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ISO 14229-7

Second edition
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Road vehicles — Unified diagnostic services (UDS) —

Part 7: UDS on local interconnect network (UDSonLIN)

Véhicules routiers — Services de diagnostic unifiés (SDU) — Partie 7: SDU sur l'implémentation LIN (SDUsurLIN)

Reference number
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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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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 14229-7:2015), which has been technically revised.

The main changes are as follows:

— restructuration of the document;

— introduction of requirement numbers, names and definitions;

— technical content improvements based on implementation feedback from the automotive industry.

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.

Introduction

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

To achieve this, the ISO 14229 series is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO/IEC 7498-1[1] and ISO/IEC 10731[2], 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 structured into the following layers:

— application layer (layer 7) specified in ISO 14229-1 and ISO 14229-3 to ISO 14229-8;

— presentation layer (layer 6) specified in ISO 14229-1 and ISO 14229-3 to ISO 14229-8;

— session layer services (layer 5) specified in ISO 14229-2 and ISO 14229-3 to ISO 14229-8.

Figure 1 illustrates the UDSonLIN document and related documents according to the OSI model.

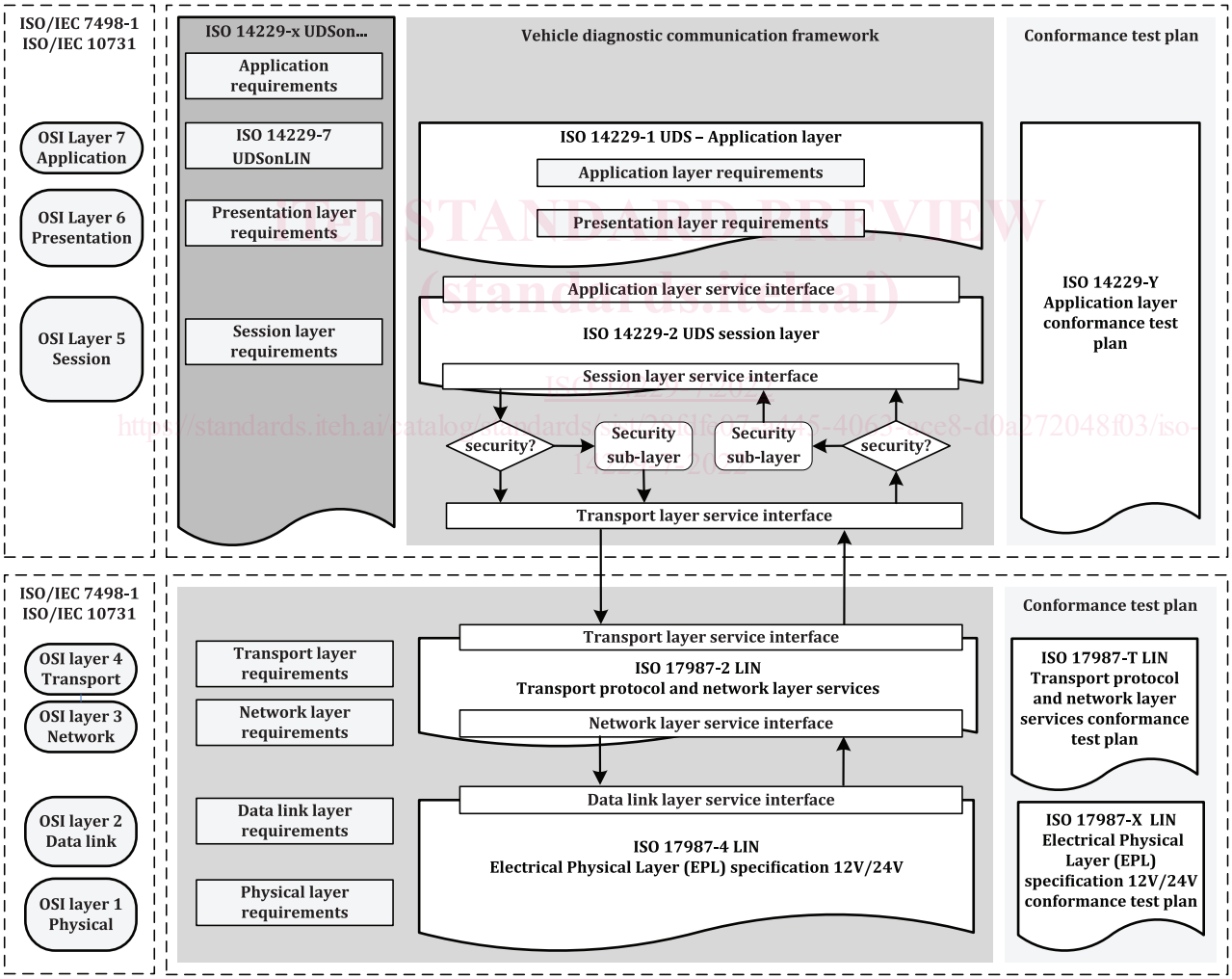


Figure 1 — UDSonLIN document reference according to OSI model

Road vehicles — Unified diagnostic services (UDS) —

Part 7:
UDS on local interconnect network (UDSonLIN)

1 Scope

This document specifies an application profile for the implementation of unified diagnostic services (UDS) local interconnect network (LIN) in road vehicles (UDSonLIN).

UDSonLIN references ISO 14229-1 and ISO 14229-2 and specifies implementation requirements of the diagnostic services to be used for diagnostic communication on Local Interconnect Network.

This document includes:

— additional requirements specific to the implementation of UDS on local interconnect network; and

— specific restrictions in the implementation of UDS on local interconnect network.

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 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Application layer*

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

ISO 17987-2, *Road vehicles — Local Interconnect Network (LIN) — Part 2: Transport protocol and network layer services*

ISO 17987-3, *Road vehicles — Local Interconnect Network (LIN) — Part 3: Protocol specification*

ISO 17987-4, *Road vehicles — Local Interconnect Network (LIN) — Part 4: Electrical physical layer (EPL) specification 12 V/24 V*

3 Terms and definitions

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

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

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

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

4 Symbols and abbreviated terms

4.1 Symbols

—	empty table cell or feature undefined
t	time
$t_{P2\_CAN\_Client}$	time axis of CAN client
$t_{P2\_CAN\_Server}$	time axis of CAN server
$t_{P2\_LIN\_Commander}$	time axis of LIN commander
$t_{P2\_LIN\_Responder}$	time axis of LIN responder
$t_{P2\_CAN\_Client\_Max}$	maximum time value of the CAN client
$t_{P2\_CAN\_Server\_Max}$	maximum time value of the CAN server
$t_{P2\_LIN\_Commander\_Max}$	maximum time value of the LIN commander
$t_{P2\_LIN\_Responder\_Max}$	maximum time value of the LIN responder

4.2 Abbreviated terms

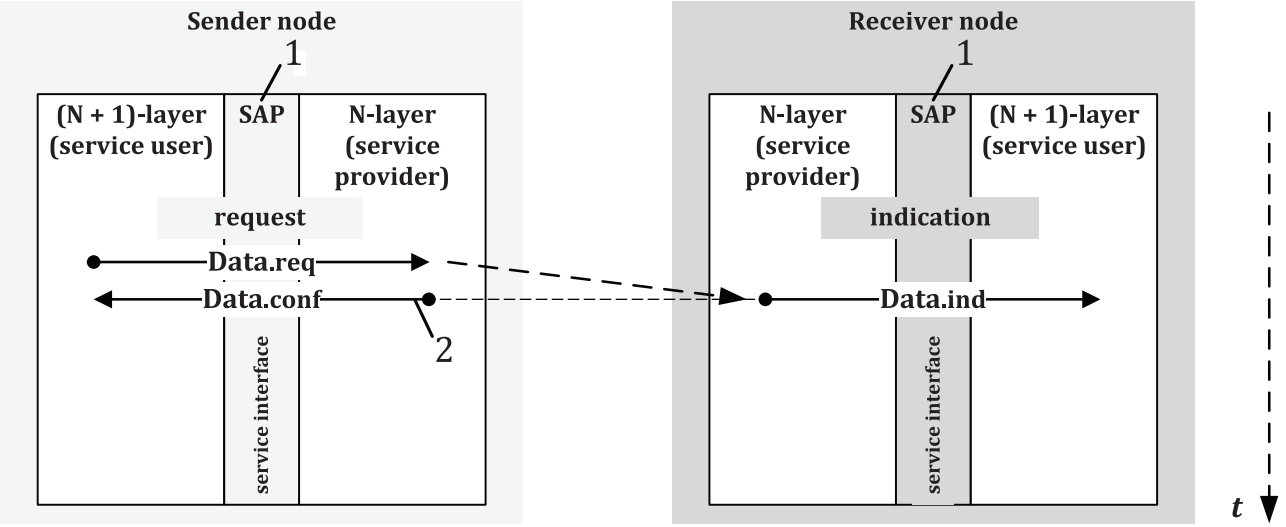
AE	address extension
Mtype	message type
NAD	node address
OSI	Open System Interconnection
UDS	unified diagnostic services
SA	source address
TA	target address

5 Conventions

This document is based on OSI service conventions as specified in ISO/IEC 10731[2].

6 Service primitive interface definition

Figure 2 shows the `Data.req` (request), `Data.ind` (indication), and `Data.conf` (confirmation) service interface.



Key

1 service access point between application and application layer

2 read back from N-layer service provider

t time

Figure 2 — Data.req, Data.ind, and Data.conf service interface

7 Technical requirements

7.1 Overview

Table 1 provides an overview on the technical requirements and their associated requirement number.

Table 1 — Technical requirements overview

OSI#.REQ#	Technical requirement title
7	**Application layer**
7.1	ISO 14229-1 service primitive parameters
7.2	A_Data.req, A_Data.ind, and A_Data.conf service interface
7.3	UDSonLIN – UDSonLIN-specific requirements
7.4	UDSonLIN – No UDSonLIN-specific requirements
7.5	UDSonLIN – A_Length – Definition
7.6	UDSonLIN – A_Length – Message buffer
7.7	UDSonLIN – A_Length – Commander node determines maximum size of receive buffer
7.8	UDSonLIN – CommunicationControl – Activation and de-activation of message type
7.9	UDSonLIN – ResponseOnEvent – ResponseHeader
7.10	UDSonLIN – Request and response message timing parameter values
6	**Presentation layer**
—	No requirement statement in this document
5	**Session layer**
5.1	UDSonLIN – Service primitive parameter definition
5.2	UDSonLIN – S_Data.req, S_Data.ind, and S_Data.conf service interface
4	**Transport layer**

Table 1 *(continued)*

OSI#.REQ#	Technical requirement title
4.1	UDSonLIN – Service primitive parameters
4.2	UDSonLIN – T_Data.req, T_Data.ind, and T_Data.conf service interface
4.3	UDSonLIN – Mapping of data link independent service primitives onto LIN data link-dependent service primitives
4.4	UDSonLIN – Mapping of T_PDU onto N_PDU
3	**Network layer**
3.1	UDSonLIN – Service primitive parameter definition
3.2	UDSonLIN – N_Data.req, N_Data.ind, and N_Data.conf service interface
3.3	UDSonLIN – N_TAtype service primitive parameter
3.4	UDSonLIN – Same N_TAtype request and associated response message format
3.5	UDSonLIN – Responder node diagnostic class I – No additional network layer requirements
3.6	UDSonLIN – Responder node diagnostic class II – Conform to ISO 17987-2
3.7	UDSonLIN – Responder node diagnostic class II – Fixed node address
3.8	UDSonLIN – Responder node diagnostic class II – Ignore NAD 7E16 as broadcast address
3.9	UDSonLIN – Responder node diagnostic class III – Conform to ISO 17987-2
3.10	UDSonLIN – Responder node diagnostic class III – Fixed node address
3.11	UDSonLIN – Responder node diagnostic class III – Ignore NAD 7E16 as broadcast address
3.12	UDSonLIN – Commander node diagnostic class III – Conform to ISO 17987-2
3.13	UDSonLIN – Commander node diagnostic class III – Usage of NAD assignment in LIN cluster
3.14	UDSonLIN – Commander node diagnostic class III – Assignment of subnet number
2	**Data link layer**
2.1	UDSonLIN – Service primitive parameter definition
2.2	UDSonLIN – L_Data.req, L_Data.ind, and L_Data.conf service interface
1	**Physical layer**
—	No requirement statement in this document

7.2 Implementation guidelines

7.2.1 General

This clause defines how the diagnostic services, as defined in ISO 14229-1, apply to LIN.

To allow a common implementation of application layer and session layer, this document uses the session layer protocol as defined in ISO 14229-2 and focuses on necessary modifications and interfaces to adopt it to the ISO 17987 series.

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

It is the vehicle manufacturer's responsibility to setup the LIN commander and responder nodes to exchange UDSonLIN information according to the ISO 17987 series.

7.2.2 Definition of diagnostic classes

7.2.2.1 Overview

Architectural, diagnostic communication performance, and transport protocol needs of responder nodes are accommodated by dividing diagnostic services functionality into three diagnostic classes.

Therefore, a diagnostic class is assigned to each responder node according to its level of diagnostic functionality and complexity.

7.2.2.2 Diagnostic class I

Smart and simple devices like intelligent sensors and actuators requiring none or very low amount of diagnostic functionality. Actuator control, sensor reading, and fault memory handling is done by the commander node, using signal carrying frames. Therefore, specific diagnostic support for these tasks is not required. Fault indication is always signal-based.

7.2.2.3 Diagnostic class II

A diagnostic class II responder node is similar to a diagnostic class I responder node, but it provides node identification support. The extended node identification is normally required by vehicle manufacturers. Testers or commander nodes use ISO 14229-1 diagnostic services to request the extended node identification information. Actuator control, sensor reading, and fault memory handling is done by the commander node, using signal carrying frames. Therefore, specific diagnostic support for these tasks is not required. Fault indication is always signal-based.

7.2.2.4 Diagnostic class III

Diagnostic class III responder nodes are devices with enhanced application functions typically performing their own local information processing (e.g. function controllers, local sensor/actuator loops). The responder nodes execute tasks beyond the basic sensor/actuator functionality and, therefore, require extended diagnostic support. Direct actuator control and raw sensor data are often not exchanged with the commander node and, therefore, not included in signal carrying frames. ISO 14229-1 diagnostic services for I/O control, sensor value reading, and parameter configuration (beyond node configuration) are required.

Diagnostic class III responder nodes have internal fault memory, along with associated reading and clearing services. Optionally, reprogramming (flash/NVRAM reprogramming) of the responder node is possible. This requires an implementation of a boot loader and necessary diagnostic services to unlock the device initiate downloads and transfer data, etc.

The primary difference between diagnostic class II and diagnostic class III is the distribution of diagnostic capabilities between the LIN commander node and the LIN responder node for diagnostic class II while for a diagnostic class III LIN responder node, no diagnostic application features of the LIN responder node are implemented in the LIN commander node.

7.2.3 LIN node requirements

7.2.3.1 Commander node requirements

7.2.3.1.1 Commander message routing

The commander node usually is a high-performance ECU and, in most implementations, supports the ISO 14229-1 diagnostic services. The commander node and the external test equipment are connected through a backbone network (e.g. ISO 11898 series). The commander node shall receive all diagnostic requests addressed to the responder nodes from the backbone network and route them to the appropriate LIN cluster(s). Responses from the responder nodes shall be routed back to the backbone network through the commander node.

All diagnostic request and response messages addressed to the responder nodes can be routed in the network layer (i.e. no application layer routing). The commander node shall implement the LIN transport protocol (see ISO 17987-2) as well as the transport protocols used on the backbone network (e.g. ISO 15765-2).