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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*

ISO 15765-5:2021

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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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

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

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](http://www.iso.org/iso/foreword.html).

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

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](http://www.iso.org/members.html).

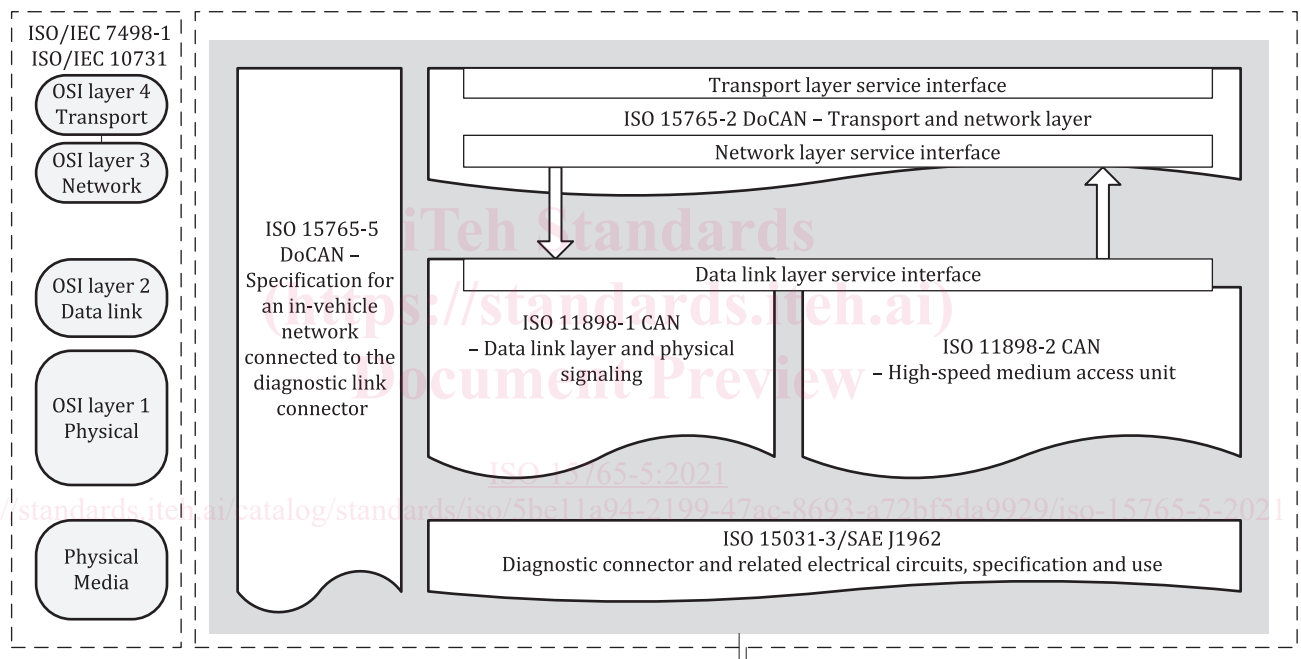
## Introduction

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 does not specify any requirements related to the in-vehicle CAN network architecture. It 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**

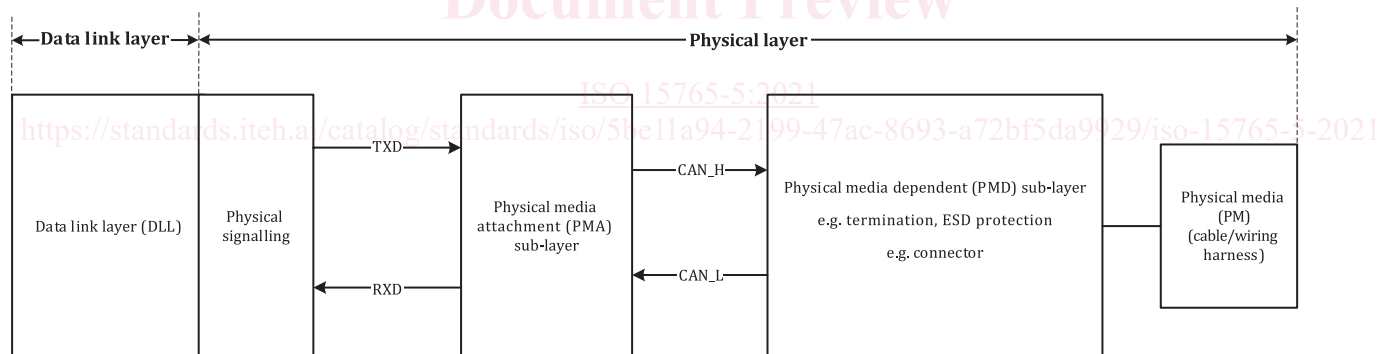
The documents include the following content:

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

The PS sub-layer 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 may 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 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, maintain and terminate communication.

### 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* 15765-5:2021

ISO 15765-4, *Road vehicles — Diagnostic communication over Controller Area Networks (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 and ISO 15765-4 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/>

### 4 Symbols and abbreviated terms

#### 4.1 Symbols

- |            |                                       |
|------------|---------------------------------------|
| –          | empty table cell or feature undefined |
| $\Delta f$ | oscillator tolerance                  |
| $f_{Ba}$   | nominal data 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
CAN	controller area network
CAN FD	controller area network flexible data-rate
CBFF	classical base frame format
CEFF	classical extended frame format
DCC	diagnostic communication channel
DLL	data link layer
DoCAN	diagnostic communication over controller area network
Ftype	frame type
FBFF	FD base frame format
FEFF	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
PDU	protocol data unit
PHY	physical layer
Ptype	packet type
SA	source address
SJW	synchronisation jump width
SP	sample point
T_	transport
TA	target address
TAtype	target address type
TL	transport layer
T_PDU	transport protocol data unit
DiagNormAddr	diagnostic message with normal addressing
DiagNormFixAddr	diagnostic message with normal fixed addressing
DiagExtAddr	diagnostic message with extended addressing
RDiagMixAddr	remote diagnostic message with mixed addressing

<https://standards.iteh.ai/catalog/standards/iso/5be11a94-2199-47ac-8693-a72bf5da9929/iso-15765-5-2021>

## 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
4	Transport layer (TL)
4.1	TL – ISO 15765-2 T_Data interface primitive parameter mapping
4.2	TL – ISO 15765-2 TX_DL = 8

**Table 1** (continued)

REQ #	Technical requirement title
4.3	TL – ISO 15765-2 TX_DL > 8
3	Network layer (NL)
3.1	NL – ISO 15765-2 N_Data interface primitive parameter mapping
3.2	NL – ISO 15765-2 network layer services
3.3	NL – ISO 15765-2 network layer timing parameters
3.4	NL – ISO 15765-2 uniqueness of node diagnostic address
3.5	NL – ISO 15765-2 supported addressing formats
3.6	NL – ISO 15765-2 functional addressing
3.7	NL – ISO 15765-2 reception of N_PDU
2	Data link layer (DLL)
2.1	DLL – Data interface primitive parameter mapping – Mapping of upper OSI layer service interface parameters
2.2	DLL – Data interface primitive parameter mapping – ISO 11898-1
2.3	DLL – Mapping of N_AI into the 11-bit CAN identifier
2.4	DLL – Mapping of N_AI into the 29-bit CAN identifier
2.5	DLL – Device acceptance of CAN identifier
1	Physical layer (PHY)
1.1	PHY – PS entity requirements – ISO 11898-1 conformance
1.2	PHY – PS device interface requirements – Classical CAN bit timing parameters
1.3	PHY – PS device interface requirements – CAN FD sampling method
1.4	PHY – PS device interface requirements – CAN FD bit timing parameters
1.5	PHY – PS device interface requirements – CAN FD transmitter delay compensation
1.6	PHY – PS device interface requirements – Termination resistance
1.7	PHY – PMA entity requirements – ISO 11898-2 conformance
1.8	PHY – PMA entity requirements – Qualification
1.9	PHY – PMD entity requirements – Diagnostic link connector
1.10	PHY – PMD entity requirements – DoCAN pin assignment on diagnostic link connector
1.11	PHY – PMD entity requirements – Cable characteristics between vehicle network connected to the diagnostic link connector for data bit rates > 500 kbit/s
1.12	PHY – PMD network system requirements
1.13	PHY – PMD network system requirements – Cable length between single CAN node and diagnostic link connector

### 6.3 SI — Data.req, Data.ind and Data.conf service interface

The service 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) service interface.