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Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) —

Part 5: Specification for an in-vehicle network connected to the diagnostic link connector

Véhicules routiers — Communication de diagnostic sur gestionnaire de réseau de communication (DoCAN) —

Partie 5: spécification pour un réseau véhicule connecté sur la prise de diagnostic

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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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 document 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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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 15765-5:2021), which has been technically revised.

The main changes are as follows:

— clarification on network address translation between OSI-layers;

— editorial corrections.

A list of all parts in the ISO 15765 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 15765 series defines common requirements for vehicle diagnostic systems using the controller area network (CAN), as specified in the ISO 11898 series.

The ISO 15765 series presumes the use of external test equipment for inspection, diagnostics, repair and other possible use cases connected to the vehicle.

This document defines the requirements to enable the in-vehicle CAN network to successfully establish, maintain and terminate communication with the devices externally connected to the diagnostic link connector.

This document has been structured according to 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 OSI layer 4 to OSI layer 1 framework requirements specified or referenced in the ISO 15765 series are structured according to Figure 1, which shows the related documents of OSI layer 4 to OSI layer 1.

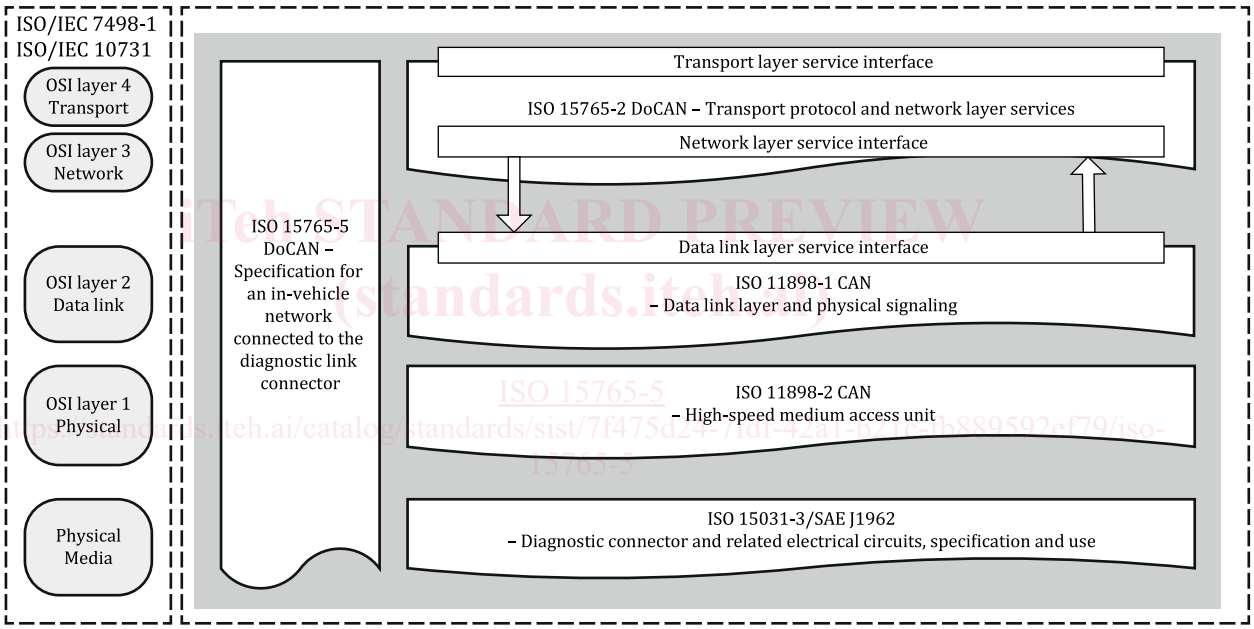


Figure 1 — CAN documents reference according to OSI model

The documents include the following content:

— transport layer (TL) -related requirements with reference to ISO 15765-2;

— network layer (NL) -related requirements with reference to ISO 15765-2;

— data link layer (DLL) -related requirements with reference to ISO 11898-1, which are composed of:

  — DLL protocol entity requirements;

  — DLL device interface requirements;

  — DLL network system requirements;

— physical layer (PHY) -related requirements with reference to ISO 11898-2, which are composed of:

  — physical coding sub-layer (PCS) requirements, which are composed of:

    — PCS entity requirements;

  - PCS interface requirements;
  - PCS network system requirements;
- physical media attachment (PMA) requirements, which are composed of:
  - PMA protocol entity requirements;
  - PMA device interface requirements;
- physical media dependent (PMD) requirements, which are composed of:
  - PMD entity requirements;
  - PMD device interface requirements;
  - PMD network system requirements.

The PCS is implemented in the CAN protocol controller. The PMA sub-layer is implemented normally in the CAN transceiver or the system base chip (SBC). Optionally it can comprise also additional protection circuitry. The media-dependent sub-layer comprises the connectors and the cabling.

Figure 2 shows an implementation example of the data link and physical layers block diagram.

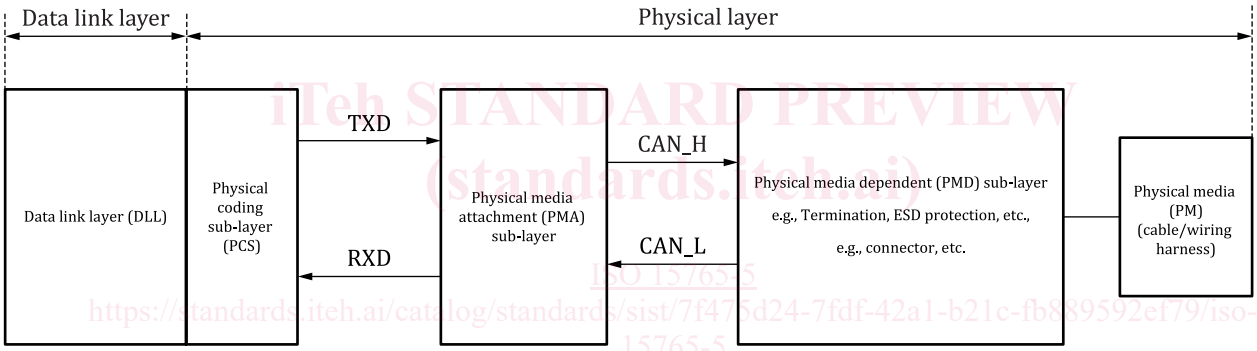


Figure 2 — Implementation example of lower OSI layers block diagram

The above structure is chosen to provide the following implementers with relevant requirements:

- transceiver developers;
- device (e.g. electronic control unit) developers;
- system network developers.

All requirements are numbered and headlined uniquely, so that each implementer can reference them.

Annex A provides a description of the compatibility between test equipment and in-vehicle network connected to the diagnostic link connector.

Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) —

Part 5: Specification for an in-vehicle network connected to the diagnostic link connector

1 Scope

This document specifies the OSI layers 4 to 1 (transport layer, network layer, data link layer and physical layer) requirements related to the connection between the external test equipment externally connected to the diagnostic link connector and the in-vehicle CAN network to successfully establish and maintain communication utilizing the communication parameters (communication profile) specified in (application-type) standards referencing this document.

The SIC (signal improvement capability) transceiver options, as specified in ISO 11898-2, are out of scope in this document.

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

ISO 15031-3, *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 3: Diagnostic connector and related electrical circuits: Specification and use*

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 and definitions

For the purposes of this document, the terms and definitions given in the ISO 11898 series, ISO 15765-2, ISO 15765-4 and the following 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/

3.1
segment
TL_PDU which consists of the TL_PCI and TL_DATA

3.2
application-type standard
standard which specifies application-related use cases, requirements and communication profile parameter values of the protocol stack

4 Symbols and abbreviated terms

4.1 Symbols

–	empty table cell or feature undefined
Δf	oscillator tolerance
f_{Ba}	nominal arbitration bit rate
f_{Bd}	data bit rate
L_{CABLE}	cable length between in-vehicle CAN node and diagnostic link connector
t_{Ba}	arbitration bit time
t_{Bd}	data bit time
t_{BIT}	bit time
t_{BIT_RX}	receive bit time
t_{BIT_TX}	transmit bit time
t_{Qa}	nominal arbitration bit time quantum length
t_{Qd}	nominal data bit time quantum length
t_{SJWa}	arbitration bit synchronisation jump width
t_{SJWd}	data bit synchronisation jump width
t_{Q}	time quantum
t_{SPa}	nominal arbitration bit sample point position
t_{SPd}	nominal data bit sample point position
X	table cell selected or feature defined

4.2 Abbreviated terms

AE	address extension
AL	application layer
ASP	abstract service primitive
CAN	controller area network
CAN FD	controller area network flexible data-rate
CBFF	CAN classical base frame format

CEFF	CAN classical extended frame format
DCC	diagnostic communication channel
DiagNormAddr	diagnostic message with normal addressing
DiagNormFixAddr	diagnostic message with normal fixed addressing
DiagExtAddr	diagnostic message with extended addressing
DLL	data link layer
DoCAN	diagnostic communication over controller area network
Ftype	frame type
FBFF	CAN FD base frame format
FEFF	CAN FD extended frame format
L_	data link
MSb	most significant bit
Mtype	message type
N_	network
NL	network layer
N_PDU	network protocol data unit
OSI	open system interconnection
PDU	protocol data unit
PCS	physical coding sub-layer
PHY	physical layer
PMA	physical media attachment
PMD	physical media dependent
Ptype	packet type
RDiagMixAddr	remote diagnostic message with mixed addressing
SA	source address
SIC	signal improvement capability
SJW	synchronisation jump width
SP	sample point
T_Data	T_Data interface
TA	target address
TAtype	target address type

TL transport layer

T_PDU transport protocol data unit

5 Conventions

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

6 In-vehicle network to external test equipment connection

6.1 Connectivity scenarios between external test equipment and vehicle

This document specifies the requirements for the diagnostic link connector providing access to CAN FD network. A backward compatibility to classical CAN is described in Annex A.

6.2 Technical requirements overview

Table 1 provides an overview of the technical requirements and associated requirement numbers.

Table 1 — Technical requirements overview

REQ #	Technical requirement title
OSI4	Transport layer (TL)
OSI4.1	TL – ISO 15765-2 T_Data interface primitive parameter mapping
OSI4.2	TL – ISO 15765-2 TX_DL = 8
OSI4.3	TL – ISO 15765-2 TX_DL > 8
OSI3	Network layer (NL)
OSI3.1	NL – ISO 15765-2 N_Data interface primitive parameter mapping
OSI3.2	NL – ISO 15765-2 network layer services
OSI3.3	NL – ISO 15765-2 network layer timing parameters
OSI3.4	NL – ISO 15765-2 uniqueness of node diagnostic address
OSI3.5	NL – ISO 15765-2 supported addressing formats
OSI3.6	NL – ISO 15765-2 functional addressing
OSI3.7	NL – ISO 15765-2 reception of N_PDU
OSI2	Data link layer (DLL)
OSI2.1	DLL – Data interface primitive parameter mapping – Mapping of upper OSI layer service interface parameters
OSI2.2	DLL – Data interface primitive parameter mapping – ISO 11898-1
OSI2.3	DLL – Mapping of N_AI into the 11-bit CAN identifier
OSI2.4	DLL – Mapping of N_AI into the 29-bit CAN identifier
OSI2.5	DLL – Device acceptance of CAN identifier
OSI1	Physical layer (PHY)
OSI1.1	PHY – PCS entity requirements – ISO 11898-1 conformance
OSI1.2	PHY – PCS interface requirements – Classical CAN bit timing parameters
OSI1.3	PHY – PCS interface requirements – CAN FD sampling method
OSI1.4	PHY – PCS interface requirements – CAN FD bit timing parameters
OSI1.5	PHY – PCS interface requirements – CAN FD transmitter delay compensation
OSI1.6	PHY – PCS interface requirements – Termination resistance
OSI1.7	PHY – PMA entity requirements – ISO 11898-2 conformance

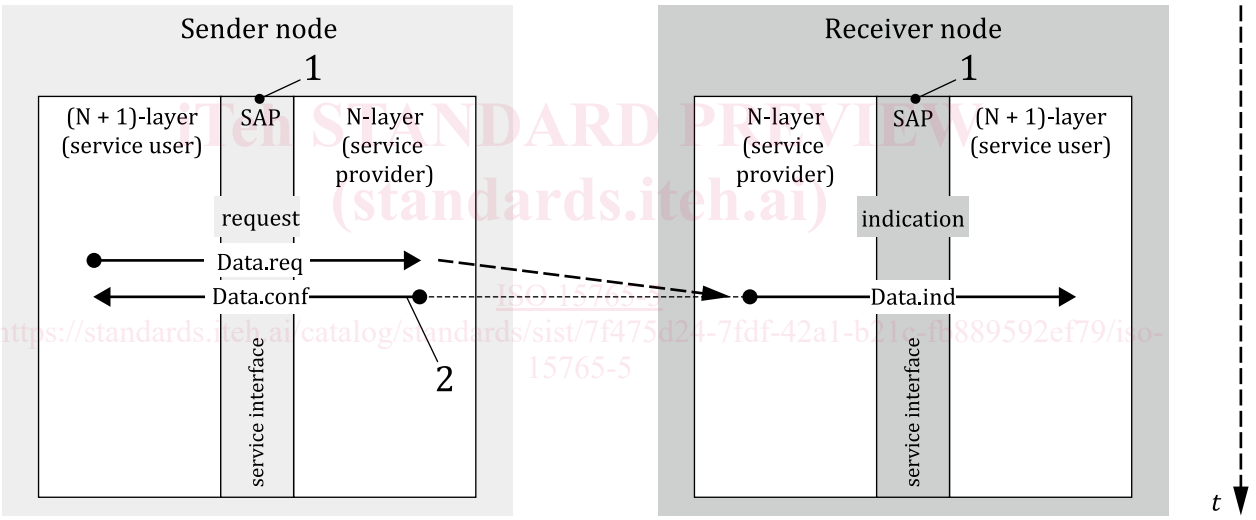
Table 1 *(continued)*

REQ #	Technical requirement title
OSI1.8	PHY – PMA entity requirements – Qualification
OSI1.9	PHY – PMD entity requirements – Diagnostic link connector
OSI1.10	PHY – PMD entity requirements – DoCAN pin assignment on diagnostic link connector
OSI1.11	PHY – PMD entity requirements – Cable characteristics between vehicle network connected to the diagnostic link connector for data bit rates > 500 kbit/s
OSI1.12	PHY – PMD network system requirements
OSI1.13	PHY – PMD network system requirements – Cable length between single CAN node and diagnostic link connector

6.3 ASP — Data.req, Data.ind and Data.conf service interface

The abstract service primitive interface defines the service and parameter mapping from the application layer (AL) to the session layer.

Figure 3 shows the Data.req (request), Data.ind (indication) and Data.conf (confirmation) abstract service primitive interface.



Key

1 service access point

2 read back from N-layer service provider

Figure 3 — Data.req, Data.ind and Data.conf abstract service primitive interface

6.4 ASP — Parameter mapping and configuration of OSI layers

Each OSI layer contains layer-specific information to manipulate or edit the PDU depending on whether the PDU is provided as a Data.req (sender node), Data.ind (receiver node) or Data.conf (sender node).

A PDU, which is sent by an application (service user), is assembled by each applicable OSI-layer based on PDU identification information. A PDU, which is received by the OSI-layers (service provider), has PDU identification information used by each applicable OSI layer to disassemble the PDU before it is transferred to the application (service user).

A specific implementation of the abstract service primitive interface parameter management for each OSI-layer is not specified in this document.