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Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles —

Part 4: Diagnostic communication

Véhicules routiers — Échange d'informations numériques sur les connexions électriques entre véhicules tracteurs et véhicules tractés —

Partie 4: Communication de diagnostic

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Contents

Page

Foreword.....	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Symbols and abbreviated terms	6
5 General definitions	7
5.1 Conventions	7
5.2 Use case definitions	7
5.3 Diagnostic applications	9
5.4 Vehicle network architecture	9
5.5 Diagnostic communication channels	11
6 Application layer requirements	12
6.1 Application layer services	12
6.2 Application layer protocol	12
6.3 Timing definition	12
6.4 Overview on diagnostic services	14
6.5 Non-applicable or restricted services	15
6.6 Basic diagnostic services	15
6.7 Enhanced diagnostic services	18
7 Presentation layer requirements	18
8 Session layer requirements	18
9 Network layer requirements	18
9.1 General	18
9.2 Message routing	18
9.3 Establishing, maintaining and termination of connections	18
9.4 Diagnostic communication channels (DCC)	19
9.5 Network layer service parameter	19
9.6 Network layer gateway function	22
9.7 Network layer protocol timing	22
10 Transport layer requirements	23
10.1 General	23
10.2 Transport layer service parameters	23
11 Data link layer requirements	24
12 Physical layer requirements	24
Annex A (normative) Basic diagnostic service parameters	25
Annex B (normative) Address definitions	30
Annex C (informative) Message routing examples	32
Bibliography	37

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.

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ISO 11992-4 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

ISO 11992 consists of the following parts, under the general title *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles*:

- Part 1: *Physical layer and data-link layer*
- Part 2: *Application layer for brakes and running gear equipment*
- Part 3: *Application layer for equipment other than brakes and running gear*
- Part 4: *Diagnostic communication*

Introduction

This part of the international standard has been established in order to define the implementation of a diagnostic data interchange between a commercial vehicle and its towed vehicle(s), including communication between towed vehicles, using a Controller Area Network (CAN) serial data link according to ISO 11992-1 and based on the definitions for unified diagnostic services and their implementation on CAN given in the ISO 14229 and ISO 15765 document series.

To achieve this, the document is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO 7498 and ISO/IEC 10731, 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) based on this document are broken into the following layers according to Table 1:

- Application layer (layer 7), based on ISO 14229-1 and ISO 14229-3
- Presentation layer (layer 6), vehicle manufacturer / system supplier specific or ISO 22901 ODX
- Session layer services (layer 5), based on ISO 14229-2
- Transport layer services (layer 4), based on ISO 15765-2
- Network layer services (layer 3), based on ISO 15765-2
- Data link layer (layer 2), specified in ISO 11898-1
- Physical layer (layer 1), specified in ISO 11992-1

This document does not include any redundant information of the documents listed in this introduction. It focuses on

- additional requirements specific to the implementation of UDS on a ISO 11992 network, and
- specific restrictions in the implementation of UDS on a ISO 11992 network.

In case of any contradictions the definitions given in this document shall have precedence.

Table 1 — International standards applicable to the O.S.I. layers

Applicability	OSI 7 layer	Diagnostics services on communication between commercial vehicles and their towed vehicles
Seven layer according to ISO/IEC 7498 and ISO/IEC 10731	Application (layer 7)	ISO 11992-4, ISO 14229-1, ISO 14229-3
	Presentation (layer 6)	vehicle manufacturer specific
	Session (layer 5)	ISO 11992-4, ISO 14229-2
	Transport (layer 4)	ISO 11992-4, ISO 15765-2
	Network (layer 3)	ISO 11992-4, ISO 15765-2
	Data link (layer 2)	ISO 11898-1
	Physical (layer 1)	ISO 11992-1

Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles —

Part 4: Diagnostic communication

1 Scope

This document specifies the diagnostic communication over CAN on a serial data link between the towing and towed vehicle(s) of a commercial vehicle and its trailer(s) according to ISO 11992-2 or ISO 11992-3, which allow a diagnostic tester (client) to control diagnostic functions in an on-vehicle Electronic Control Unit (server) embedded in a road vehicle using the communication gateways between the vehicles.

It defines the data link layer specific implementation of the unified diagnostic communication requirements mainly given in the ISO 14229 and ISO 15765 document series by additional requirements and restrictions specific to the implementation of UDS on an ISO 11992 network.

This document does not apply to any non-diagnostic message transmission use of the communication data link between two Electronic Control Units.

2 Normative references

The following referenced documents are indispensable for the application 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 11992-2, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 2: Application layer for brakes and running gear*

ISO 11992-3, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 3: Application layer for equipment other than brakes and running gear*

ISO 14229-1:2011, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 14229-2:2011, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

ISO 14229-3:2011, *Road vehicles — Unified diagnostic services (UDS) — Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)*

ISO 15031-6 *Road vehicles — Communication between vehicle and external equipment for emissions-related diagnostics — Part 6: Diagnostic trouble code definitions*

ISO 15765-1:2010, *Road vehicles — Diagnostic communication over Controller Area Networks (DoCAN) — Part 1: General information and use case definition*

ISO 15765-2:2010, *Road vehicles — Diagnostic communication over Controller Area Networks (DoCAN) — Part 2: Transport protocol and network layer services*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11992-1, ISO 11992-2, ISO 11992-3, ISO 14229-1, ISO 14229-2, ISO 14229-3, ISO-15765-1 and ISO 15765-2 and the following apply.

3.1

Diagnostic network

The diagnostic network, as a whole, contains all clients and servers that can communicate with each other on the different vehicles of a road-train, as well as the diagnostic gateways between the vehicles.

3.2

Diagnostic sub-network

All clients and servers of a sub-network are connected to the same vehicle's diagnostic network. Sub-networks are separated by the gateways between the vehicles.

3.2

Diagnostic gateway

A diagnostic gateway is a node in the network that is physically connected to two (or more) sub-networks and has the ability to transfer diagnostic messages between the sub-networks.

4 Symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 11898-1, ISO 11992-1, ISO 14229-1, ISO 14229-3 and ISO 15765-2 and the following apply.

A_PDU	Application layer protocol data unit
BS	block size
CAN	Controller area network
CAN-ID	CAN identifier
Cvt	convention
DCC	Diagnostic communication channel
DID	Data identifier
DLC	Data length code
DP	Data page
DTC	Diagnostic trouble code
ECU	Electronic control unit
EDP	Extended data page
FS	Flow status
N_AE	Network layer address extension
N_AI	Network layer address information
N_SA	Network layer source address
N_TA	Network layer target address
N_TAtype	Network layer target address type
N_WFTmax	Network layer maximum number of wait frames
P	Priority

PDU	Protocol data unit
PF	Parameter format
PGN	Parameter group number
PS	Parameter specific
RA	Remote address
SA	Source address
SID	Service identifier
STmin	Separation time
TA	Target address
TA_type	Target address type

5 General definitions

5.1 Conventions

This document is based on the conventions used in ISO 14229-1 and the underlying OSI Service Conventions (ISO/IEC 10731:1994) as they apply for diagnostic services.

These conventions specify the interactions between the service user and the service provider. Information is passed between the service user and the service provider by service primitives, which may convey parameters.

5.2 Use case definitions

5.2.1 General

This section lists the individual use cases which will be covered by the diagnostic communication over ISO 11992 protocol at the following areas:

- Vehicle / ECU engineering (development)
- Vehicle / ECU manufacturing (production plant, assembly line)
- Service (dealership, aftermarket repair shop)
- Retrieval of information between connected vehicles

The following use cases are supported by the communication protocol

5.2.2 Use case 1 – Driver information

Driver information specifies the use case to enable an in-vehicle information retrieval system at the commercial vehicle to qualify readiness of the towed vehicle(s).

In this case usually an information retrieval entity is installed in the commercial vehicle that gets data from the various ECUs located in the road train, including the towed vehicle(s), and forwards relevant information about the road worthiness of the road train to the driver.

5.2.3 Use case 2 – Vehicle inspection and repair

Vehicle inspection and repair specifies the use case to enable an external test equipment connected to the road-train to qualify readiness of any vehicle and to perform vehicle diagnostic fault tracing as part of a repair.

In this case usually an external test equipment is connected to the commercial vehicle and request road train data which can be qualified to determine the readiness of the vehicle(s) or to perform vehicle diagnostic fault tracing as part of a repair.

5.2.4 Use case 3 – ECU/vehicle software reprogramming

ECU/vehicle software reprogramming specifies the use case to reprogram the ECU(s) of a towed vehicle through its data communication channel.

In this case usually an external programming equipment is connected to the commercial vehicle or directly to a towed vehicle and uses diagnostic communication to (re-)program or configure ECU(s) located in the towed vehicle.

5.2.5 Use case 4 – ECU/vehicle assembly line inspection and repair

ECU/vehicle assembly line inspection and repair specifies the use case to enable an external test system connected to a towed vehicle to support the assembly line inspection and repair of towed vehicle ECU systems.

In this case usually an external test equipment is connected to the commercial vehicle or directly to the towed vehicle and uses diagnostic services to determine the readiness of the vehicle(s) or to perform vehicle diagnostic fault tracing as part of a repair.

5.2.6 Use case 5 – Multi-purpose data transfer between vehicles

Multi-purpose data transfer between vehicles specifies the use case to enable ECU(s) in any vehicle of the road-train to retrieve information from other vehicle's ECU(s).

In this case an ECU may use diagnostic services to retrieve information from another ECU for various purposes.

5.3 Diagnostic applications

The diagnostic applications are divided into two types

— Basic diagnostics

The purpose of the basic diagnostics is to provide vehicle independent identification and diagnostic information. All basic diagnostic functions and services shall be provided under all operation conditions in the default diagnostic session without the need for specific access rights.

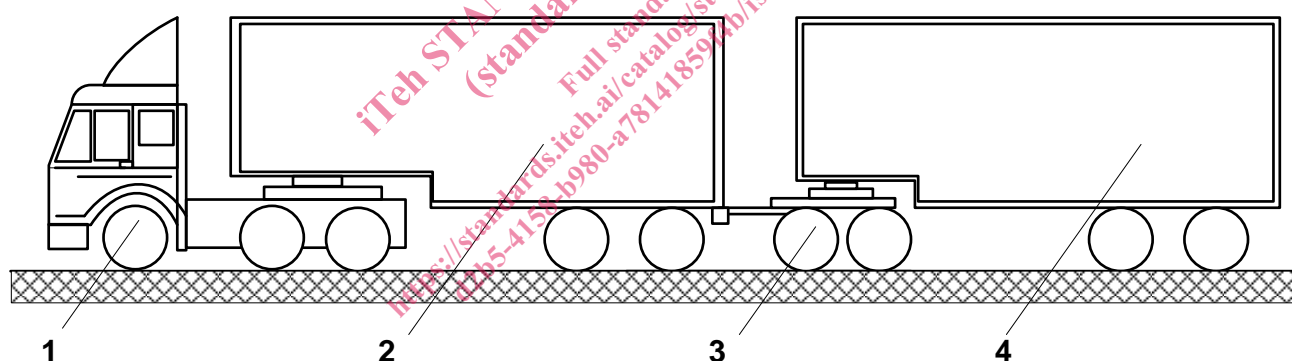
— Enhanced diagnostics

The support and the conditions under which enhanced diagnostic functions and services are provided are manufacturer/system supplier specific. It is in the responsibility of the manufacturer/system supplier to secure a server against unauthorized access and to ensure performance and safe operation in all operation modes allowing enhanced diagnostics.

Functions, services and protocols of the OSI layers 1 to 4 shall be identical for basic diagnostics and enhanced diagnostics. For OSI layers 5 to 7 the implementation of functions, services and protocols are varying according the definitions given in this document.

5.4 Vehicle network architecture

This document supports the diagnostic communication between a commercial vehicle and its towed vehicles as illustrated in Figure 1.



Key:

- 1 truck / commercial vehicle (position #0)
- 2 trailer / towed vehicle position #1
- 3 dolly / towed vehicle position #2
- 4 trailer / towed vehicle position #3

Figure 1 — Example of a possible road train configuration