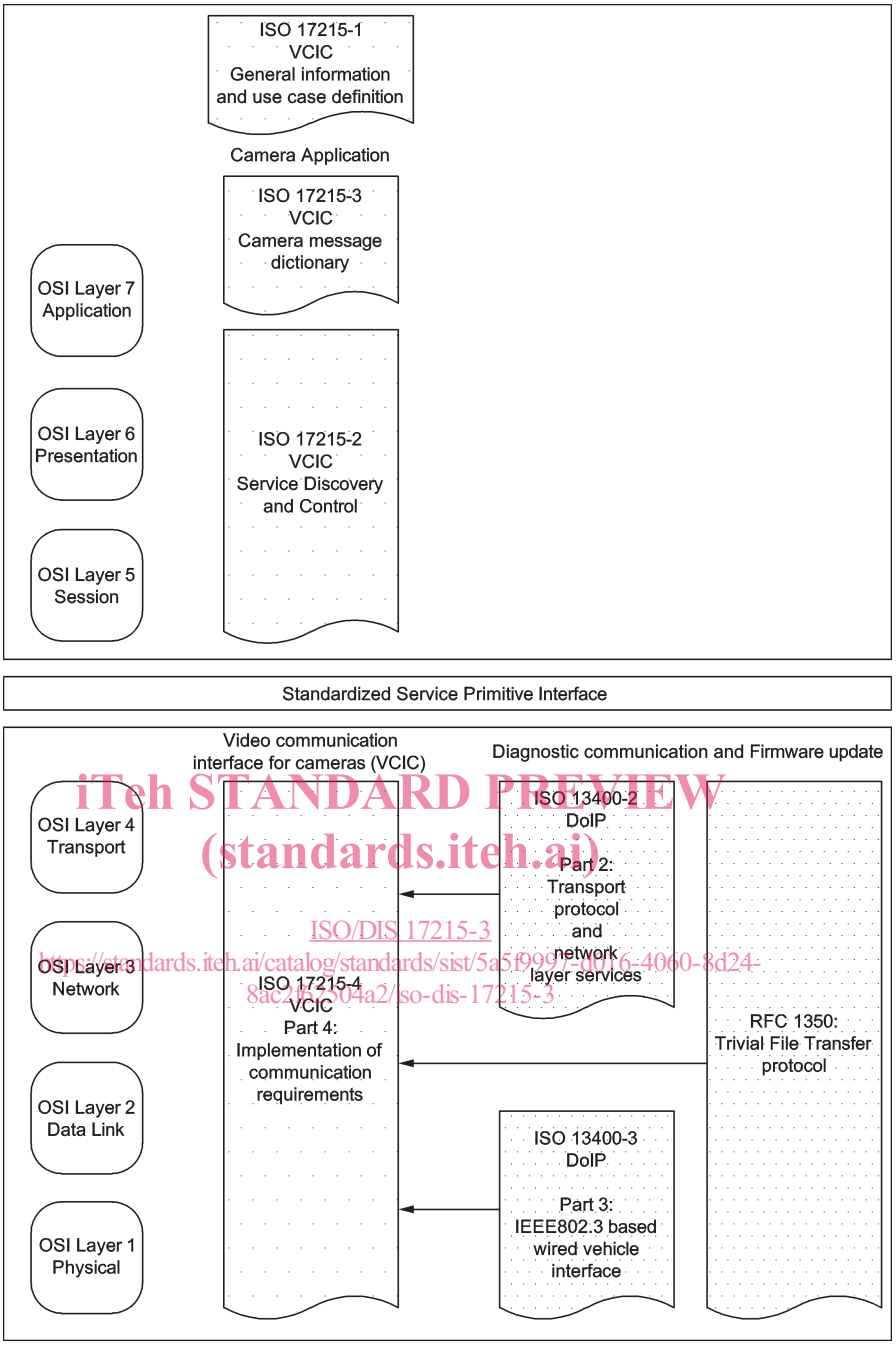

Figure 2 — Document reference according to OSI model

7 Camera application interface (OSI layer 7)

7.1 Specific properties

In the automotive environment, the network topologies are semi-static and the characteristics of all components, including cameras, are bound to a specific car platform design. Components and characteristics of components not included in the design need not to be supported.

There is no requirement for a least common video mode. The minimum compatibility requirement is to recognize the reason of unexpected behaviour. Compatibility is ensured during the design phase. Incompatibility will be detected during development, assembling, or repair of a car.

Consequently, the standard specifies the interface to an automotive camera, but doesn't specify the characteristics of automotive cameras.

For instance, no mandatory or standard video formats are specified. However, all provisions are made to implement standard video formats.

7.2 API principles

The camera API consists of a variety of data structures describing video modes, camera controls, and stored items and a set of API functions.

The API is independent of specific programming languages. It is an abstract list of data structures and functions to be offered by all implementations. A fundamental principle of all camera API functions is the usage of remote procedure calls (RPC).

The addressing of multiple cameras can be expressed by:

$$Camerafunction = f\{camerainstance, apifunction\{MethodID, arg1, ..argn\}\}$$

The implementation depends highly on the programming language used. Therefore, this document only covers the api_function itself.

Camera data structures can be read, written, and deleted using the associated camera API functions.

Camera API functions can be grouped by the mechanism they are using in

— set, get, and erase functions, and

— subscribe and unsubscribe functions.

All API functions starting with set, get, and erase are used to modify the cameras data structures and the underlying functionality, for instance setting the exposure time of the imager. They are using a request/response mechanism. A request is followed by a single response.

Functions are generally identified by its Method ID.

The Method IDs are specified in 7.5.1.

All API functions starting with unsubscribe/subscribe are used to acquire cyclically data from the camera, for instance, a video stream. They are using subscribe/notification mechanism. After subscribing an event, multiple notification packages will follow.

Events are identified by its respective Eventgroup ID.

The Eventgroup IDs are specified in 7.5.2.

The SOME/IP protocol defined in ISO 17215-2 provides the mechanism for such a RPC-based implementation.

Camera functions and the associated structures can be grouped in functional context in

— general camera functions (MethodID 0x0001 – 0x00FF);

— video format functions (MethodID 0x0101 – 0x01FF);

— image control functions (MethodID 0x0201 – 0x02FF), and;

— imager functions (MethodID 0x0301 – 0x03FF).

7.2.1 Image cropping and windowing

The definition of the image windows is shown below.

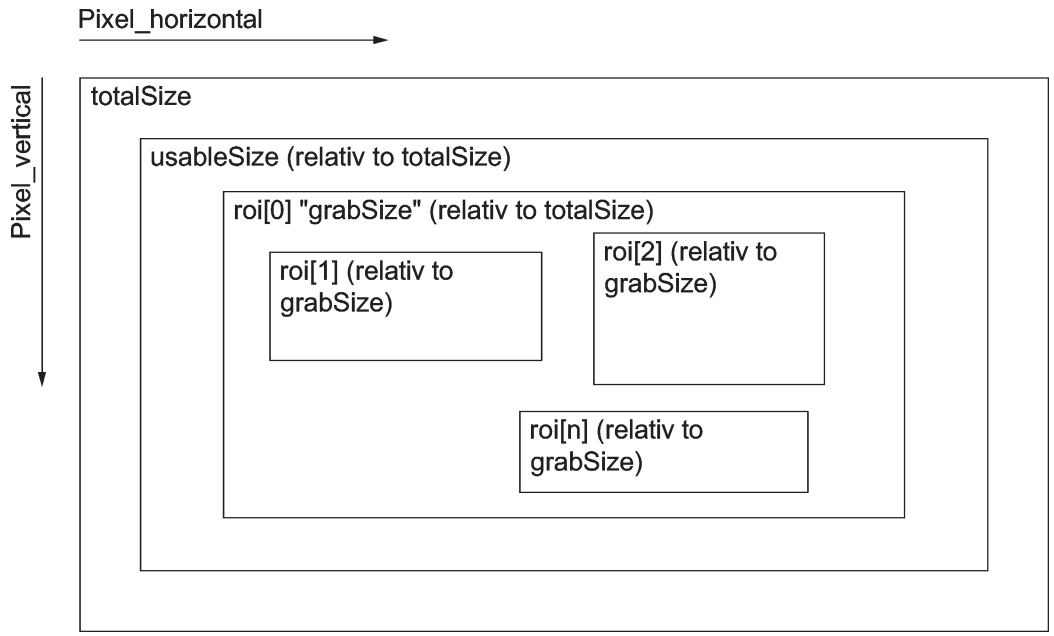

Figure 3 — Image cropping and windowing

7.3 API data types

All used data types are specified in 6.3.1 of ISO 17215-2.

7.4 API Return codes

Each function of the API returns a byte (8 bits) to signalize the status of the operation.

— The return codes (0x00 to 0x1F) are defined in 6.1.1.7 of ISO 17215-2.

— The return codes (0x20 to 0x3F) are function-specific and are described in 7.5.3.

7.5 API enumerations

7.5.1 enumeration eMethodID

Purpose: This enumeration is used to identify the methods supported by the camera.

This enumeration is based on uint16 data type.

Table 2 — enumeration eMethodID

Name	Value	Description
getDataSheet	0x0001	returns the datasheet of the camera
getCamStatus	0x0002	returns the current status of the camera
setCamMode	0x0003	start, stops, and restarts the camera application in the camera
setCamExclusive	0x0011	assigns the control of the camera exclusively to the requesting client
eraseCamExclusive	0x0019	removes the exclusive control look for the requesting client
setHostParameters	0x0022	sets the host parameters using persistent storage entries
getHostParameters	0x0024	the requested host parameter by reading persistent storage entries