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Third edition
2020-02

Road vehicles — Unified diagnostic services (UDS) —

Part 1: Application layer

Véhicules routiers — Services de diagnostic unifiés (SDU) —

Partie 1: Couches application

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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.

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).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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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.

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This third edition cancels and replaces the second edition (ISO 14229-1:2013), which has been technically revised. The main changes compared to the previous edition are as follows:

— new diagnostic service for Authentication has been introduced to address cyber security topics;

— new clause "Security sub-layer definition";

— some unused SubFunction of ReadDTCInformation service are deleted, e.g. Mirror Memory;

— the ReadDataByPeriodicIdentifier is updated; and

— several clarifications and corrections are implemented.

A list of all parts in the ISO 14229 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.

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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/IEC 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 this document, ISO 14229-3 UDSonCAN, ISO 14229-4 UDSonFR, ISO 14229-5 UDSonIP, ISO 14229-6 UDSonK-Line, ISO 14229-7 UDSonLIN, ISO 14229-8[1] UDSonCXPI, further standards and ISO 27145-3 VOBD.

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

— 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 20794-3[2] CXPI, ISO 27145-4 VOBD.

— 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 20794-3 CXPI, ISO 27145-4 VOBD.

— 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, ISO 20794-4[3] CXPI, and further standards, ISO 27145-4 VOBD.

— 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, ISO 20794-4 CXPI, and further standards, ISO 27145-4 VOBD.

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NOTE The diagnostic services in this document 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. Future modifications to this document will provide long-term backward compatibility with the implementation standards as described above.

[1] Under preparation. Stage at the time of publication: ISO/FDIS 14229-8:2020.

[2] Under preparation. Stage at the time of publication: ISO/FDIS 20794-3:2020.

[3] Under preparation. Stage at the time of publication: ISO/FDIS 20794-4:2020.

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

<table>
<tr><th>OSI seven layer[a]</th><th colspan="7">Enhanced diagnostics services</th><th>VOBD</th></tr>
<tr><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, ISO 14229-8 UDSonCXPI, 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 rowspan="2">ISO 20794-3</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 rowspan="2">ISO 20794-4</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>
<tr><td colspan="9">[a] Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731.</td></tr>
</table>

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Road vehicles — Unified diagnostic services (UDS) —

Part 1: Application layer

1 Scope

This document 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 gearbox, 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 document does not apply to non-diagnostic message transmission on the vehicle's communication data link between two electronic control units. However, this document 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.

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This document does not specify any implementation requirements.

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

ISO 7816-8, *Identification cards — Integrated circuit cards — Part 8: Commands and mechanisms for security operations*

ISO/IEC 9594-8, *Information technology — Open Systems Interconnection — The Directory — Part 8: Public-key and attribute certificate frameworks*

IEEE 754-2008, *IEEE Standard for Floating-Point Arithmetic*

IEEE 1609.2, *Standard for Wireless Access in Vehicular Environments — Security Services for Applications and Management Messages*

X.509, *Information technology — Open Systems Interconnection — The Directory: Public-key and attribute certificate frameworks*

RFC 5280, *Internet Engineering Task Force — Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*

RFC 5755, *Internet Engineering Task Force — An Internet Attribute Certificate Profile for Authorization*

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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
boot memory partition
area of the *server* (3.18) memory in which the *boot software* (3.2) is located

3.2
boot software
software which is executed in a special part of *server* (3.18) memory which is used primarily to boot the *ECU* (3.9) and perform server programming

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

Note 2 to entry: See 0 and 17.3.1.1.

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3.3
client
function that is part of the *tester* (3.20) and that makes use of the *diagnostic services* (3.6)

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Note 1 to entry: A tester normally makes use of other functions such as data base management, specific interpretation, human-machine interface.

3.4
diagnostic channel
dedicated transmission path from *client* (3.3) to *server* (3.18) for diagnostic communication

Note 1 to entry: Several simultaneously connected clients to one server can be differentiated by an individual *tester* (3.20) source address.

3.5
diagnostic data
data that is located in the memory of an *electronic control unit* (3.9) which may be inspected and/or possibly modified by the *tester* (3.20)

Note 1 to entry: Diagnostic data includes analogue inputs and outputs, digital inputs and outputs, intermediate values and various status information.

Note 2 to entry: 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.

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The *server* (3.18) 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 to entry: 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).

3.6
diagnostic service
information exchange initiated by a *client* (3.3) in order to require diagnostic information from a *server* (3.18) or/and to modify its behaviour for diagnostic purpose

3.7
diagnostic session
state within the *server* (3.18) in which a specific set of *diagnostic services* (3.6) and functionality is enabled

3.8
diagnostic trouble code
DTC
numerical common identifier for a fault condition identified by the on-board diagnostic system

3.9
ECU
electronic control unit
unit providing information regarding the connected sensor and control network

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Note 1 to entry: Systems considered as electronic control units include anti-lock braking system (ABS) and engine management system.

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3.10
functional unit
set of functionally close or complementary *diagnostic services* (3.6)

3.11
local server
server (3.18) that is connected to the same local network as the *client* (3.3) and is part of the same address space as the client

3.12
permanent DTC
diagnostic trouble code (3.8) 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 1 to entry: Refer to the relevant legislation for all necessary requirements.

3.13
record
one or more *diagnostic data* (3.5) elements that are referred to together by a single means of identification

Note 1 to entry: A snapshot including various input/output data and trouble codes is an example of a record.

3.14
remote server

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