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**Road vehicles — Unified diagnostic
services (UDS) —**

**Part 1:
Specification and requirements**

Véhicules routiers — Services de diagnostic unifiés (SDU) —

*Partie 1:
Spécification et exigences*



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Contents

Page

Foreword.....	v
Introduction	vi
1 Scope	1
2 Normative references	2
3 Terms and definitions.....	3
4 Symbols and abbreviated terms	5
5 Conventions	5
6 Application layer services	6
6.1 General.....	6
6.2 Format description of application layer services	8
6.3 Format description of standard service primitives	8
6.4 Format description of remote service primitives	10
6.5 Service data unit specification	13
7 Application layer protocol	19
7.1 General definition	19
7.2 Protocol data unit specification	19
7.3 Application protocol control information.....	19
7.4 Negative response/confirmation service primitive	21
7.5 Server response implementation rules	22
8 Service description conventions	29
8.1 Service description.....	29
8.2 Request message	30
8.3 Positive response message.....	32
8.4 Supported negative response codes (NRC_)	34
8.5 Message flow examples	34
9 Diagnostic and communication management functional unit.....	36
9.1 Overview.....	36
9.2 DiagnosticSessionControl (10 hex) service.....	36
9.3 ECUReset (11 hex) service	42
9.4 SecurityAccess (27 hex) service	45
9.5 CommunicationControl (28 hex) service.....	52
9.6 TesterPresent (3E hex) service	55
9.7 AccessTimingParameter (83 hex) service.....	58
9.8 SecuredDataTransmission (84 hex) service	63
9.9 ControlDTCSetting (85 hex) service	69
9.10 ResponseOnEvent (86 hex) service.....	73
9.11 LinkControl (87 hex) service.....	91
10 Data transmission functional unit.....	97
10.1 Overview	97
10.2 ReadDataByIdentifier (22 hex) service	97
10.3 ReadMemoryByAddress (23 hex) service	102
10.4 ReadScalingDataByIdentifier (24 hex) service	106
10.5 ReadDataByPeriodicIdentifier (2A hex) service	112
10.6 DynamicallyDefineDataIdentifier (2C hex) service	123
10.7 WriteDataByIdentifier (2E hex) service.....	143
10.8 WriteMemoryByAddress (3D hex) service	146

11	Stored data transmission functional unit	152
11.1	Overview	152
11.2	ClearDiagnosticInformation (14 hex) service	152
11.3	ReadDTCInformation (19 hex) service	154
12	InputOutput control functional unit	208
12.1	Overview	208
12.2	InputOutputControlByIdentifier (2F hex) service.....	209
13	Remote activation of routine functional unit	224
13.1	Overview	224
13.2	RoutineControl (31 hex) service	225
14	Upload download functional unit	231
14.1	Overview	231
14.2	RequestDownload (34 hex) service.....	231
14.3	RequestUpload (35 hex) service.....	234
14.4	TransferData (36 hex) service	237
14.5	RequestTransferExit (37 hex) service	242
Annex A (informative)	Global parameter definitions	250
Annex B (normative)	Diagnostic and communication management functional unit data parameter definitions	257
Annex C (normative)	Data transmission functional unit data parameter definitions	259
Annex D (normative)	Stored data transmission functional unit data parameter definitions	272
Annex E (normative)	Input output control functional unit data parameter definitions	289
Annex F (normative)	Remote activation of routine functional unit data parameter definitions	290
Annex G (informative)	Examples for addressAndLengthFormatIdentifier parameter values	291
Bibliography	293

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 14229-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This first edition of ISO 14229-1 cancels and replaces ISO 14229:1998, which has been technically revised.

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

— *Part 1: Specification and requirements*

The following part is under preparation:

— *Part 2: Session layer services*

This corrected version of ISO 14229-1:2006 incorporates the following corrections:

— the document reference number, title and edition have been changed from “ISO 14229:2006, *Road vehicles — Unified diagnostic services (UDS) — Specification and requirements*, Second edition” to “ISO 14229-1:2006, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*, First edition” throughout the document;

— mention of “Part 2: Lager services” has been added to the Foreword.

Introduction

This part of ISO 14229 has been established in order to define common requirements for diagnostic systems, whatever the serial data link is.

To achieve this, it is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the services used by a diagnostic tester (client) and an Electronic Control Unit (ECU, server) are broken into:

- unified diagnostic services (layer 7); and
- communication services (layers 1 to 6).

NOTE The diagnostic services in this part of ISO 14229 are implemented in various applications, e.g. ISO 16844 (all parts), ISO 11992 (all parts), ISO 9141 (all parts), ISO 14230 (all parts), etc. Future modifications to this part of ISO 14229 will provide long-term backward compatibility with the implementation standards as described above.

Table 1 — Example of diagnostic/programming specifications applicable to the OSI layers

Applicability	OSI layer	Enhanced diagnostics services (non-emissions-related)	
Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 14229-1/ISO 15765-3/ISO 11992-4	ISO 14229-1/further standards
	Presentation (layer 6)	—	—
	Session (layer 5)	ISO 15765-3/ISO 11992-4	further standards
	Transport (layer 4)	ISO 15765-2/ISO 11992-4	further standards
	Network (layer 3)	ISO 15765-2/ISO 11992-4	further standards
	Data link (layer 2)	ISO 11898/ISO 11992-1/SAE J1939-15	further standards
	Physical (layer 1)	ISO 11898/ISO 11992-1/SAE J1939-15	further standards

Figure 1 shows an example of the possible future implementation of this part of ISO 14229 onto various data links.

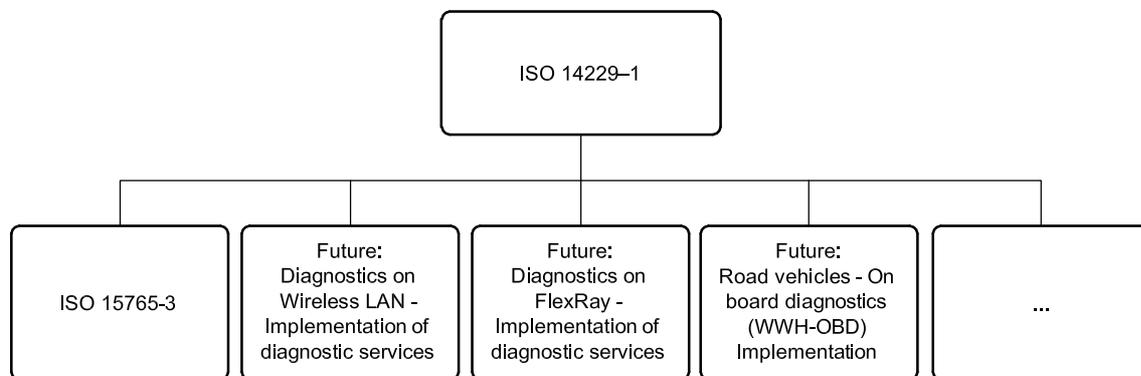


Figure 1 — Available International Standards and possible future implementations of this part of ISO 14229

Road vehicles — Unified diagnostic services (UDS) — Specification and requirements

Part 1: Specification and requirements

1 Scope

This part of ISO 14229 specifies data link independent requirements of diagnostic services, which allow a diagnostic tester (client) to control diagnostic functions in an on-vehicle Electronic Control Unit (server) such as an electronic fuel injection, automatic gear box, anti-lock braking system, etc. connected on a serial data link embedded in a road vehicle. It specifies generic services which allow the diagnostic tester (client) to stop or to resume non-diagnostic message transmission on the data link. This part of ISO 14229 does not apply to non-diagnostic message transmission or to use of the communication data link between two Electronic Control Units. It does not specify any implementation requirements.

The vehicle diagnostic architecture of this part of ISO 14229 applies to:

- a single tester (client) that may be temporarily or permanently connected to the on-vehicle diagnostic data link; and
- several on-vehicle Electronic Control Units (servers) connected directly or indirectly.

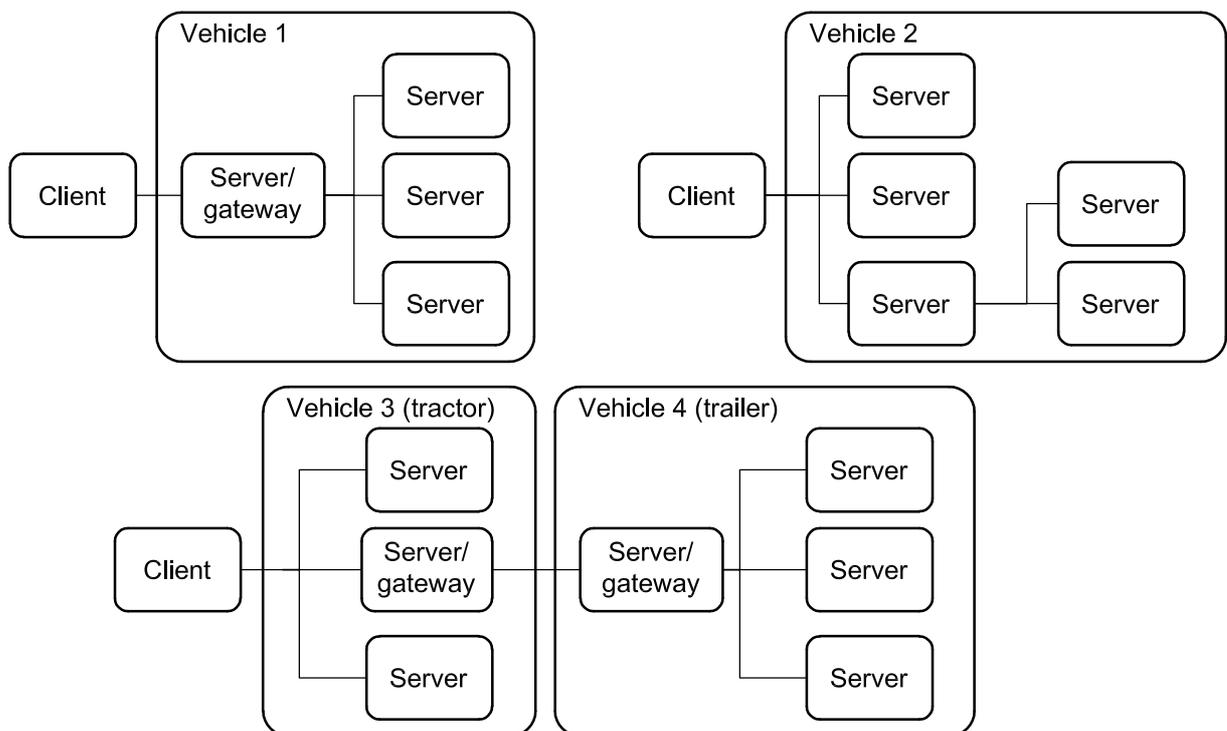


Figure 2 — Vehicle diagnostic architecture

In Figure 2:

- For vehicle 1, the servers are connected over an internal data link and indirectly connected to the diagnostic data link through a gateway. This part of ISO 14229 applies to the diagnostic communications over the diagnostic data link; the diagnostic communications over the internal data link may conform to this part of ISO 14229 or to another protocol.
- For vehicle 2, the servers are directly connected to the diagnostic data link.
- For vehicle 3, the servers are directly connected to the diagnostic data link through a gateway (same as vehicle 2) and vehicle 4 connects its server/gateway directly to the vehicle 3 server/gateway.

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 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

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

ISO 11898 (all parts), *Road vehicles — Controller area network (CAN)*

ISO 11992-1, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 1: Physical and data-link layers*

ISO 11992-4, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 4: Diagnostics*

ISO 14230 (all parts), *Road vehicles — Diagnostic systems — Keyword Protocol 2000*

ISO 15765-2, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 2: Network layer services*

ISO 15765-3, *Road vehicles — Diagnostics on Controller Area Networks (CAN) — Part 3: Implementation of unified diagnostic services (UDS on CAN)*

ISO/TR 15031-2, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 2: Terms, definitions, abbreviations and acronyms*

ISO 15031-5, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 5: Emissions-related diagnostic services*

ISO 15031-6, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 6: Diagnostic trouble code definitions*

ISO 15031-7, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 7: Data link security*

ISO 15764, *Road vehicles — Extended data link security*

3 Terms and definitions

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

3.1

integer type

simple type with distinguished values which are the positive and the negative whole numbers

NOTE The range of integer type is not specified within this document.

3.2

diagnostic trouble code

numerical common identifier for a fault condition identified by the on-board diagnostic system

3.3

diagnostic service

information exchange initiated by a client in order to require diagnostic information from a server and/or to modify its behaviour for diagnostic purposes

3.4

client

function that is part of the tester and that makes use of the diagnostic services

NOTE A tester normally makes use of other functions such as database management, specific interpretation, human-machine interface.

3.5

server

function that is part of an electronic control unit and that provides the diagnostic services

NOTE This part of ISO 14229 differentiates between the server (i.e. the function) and the electronic control unit so that it remains independent from the implementation.

3.6

tester

system that controls functions such as test, inspection, monitoring or diagnosis of an on-vehicle electronic control unit and which may be dedicated to a specific type of operator (e.g. a scan tool dedicated to garage mechanics or a test tool dedicated to assembly plant agents)

NOTE The tester is also referenced as the client.

3.7

diagnostic data

data that is located in the memory of an electronic control unit which may be inspected and/or possibly modified by the tester (diagnostic data includes analogue inputs and outputs, digital inputs and outputs, intermediate values and various status information)

EXAMPLES Examples of diagnostic data include vehicle speed, throttle angle, mirror position, system status, etc. Three types of values are defined for diagnostic data:

- the current value: the value currently used by (or resulting from) the normal operation of the electronic control unit;
- a stored value: an internal copy of the current value made at specific moments, e.g. when a malfunction occurs or periodically (this copy is made under the control of the electronic control unit);
- a static value: e.g. VIN; the server is not obliged to keep internal copies of its data for diagnostic purposes, in which case the tester may only request the current value.

3.8
diagnostic session

current mode of the server, which affects the level of diagnostic functionality

NOTE Defining a repair shop or development testing session selects different server functionality (e.g. access to all memory locations may only be allowed in the development testing session).

3.9
diagnostic routine

routine that is embedded in an electronic control unit and that may be started by a server upon a request from the client

NOTE It could either run instead of a normal operating program or run concurrently to the normal operating program. In the first case, normal operation of the ECU is not possible. In the second case, multiple diagnostic routines may be enabled that run while all other parts of the electronic control unit are functioning normally.

3.10
record

one or more diagnostic data elements that are referred to together by a single means of identification

NOTE A snapshot including various input/output data and trouble codes is an example of a record.

3.11
security

as used in this part of ISO 14229, security access method that satisfies the requirements for tamper protection as specified in ISO 15031-7

3.12
functional unit

set of functionally close or complementary diagnostic services

3.13
local server

server that is connected to the same local network as the client and is part of the same address space as the client

3.14
local client

client that is connected to the same local network as the server and is part of the same address space as the server

3.15
remote server

server that is not directly connected to the main diagnostic network

NOTE 1 A remote server is identified by means of a remote network address. Remote network addresses represent an own network address space that is independent from the addresses on the main network.

NOTE 2 A remote server is reached via a local server on the main network. Each local server on the main network can act as a gate to one independent set of remote servers. A pair of addresses will therefore always identify a remote server: a local address that identifies the gate to the remote network and a remote address identifying the remote server itself.

3.16
remote client

client that is not directly connected to the main diagnostic network

NOTE A remote client is identified by means of a remote network address. Remote network addresses represent an own address space that is independent from the addresses on the main network.

3.17**permanent DTC**

stored in NVRAM and not erasable by any test equipment command or by disconnecting power to the on-board computer

4 Symbols and abbreviated terms

A_PCI Application layer Protocol Control Information

A_PDU Application layer Protocol Data Unit

A_SDU Application layer Service Data Unit

ECU Electronic Control Unit

NOTE An ECU contains at least one server. Systems considered as Electronic Control Units include anti-lock braking system (ABS), engine management system, etc.

NR_SI Negative Response Service Identifier

OBD On-Board Diagnostic

OSI Open Systems Interconnection

RA Remote Address

SA Source Address

SI Service Identifier

TA Target Address

TA_type Target Address type

5 Conventions

This part of ISO 14229 is guided by the conventions discussed in the OSI Service Conventions (ISO 10731) as they apply to diagnostic services. These conventions specify the interactions between the service user and the service provider. Information is passed between the service user and the service provider by service primitives, which may convey parameters.

The distinction between service and protocol is summarized in Figure 3.

This part of ISO 14229 defines both, confirmed and unconfirmed services.

— **Confirmed services** use the six (6) service primitives, request, req_confirm, indication, response, rsp_confirm and confirmation.

— **Unconfirmed services** use only the request, req_confirm and indication service primitives.

For all services defined in this part of ISO 14229, the request and indication service primitives always have the same format and parameters. Consequently, for all services the response and confirmation service primitives (except req_confirm and rsp_confirm) always have the same format and parameters. When the service primitives are defined in this part of ISO 14229, only the request and response service primitives are listed.

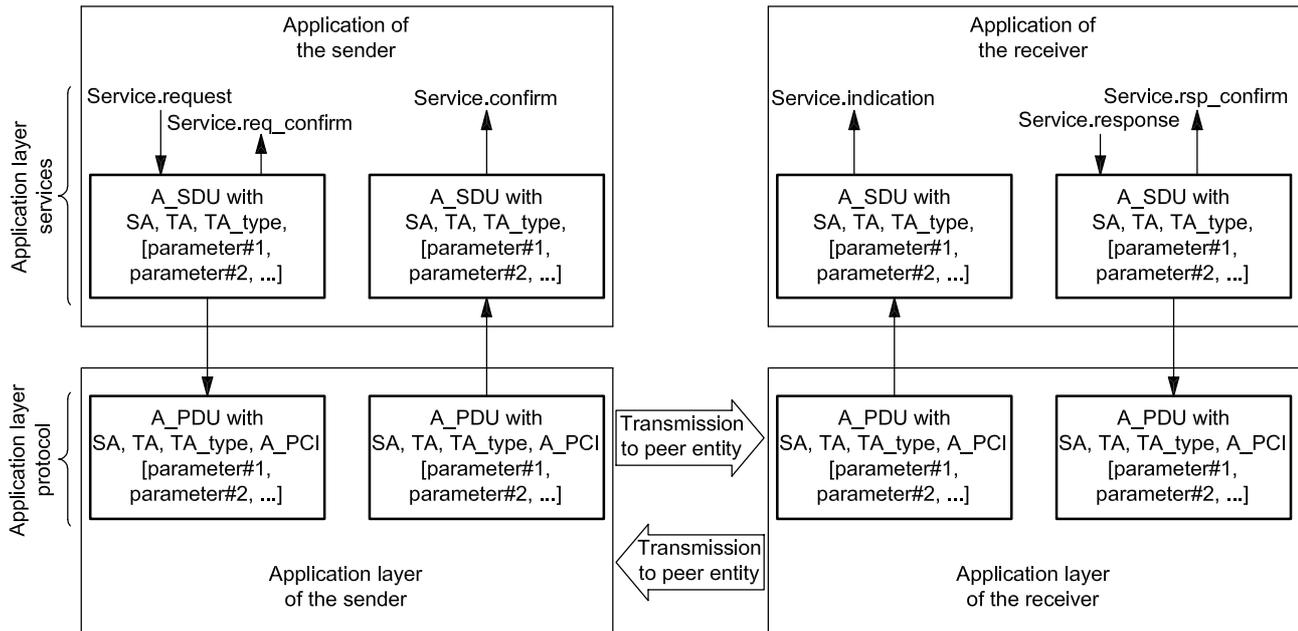


Figure 3 — The services and the protocol

6 Application layer services

6.1 General

Application layer services are usually referred to as diagnostic services. The application layer services are used in client-server-based systems to perform functions such as test, inspection, monitoring or diagnosis of on-board vehicle servers. The client, usually referred to as an External Test Equipment, uses the application layer services to request diagnostic functions to be performed in one or more servers. The server, usually a function that is part of an ECU, uses the application layer services to send response data, provided by the requested diagnostic service, back to the client. The client is usually an off-board tester but can, in some systems, also be an on-board tester. The usage of application layer services is independent from the client being an off-board or on-board tester. It is possible to have more than one client in the same vehicle system.

The service access point of the diagnostics application layer provides a number of services that all have the same general structure. For each service, six (6) service primitives are specified:

- a **service request primitive**, used by the client function in the diagnostic tester application to pass data about a requested diagnostic service to the diagnostics application layer;
- a **service request-confirmation primitive**, used by the client function in the diagnostic tester application to indicate that the data passed in the service request primitive is completely transferred to the server;
- a **service indication primitive**, used by the diagnostics application layer to pass data to the server function of the ECU diagnostic application;
- a **service response primitive**, used by the server function in the ECU diagnostic application to pass response data provided by the requested diagnostic service to the diagnostics application layer;



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