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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 gest ionnaire de réseau de communication
(DoCAN) —*

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

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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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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.

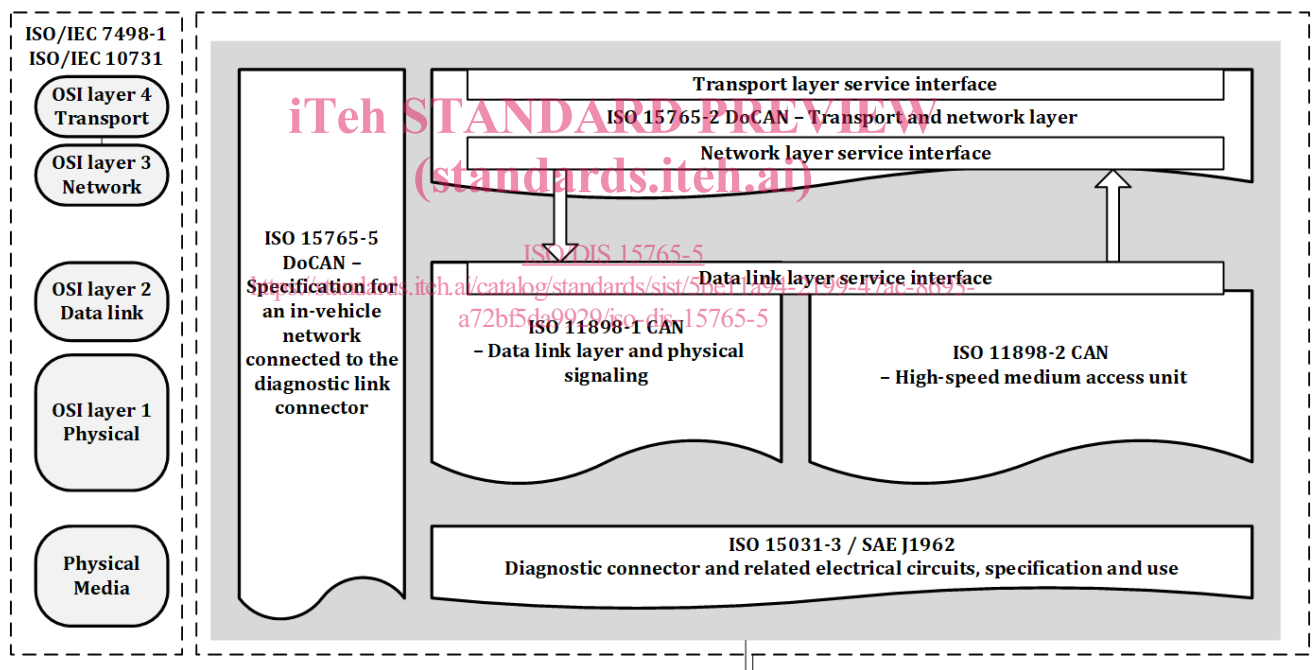
Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

72 This document has been established in order to define common requirements for vehicle diagnostic
 73 systems implemented on a Controller Area Network (CAN) communication link, as specified in
 74 ISO 11898 series documents. Although primarily intended for diagnostic systems, it also meets
 75 requirements from other CAN based systems.

76 This document has been structured according to the Open Systems Interconnection (OSI) Basic
 77 Reference Model, in accordance with ISO/IEC 7498-1 [1] and ISO/IEC 10731 [2], which structures
 78 communication systems into seven layers. When mapped on this model, the application protocol and
 79 lower OSI layers framework requirements specified/referenced in ISO 15765 series standard are
 80 structured according to Figure 1.

81 Figure 1 illustrates a standards-based documentation concept, which consists of the lower OSI layers
 82 framework, which specifies requirements related to the transport layer, network layer, data link layer,
 83 and physical layer standards of the OSI layers 4, 3, 2 and 1.



84
85 **Figure 1 — CAN lower OSI layers framework**
86

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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

1 Scope

This document specifies requirements for controller area networks (CAN) between the in-vehicle network and the diagnostic link connector of the vehicle.

The network presumes the use of external test equipment for inspection, diagnostics and repair, and other possible use cases. This document does not specify any requirements related to the in-vehicle CAN network architecture. 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.

Two CAN network configurations are described in this document. In-vehicle networks connected to the diagnostic link connector running with a bit rate up to 500 kbit/s can comprise multiple CAN nodes. In-vehicle networks connected to the diagnostic link connector running with a bit rate >500 kbit/s can comprise only one CAN node.

This document is the entry point for DoCAN (Diagnostic communication over CAN) and specifies OSI layers 4 to 1.

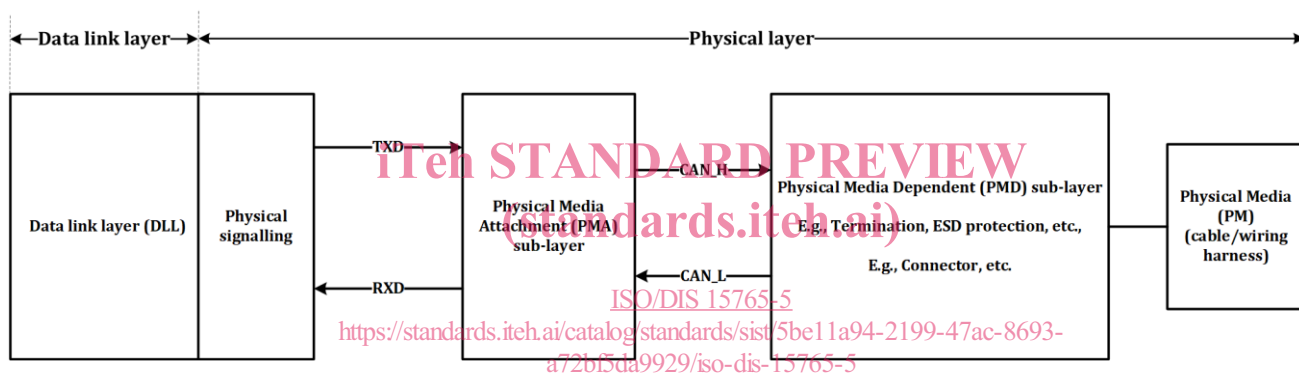
The document describes the following content and is structured accordingly

- 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) requirements, which are composed of:
 - DLL protocol entity requirements,
 - DLL device interface requirements,
 - DLL network system requirements.
- 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:

- 116 — PMA protocol entity requirements,
- 117 — PMA device interface requirements.
- 118 — Physical medium dependent (PMD) requirements, which are composed of:
 - 119 — PMD entity requirements,
 - 120 — PMD device interface requirements,
 - 121 — PMD network system requirements.

122 The physical signalling sub-layer is implemented in the CAN protocol controller. The physical medium
 123 attachment sub-layer is implemented normally in the CAN transceiver or the System Base Chip (SBC).
 124 Optionally it may comprise also additional protection circuitry. The media-dependent sub-layer
 125 comprises the connectors and the cabling.

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



127
128 **Figure 2 — Implementation example of lower OSI layers block diagram**

129 Above structure is chosen to provide the following implementers with relevant requirements:

- 130 — Transceiver developers,
- 131 — Device (e.g., electronic control unit) developers,
- 132 — System network developers.

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

134 2 Normative references

135 The following documents are referred to in the text in such a way that some or all of their content
 136 constitutes requirements of this document. For dated references, only the edition cited applies. For
 137 undated references, the latest edition of the referenced document (including any amendments) applies.

138 ISO 11898-1:2015, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical*
 139 *signalling*

140 ISO 11898-2:2016, *Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access*
 141 *unit*

- 142 ISO 15031-3:2016, *Road vehicles — Communication between vehicle and external equipment for*
143 *emissions related diagnostics — Part 3: Diagnostic connector and related electrical circuits, specification*
144 *and use*
- 145 ISO 15765-2:2016, *Road vehicles — Diagnostic communication over Controller Area Networks*
146 *(DoCAN) — Part 2: Transport protocol and network layer services*
- 147 SAE J1962, *Diagnostic Connector*

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148 **3 Terms and definitions**

149 For the purposes of this document, the terms and definitions given in ISO 15765 and ISO 11898 series
150 apply.

151 **4 Symbols and abbreviated terms**

152 **4.1 Symbols**

153	f_{Ba}	nominal bit rate
154	f_{Bd}	data bit rate
155	L_{CABLE}	length of cable between in-vehicle network CAN interface and diagnostic link connector
156	SP_a	nominal arbitration bit sample point position a
157	SP_d	nominal data bit sample point position a
158	t_{Ba}	arbitration bit time
159	t_{Bd}	data bit time
160	t_{Qa}	nominal arbitration bit time quantum length
161	t_{Qd}	nominal data bit time quantum length
162	t_{SJWa}	arbitration bit resynchronisation jump width
163	t_{SJWd}	data bit resynchronisation jump width

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164 **4.2 Abbreviated terms**

165 For the purposes of this document, the abbreviations given in ISO 15765 and ISO 11898 series apply.

166	AL	application layer
167	DLL	data link layer
168	LSb	least significant bit
169	MSb	most significant bit
170	Mtype	message type
171	NL	network layer
172	PDU	protocol data unit
173	PHY	physical layer
174	SA	source address
175	SP	sample point

176	TA	target address
177	TL	transport layer
178	Ttype	target type

179 5 In-vehicle network to external test equipment connection

180 5.1 Overview

181 Table 1 provides an overview about the technical requirements and associated requirement number.

182 **Table 1 — Technical requirements overview**

REQ #	Technical requirement title
4	Transport layer (TL)
4.1	TL – TL_Data interface primitive parameter mapping
4.2	TL – ISO 15765-2 Classical CAN
4.3	TL – ISO 15765-2 CAN Flexible Data Rate
3	Network layer (NL)
3.1	NL – NL_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 – Definition of Flow Control parameter values
3.5	NL – 29-bit CAN identifier functional and physical addressing
3.6	NL – Uniqueness of device diagnostic address
3.7	NL – Maximum number of device CAN identifiers
3.8	NL – Addressing formats (11-bit CAN identifier)
3.9	NL – Addressing formats (29-bit CAN identifier)
3.10	NL – Functional addressing
3.11	NL – Physical addressing
3.12	NL – Device acceptance of CAN identifier
2	Data link layer (DLL)
2.1	DLL – Protocol entity requirements – Mapping of upper OSI layer service interface parameters
2.2	DLL – Protocol entity requirements – ISO 11898-1 compliance
2.3	DLL – Network system requirements
1	Physical layer (PHY)
1.1	PHY – PS entity requirements – ISO 11898-1 compliance
1.2	PHY – PS device interface requirements – Classical CAN bit timing parameters
1.3	PHY – PHY – PS device interface requirements – CAN FD sampling method
1.4	PHY – PS device interface requirements – CAN FD bit timing parameters