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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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Contents

Page

Foreword

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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

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

This document has been structured according to 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 application protocol and lower OSI layers framework requirements specified/referenced in ISO 15765 series standard are structured according to Figure 1.

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

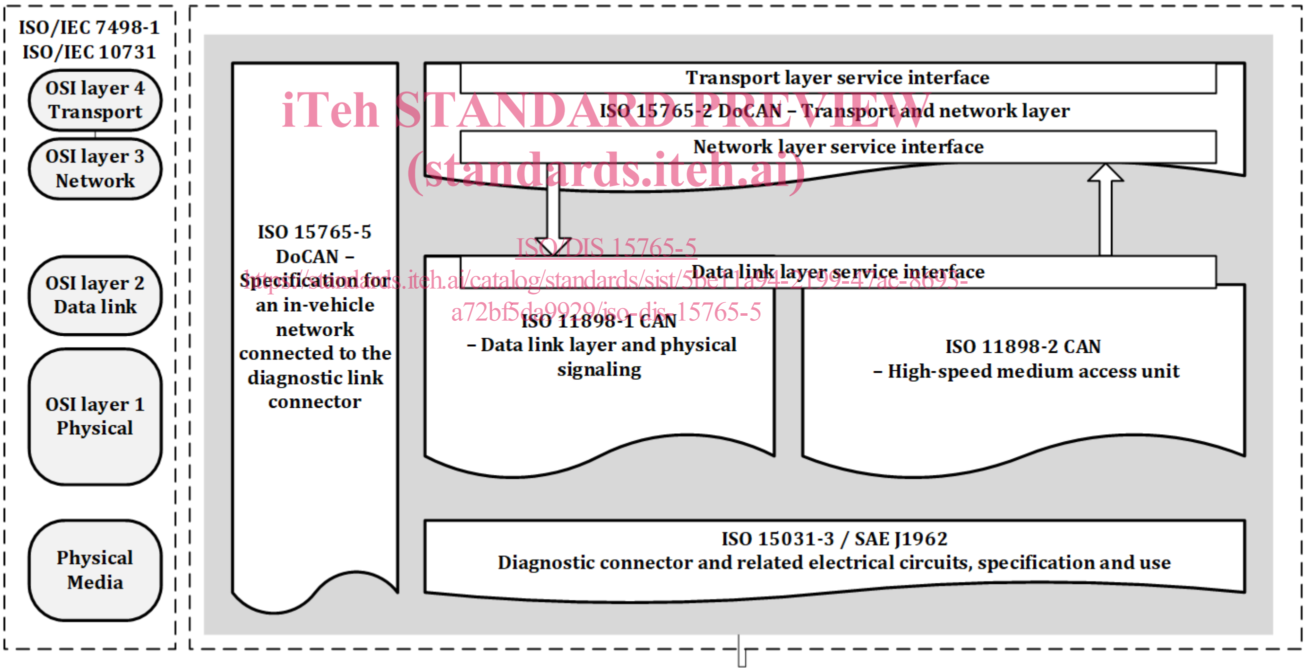

Figure 1 — CAN lower OSI layers framework

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:

- 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 physical signalling sub-layer is implemented in the CAN protocol controller. The physical medium attachment 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.

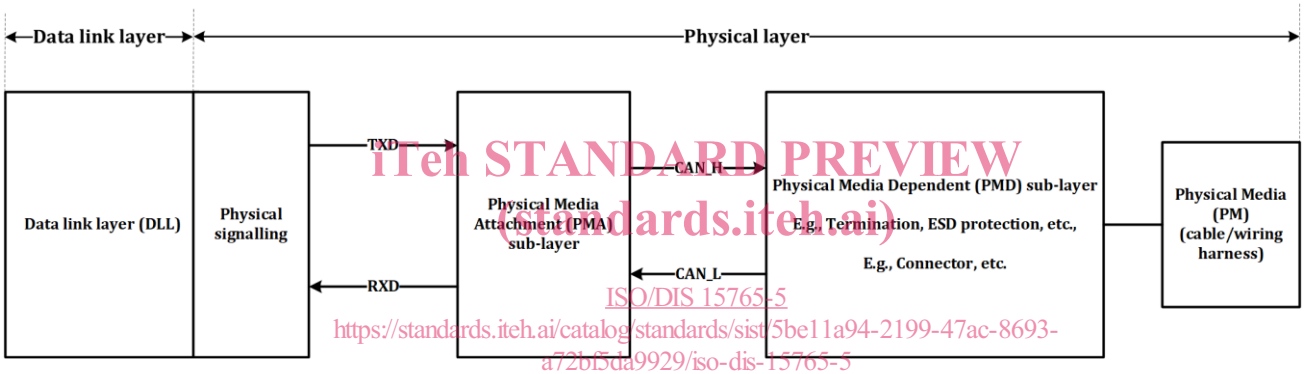

Figure 2 — Implementation example of lower OSI layers block diagram

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.

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

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

3 Terms and definitions

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

4 Symbols and abbreviated terms

4.1 Symbols

f_{Ba}	nominal bit rate
f_{Bd}	data bit rate
L_{CABLE}	length of cable between in-vehicle network CAN interface and diagnostic link connector
SP_a	nominal arbitration bit sample point position a
SP_d	nominal data bit sample point position a
t_{Ba}	arbitration bit time
t_{Bd}	data bit time
t_{Qa}	nominal arbitration bit time quantum length
t_{Qd}	nominal data bit time quantum length
t_{SJWa}	arbitration bit resynchronisation jump width
t_{SJWd}	data bit resynchronisation jump width

4.2 Abbreviated terms

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

AL	application layer
DLL	data link layer
LSb	least significant bit
MSb	most significant bit
Mtype	message type
NL	network layer
PDU	protocol data unit
PHY	physical layer
SA	source address
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