INTERNATIONAL STANDARD

ISO 14229-1

Second edition
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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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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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

This second edition cancels and replaces the first edition (ISO 14229-1:2006), 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*

— *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 part is under preparation:

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

The titles of future parts will be drafted as follows:

— *Part n: Unified diagnostic services on … implementation (UDSon…)*

Introduction

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

To achieve this, ISO 14229 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 the following layers in accordance with Table 1:

— Application layer (layer 7), unified diagnostic services specified in ISO 14229-1, ISO 14229-3 UDSonCAN, ISO 14229-4 UDSonFR, ISO 14229-5 UDSonIP, ISO 14229-6 UDSonK-Line, ISO 14229-7 UDSonLIN, further standards and ISO 27145-3 WWH-OBD.

— Presentation layer (layer 6), vehicle manufacturer specific, ISO°27145-2 WWH-OBD.

— Session layer services (layer 5) specified in ISO 14229-2.

— Transport layer services (layer 4), specified in ISO 15765-2 DoCAN, ISO 10681-2 Communication on FlexRay, ISO 13400-2 DoIP, ISO 17987-2 LIN, ISO 27145-4 WWH-OBD.

— Network layer services (layer 3), specified in ISO 15765-2 DoCAN, ISO 10681-2 Communication on FlexRay, ISO 13400-2 DoIP, ISO 17987-2 LIN, ISO 27145-4 WWH-OBD.

— Data link layer (layer 2), specified in ISO 11898-1, ISO 11898-2, ISO 17458-2, ISO 13400-3, IEEE 802.3, ISO 14230-2, ISO 17987-3 LIN and further standards, ISO 27145-4 WWH-OBD.

— Physical layer (layer 1), specified in ISO 11898-1, ISO 11898-2, ISO 17458-4, ISO 13400-3, IEEE 802.3, ISO 14230-1, ISO 17987-4 LIN and further standards, ISO 27145-4 WWH-OBD.

NOTE The diagnostic services in this standard are implemented in various applications e.g. Road vehicles – Tachograph systems, Road vehicles – Interchange of digital information on electrical connections between towing and towed vehicles, Road vehicles – Diagnostic systems, etc. It is required that future modifications to this standard provide long-term backward compatibility with the implementation standards as described above.

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

<table>
<tr><th>Applicability</th><th>OSI seven layer</th><th colspan="7">Enhanced diagnostics services</th><th>WWH-OBD</th></tr>
<tr><td rowspan="8">Seven layer according to ISO/IEC 7498-1 and ISO/IEC 10731</td><td>Application (layer 7)</td><td colspan="7">ISO 14229-1, ISO 14229-3 UDSonCAN, ISO 14229-4 UDSonFR, ISO 14229-5 UDSonIP, ISO 14229-6 UDSonK-Line, ISO 14229-7 UDSonLIN, further standards</td><td>ISO 27145-3</td></tr>
<tr><td>Presentation (layer 6)</td><td colspan="7">vehicle manufacturer specific</td><td>ISO 27145-2</td></tr>
<tr><td>Session (layer 5)</td><td colspan="8">ISO 14229-2</td></tr>
<tr><td>Transport (layer 4)</td><td rowspan="2">ISO 15765-2</td><td rowspan="2">ISO 10681-2</td><td rowspan="2">ISO 13400-2</td><td rowspan="2">Not applicable</td><td rowspan="2">ISO 17987-2</td><td>further standards</td><td rowspan="4">ISO 27145-4</td></tr>
<tr><td>Network (layer 3)</td><td>further standards</td></tr>
<tr><td>Data link (layer 2)</td><td rowspan="2">ISO 11898-1, ISO 11898-2</td><td>ISO 17458-2</td><td rowspan="2">ISO 13400-3, IEEE 802.3</td><td>ISO 14230-2</td><td>ISO 17987-3</td><td>further standards</td></tr>
<tr><td>Physical (layer 1)</td><td>ISO 17458-4</td><td>ISO 14230-1</td><td>ISO 17987-4</td><td>further standards</td></tr>
</table>

Road vehicles — Unified diagnostic services (UDS) —

Part 1: Specifications 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 (ECU, server) such as an electronic fuel injection, automatic gear box, anti-lock braking system, etc. connected to 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 on the vehicle's communication data link between two Electronic Control Units. However, this part of ISO 14229 does not restrict an in-vehicle on-board tester (client) implementation in an ECU in order to utilize the diagnostic services on the vehicle's communication data link to perform bidirectional diagnostic data exchange.

This part of ISO 14229 does not specify any implementation requirements.

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

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

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

3.1.1
boot manager
part of the boot software that executes immediately after an ECU power on or reset whose primary purpose is to check whether a valid application is available to execute as compared to transferring control to the reprogramming software

NOTE The boot manager may also take into account other conditions for transitioning control to the reprogramming software.

3.1.2
boot memory partition
area of the server memory in which the boot software is located

3.1.3
boot software
software which is executed in a special part of server memory which is used primarily to boot the ECU and perform server programming

NOTE 1 This area of memory is not erased during a normal programming sequence and must execute when the server application is missing or otherwise deemed invalid to always ensure the capability to reprogram the server.

NOTE 2 See also 3.1.1 and 3.1.17.

3.1.4
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 data base management, specific interpretation, human-machine interface.

3.1.5
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

NOTE 1 Diagnostic data includes analogue inputs and outputs, digital inputs and outputs, intermediate values and various status information.

NOTE 2 Examples of diagnostic data are 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.

NOTE 3 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).

3.1.6
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 could be enabled in this mode and executed with the normal operating program. In the first case, normal operation for the server 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.

3.1.7
diagnostic service
information exchange initiated by a client in order to require diagnostic information from a server or/and to modify its behaviour for diagnostic purpose

3.1.8
diagnostic session
state within the server in which a specific set of diagnostic services and functionality is enabled

3.1.9
diagnostic trouble code
DTC
numerical common identifier for a fault condition identified by the on-board diagnostic system

3.1.10
ECU
electronic control unit, containing at least one server

NOTE Systems considered as Electronic Control Units include Anti-lock Braking System (ABS) and Engine Management System.

3.1.11
functional unit
set of functionally close or complementary diagnostic services

3.1.12
integer type
simple type with distinguished values which are the positive and the negative whole numbers, including zero

NOTE The range of type integer is not specified within this part of ISO 14229.

3.1.13
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

3.1.14
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

3.1.15
OSI
open systems interconnection

3.1.16
permanent DTC
diagnostic trouble code (DTC) that remains in non-volatile memory, even after a clear DTC request, until other criteria (typically regulatory) are met (e.g. the appropriate monitors for each DTC have successfully passed)

NOTE Refer to the relevant legislation for all necessary requirements.

3.1.17
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.

3.1.18
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 address. Remote addresses represent an own 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 must therefore always identify a remote server: one local address that identifies the gate to the remote network and one remote address identifying the remote server itself.

3.1.19
remote client
client that is not directly connected to the main diagnostic network

NOTE 1 A remote client is identified by means of a remote address.

NOTE 2 Remote addresses represent an own address space that is independent from the addresses on the main network.

3.1.20
reprogramming software
part of the boot software that allows for reprogramming of the electronic control unit

3.1.21
security
mechanism for protecting vehicle modules from "unauthorized" intrusion through a vehicle diagnostic data link

3.1.22
server
function that is part of an electronic control unit and that provides the diagnostic services

NOTE This international standard differentiates between the server (i.e. the function) and the electronic control unit so that this standard remains independent from the implementation.

3.1.23
supported DTC
diagnostic trouble code which is currently configured/calibrated and enabled to execute under pre-defined vehicle conditions

3.1.24
tester
system that controls functions such as test, inspection, monitoring, or diagnosis of an on-vehicle electronic control unit and may be dedicated to a specific type of operator (e.g. an off-board scan tool dedicated to garage mechanics, an off-board test tool dedicated to assembly plants, or an on-board tester)

NOTE The tester is also referenced as the client.

3.2 Abbreviated terms

.con	service primitive .confirmation
.ind	service primitive .indication
.req	service primitive .request
A_PCI	application layer protocol control information
ECU	electronic control unit
EDR	event data recorder
N/A	not applicable
NR_SI	negative response service identifier
NRC	negative response code
OSI	open systems interconnection

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