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Road vehicles — Unified diagnostic services (UDS) —

Part 3:
Unified diagnostic services on CAN implementation (UDSonCAN)

Véhicules routiers — Services de diagnostic unifiés (SDU) —

Partie 3: SDU sur l'implémentation du gestionnaire de réseau de communication (SDUsurCAN)

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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 14229-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This first edition of ISO 14229-3 cancels and replaces ISO 15765-3:2004.

This corrected version incorporates the above information regarding ISO 14229-3 cancelling and replacing ISO 15765-3:2004.

ISO 14229 consists of the following parts, under the general title *Road vehicles — Unified diagnostic services (UDS)*:

— *Part 1: Specification and requirements*

— *Part 2: Session layer services*

— *Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)*

— *Part 4: Unified diagnostic services on FlexRay implementation (UDSonFR)*

— *Part 5: Unified diagnostic services on Internet Protocol implementation (UDSonIP)*

— *Part 6: Unified diagnostic services on K-Line implementation (UDSonK-Line)*

The following parts are under preparation / are planned:

— *Part 7: Unified diagnostic services on Local Interconnet Network implementation(UDSonLIN)*

Introduction

This part of ISO 14229 has been established in order to enable the implementation of unified diagnostic services, as specified in ISO 14229-3, on Controller Area Networks (UDSonCAN).

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 services specified by ISO 14229 are divided into

— Application layer (layer 7):

   — Vehicle manufacturer enhanced diagnostics: ISO 14229-1, ISO 14229-3,

   — Legislated OBD: ISO 15031-5,

   — Legislated WWH-OBD: ISO 14229-1 / ISO 27145-3;

— Presentation layer (layer 6):

   — Vehicle manufacturer enhanced diagnostics: vehicle manufacturer specific,

   — Legislated OBD: SAE J1930-DA, SAE J1979-DA, SAE J2012-DA,

   — Legislated WWH-OBD: ISO 27145-2 with reference to SAE J1930-DA, SAE J1939, Companion Spreadsheet (SPNs), SAE J1939-73:2010, Appendix A (FMIs), SAE J1979-DA and SAE J2012-DA;

— Session layer services (layer 5):

   — Vehicle manufacturer enhanced diagnostics: ISO 14229-2,

   — Legislated OBD: ISO 14229-2,

   — Legislated WWH-OBD: ISO 14229-2;

— Transport layer services (layer 4):

   — Vehicle manufacturer enhanced diagnostics: ISO 15765-2,

   — Legislated OBD: ISO 15765-2, ISO 15765-4

   — Legislated WWH-OBD: ISO 27145-4;

— Network layer services (layer 3):

   — Vehicle manufacturer enhanced diagnostics: ISO 15765-2,

   — Legislated OBD: ISO 15765-2, ISO 15765-4

   — Legislated WWH-OBD: ISO 27145-4;

— Data link layer (layer 2):

   — Vehicle manufacturer enhanced diagnostics: ISO 11898-1, ISO 11898-2, ISO 11898-3, ISO 11898-5,

   — Legislated OBD: ISO 11898-1, ISO 11898-2, ISO 15765-4,

   — Legislated WWH-OBD: ISO 27145-4;

— Physical layer (layer 3):

   — Vehicle manufacturer enhanced diagnostics: ISO 11898-1, ISO 11898-2, ISO 11898-3, ISO 11898-5,

   — Legislated OBD: ISO 11898-1, ISO 11898-2, ISO 15765-4,

— Legislated WWH-OBD: ISO 27145-4;

in accordance with Table 1.

Table 1 — DoCAN enhanced diagnostics, legislated OBD and WWH-OBD specification reference applicable to the OSI layers

Applicability	OSI 7 layers	Vehicle manufacturer enhanced diagnostics	Legislated OBD (On-Board Diagnostics)	Legislated WWH-OBD (On-Board Diagnostics)		
Seven layer according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1, ISO/FDIS 14229-3	ISO 15031-5	ISO 14229-1, ISO 27145-3		
	Presentation (layer 6)	vehicle manufacturer specific	SAE J1930-DA, SAE J1979-DA, SAE J2012-DA	ISO 27145-2 SAE J1930-DA, SAE J1939 Companion Spreadsheet (SPNs), SAE J1939 –73:2010, Appendix A (FMIs), SAE J1979-DA, SAE J2012-DA		
	Session (layer 5)	ISO 14229-2				
	Transport (layer 4)	ISO 15765-2	ISO 15765-2, ISO 15765-4	ISO 15765-2, ISO 15765-4	ISO 27145-4	ISO 13400-2
	Network (layer 3)					
	Data link (layer 2)	ISO 11898-1, ISO 11898-2, ISO 11898-3, ISO 11898-5	ISO 11898-1, ISO 11898-2, ISO 15765-4	ISO 11898-1, ISO 11898-2, ISO 15765-4		ISO 13400-3, IEEE 802.3
	Physical (layer 1)					

Road vehicles — Unified diagnostic services (UDS) —

Part 3:
Unified diagnostic services on CAN implementation (UDSonCAN)

1 Scope

This part of ISO 14229 specifies the implementation of a common set of unified diagnostic services (UDS) on controller area networks (CAN) in road vehicles (UDSonCAN).

UDSonCAN references ISO 14229-1 and ISO 14229-2 and specifies implementation requirements of the diagnostic services to be used for diagnostic communication over CAN.

NOTE   UDSonCAN does not specify any requirement for the in-vehicle CAN bus architecture.

This part of ISO 14229 does not include any redundant information of the documents as listed in the Introduction. It focuses on

— additional requirements specific to the implementation of UDS on the CAN network, and

— specific restrictions in the implementation of UDS on the CAN network.

2 Normative references

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

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 14229-2, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

ISO 15765-1, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 1: General information and use case definition*

ISO 15765-2, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 2: Transport protocol and network layer services*

ISO 15765-4, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 4: Requirements for emissions-related systems*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14229-1, ISO 14229-2, ISO 15765-1, ISO 15765-2 and ISO 15765-4 apply.

3.2 Abbreviated terms

CF	consecutive frame
DA	destination address
DLC	data length code
FF	first frame
FC	flow control
ID	identifier
NA	network address
SA	source address
SF	single frame
SM	subnet mask
SOM	start of message
STRT	serviceToRespondTo
TA	target address
UDS	unified diagnostic services
USDT	unacknowledged segmented data transfer
UUDT	unacknowledged unsegmented data transfer

4 Conventions

This part of ISO 14229 is based on the conventions discussed in the OSI Service Conventions (ISO/IEC 10731:1994) as they apply for diagnostic services.

5 Document overview

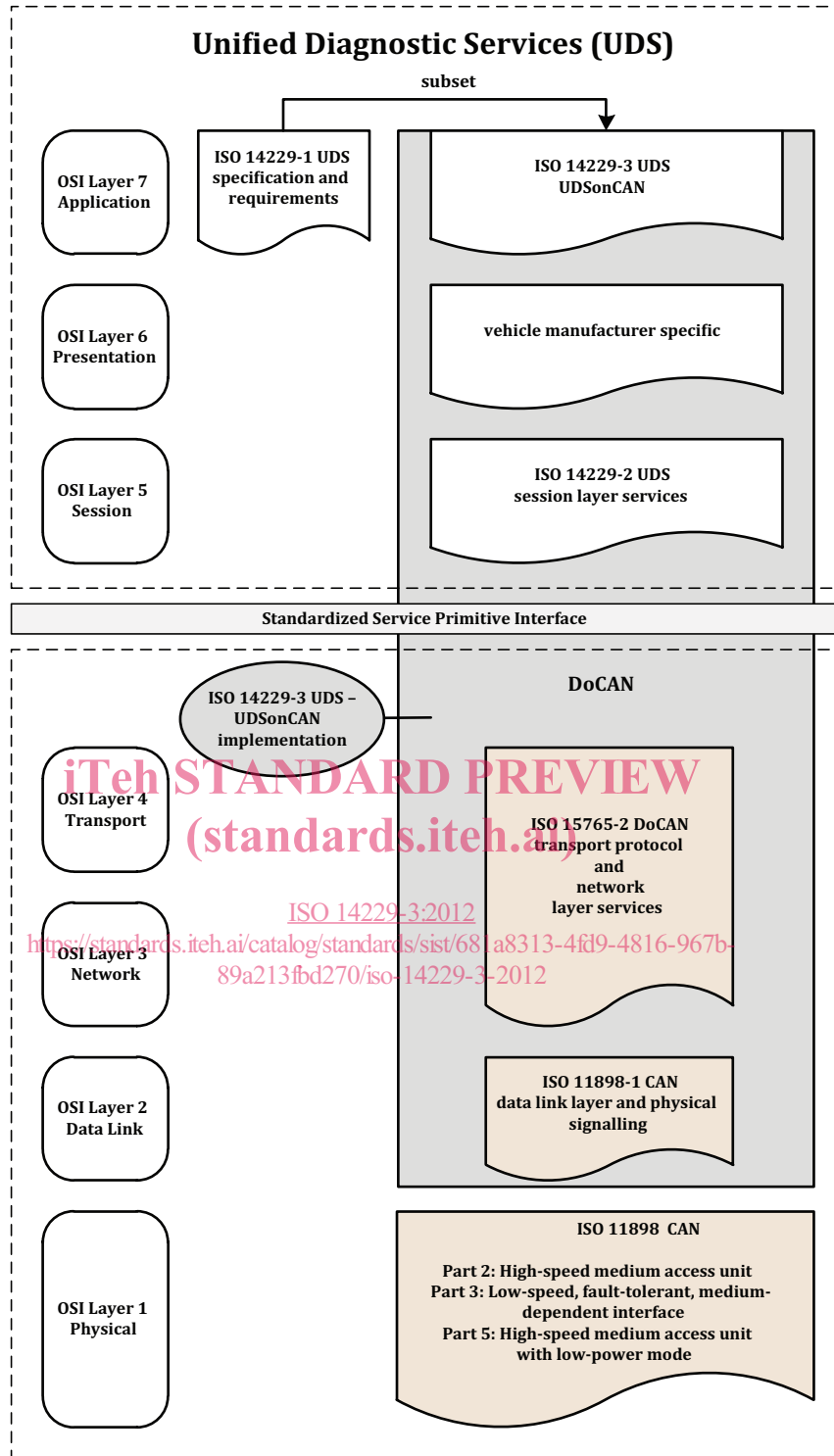Figure 1 illustrates the documents required to implement UDSonCAN.

Figure 1 — UDSonCAN document reference according to OSI model

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6 Unified diagnostic services implementation on CAN

6.1 General

This clause defines how the diagnostic services as defined in ISO 14229-1 apply to DoCAN. For each applicable service, the applicable sub-function and data parameters are defined.

NOTE   The sub-function parameter definitions take into account that the most significant bit is used for the suppressPosRspMsgIndicationBit parameter as defined in ISO 14229-1.

6.2 UDS on CAN services overview

The purpose of Table 2 is to reference all ISO 14229-1 and ISO 14229-2 services as they are applicable for an implementation in ISO 14229-3, UDSonCAN. Table 2 contains the sum of all applicable services. Certain applications using this part of ISO 14229 to implement UDSonCAN may restrict the number of useable services and may categorize them in certain application areas/diagnostic sessions (default session, programming session, etc.).

Services in Table 2 that are marked "No CAN specific requirements" shall be implemented as defined in ISO 14229-1 and ISO 14229-2 with no additional restrictions. Services that are marked "CAN specific requirements" shall be implemented as defined by the subclause listed in the Table 2 entry.

Table 2 — Overview of applicable ISO 14229-1, Unified diagnostic services and data ranges

Diagnostic service name (ISO 14229-1)	Comment	Reference in this document
Diagnostic and Communication Management Functional Unit		
DiagnosticSessionControl	No CAN specific requirements	—
ECUReset	No CAN specific requirements	—
SecurityAccess	No CAN specific requirements	—
CommunicationControl	No CAN specific requirements	—
TesterPresent	No CAN specific requirements	—
SecuredData-Transmission	No CAN specific requirements	—
ControlDTCSetting	No CAN specific requirements	—
ResponseOnEvent	CAN specific requirements	see 6.3
LinkControl	No CAN specific requirements	—
Data Transmission Functional Unit		
ReadDataByIdentifier	No CAN specific requirements	—
ReadMemoryByAddress	No CAN specific requirements	—
ReadScalingDataByIdentifier	No CAN specific requirements	—
ReadDataByPeriodicIdentifier	CAN specific requirements	see 6.4
DynamicallyDefineDataIdentifier	No CAN specific requirements	—
WriteDataByIdentifier	No CAN specific requirements	—
WriteMemoryByAddress	No CAN specific requirements	—
ReadDTCInformation	No CAN specific requirements	—
ClearDiagnosticInformation	No CAN specific requirements	—
Data Transmission Functional Unit		
ReadDTCInformation	No CAN specific requirements	—
ClearDiagnosticInformation	No CAN specific requirements	—

Table 2 *(continued)*

Input/Output Control Functional Unit		
InputOutputControlByIdentifier	No CAN specific requirements	—
Remote Activation Of Routine Functional Unit		
RoutineControl	No CAN specific requirements	—
Upload/Download Functional Unit		
RequestDownload	No CAN specific requirements	—
RequestUpload	No CAN specific requirements	—
TransferData	No CAN specific requirements	—
RequestTransferExit	No CAN specific requirements	—
RequestFileTransfer	No CAN specific requirements	—

6.3   ResponseOnEvent (0x86) service DoCAN implementation requirements

In addition to the generic implementation requirements stated in ISO 14229-1 the following additional CAN specific implementation requirements shall apply.

While the ResponseOnEvent service is active, the server shall be able to process concurrent diagnostic request and response messages accordingly. This should be accomplished with a different serviceToRespondTo CAN Identifiers. If the same diagnostic request/response CAN Identifiers are used for diagnostic communication and the serviceToRespondTo-responses, the following restrictions shall apply:

a)   The server may ignore an incoming diagnostic request issued by the client that initiated the event, after an event has occurred and the serviceToRespondTo-response is in progress, until the serviceToRespondTo-response is completed. If another client issued the request, the server may or may not ignore the request, depending on the server's capabilities.

b)   When the client receives any response after sending a diagnostic request, the response shall be classified according to the possible serviceToRespondTo-responses and the expected diagnostic responses to the previously sent request.

  1)   If the response is a serviceToRespondTo-response (one of the possible responses set up with ResponseOnEvent-service), the client shall repeat the request after the serviceToRespondTo-response has been received completely.

  2)   If the response is ambiguous (i.e. the response could originate from the serviceToRespondTo initiated by an event or from the response to a diagnostic request), the client shall present the response both as a serviceToRespondTo-response and as the response to the diagnostic request. The client shall not repeat the request with the exception of NegativeResponseCode busyRepeatRequest (0x21) (see the negative response code definitions in ISO 14229-1.