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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

Reference number
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Contents

Page

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 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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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 11992-4:2005), which has been technically revised. It also incorporates ISO 11992-4:2005/Cor1:2006.

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 layers*

— *Part 2: Application layer for brakes and running gear*

— *Part 3: Application layer for equipment other than brakes and running gear*

— *Part 4: Diagnostic communication*

Introduction

This part of ISO 11992 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) 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/IEC 7498-1 and ISO/IEC 10731, which structures the 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 11992-4, 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 11992-4 and ISO 14229-2;

— transport layer services (layer 4), based on ISO 11992-4 and ISO 15765-2;

— network layer services (layer 3), based on ISO 11992-4 and 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 an ISO 11992 network and

— specific restrictions in the implementation of UDS on an ISO 11992 network.

In case of any contradictions, the definitions given in this document take precedence.

Table 1 — International Standards applicable to the OSI layers

Applicability	OSI seven layers	Diagnostics services on the communication between the commercial vehicles and their towed vehicles
seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731	application (layer 7)	ISO 11992-4, ISO 14229-1, ISO 14229-3
	presentation (layer 6)	vehicle manufacturer specific or ISO 22901
	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 part of ISO 11992 specifies the diagnostic communication over a CAN 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 allows a diagnostic tester (client) to control diagnostic functions in an on-vehicle ECU (server) embedded in a road vehicle using the communication gateways between the vehicles.

It defines the data link layer's 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 part of ISO 11992 does not apply to any non-diagnostic message transmission use of the communication data link between two ECUs.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11992-1, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 1: Physical and data-link layers*

ISO 14229-1:2013, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Specification and requirements*

ISO 14229-2:2013, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

ISO 14229-3:2012, *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 15765-1:2011, *Road vehicles — Diagnostic communication over Controller Area Networks (DoCAN) — Part 1: General information and use case definition*

ISO 15765-2:2011, *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 14229-1, ISO 14229-2, ISO 14229-3, ISO 15765-1, and ISO 15765-2 apply.

4 Symbols and abbreviated terms

For the purposes of this International Standard, the following abbreviated terms apply.

A_AE	application layer address extension
A_Mtype	application layer message type
A_SA	application layer source address
A_TA	application layer target address
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
N_Subnet	width of the subnet mask used for subnet addressing
P	priority
PDU	Protocol Data Unit
PF	parameter format
PGN	parameter group number
PS	parameter specific
SID	service identifier
STmin	separation time

5 General definitions

5.1 Conventions

This International Standard 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. The information is passed between the service user and the service provider by the service primitives, which can convey parameters.

5.2 Network components

5.2.1 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.

5.2.2 Diagnostic subnetwork

All the clients and servers of a subnetwork are connected to the same vehicle's diagnostic network. Subnetworks are separated by the gateways between the vehicles.

5.2.3 Diagnostic gateway

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

5.3 Use case definitions

5.3.1 General

This section lists the individual use cases that will be covered by the diagnostic communication over the 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.

5.3.2 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 the 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 roadworthiness of the road train to the driver.

5.3.3 Use case 2 — Vehicle inspection and repair

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

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

5.3.4 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 the 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.

5.3.5 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 the towed vehicle's ECU systems.

In this case, usually the 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.

5.3.6 Use case 5 — Multipurpose data transfer between vehicles

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

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

5.4 Diagnostic applications

The diagnostic applications are divided into two types.

— Basic diagnostics:

  The purpose of the basic diagnostics is to provide the vehicle's 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.

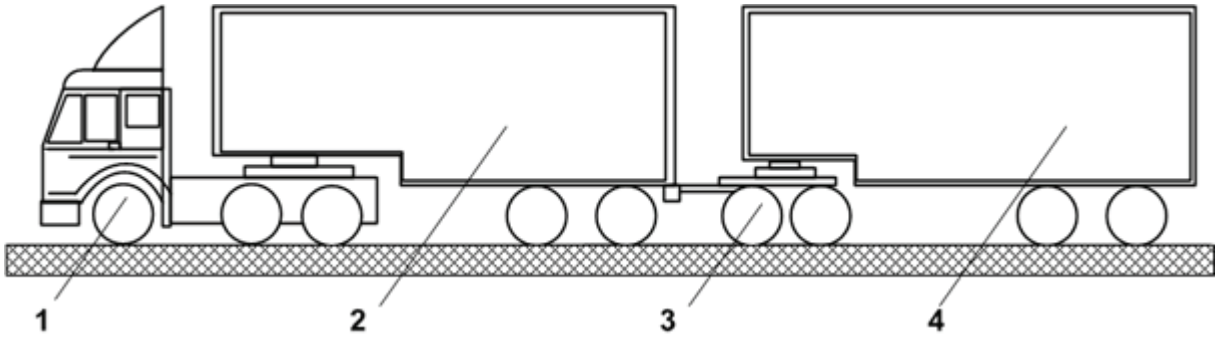
— Enhanced diagnostics:

  The support and the conditions, under which the 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.

The 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 the functions, services, and protocols are varying according to the definitions given in this document.

5.5 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
2 trailer/towed vehicle #1
3 dolly/towed vehicle #2
4 trailer/towed vehicle #3

Figure 1 — Example of a possible road train configuration

Subnet definitions shall be as follows.

— The commercial vehicle's logical network shall expand over
  — all servers and clients located at the commercial vehicle and
  — the towed vehicle gateways.
— The physical network segments between each towing and towed vehicle shall be part of the local logical network of the commercial vehicle and share the logical addressing scheme of the commercial vehicle.
— Each towed vehicle shall implement its own local logical network(s) with its own addressing scheme.
— Server and client entities that are not located at the same logical network shall be addressed and identified by means of remote network addressing.

Details about the used addressing scheme are given in Clause 11 (Network layer requirements).

Figure 2 shows an example of the vehicle network architecture.

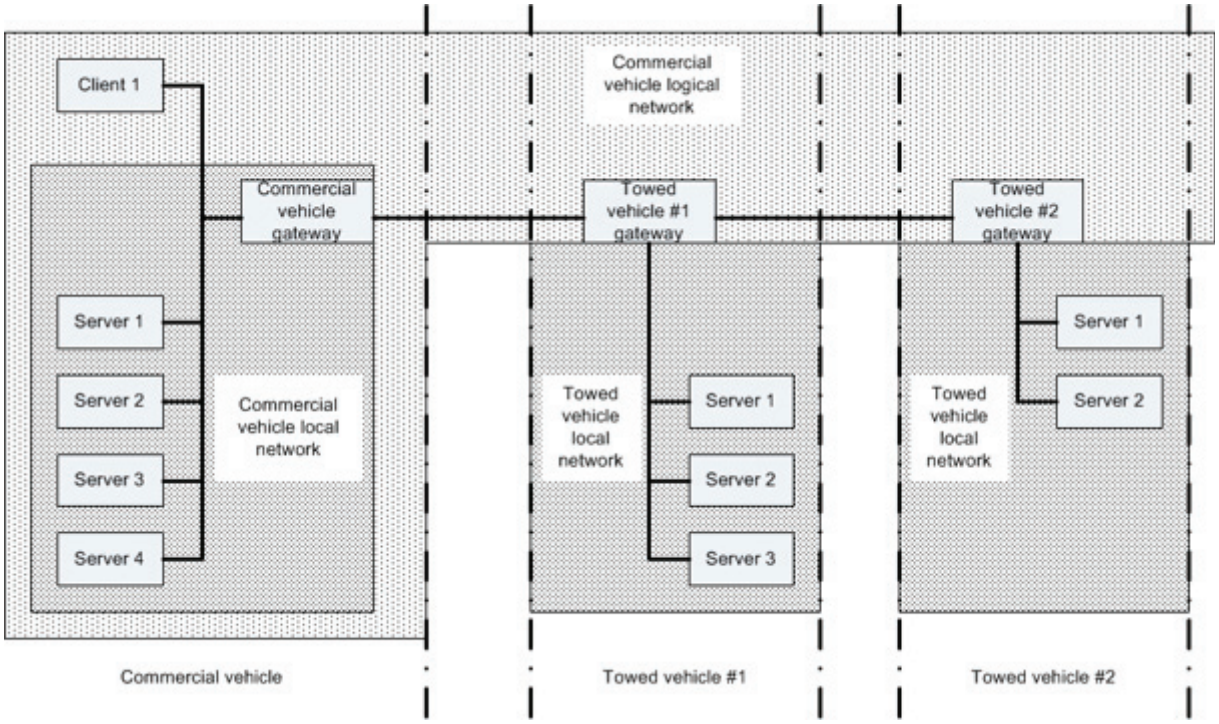


Figure 2 — Vehicle network architecture example

5.6 Diagnostic communication channels

This document specifies the diagnostic requests sent from any of the vehicles to any other vehicle of a road train. For the communication between those vehicles, defined diagnostic communication channels (DCC) shall be used as specified in Clause 11.

The defined communication channels shall be used as follows.

— For the communication between a client located in the commercial vehicle network and a server located in a towed vehicle, network DCC11, DCC12, DCC21, and DCC22 shall be used.

— For the communication between a client located in a towed vehicle network and a server located elsewhere in the road train, DCCX shall be used.

The address mapping between the vehicle networks shall be implemented in the gateway entities and is specified in this document. Address mapping at the vehicle's local networks is left open to the system builder. Examples that are more detailed are given in Annex C.

EXAMPLE Diagnostic communication between a client (test equipment) located at the commercial vehicle and a server (ECU) located at towed vehicle #1.

An example is given in Figure 3 and Table 2.

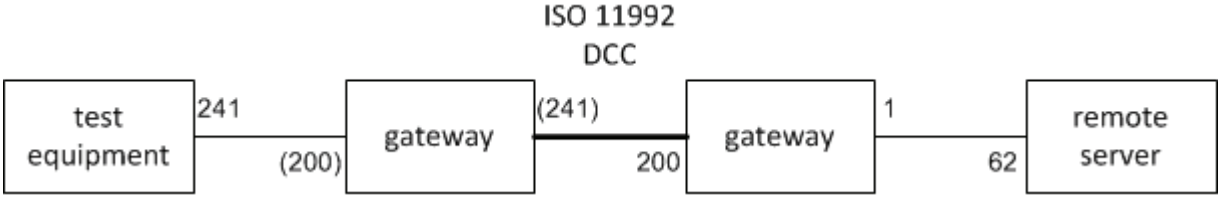


Figure 3 — Application layer address mapping example

Table 2 — Application layer address mapping example

Message	A_SA	A_TA	A_AE
The test equipment sends a remote diagnostic request message.	241	200	62
The gateway at the client side receives the message and forwards it onto the CAN network between the towing and towed vehicles.	241	200	62
The gateway at the server side receives the message and forwards it onto the server's vehicle local bus.	1	62	241
The remote server receives the message and sends back a diagnostic response.	62	1	241
The gateway at the server side receives the message and forwards it onto the CAN network between the towing and towed vehicles.	200	241	62
The gateway at the client side receives the message and forwards it onto the client's vehicle local bus.	200	241	62

6 Unified diagnostic services implementation

6.1 General

This clause defines how the diagnostic services as defined in ISO 14229-1 apply to the diagnostics on ISO 11992. For each applicable service, the applicable sub-function and data parameters are defined.

6.2 Overview on diagnostic services

The purpose of Table 3 is to reference all unified diagnostic services, as they are applicable for an implementation of UDS on ISO 11992. The table contains the sum of all applicable services. Certain applications using this document can restrict the number of useable services and can categorize them in certain application areas/diagnostic sessions (default session, extended session, etc.).