INTERNATIONAL STANDARD

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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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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

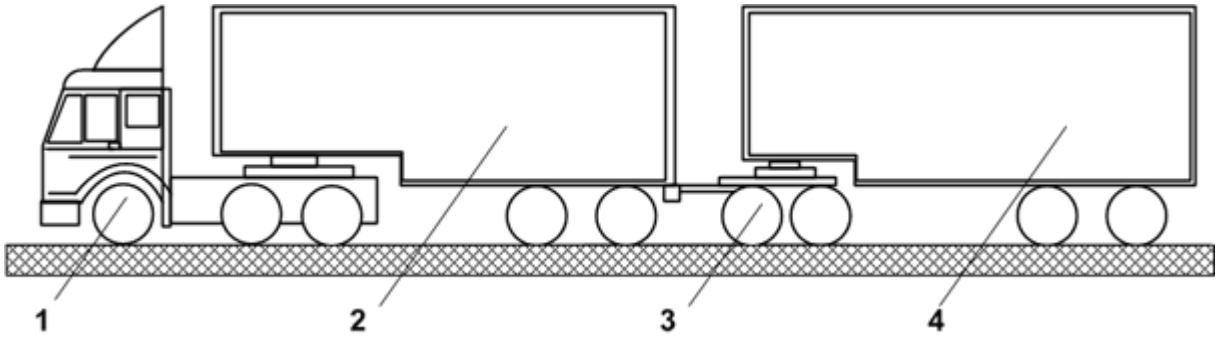
— Enhanced diagnostics:

  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.

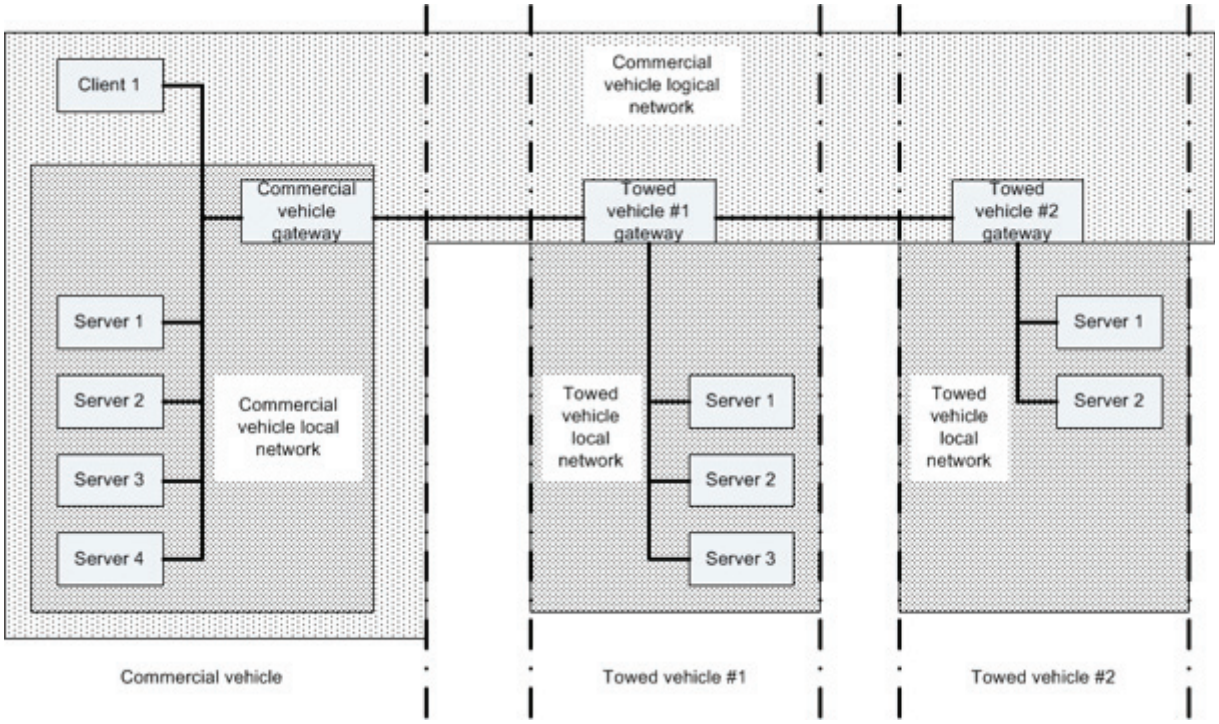


Figure 2 — Vehicle network architecture example

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.

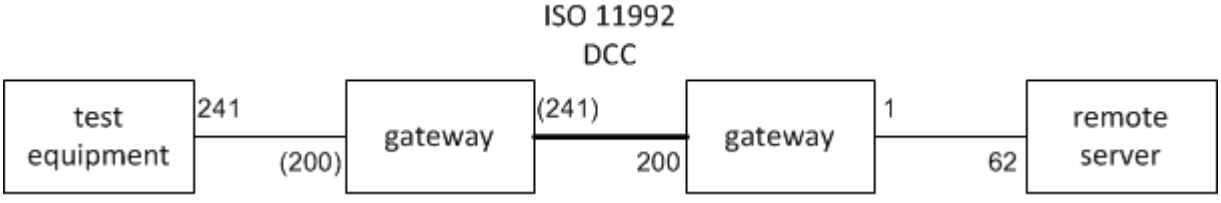


Figure 3 — Application layer address mapping example

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.).

Table 3 — Overview of applicable ISO 14229-1 Unified Diagnostic Services

Diagnostic service name (ISO 14229-1)	SID value	Specification	Document reference
Diagnostic and Communication Management Functional Unit			
DiagnosticSessionControl	10_{16}	No specific requirements	—
ECUReset	11_{16}	No specific requirements	—
SecurityAccess	27_{16}	No specific requirements	—
CommunicationControl	28_{16}	Restricted use	6.3
TesterPresent	$3E_{16}$	No specific requirements	—
AccessTimingParameters	83_{16}	Not supported	6.3
SecuredDataTransmission	84_{16}	No specific requirements	—
ControlDTCSetting	85_{16}	No specific requirements	—
ResponseOnEvent	86_{16}	Not supported	6.3
LinkControl	87_{16}	Not supported	6.3
Data Transmission Functional Unit			
ReadDataByIdentifer	22_{16}	Data link layer specific definitions exist	6.4.3
ReadMemoryByAddress	23_{16}	No specific requirements	—
ReadScalingDataByIdentifier	24_{16}	No specific requirements	—
ReadDataByPeriodicIdentifier	$2A_{16}$	Not supported	6.3
DynamicallyDefineDataIdentifier	$2C_{16}$	No specific requirements	—
WriteDataByIdentifier	$2E_{16}$	No specific requirements	—
WriteMemoryByAddress	$3D_{16}$	No specific requirements	—
Stored Data Transmission Functional Unit			
ReadDTCInformation	19_{16}	Data link layer specific definitions exist	6.4.2
ClearDiagnosticInformation	14_{16}	Data link layer specific definitions exist	6.4.2
Input/output Control Functional Unit			
InputOutputControlByIdentifier	$2F_{16}$	No specific requirements	—
Remote Activation Of Routine Functional Unit			
RoutineControl	31_{16}	No specific requirements	—
Upload/Download Functional Unit			
RequestDownload	34_{16}	No specific requirements	—
RequestUpload	35_{16}	No specific requirements	—
TransferData	36_{16}	No specific requirements	—
RequestTransferExit	37_{16}	No specific requirements	—

6.3 Non-applicable or restricted services

The following services are not applicable for the implementation on ISO 11992 and are not within the scope of this document or can be used under restrictions.

— CommunicationControl

Disabling the normal communication specified in ISO 11992-2 between towing and towed vehicles is not permitted due to the requirements given by UNECE Regulation 13. [5]

— AccessTimingParameter

This service is not applicable as there is no use case on a CAN-based system.

— ResponseOnEvent

This service is not supported as there is no specification given for the communication between the gateways for that type of communication.

— LinkControl

This service shall not be supported during the communication between the towing and towed vehicles as it is not supported by a data link based on ISO 11992-1.

— ReadDataByPeriodicIdentifier

This service is not supported as there is no specification given for the communication between the gateways for that type of communication.

6.4 Basic diagnostic services

6.4.1 Services

Within the scope of basic diagnostic services, the following diagnostic services shall be supported:

— ReadDTCInformation, as specified in 6.4.2;

— ReadDataByIdentifier, as defined in 6.4.3.

The diagnostic services specification includes tables that list the diagnostic services and respective service primitive parameters. For all services and service primitive parameters, the presence is specified by the convention values (Cvt) in Table 4.

Table 4 — Diagnostic service primitive parameter conventions

Cvt	Name	Description
M	Mandatory	The service or service primitive parameter has to be present.
C	Conditional	The service or service primitive parameter can be present, based on certain criteria (e.g. due to a certain sub-function).
S	Selection	The service or service primitive parameter is mandatory (unless otherwise specified) and is a selection from a given list of services or service primitive parameters.
U	User option	The service or service primitive parameter can or cannot be present, depending on the dynamic usage by the user.

NOTE A service identifier marked as mandatory does not imply that this service has to be supported.

6.4.2 ReadDTCInformation service

6.4.2.1 General description

This service allows a client to read the status of the server's resident Diagnostic Trouble Code (DTC) information from any server or group of servers within a vehicle, as defined in ISO 14229-1. Within the scope of basic diagnostics, this service shall allow the client to do the following:

— retrieve the number of DTCs matching a client-defined severity mask;

— retrieve the list of DTCs matching a client-defined severity mask record;

— retrieve the severity information for a client-defined DTC.

Other sub-functions can be supported within the scope of enhanced diagnostics.

6.4.2.2 Request message sub-function definition

The server shall support the request and response service messages as defined in ISO 14229-1 for the sub-functions listed in Table 5.

Table 5 — ReadDTCInformation sub-functions for basic diagnostics

Value	Definition	Cvt
07_{16}	reportNumberOfDTCBySeverityMaskRecord This parameter specifies that the server shall transmit to the client the number of DTCs matching a client-defined severity mask record.	M
08_{16}	reportDTCBySeverityMaskRecord This parameter specifies that the server shall transmit to the client a list of DTCs and corresponding statuses matching a client-defined severity mask record.	M
09_{16}	reportSeverityInformationOfDTC This parameter specifies that the server shall transmit to the client the severity information of a specific DTC specified in the client request message.	U

6.4.2.3 Request and response message data parameter definition

The server shall support the definition of the message data parameter as given in ISO 14229-1 with the implementation specific requirements given in Table 6.

Table 6 — Message data parameter definition

Definition
DTCAndSeverityRecord This parameter record contains one or more groupings of DTCSeverity, DTCFunctionalUnit, DTCHighByte, DTCMiddleByte, DTCLowByte, and statusOfDTC of ISO 11992-4_DTCFormat with the details given in A.3.
DTCFormatIdentifier This 1-byte parameter value defines the format of a DTC reported by the server and shall have these values: — 0 to 2 (reserved by ISO 14229-1, not supported); — 3 (ISO 11992–4_DTCFormat); — 4 to 255 (reserved by ISO 14229-1, not supported).
DTCMaskRecord [DTCHighByte, DTCMiddleByte, DTCLowByte] The decoding of the DTCHighByte, DTCMiddleByte, and DTCLowByte shall be according to this International Standard's specification. This format is identified by the DTCFormatIdentifier = ISO 11992-4_DTCFormat. Definitions are given in A.3.1.
DTCSeverityMaskRecord [DTCSeverityMask, DTCStatusMask] DTCSeverityMaskRecord is a 2-byte value containing the DTCSeverityMask and the DTCStatusMask as given A.3.2.
FunctionalGroupID The FunctionalGroupID parameter shall be supported as given in A.3.5.

6.4.3 ReadDataByIdentifier service

6.4.3.1 General

This service shall be used to request information from a server identified by a dataIdentifier. Within the scope of basic diagnostics, only one dataIdentifier shall be present in a request message.

6.4.3.2 Request message data parameter definition

The service parameter of the ReadDataByIdentifier service request shall be supported for basic diagnostics as specified in Table 7 with the dataIdentifier specified in A.2.1.

Table 7 — ReadDataByIdentifier request parameters

A_Data byte	Parameter name	Cvt	Value
#1	ReadDataByIdentifier request service identifier	M	22_{16}
	dataIdentifier[] = {		
#2	Byte 1 (MSB)	M	00_{16}-FF_{16}
#3	Byte 2 (LSB)}	M	00_{16}-FF_{16}

6.4.3.3 Response message data parameter definition

The service parameter of the ReadDataByIdentifier service response shall be supported for basic diagnostics as specified in Table 8 with the dataIdentifier and dataRecord as specified in A.2.1.

Table 8 — ReadDataByIdentifier positive response parameters

A_Data byte	Parameter name	Cvt	Value
#1	ReadDataByIdentifier response service identifier	M	62_{16}
	dataIdentifier[] = {		
#2	byte 1 (MSB)	M	00_{16}-FF_{16}
#3	byte 2 (LSB)}	M	00_{16}-FF_{16}
	dataRecord[] = {		
#4	data#1	M	00_{16}-FF_{16}
:	:	:	:
#(m-1)+4	data#m}	U	00_{16}-FF_{16}

6.5 Enhanced diagnostic services

Within the scope of enhanced diagnostics, all services defined to be applicable in 6.2 with the exclusions given in 6.3 can be used as specified in ISO 14229-3.

7 Application layer requirements

7.1 Application layer services

The application layer services, as defined in ISO 14229-1 for client-server based systems, shall be used to perform functions such as test, inspection, monitoring, diagnosis, or programming of on-board vehicle servers.

7.2 Application layer protocol

The application layer protocol, as defined in ISO 14229-1, shall be used with the parameters defined in Table 9 at peer entity networks.

Table 9 — Application layer parameters

Parameter	Definition	Data range
A_Mtype	application layer message type	remote diagnostics
A_SA request	local address of the client	any allowed client address except e.g. the specified addresses given in Table B.1
A_SA response	local gateway address at the vehicle the server is located on	any gateway address according to the definitions given in Table B.3
A_TA request	local gateway address at the vehicle the server is located on	any gateway address according to the definitions given in Table B.3
A_TA response	local address of the client	any allowed client address except e.g. the specified addresses given in Table B.1
A_Length	length of data to be transmitted/received	0 to 255
A_AE request	remote address of the server	any allowed server address within the server's vehicle network
A_AE response	remote address of the server	any allowed server address within the server's vehicle network

7.3 Timing definition

7.3.1 General

This sub-clause specifies the parameters for the timing of messages and how they apply to a client and a server.

7.3.2 Message timing parameter values

The message timing parameter values shall be in accordance with ISO 14229-2 and the additional requirements specified in Table 10.

Table 10 — Message timing parameters

Timing parameter	Definition	Minimum	Maximum
$\Delta P2$	The $\Delta P2$ parameter is defined to be the worst-case system network design-dependent message transmission delays, such as delays introduced by the gateways between the towing and towed vehicles and the busload arbitration delay.	0 ms	200 ms
$P2_{\text{server}}$	The $P2_{\text{server}}$ parameter is a performance requirement for the server/ECU to start with the response message after the reception of a request message.	0 ms	50 ms
$P2_{\text{client}}$	$P2_{server,\max} + \Delta P2_{\max}$	250 ms	—
$P2*_{\text{server}}$	The $P2*_{\text{server}}$ parameter is a performance requirement for the server to start with the response message after the transmission of a negative response message with the NRC RCRRP.	0 ms	5 000 ms
$P2*_{\text{client}}$	$P2*_{server,\max} + \Delta P2_{\max}$	5 200 ms	—

7.3.3 Unsolicited response messages

Unsolicited response messages are not applicable for this document.

8 Presentation layer requirements

The presentation layer requirements are in the responsibility of the vehicle manufacturer/system supplier.

9 Session layer requirements

The session layer requirements are specified in ISO 14229-2.

10 Transport layer requirements

10.1 General

The transport layer specification is given in ISO 15765-2 with the following amendments. In case of differences, the specifications of this part of ISO 11992 shall have precedence.

10.2 Transport layer service parameters

10.2.1 FirstFrame.DataLength (FF.DL)

The parameter FirstFrame.DataLength (FF.DL) determines the number of message data bytes of a segmented multiframe message.

Table 11 — Definition of BS values

Value	Description
0_{16} to 6_{16}	invalid
7_{16} to FF_{16}	DataLength (DL) range: 7 to 255
FF_{16} to $3FF_{16}$	reserved by document

NOTE The USDT protocol on the CAN allows a maximum of 4 095_{10} MessageData bytes. For the diagnostic communication between the towing and towed vehicles, the length is limited to 255_{10} bytes.

10.2.2 BlockSize (BS)

The parameter BlockSize (BS) shall be used by the peer entity of the receiving network layer in the flow control frame to request the transmission of a maximum number of consecutive frames by the peer entity of the sending network layer without an intermediate flow control frame.

Table 12 — Definition of BS values

Value	Description
0_{16}	reserved by document
1_{16} to $0F_{16}$	BlockSize (BS) range: 1 to 15
10_{16} to FF_{16}	reserved by document

The value BS = 0, i.e. no intermediate flow control frames, shall not be used.

10.2.3 SeparationTime (STmin)

The parameter SeparationTime (STmin) shall be used by the peer entity of the receiving network layer in the FlowControl frame to request a minimum time gap between the transmissions of consecutive frames from the peer entity of the sending network layer as defined in Table 13.

Table 13 — Definition of STmin values

Value	Description
0_{16} to 09_{16}	invalid This range of values are not applicable and shall not be used.
$0A_{16}$ to $7F_{16}$	SeparationTime (STmin) range: 10 ms to 127 ms The units of STmin in the range 10 to 127 ($0A_{16}$ – $7F_{16}$) are absolute milliseconds (ms).
80_{16} to FF_{16}	reserved This range of values is reserved by this part of ISO 11992.

10.2.4 FlowStatus (FS)

The FlowStatus (FS) shall be used by the receiving network layer peer entity in the FlowControl frame to indicate to the sender whether it is ready to receive < BS > consecutive frames sent with a minimum of < STmin > separation time.

Table 14 — Definition of FlowStatus values

Value	Description
0000_2	continue to send (CTS)
0001_2	wait (WT)
0010_2	overflow

10.2.5 Maximum number of FC.Wait frame transmissions (N_WFTmax)

The local entity parameter's maximum number of FC.Wait frame transmissions, N_WFTmax, defines the allowed maximum number of consecutive FlowControl frames with FlowStatus set to wait.

Table 15 — Definition of N_WFTmax values

Value	Description
$0A_{16}$	N_WFTmax value: 10_{10}

11 Network layer requirements

11.1 General

This section specifies the network layer requirements on the ISO 11992 data link. Network layer specification is given in ISO 15765-2 with the following amendments. In case of differences, the specifications of this part of ISO 11992 shall have precedence.

11.2 Message routing

The network layer entities shall provide message routing functions to support the communication between the servers and clients on the local networks of the commercial vehicle and towed vehicle(s). Examples are given in Annex C.

11.3 Establishing, maintaining, and terminating of connections

For the diagnostic data transmission between the towing and towed vehicles, the following limitations apply.

a) Multiframe (segmented) messages shall use point-to-point (one-to-one) connections with physical addressing only.

b) Single-frame messages can use multipoint (one-to-*n*) connectionless transmission with functional addressing or point-to-point (one-to-one) connections with physical addressing.

11.4 Diagnostic communication channels (DCC)

There are two network layer implementations specified to establish diagnostic communication channels between peer entities.

a) Mixed addressing format using DCC11, DCC12, DCC21, and DCC22.

   This is the format specified in the first edition of ISO 11992-4 and shall be used for the communication between the client located in the commercial vehicle's local network and the server located in the towed vehicle's remote network. It is identified by the following:

   — the network target address, N_TA;

   — the network source address, N_SA;

   — the network address extension, N_AE;

   — the parameters specified in Table 16.

b) Subnet addressing format using DCCX.

   This format shall be used for the communication between the clients located in the towed vehicle's local network and the servers located either in the commercial vehicle's local network or in another towed vehicle's local network. It is identified by the following:

   — the network target address, N_TA, consisting of a subnetwork and a node part;

   — the network source address, N_SA, consisting of a subnetwork and a node part;

   — the parameters specified in Table 17.

Table 16 — Diagnostic PDUs overview

P	EDP	DP	PF	PS	PGN	Label	Acro-nym	Rep. time	Remarks
7	0	0	206	DA	52736	diagnostic channel physical addressing	DCC11	n/a	sent from towing to towed vehicle
7	0	0	206	DA	52736	diagnostic channel physical addressing	DCC21	n/a	sent from towed to towing vehicle
7	0	0	205	DA	52480	diagnostic channel functional addressing	DCC12	n/a	sent from towing to towed vehicle
7	0	0	205	DA	52480	diagnostic channel functional addressing	DCC22	n/a	sent from towed to towing vehicle

NOTE 1 DCC11 and DCC21 refer to the same PGN as KWP3 in SAE J1939.

NOTE 2 DCC12 and DCC22 refer to the same PGN as KWP4 in SAE J1939.

Table 17 — Subnet addressing diagnostic messages overview

P	EDP	DP	–	–	–	Label	Acro-nym	Rep. time	Remarks
7	1	1	–	–	–	subnet addressing diagnostic channel	DCCX	n/a	sent from any towed to any other vehicle
NOTE DCCX is not a PGN as defined in SAE J1939 but is compatible with that specification.									

11.5 Mixed addressing network layer service parameter

11.5.1 General

This section specifies the network layer service parameters used for the diagnostic communication. All parameters shall be used in accordance to the message definition given in ISO 11992-2, ISO 11992-3, ISO 15765-2, and the requirements given below.

The general requirements are as follows:

— The data link layer PDUs shall be used as defined in ISO 11992-2 and ISO 11992-3 using 29-bit CAN identifiers.

— The CAN frame shall always be padded for transmission with 8 data bytes, i.e. DLC = 8.

— Mapping of N_PDU fields shall be done according to ISO 15765-2, mixed addressing scheme using 29-bit CAN identifiers.

For diagnostic service requests and responses, the mapping parameters according to the definitions given in this section shall apply. Vehicle network addresses in the case of a trailer vehicle shall be assigned according to the definitions given in Tables B.3 and B.4. Local addresses used on the commercial vehicle's networks are usually defined by the vehicle manufacturer.

11.5.2 Network layer target address (N_TA)

The network layer target address, N_TA, shall represent the target address of the network layer message receiver on the ISO 11992 network and shall correspond to

— the destination address, DA, of the ISO 11992-2 and ISO 11992-3 address definition as given in Table B.1 for the network layer messages directed from the client to the server entities and

— the local network address the client is mapped to for the network layer messages directed from the server to the client entities.

11.5.3 Network layer source address (N_SA)

The network layer source address, N_SA, shall represent the source address of the network layer message sender on the ISO 11992 network and shall correspond to

— the source address, SA, of the ISO 11992-2 and ISO 11992-3 address definition as given in Table B.1 for the network layer messages directed from the server to the client entities and

— the local network address the server is mapped to for the network layer messages directed from the client to the server entities.

11.5.4 Network layer address extension (N_AE)

The network layer address extension, N_AE, shall represent the server's address on the vehicle's local network.

11.5.5 Target address type (N_TAtype)

The target address type to be used for N_TA shall be <physical target address> or <functional target address>.

11.5.6 Message length

The parameter length identifies the number of message data bytes. The maximum length allowed is 255_{10} bytes.

NOTE The USDT protocol on the CAN allows a maximum of 4 095_{10} MessageData bytes. For the diagnostic communication between the towing and towed vehicles, the length is limited to 255_{10} bytes.

11.6 Subnet addressing network layer service parameter

11.6.1 General

This section specifies the network layer service parameters used for the diagnostic communication. All parameters shall be used in accordance to the message definition given in ISO 11992-2, ISO 11992-3, ISO 15765-2, and the requirements given below.

The general requirements are as follows:

— The data link layer PDUs shall be used as defined in ISO 11992-2 and ISO 11992-3 using 29-bit CAN identifiers.

— The CAN frame shall always be padded for transmission with 8 data bytes, i.e. DLC = 8.

— The mapping of N_PDU fields shall be done according to the subnet addressing scheme using 29-bit CAN identifiers.

For diagnostic service requests and responses, the mapping parameters according to the definitions given in this section shall apply. Local addresses used on the commercial vehicle's networks are usually defined by the vehicle manufacturer.

11.6.2 Subnet addressing definitions

11.6.2.1 General

An address is defined as an 11-bit wide field that consists of two parts.

a) Network address part

The network address part consists of the upper N_Subnet bits of the address and determines the node's subnetwork. The same network address shall be assigned to the nodes on one physical bus. The network address part shall not have all bits set to one. Therefore the maximum number of subnetworks is

$$2^{N\_Subnet} - 1$$

b) Node address part

The node address part consists of the remaining (11–N_Subnet) bits and determines the node within a subnetwork. It shall be unique within the subnetwork. All bits set to zero and all bits set to one are not allowed. Therefore the maximum number of nodes per subnetwork is

$$2^{(11-N\_Subnet)} - 2$$

11.6.2.2 Subnet mask

The subnet mask assigns the number of bits used for the network address part and for the node address part.

The length of the subnet mask is 11 bits (same as the length of the address). The value of a subnet mask is assigned by setting the first N_Subnet sequential bits to one. The number of sequential bits set to one selects the network address part from the whole address. The remaining sequential bits set to zero select the node address part from the whole address. The parameter N_Subnet is used as a short notation for the subnet mask value. An example for N_Subnet = 4 is given in Figure 4.

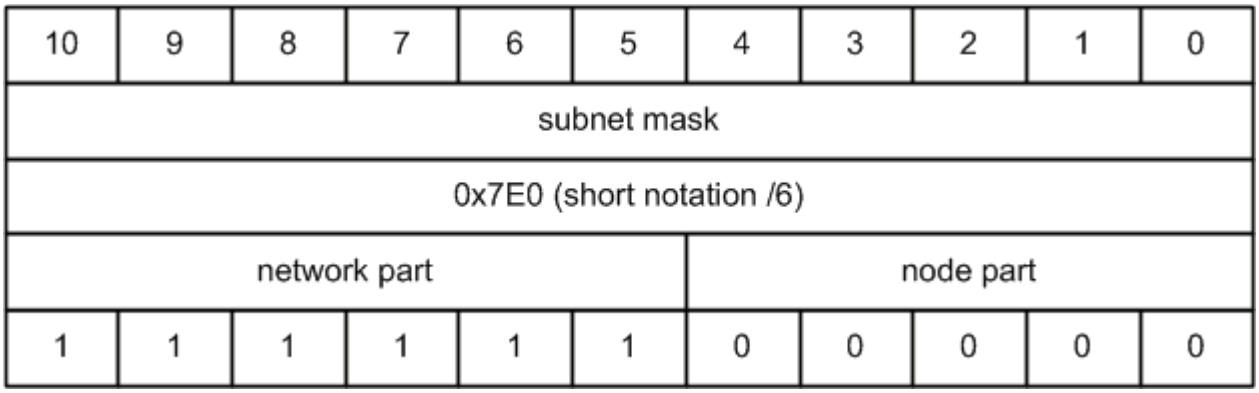


Figure 4 — Example of a subnet mask

11.6.2.3 Network address

The network address of a node shall be calculated using its assigned address and subnet mask by a logical AND operation of the address and subnet mask. An example is given in Figure 5.

Bit	10	9	8	7	6	5	4	3	2	1	0
Address $2ED_{16}$	0	1	0	1	1	1	0	1	1	0	1
Subnet mask /6	1	1	1	1	1	1	0	0	0	0	0
Network address $2E0_{16}$	0	1	0	1	1	1	0	0	0	0	0

Figure 5 — Example of a network address calculation

11.6.2.4 Node address

The node address of a node shall be calculated using its assigned address and subnet mask by a logical AND operation of the address and the one's complement of the subnet mask. An example is given in Figure 6.

Bit	10	9	8	7	6	5	4	3	2	1	0
Address $2ED_{16}$	0	1	0	1	1	1	0	1	1	0	1
Subnet mask /6	1	1	1	1	1	1	0	0	0	0	0
Network address $2E0_{16}$	0	0	0	0	0	0	0	1	1	0	1

Figure 6 — Example of a node address calculation

11.6.2.5 Broadcast address

11.6.2.5.1 Generic broadcast

The generic broadcast allows broadcasting messages to all the nodes of a network. To send a broadcast to the whole network, the target address 0x7FF (all bits set to one) shall be used. A message with that target address will be routed by all the gateways. All nodes on the network shall receive and process messages with the destination address 0x7FF.

11.6.2.5.2 Subnet broadcast

The intended use of subnet broadcasts is to send messages to all the nodes of a specific subnetwork. To send a broadcast to a specific subnet, the broadcast address of that subnet shall be calculated. This is done by taking the destination's subnet information (network address and subnet mask) and setting all the bits of the node address part (marked with zero in the subnet mask) to one. See Figure 7 for a subnet broadcast example for the receiver's subnet.

Bit	10	9	8	7	6	5	4	3	2	1	0
Address 280_{16}	0	1	0	1	0	0	0	0	0	0	0
Subnet mask /6	1	1	1	1	1	1	0	0	0	0	0
broadcast address $29F_{16}$	0	1	0	1	0	0	1	1	1	1	1

Figure 7 — Example of a subnet broadcast

11.6.2.6 Message routing

Routing applies whenever the nodes from the physically separated subnets communicate with each other and their CAN frames have to be transferred from one subnet to another subnet. This is performed by the gateways on an ISO 11992-2 or ISO 11992-3 network, which are physically connected to the network where the CAN frame is received and the network where the CAN frame shall be transmitted to, to reach its destination.

For the routing of messages between the subnets, the following definitions shall apply:

— Upon reception of a message, each gateway shall forward the message to the receiver's subnet if
  — the receiver's network is different from the sender's network and
  — the receiver's network is physically reachable.
— If the destination address is 0x7FF, the gateway shall copy the message to all the connected subnets except the sender's subnet.
— If the receiver's subnet uses a different addressing method, the gateway shall perform the necessary address translation.

11.6.2.7 Implementation on ISO 11992-4

For the implementation of the subnet addressing on ISO 11992-4, the definitions given in Table 18 shall apply with these definitions:

— The address ranges for the individual vehicles shall be dynamically assigned along with the address claim method specified in ISO 11992-2 and ISO 11992-3 for normal communication.

— If necessary, the gateways shall perform a mapping of the local network addresses to the node address ranges. Implementation of such routing tables is not specified within ISO 11992-4 and is left open to the vehicle manufacturer/system builder.

Table 18 — Subnet addressing definitions and values

Parameter	Commercial vehicle	Towing vehicle #1	Towing vehicle #2	Towing vehicle #3	Towing vehicle #4	Towing vehicle #5
N_Subnet	3	6				
Subnet mask	0x700	0x7E0				
Global broadcast	0x7FF					
Subnets for braking and running gear (ISO 11992-2**)**						
Network address	0x0	0x7C0	0x780	0x740	0x700	0x6C0
Address range	0x001 to 0x0FE	0x7C1 to 0x7DE	0x781 to 0x79E	0x741 to 0x75E	0x701 to 0x71E	0x6C1 to 0x6DE
Broadcast address	0x0FF	0x7DF	0x79F	0x75F	0x71F	0x6DF
Subnets for equipment other than braking and running gear (ISO 11992-3**)**						
Network address	0x100	0x7A0	0x760	0x720	0x6E0	0x6A0
Address range	0x101 to 0x1FE	0x7A1 to 0x7BE	0x761 to 0x77E	0x721 to 0x73E	0x6E1 to 0x6FE	0x6A1 to 0x6BE
Broadcast address	0x1FF	0x7BF	0x77F	0x73F	0x6FF	0x6BF
NOTE All other addresses are reserved by ISO for future use.						

11.6.3 Network layer type of service (N_TOS)

The network layer parameter TOS shall be used to address different types of services of a network node without having to assign different addresses. The different types of services and their usage are specified in Table 19.

Table 19 — Definitions of type of service (TOS)

Value	Type of service (TOS)	Description
00_2	ISO reserved	This value is reserved for future use by ISO.
01_2	ISO reserved	This value is reserved for future use by ISO.
10_2	ISO reserved	This value is reserved for future use by ISO.
11_2	diagnostic messages	This bit combination indicates an ISO 11992-4 defined diagnostic service addressed to a node. The user data bytes of the message contain the diagnostic requests and responses using the subnet-addressing network layer services and transport layer defined in ISO 15765-2.

11.6.4 Network layer target address (N_TA)

The target address N_TA on the network layer shall represent the target address and target entity subnet of the message receiver on the ISO 11992 network. This can be a single node, the broadcast address of a network, or a generic broadcast. The target address is used by the gateways to determine whether the message shall be routed to another subnetwork or not. The structure of the address is specified in 11.6.2.

11.6.5 Network layer source address (N_SA)

The source address N_SA on the network layer shall represent the source address and source entity subnet of the message sender on the ISO 11992 network. This information ensures the correct arbitration and enables the receiver of the message to address its replies. The structure of the address is specified in 11.6.2.

11.6.6 Message length

The parameter length identifies the number of message data bytes. The maximum length allowed is 255_{10} bytes.

NOTE The USDT protocol on the CAN allows a maximum of 4095_{10} MessageData bytes. For the diagnostic communication between the towing and towed vehicles, the length is limited to 255_{10} bytes.

11.7 Network layer protocol timing

The network layer protocol timing shall apply as specified in ISO 15765-2.

12 Data link layer requirements

12.1 General

For the data link layer requirements, the following shall apply:

— the CAN data frame in extended frame format shall be used (see ISO 11898-1);

— the CAN frame shall use a DLC of 8 (see ISO 15765-2);

— the CAN data frame shall not be scheduled by means of RTR (CAN remote frame).

12.2 Mapping for mixed addressing

Remote network addressing shall be implemented by means of the mixed address format. The address information of the network layer N_AI shall be encapsulated in the CAN_ID and the first data byte of the CAN PDU. The relation between the address information of the network layer, PDU1 parameters, and the CAN identifier usage according to ISO 11992-2 and ISO 11992-3 shall be implemented as given in Figure 8 and Table 20.

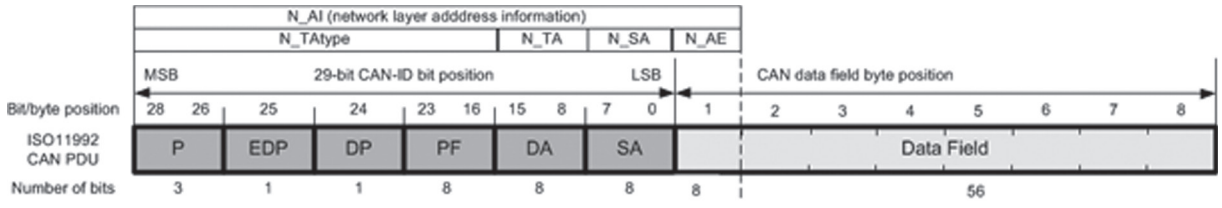


Figure 8 — Mixed addressing network layer address encoding (PDU1)

Table 20 — Parameter specification for mixed addressing

Parameter	Specification/value
P	7_{10} – default priority
EDP	0
DP	0
PF	205_{10} – functional addressing 206_{10} – physical addressing
DA	mapped to N_TA (mixed addressing)
SA	mapped to N_SA (mixed addressing)

12.3 Mapping for subnet addressing

Remote network addressing shall be implemented by means of the subnet address format. The address information of the network layer N_AI shall be encapsulated in the CAN_ID. The relation between the address information of the network layer, PDU3 parameters, and the CAN identifier usage according to ISO 11992-2 and ISO 11992-3 shall be implemented as given in Figure 9 and Table 21.

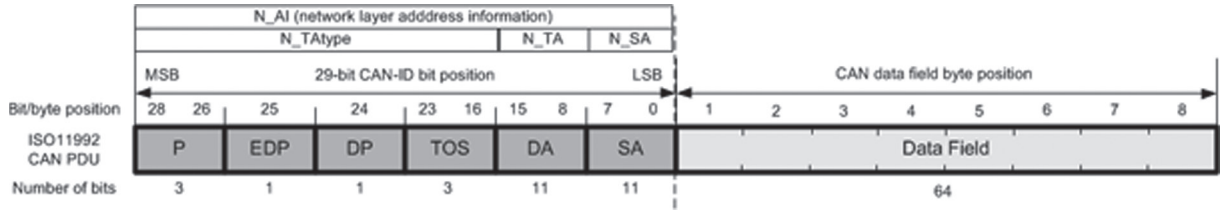


Figure 9 — Subnet addressing network layer address encoding (PDU3)

Table 21 — Parameter specification for subnet addressing

Parameter	Specification/value
P	7_{10} – default priority
EDP	1
DP	1
TOS	mapped to N_TOS
DA	mapped to N_TA (subnet addressing)
SA	mapped to N_SA (subnet addressing)

13 Physical layer requirements

All requirements regarding the physical layer are given in ISO 11992-1.

Annex A
(normative)

Basic diagnostic service parameters

A.1 Negative response codes (NRC)

The negative response codes specify the reason for a diagnostic request service to be rejected by a server and shall be in accordance to ISO 14229-1. The codes given in Table A.1 shall be supported by all the servers.

Table A.1 — Negative response codes (NRC)

Negative response code	Mnemonic	Value	Specification
GeneralReject	GR	10_{16}	The service request is rejected without any specific reason. This response code shall only be used if none of the other negative response codes specified in ISO 14229-1 describes the reason of the service reject.
ServiceNotSupported	SNS	11_{16}	The server does not support the requested service.
SubFunctionNotSupported	SFNS	12_{16}	The service execution is not possible with the given service request parameters.
BusyRepeatRequest	BRR	21_{16}	The server has understood the service request, but it cannot execute the service at this time and will not start the service later, e.g. because a diagnostic service is already in progress. The client shall repeat the request later.
RequestOutOfRange	ROOR	31_{16}	The requested action would have exceeded a predefined parameter range.
RequestCorrectlyReceived-ResponsePending	RCRRP	78_{16}	The request has been correctly received and is executed by the server. The final positive or negative response is delayed because of the execution time needed for this service. A further service request will be rejected.

A.2 Data transmission functional unit parameter definitions

A.2.1 Data identifier (DID) definition

The data identifier (DID) and their record definition shall be used as defined by Table A.2 for all diagnostic services used on ISO 11992.

Table A.2 — Data Identifier (DID) definition

DID value	Record definition	Cvt
$F000_{16}$ – $F00F_{16}$	**NetworkConfigurationDataForTractorTrailerApplication** This range of values shall be used to request the remote addresses of all the trailer systems independent of their functionality.	M
$F000_{16}$	**NetworkConfigurationData – TrailerRemoteAddress** This value shall be used to request the remote addresses of all the trailer systems independent of their functionality.	U

Table A.2 *(continued)*

DID value	Record definition	Cvt
$F001_{16}$	**NetworkConfigurationData – BrakesAndRunningGearTrailerRemoteAddress** This value shall be used to request the remote addresses of the brakes and running gear trailer systems according to ISO 11992-2. This information/PID shall be supported by all the servers belonging to the brakes and running gear applications.	M
$F002_{16}$	**NetworkConfigurationData – GeneralPurposeTrailerRemoteAddress** This value shall be used to request the remote addresses of the general-purpose trailer systems according to ISO 11992-3. This information/PID shall be supported by all the servers belonging to the general-purpose applications.	M
$F187_{16}$	**VehicleManufacturerSparePartNumber** This value shall be used to reference the vehicle manufacturer's spare part number. Record data content and format shall be in ASCII and defined by the vehicle manufacturer.	U
$F188_{16}$	**VehicleManufacturerECUSoftwareNumber** This value shall be used to reference the vehicle manufacturer's ECU software number. Record data content and format shall be in ASCII and defined by the vehicle manufacturer.	U
$F189_{16}$	**VehicleManufacturerECUSoftwareVersionNumber** This value shall be used to reference the vehicle manufacturer's ECU software version number. Record data content and format shall be in ASCII and defined by the vehicle manufacturer.	U
$F18A_{16}$	**SystemSupplierIdentifier** This value shall be used to reference the system supplier name and address information. Record data content and format shall be in ASCII and defined by the system supplier.	U
$F18B^{16}$	**ECUManufacturingData** This value shall be used to reference the ECU manufacturing date. Record data content and format shall be in ASCII and shall be ordered as year, month, and day.	U
$F18C_{16}$	**ECUSerialNumber** This value shall be used to reference the ECU serial number. Record data content and format shall be in ASCII and defined by the system supplier.	U
$F18D_{16}$	**SupportedFunctionalUnits** This value shall be used to request the functional units implemented in a server. This information shall be provided by all the servers.	M
$F190_{16}$	**VIN** This value shall be used to reference the VIN number. Record data content and format shall be in ASCII and specified by the vehicle manufacturer. This information shall be at least provided by the interfaces in the towing and towed vehicles.	M
$F191_{16}$	**VehicleManufacturerECUHardwareNumber** This value shall be used by the reading services to reference the vehicle manufacturer's specific ECU hardware number. Record data content and format shall be ECU-specific and defined by the vehicle manufacturer.	U
$F192_{16}$	**SystemSupplierECUHardwareNumber** This value shall be used to reference the system supplier's specific ECU hardware number. Record data content and format shall be ECU-specific and defined by the system supplier.	U
$F193_{16}$	**SystemSupplierECUHardwareVersionNumber** This value shall be used to reference the system supplier's specific ECU hardware version number. Record data content and format shall be ECU-specific and defined by the system supplier.	U
$F194_{16}$	**SystemSupplierECUSoftwareNumber** This value shall be used to reference the system supplier's specific ECU software number. Record data content and format shall be ECU-specific and defined by the system supplier.	U
$F195_{16}$	**SystemSupplierECUSoftwareVersionNumber** This value shall be used to reference the system supplier's specific ECU software version number. Record data content and format shall be ECU-specific and defined by the system supplier.	U

Table A.2 *(continued)*

DID value	Record definition	Cvt
$F197_{16}$	**SystemNameOrEngineType** This value shall be used to reference the system name or engine type. Record data content and format shall be in ASCII and defined by the vehicle manufacturer. This information should be provided by all the servers. Note: The maximum length is limited by the maximum length of a segmented message to 255 bytes.	M
$F19E_{16}$	**ODXFileIdentifier** This value shall be used to reference the Open Diagnostic Data Exchange (ODX) file of the server to be used to interpret and scale the server data.	U
$FD00_{16}$ – $FEFF_{16}$	**SystemSupplierSpecific** This range of values shall be used to reference the system supplier's specific record data identifiers and input/output identifiers within the server.	U

A.3 Stored data transmission functional unit parameter definitions

A.3.1 Diagnostic trouble codes (DTC) format

The format for the diagnostic trouble code records shall be in accordance with Figure A.1 and Table A.3.

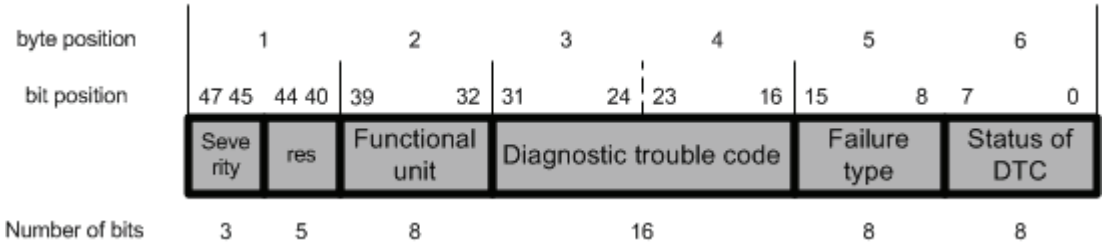


Figure A.1 — Diagnostic trouble code record for basic diagnostics

Table A.3 — Diagnostic trouble code (DTC) definition

Field name	Definition
Severity	severity information of a given DTC, as defined in A.3.2
Reserved	reserved by document for future use and shall always be transmitted as 00000_2
Functional unit	contains the functional unit a DTC belongs to, as given in A.3.5
Diagnostic trouble code	contains the base diagnostic trouble code, as specified in A.3.4
Failure type	contains the failure type information of a given DTC, as defined in A.3.3
Status of DTC	contains the status flags of a given DTC, as specified in ISO 14229-1

A.3.2 DTC severity definition

The mapping of the DTCSeverityMask/DTCSeverity parameters used with the ReadDTCInformation service shall be supported as specified in Figure A.2 with the definition given in Table A.4.

Figure A.2 — Severity information

Table A.4 — DTC severity definition

Field name	Definition
Reserved	This field shall be reserved for future definitions and shall always be reported as 00000_2.
Severity	The severity information of a given DTC defined as follows: — 000_2 (severity information not available); — 001_2 (driver information, for maintenance only); — 010_2 (driver information, check at next halt); — 100_2 (driver information, check immediately).

A.3.3 DTC failure type byte (FTB) definition

The failure type information shall be used as defined in ISO 15031-6.

A.3.4 Diagnostic trouble codes

The diagnostic trouble codes (DTCs) are server-specific and shall identify either a subcomponent or a functionality of the ECU of the diagnostic server. The DTC specifications of ISO 15031-6 can be used.

A.3.5 DTC functional unit definition

The DTC functional unit identifier shall be in accordance with Table A.5.

Table A.5 — DTC functional unit definition

Description	Functional unit identifier
Telematics (GPS, GSM)	0_{10}
General braking	1_{10}
ABS	2_{10}
EBS	3_{10}
Stability support	4_{10}
Retarder	5_{10}
Tyre	6_{10}
Suspension	7_{10}
Axle	8_{10}
Lift axle	9_{10}
Steering axle	10_{10}
General body application	11_{10}
Lights	12_{10}
Power take-off	13_{10}
Back-up assistance (rear obstacle detection, camera, etc.)	14_{10}
Security	15_{10}
Loading ramp application (lift, ramp control, etc.)	16_{10}
Temperature control (cooler, heater)	17_{10}
Temperature recorder	18_{10}
Auxiliary power unit	19_{10}
Local trailer communication (not ISO 11992)	20_{10}
On-board diagnostic/data recorder	21_{10}
Tractor power supply	22_{10}
Trailer battery power supply	23_{10}
Hitch (trailer coupling)	24_{10}
Tractor-trailer communication (ISO 11992)	25_{10}
Reserved	$26_{10} – 254_{10}$
Manufacturer specific	255_{10}

Annex B
(normative)

Address definitions

The physical addresses used on the data link between the towing and towed vehicles and of the local trailer network shall be in accordance with Tables B.1 and B.3. The functional addresses on the data link between the towing and towed vehicles and of the local trailer network shall be in accordance with Tables B.2 and B.4.

Table B.1 — Towing/towed vehicle data link — Physical addresses

Address		Name
0_{10} – 31_{10}	0_{16} – $1F_{16}$	Reserved
32_{10}	20_{16}	Tractor gateway for brakes and running gear equipment
33_{10} – 167_{10}	21_{16} – $A7_{16}$	Reserved
168_{10}	$A8_{16}$	Trailer #5 brakes and running gear equipment
169_{10}	$A9_{16}$	Trailer #5 equipment other than brakes and running gear equipment
170_{10} – 175_{10}	AA_{16} – AF_{16}	Reserved
176_{10}	$B0_{16}$	Trailer #4 brakes and running gear equipment
177_{10}	$B1_{16}$	Trailer #4 equipment other than brakes and running gear equipment
178_{10} – 183_{10}	$B2_{16}$ – $B7_{16}$	Reserved
184_{10}	$B8_{16}$	Trailer #3 brakes and running gear equipment
185_{10}	$B9_{16}$	Trailer #3 equipment other than brakes and running gear equipment
186_{10} – 191_{10}	BA_{16} – BF_{16}	Reserved
192_{10}	$C0_{16}$	Trailer #2 brakes and running gear equipment
193_{10}	$C1_{16}$	Trailer #2 equipment other than brakes and running gear equipment
194_{10} – 199_{10}	$C2_{16}$ – $C7_{16}$	Reserved
200_{10}	$C8_{16}$	Trailer #1 brakes and running gear equipment
201_{10}	$C9_{16}$	Trailer #1 equipment other than brakes and running gear equipment
202_{10} – 234_{10}	CA_{16} – EA_{16}	Reserved
235_{10}	EB_{16}	Tractor gateway for equipment other than brakes and running gear
236_{10} – 255_{10}	EC_{16} – FF_{16}	Reserved

NOTE These addresses are also defined in ISO 11992-2 and ISO 11992-3.

Table B.2 — Towing/towed vehicle data link — Functional addresses

Address		Name
0_{10} – 254_{10}	0_{16} – FE_{16}	Reserved
255_{10}	FF_{16}	GLOBAL (all/any node)

Table B.3 — Trailer local network — Physical addresses

Address		Name
0_{10}	0_{16}	Trailer gateway application
1_{10}	1_{16}	Trailer gateway for brakes and running gear, local address
2_{10}	2_{16}	Trailer gateway for equipment other than brakes and running gear, local address
3_{10} – 254_{10}	3_{16} – FE_{16}	System or vehicle manufacturer specific
255_{10}	FF_{16}	Reserved

Table B.4 — Trailer local network — Functional addresses

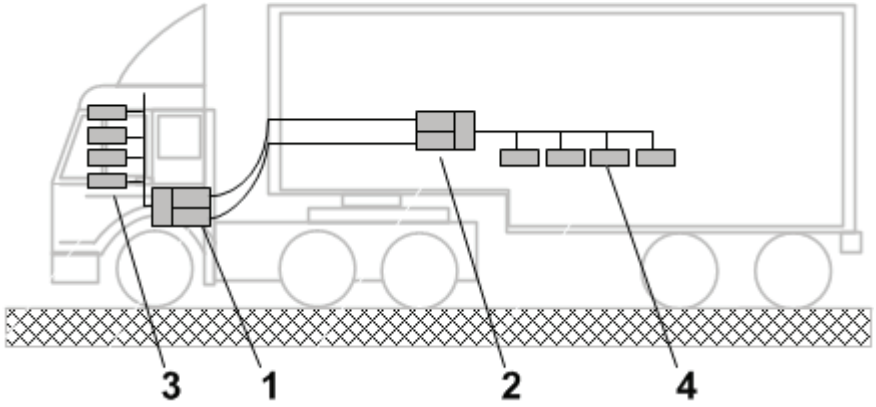
Address		Name
0_{10} – 254_{10}	0_{16} – FE_{16}	System or vehicle manufacturer specific
255_{10}	FF_{16}	GLOBAL (all/any node)

Annex C
(informative)

Message routing examples

C.1 Routing example — Commercial vehicle to towed vehicle

The example in Figure C.1 shows a diagnostic communication between a tractor on-board tester (client) and a trailer's ECU (server).



Key

1 tractor gateway(s)
2 trailer gateway (s)
3 client (on-board tester)
4 server (trailer's local ECU)

Figure C.1 — Commercial vehicle/towed vehicle data network

The diagnostic communication message flow for a physical-addressed request is shown in Figure C.2 with the following configurations:

— The tractor and trailer's local network is SAE J1939 based and uses a mixed addressing format for the diagnostic communication.

— Used addresses are given in Table C.1.

Table C.1 — Message routing example — Used addresses

Address		Entity
250_{10}	FA_{16}	Client local address
32_{10}	20_{16}	Tractor gateway address
200_{10}	$C8_{16}$	Trailer gateway address
01_{10}	01_{16}	Trailer local gateway address
10_{10}	10_{16}	Server local address

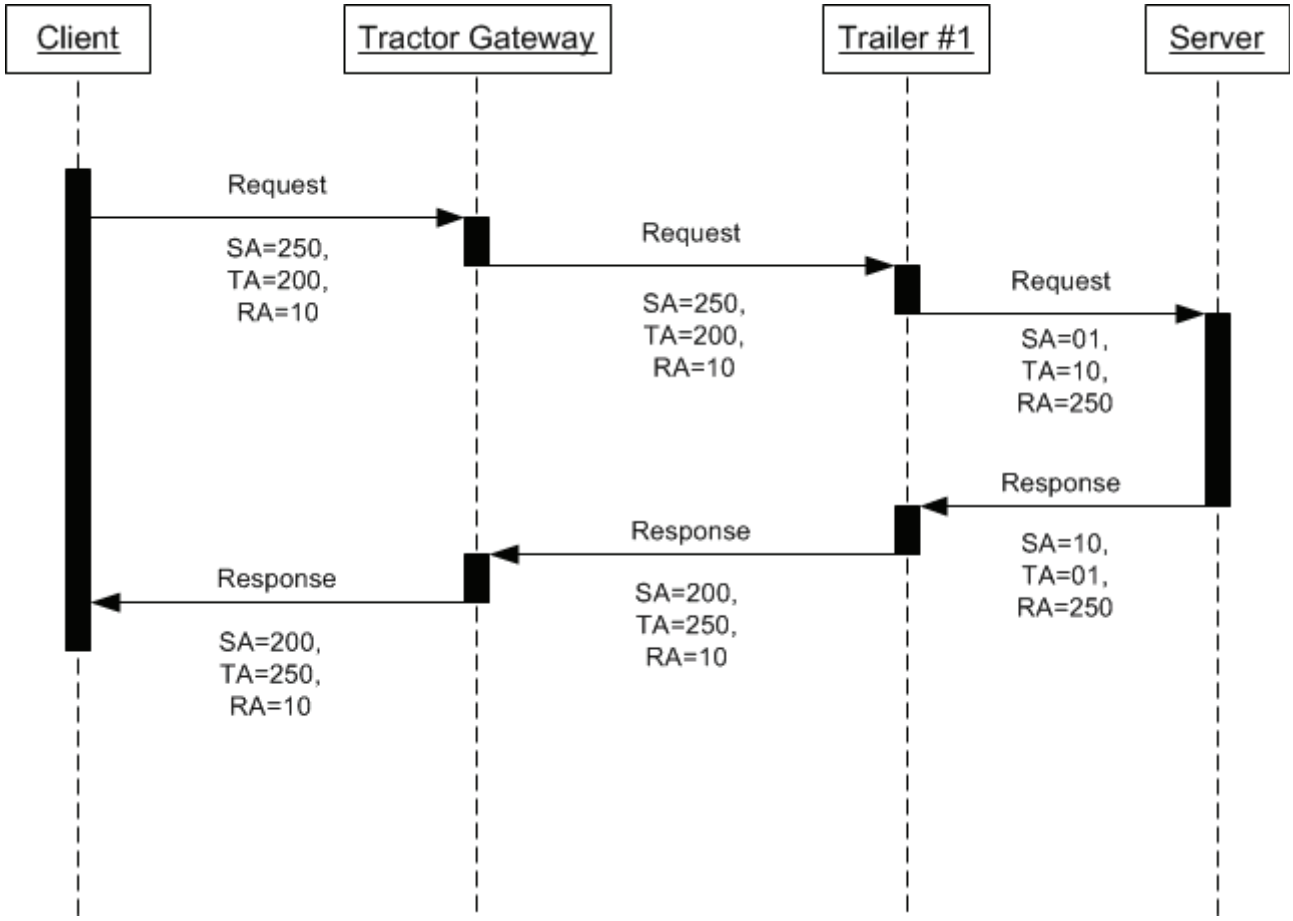


Figure C.2 — Commercial vehicle/towed vehicle data message flow

C.2 Routing example — Towed vehicle to towed vehicle

The examples given in this subclause show two diagnostic communication scenarios between a trailer on-board tester (client) and a trailer's ECU (server) in different combinations.

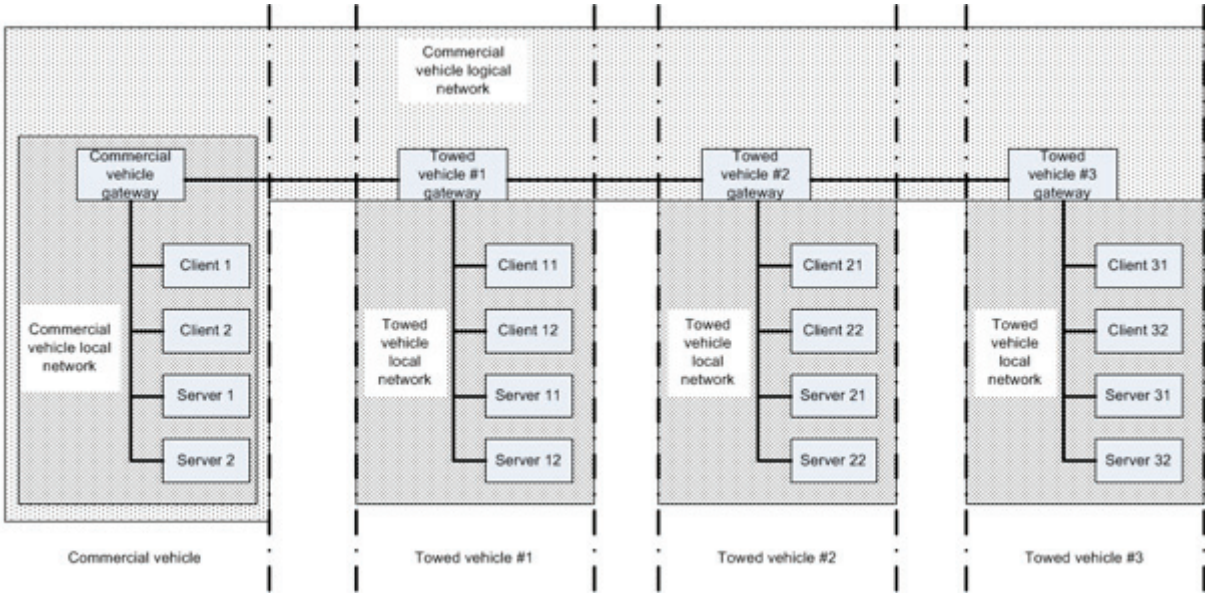


Figure C.3 — Towed vehicle/towed vehicle data network

For this example, the diagnostic communication message flow for a physical-addressed request is shown in Figure C.4 with the following configurations:

— Both the trailer local networks use the subnet addressing format for diagnostic communication.

— Used addresses are given Table C.2.

Table C.2 — Message routing example — Used addresses

Address	Entity
$7C9_{16}/6$	Client 11 global address
$7C0_{16}/6$	Trailer gateway #1 network address
$780_{16}/6$	Trailer gateway #2 network address
$781_{16}/6$	Server 21 global address

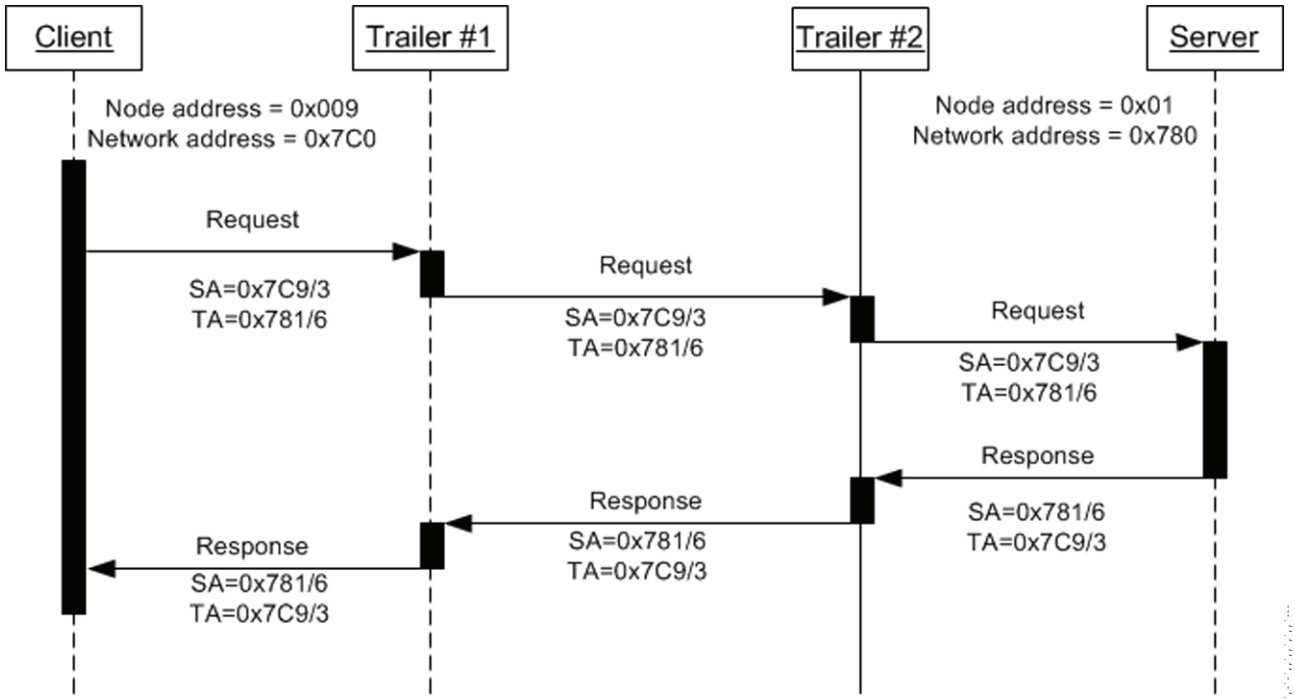


Figure C.4 — Towed vehicle #1/towed vehicle #2 data message flow

C.3 Routing example — Segmented message flow

This example shows the diagnostic message flow for a single-frame request sent by a client in the commercial vehicle network and a segmented message response from a server located at trailer #2 including the relevant application and network layer timing.

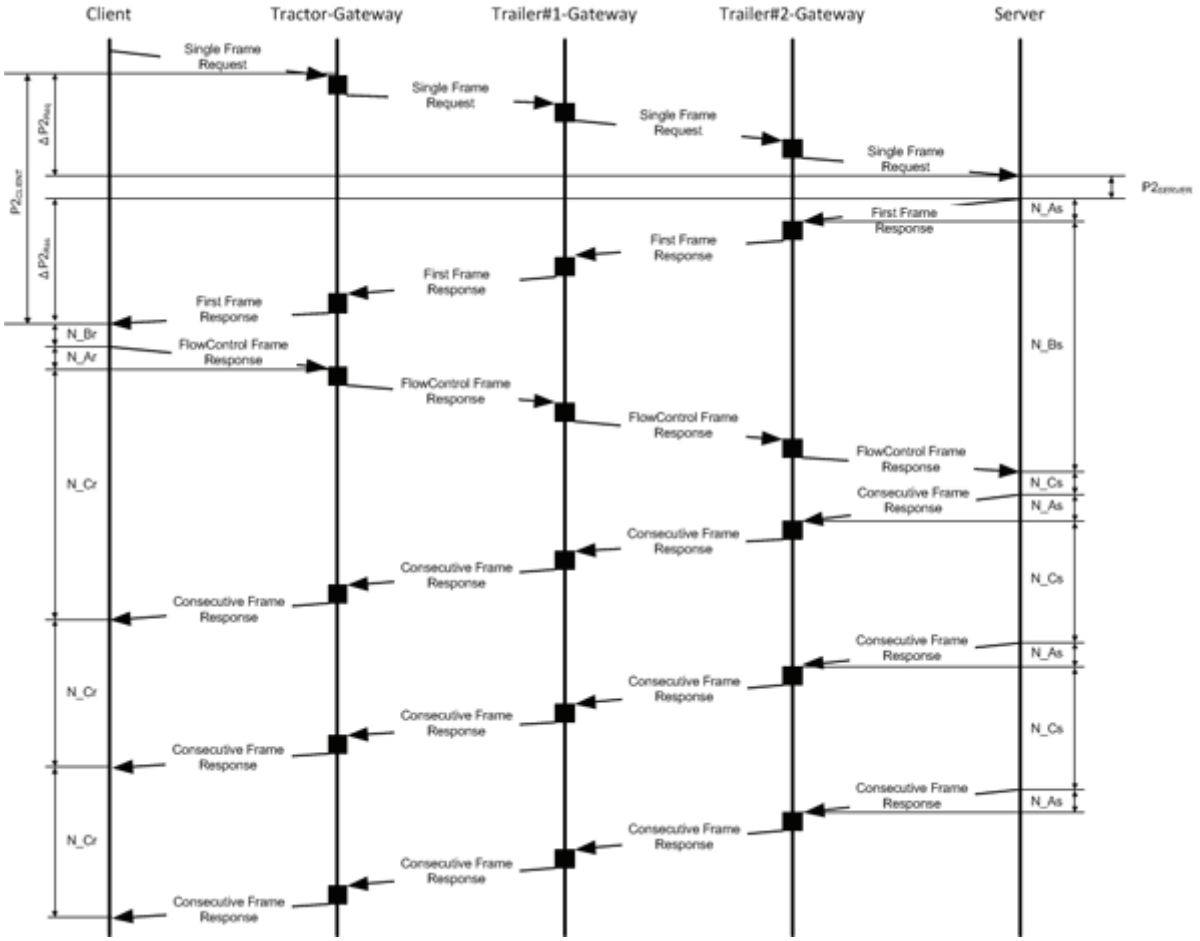


Figure C.5 — Gateway implementation example

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