INTERNATIONAL STANDARD

ISO
11992-4

Third edition
2023-04

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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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This third edition cancels and replaces the second edition (ISO 11992-4:2014), which has been technically revised.

The main changes are as follows:

— introduction of requirement structure with numbering and name;

— introduction of application requirements;

— introduction of OSI layers related requirements;

— clarification on gateway network address translation (deleted subnet addressing subclause).

A list of all parts in the ISO 11992 series can be found on the ISO website.

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

Introduction

The ISO 11992 series specifies the interchange of digital information between road vehicles with a maximum authorised total mass greater than 3 500 kg, and towed vehicles, including communication between towed vehicles in terms of parameters and requirements of the lower OSI layers (physical and data link layer) of the electrical connection used to connect the electrical and electronic systems.

This document is structured according to the Open Systems Interconnection (OSI) Basic Reference Model, in accordance with ISO/IEC 7498-1 and ISO/IEC 10731, which structures communication systems into seven layers. When mapped on this model, the application layer protocol and data link layer framework requirements specified/referenced in the ISO 11992 series are structured according to Figure 1.

Figure 1 illustrates a simplified communication framework:

— vehicle normal communication framework,

— vehicle diagnostic communication framework,

— vehicle-specific use case framework, and

— vehicle lower-layers framework.

The vehicle normal communication framework is composed of ISO 11992-2 and ISO 11992-3.

The vehicle diagnostic communication framework is composed of ISO 14229-1, ISO 14229-2, ISO 14229-3 and this document.

The vehicle-specific use case framework is composed of this document, ISO 22901-1 or vehicle manufacturer-specific diagnostic data definition.
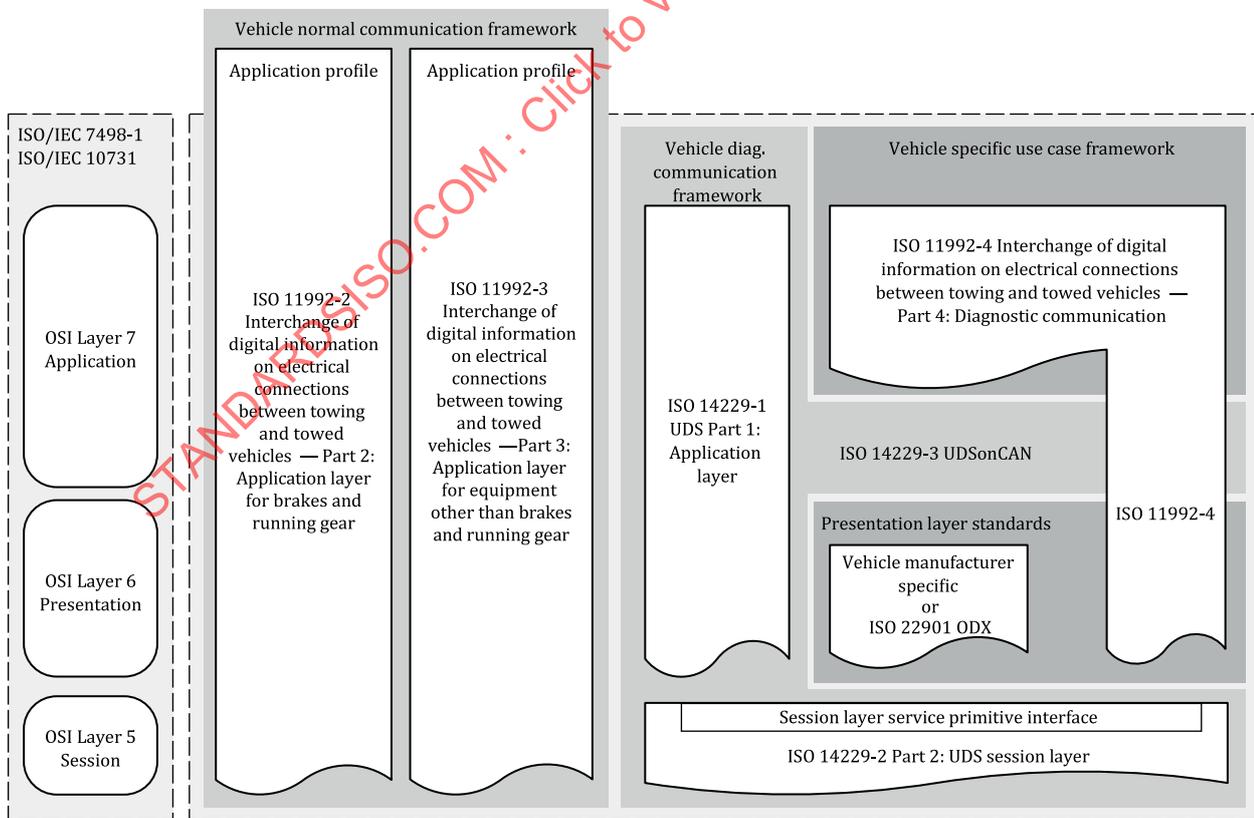
Figure 1 — ISO documents reference according to the OSI model

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

Part 4:
Diagnostic communication

1 Scope

This document specifies diagnostic application requirements and OSI-layer related communication profiles to ensure the interchange of digital information between towing and towed vehicles with a maximum authorized total mass greater than 3 500 kg.

The conformance and interoperability test plans are not part of this document.

2 Normative references

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

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

ISO 11992-2:2023, *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles — Part 2: Application layer for brakes and running gear*

ISO 11992-3:2021, *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, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Application layer*

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

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

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

ISO 15765-5, *Road vehicles — Diagnostic communication over Controller Area Network (DoCAN) — Part 5: Specification for an in-vehicle network connected to the diagnostic link connector*

SAE J1939-21, *Data Link Layer*

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 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

1

— IEC Electropedia: available at https://www.electropedia.org/

3.1
mandatory
M
keyword indicating an item that is required to be implemented as defined in this document to claim compliance with this document

[SOURCE: ISO/IEC 14776-113:2002, 3.3.3, modified — The word "standard" has been replaced by "document".]

4   Symbols and abbreviated terms

4.1   Symbols

—   empty table cell or feature undefined

4.2   Abbreviated terms

CEFF   classical extended frame format

ComProfile   communication profile

Cvt   convention

DA   destination address (see SAE J1939-21)

DP   data page (see SAE J1939-21)

ECU   electronic control unit

EDP   extended data page (see SAE J1939-21)

GW   gateway

M   mandatory

NAT   network address translation

P   priority (see SAE J1939-21)

PDU   protocol data unit

PF   PDU format (see SAE J1939-21)

PGN   parameter group number (see SAE J1939-21)

PS   PDU specific: destination address or group extension (see SAE J1939-21)

USDT   unacknowledged segmented data transfer

VIN   vehicle identification number

5   Conventions

This document is based on the conventions used in ISO 14229-1 and the underlying OSI Service Conventions (ISO/IEC 10731) 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.

6 Vehicle network architecture

Figure 2 shows a possible road train configuration.

Key

1   towing vehicle 0
2   towed vehicle 1
3   towed vehicle 2 (dolly)
4   towed vehicle 3
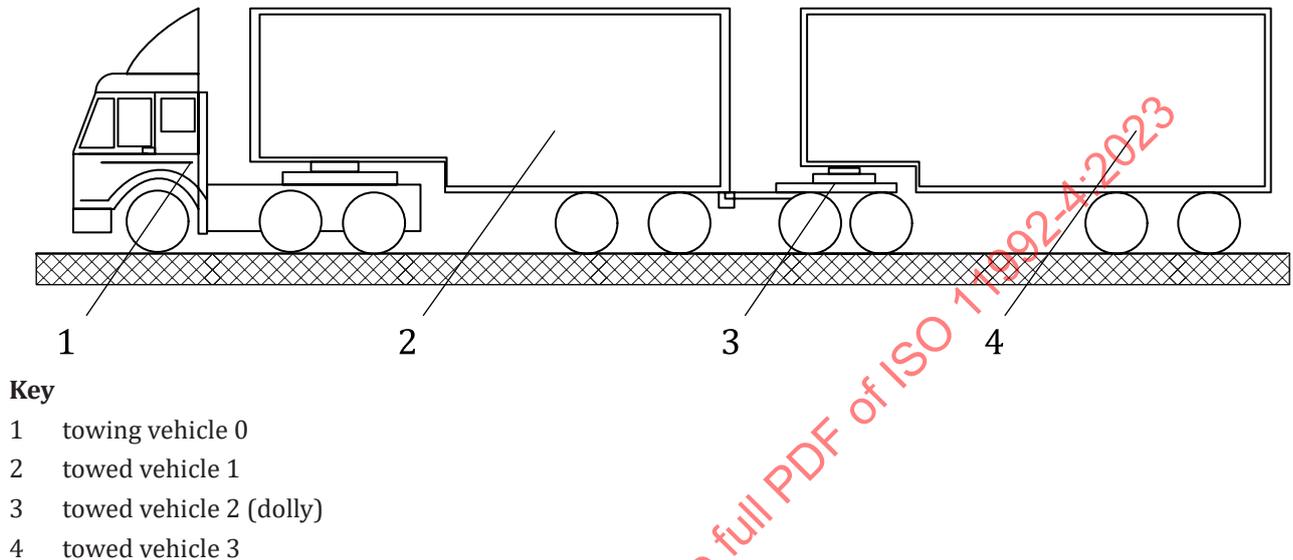
Figure 2 — Example of a possible road train configuration

Figure 3 shows the vehicle network architecture. The external client 0.0 (external test equipment) connects to the vehicle's diagnostic connector.

The gateway 0.0 of vehicle 0 connects the in-vehicle network(s) (Figure 3, key a), which is (are) comprised of, e.g. network(s) Figure 3, keys 4 and 5 with an internal client 0.0 and servers (0.1 to 0.A). It also connects vehicle 0 to the gateway 1.0 of vehicle 1 with a logical communication link Figure 3, key 2 based on ISO 11992-2 and Figure 3, key 3 based on ISO 11992-3.

Gateway 1.0 of vehicle 1 connects the in-vehicle network(s) (Figure 3, key a), which is (are) comprised of, e.g. network(s) Figure 3, keys 4 and 5 with servers (1.1 to 1.B). It also connects vehicle 1 to the gateway 2.0 (3.0, 4.0, 5.0) of vehicle 2 (3, 4, 5) with a logical communication link Figure 3, key 2 based on ISO 11992-2 and Figure 3, key 3 based on ISO 11992-3.
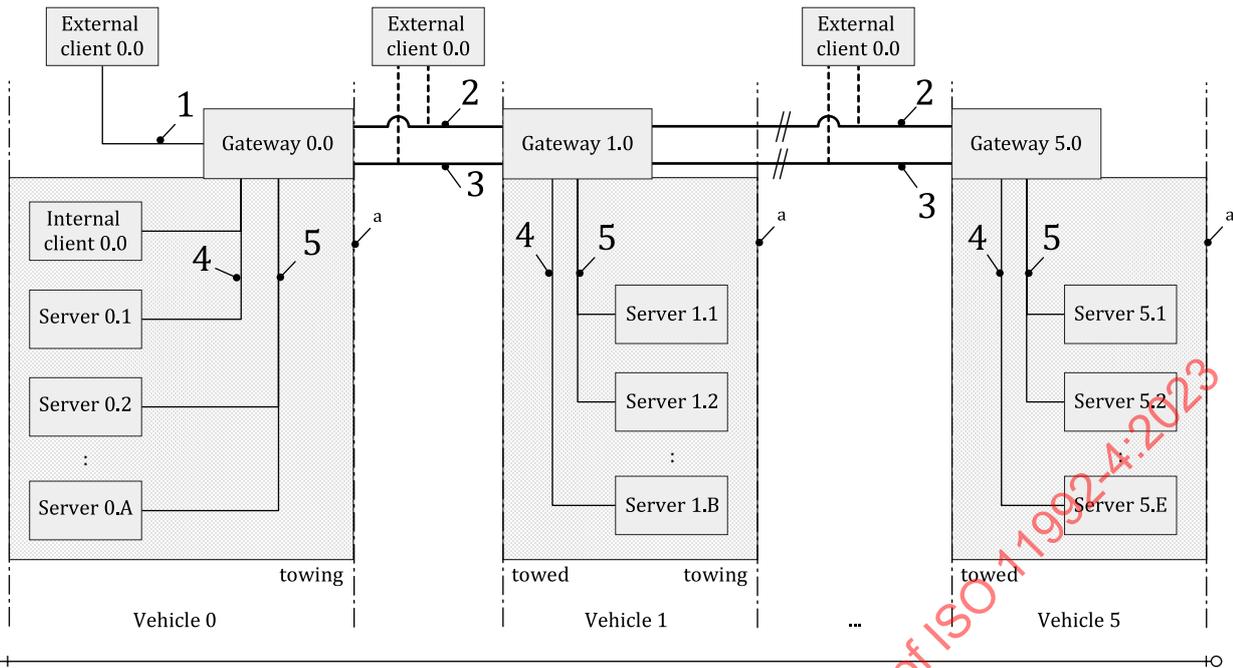
Key

1　　external diagnostic connection: ISO 11898 CAN, ISO 13400 Ethernet

2　　ISO 11992-2 messages on ISO 11992-1 communication link

3　　ISO 11992-3 messages on ISO 11992-1 communication link

4　　ISO 11992-2 messages on ISO 11992-1 communication link

5　　ISO 11992-3 messages on ISO 11992-1 communication link

a　　In-vehicle network(s): e.g. ISO 11992-2, ISO 11992-3, the ISO 17987 series, the ISO 20794 series, ISO/IEC/ IEEE 8802.3, discrete connection.

Figure 3 — Logical vehicle network architecture

The diagnostic communication addressing scheme is initiated from the client (external or internal) to one (physical: point to point addressing) or multiple (functional: one to many addressing) servers.

There is no mechanism specified in this document to synchronise multiple clients.

7　Non OSI-layer-related technical requirements overview

Tables 1 and 2 provide an overview about non OSI-layer-related technical requirements and associated requirement numbers.

Table 1 — Abstract service primitive interface-related technical requirements overview

ASP#.REQ#	Technical requirement title
0	**Abstract service primitive interface (ASP) definition**
0.1	ASP – A_Data.req, A_Data.ind, and A_Data.con service primitive interface
0.2	ASP – Abstract service primitive interface parameters
0.3	ASP – Applicable A_Data service interface parameters
0.4	ASP – Data type definitions
0.5	ASP – Mtype, message type
0.6	ASP – TAtype, target address type
0.7	ASP – AE, address extension

Table 1 *(continued)*

ASP#.REQ#	Technical requirement title
0.8	ASP – TA, target address
0.9	ASP – SA, source address
0.10	ASP – Length, length of PDU
0.11	ASP – PDU, protocol data unit
0.12	ASP – Result, result

Table 2 — Application-related technical requirements overview

APP#.REQ#	Technical requirement title
8	**Application**
8.1	APP – Data identifier (DID) definition
8.2	APP – DTC field definition
8.3	APP – DTC functional unit definition
8.4	APP – Negative response code (NRC)
8.5	APP – Communication profile (ComProfile)

8   Abstract service primitive interface (ASP) definition

8.1   ASP – A_Data.req, A_Data.ind, and A_Data.con service primitive interface

The definitions in this document follow the abstract service primitive interface definition in the ISO 14229-1 specification.

REQ	0.1 ASP – A_Data.req, A_Data.ind, and A_Data.con service primitive interface
The `A_Data.req`, `A_Data.ind`, and `A_Data.con` abstract service primitive interface shall be implemented as specified in ISO 14229-1.	

The service interface defines the service and parameter mapping to the application and the lower OSI layers.

Figure 4 shows the `A_Data.req` (request), `A_Data.ind` (indication) and `A_Data.con` (confirmation) service interface.
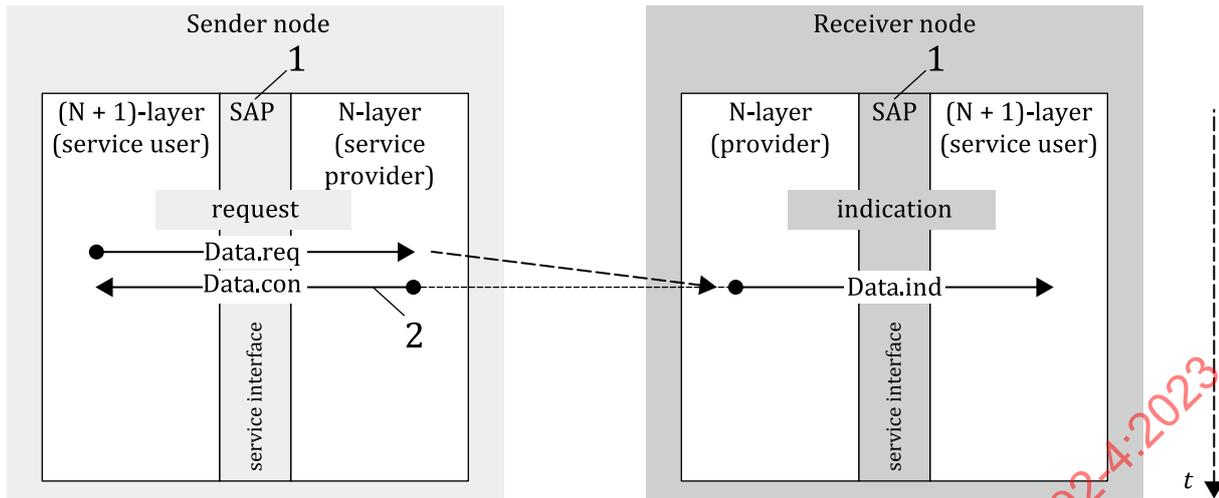
Key

t time

1 service access point

2 read back from N-layer service provider

Figure 4 — A_Data.req, A_Data.ind, and A_Data.con service interface

8.2 ASP – Service interface parameters

8.2.1 General

The abstract service primitive interface parameters are used by the management of the OSI-layers.

REQ	0.2 ASP – ISO 14229-1 service interface parameters
The service primitive interface parameters shall be implemented as specified in ISO 14229-1.	

REQ	0.3 ASP – Applicable A_Data service interface parameters
The A_Data abstract service primitives shall use the service primitive parameters as specified in Table 3.	

Table 3 — A_Data abstract service primitive parameters

ASP parameter	.req	.ind	.con	Description
A_Mtype	X	X	—	message type [RDiagMixAddr]: remote diagnostics mixed addressing
A_AI[TAtype]	X	X	X	target address type [functional, physical]
A_AI[SA]	X	X	X	source address
A_AI[TA]	X	X	X	target address
A_AI[AE]	X	X	X	address extension
A_Length	X	X	—	length of PDU
A_Data	X	X	—	A_PDU data
A_Result	—	X	X	result of service primitive interface execution

8.2.2 ASP – Data type definitions

REQ	0.4 ASP – Data type definitions
The data types shall be in accordance to: — `Enum`: 8-bit enumeration, — `Unsigned Byte`: 8-bit unsigned numeric value, — `Unsigned Word`: 16-bit unsigned numeric value, — `Unsigned Long`: 32-bit unsigned numeric value, — `Byte Array`: sequence of 8-bit aligned data, — `Bit String`: 8-bit binary coded.	

8.2.3 ASP – Mtype, message type

REQ	0.5 ASP – Mtype, message type
The `Mtype` parameter shall be of data type `Enum` and shall be used to identify the message type and range of address information included in a service call. Range: [`RDiagMixAddr`]	

8.2.4 ASP – TAtype, target address type

REQ	0.6 ASP – TAtype, target address type
The `TAtype` parameter shall be of data type `Enum` and shall be used to identify the target address type to be used with the request address. Range: [`physical`, `functional`]	

8.2.5 ASP – AE, address extension

REQ	0.7 ASP – AE, address extension
The `AE` parameter shall be of data type `Unsigned Word` and shall be used to extend the available address range for large networks and to encode both, sending and receiving network layer entities of sub-networks other than the local network where the communication takes place. `AE` is only part of the addressing information if Mtype is set to remote diagnostics (`RDiagMixAddr`). Range: [0000_{16} to $FFFF_{16}$]	

8.2.6 ASP – TA, target address

REQ	0.8 ASP – TA, target address
The `TA` parameter shall be of data type `Unsigned Word` and shall contain the target address of the node. Range: [0000_{16} to $FFFF_{16}$]	

8.2.7 ASP – SA, source address

REQ	0.9 ASP – SA, source address
The `SA` parameter shall be of data type `Unsigned Word` and shall contain the source address of the node. Range: [0000_{16} to $FFFF_{16}$]	

8.2.8 ASP – Length, length of PDU

REQ	0.10 ASP – Length, length of PDU
The `Length` parameter shall be of data type `Unsigned Byte` and shall contain the length of the PDU to be transmitted/received. Range: [00_{16} to FF_{16}]	

8.2.9 ASP – PDU, protocol data unit

REQ	0.11 ASP – PDU, protocol data unit
The `PDU` parameter shall be of data type `Byte Array` and shall contain the message data (PDU) content of the request or response message to be transmitted/received. Range: [00_{16} to FF_{16}]	

8.2.10 ASP – Result, result

REQ	0.12 ASP – Result, result
The `Result` parameter shall be of data type `Bit String` and shall contain the status relating to the outcome of a service execution (request field and response field sequence). If two or more errors are discovered at the same time, then the application layer entity shall set the appropriate error bit in the `Result` parameter. Range: [`OK`, `Err_AL_Length`, `Err_TL_PCI_Type`, `Err_TL_PCI_SF_DL_Value`, `Err_NL_AddrFmt`, `Err_DLL_Byte`] The result `OK` shall be issued to the service user when the service execution is successfully completed. The `OK` shall be issued to a service user on both the sender and receiver side. The `ERR_...` shall be issued to the service user when an error is detected by a lower layer (provider). The `ERR_...` shall be issued to the service user on both, the sender and receiver side.	

9 Application

9.1 APP – Addressing of requested information

The functional addressing by towed vehicles may be supported.

9.2 APP – Data identifier (DID) definition

The diagnostic DID(s) are used by the client to request information elements associated to the DID number.

REQ	8.1 APP – Data identifier (DID) definition
A server/ECU on the ISO 11992 network shall follow the DID(s) as specified in Table 4.	

The definition of the DID is specified in ISO 14229-1.

Table 4 — Data Identifier (DID) definition

DID value	Definition	Cvt
$F001_{16}$	NetworkConfigurationData – BrakesAndRunningGearTrailerRemoteAddress	M
$F002_{16}$	NetworkConfigurationData – GeneralPurposeTrailerRemoteAddress	M
$F00F_{16}$	Supported data identifiers	M
$F18D_{16}$	SupportedFunctionalUnits	M
$F190_{16}$	VIN	M

Table 4 *(continued)*

DID value	Definition	Cvt
$F197_{16}$	SystemNameOrEngineType	M

9.3 APP – DTC field definition

The DTC field contains additional information related to a reported DTC.

REQ	8.2 APP – DTC field definition
A server/ECU on the ISO 11992 network shall follow the DTC field definition as specified in Table 5.	

Table 5 — DTC field definition

Field name	Definition	Cvt
DTCSeverity	This field contains severity information of a given DTC, as specified in ISO 14229-1.	M
DTCClass	This field contains class information of a given DTC and shall be set to $0\ 0000_2$.	M
DTCFunctionalUnit	This field contains the functional unit identifier of a given DTC, as specified in Table 6.	M
DTCFormatIdentifier	This field contains the ISO_11992-4_DTCFormat of a given DTC, as specified in ISO 14229-1.	M
DTCRecord	This field contains the base DTC number in the DTCRecord [high byte, middle byte], as specified in ISO 14229-1.	M
DTCFailure type	This field contains the failure type information of a given DTC in the DTCRecord [low byte], as specified in ISO 14229-1.	M
StatusOfDTC	This field contains the status flags of a given DTC, as specified in ISO 14229-1.	M

9.4 APP – DTC functional unit definition

The DTC functional unit provides information about the electronic system/device the reported DTC belongs to.

REQ	8.3 APP – DTC functional unit definition
A server/ECU on the ISO 11992 network shall follow the DTC functional unit as specified in Table 6.	

Table 6 — DTC functional unit definition

DTC functional unit name	Functional unit identifier
Telematics (GPS, GSM)	00_{16}
General braking	01_{16}
ABS	02_{16}
EBS	03_{16}
Stability support	04_{16}
Retarder	05_{16}
Tyre	06_{16}
Suspension	07_{16}
Axle	08_{16}
Lift axle	09_{16}
Steering axle	$0A_{16}$
General body application	$0B_{16}$
Lights	$0C_{16}$

Table 6 *(continued)*

DTC functional unit name	Functional unit identifier
Power take-off	$0D_{16}$
Back-up assistance (rear obstacle detection, camera, etc.)	$0E_{16}$
Security	$0F_{16}$
Loading ramp application (lift, ramp control, etc.)	10_{16}
Temperature control (cooler, heater)	11_{16}
Temperature recorder	12_{16}
Auxiliary power unit	13_{16}
Local (towing, towed) vehicle communication	14_{16}
On-board diagnostic/data recorder	15_{16}
Towing vehicle power supply	16_{16}
Towed vehicle battery power supply	17_{16}
Hitch (towed vehicle coupling)	18_{16}
Towing vehicle to towed vehicle communication (ISO 11992)	19_{16}
Reserved	20_{16} to FE_{16}
Manufacturer specific	FF_{16}

9.5 APP – Negative response code (NRC)

The diagnostic NRC(s) specifies the reason for a diagnostic service request to be rejected by a server.

REQ	8.4 APP – Negative response code (NRC)
A server/ECU on the ISO 11992 network shall follow the NRCs as specified in Table 7.	

The NRCs specified in this document are a subset of the specification in ISO 14229-1. The definitions of the NRCs in Table 7 are specified in ISO 14229-1.

Table 7 — Negative response codes (NRC)

NRC value	Definition	Cvt
10_{16}	GeneralReject	M
11_{16}	ServiceNotSupported	M
12_{16}	SubFunctionNotSupported	M
21_{16}	BusyRepeatRequest	M
31_{16}	RequestOutOfRange	M
78_{16}	RequestCorrectlyReceived-ResponsePending	M

9.6 APP – Communication profile (ComProfile)

REQ	8.5 APP – Communication profile (ComProfile)
The application(s) in the server/ECU utilizing the ISO 11992 network shall follow the application timing parameters as specified in Table 8 and the parameter as specified in Table 9.	

Table 8 — Application timing ComProfile parameters

Parameter	Minimum value [ms]	Maximum value [ms]	Definition
t_{P2_Server}	0	50	see ISO 14229-2
Δt_{P2}	0	200	see ISO 14229-2

Table 8 *(continued)*

Parameter	Minimum value [ms]	Maximum value [ms]	Definition
t_{P2_Client}	250	–	see ISO 14229-2
t_{P2*_Server}	0	5 000	see ISO 14229-2
t_{P2*_Client}	5 200	–	see ISO 14229-2

Table 9 — Application message ComProfile parameter

Parameter	Minimum value	Maximum value	Definition
$C_{A\_PDU\_Length}$	01_{16}	FF_{16}	application protocol data unit (message) length

10 OSI-layers-related technical requirements overview

Table 10 provides an overview about OSI-layers-related technical requirements and associated requirement numbers.

Table 10 — OSI-layers-related technical requirements overview

OSI#.REQ#	Technical requirement title
7	**Application layer**
7.1	AL – UDSonCAN-specific requirements
7.2	AL – No UDSonCAN-specific requirements
7.3	AL – Not supported requirement
7.6	AL – Applicable ReadDtcInformation service subFunctions
7.7	AL – Application layer communication profile (ComProfile)
6	**Presentation layer**
---	No requirement statement in this document.
5	**Session layer**
5.1	SL – Service primitive interface parameter definition
5.2	SL – S_Data.req, S_Data.ind, and S_Data.con service interface
5.3	SL – Service primitive interface AL to SL parameter mapping
5.4	SL – Session layer communication profile (ComProfile)
4	**Transport layer**
4.1	TL – USDT service primitive interface parameter definition
4.2	TL – T_Data.req, T_Data.ind, and T_Data.con service interface
4.3	TL – Service primitive interface SL to TL parameter mapping
4.4	TL – Transport protocol
4.5	TL – Transport layer communication profile (ComProfile)
3	**Network layer**
3.1	NL – Service primitive interface parameter definition
3.2	NL – N_Data.req, N_Data.ind, and N_Data.con service interface
3.3	NL – Service primitive interface TL to NL parameter mapping
3.4	NL – Network layer services
3.5	NL – Network layer communication profile (ComProfile)
3.6	NL – Diagnostic CAN identifier configuration
3.7	NL – Dynamic network address assignment – NL – address assignment of TTN_1 and TTN_3

Table 10 *(continued)*

OSI#.REQ#	Technical requirement title
3.8	NL – Dynamic network address assignment – NL – address assignment of TTN_2 and TTN_4
3.9	NL – Static network address assignment – NL – address assignment of gateway application, IVN_1, and IVN_2
3.10	NL – Static network address assignment – NL – server address assignment of IVN_1 and IVN_2
3.11	NL – Network address translation – from GW TTN_1 to GW TTN_3 and GW TTN_2 to GW TTN_4
3.12	NL – Network address translation – from GW TTN_1/TTN_2 to server on IVN_1/IVN_2
3.13	NL – Network address translation – server address mapping
3.14	NL – Network address translation – from GW IVN_1/IVN_2 to GW TTN_1/TTN_2
3.15	NL – Network address translation – from GW TTN_3 to GW TTN_1 and GW TTN_4 to GW TTN_2
3.16	NL – Diagnostic communication port (DCP)
2	**Data link layer**
2.1	DL – Service primitive interface parameter definition
2.2	DL – L_Data.req, L_Data.ind, and L_Data.con service interface
2.3	DL – Service primitive interface NL to DL parameter mapping
2.4	DL – CAN data frame – extended frame format
2.5	DL – CAN data frame – CAN remote frame
2.6	DL – Data link layer communication profile (ComProfile)
1	**Physical layer**
1.1	PHY – ISO 11992-1

11 Application layer

11.1 AL – Diagnostic services overview

The purpose of Table 11 is to reference ISO 14229-1, ISO 14229-2 and ISO 14229-3 services as they are applicable for this document. Table 11 contains the applicable diagnostic services.

REQ	7.1 AL – UDSonCAN specific requirements
Services that are marked "UDSonCAN-specific requirements" (ISO 14229-3) shall be implemented as specified in the referenced subclause number in accordance with Table 11 "Reference" column.	

REQ	7.2 AL – No UDSonCAN-specific requirements
Services specified in Table 11 that are marked "No UDSonCAN-specific requirements" (ISO 14229-3) shall follow ISO 14229-1, ISO 14229-2 and ISO 14229-3 with no additional restrictions.	

REQ	7.3 AL – Not supported requirement
Services specified in Table 11 that are marked "Not supported" shall not be implemented.	

Table 11 — Overview of applicable ISO 14229-1-defined services

Functional unit name	Diagnostic service name	Comment	Reference
Diagnostic and communication management	DiagnosticSessionControl	No UDSonCAN-specific requirements	—
	ECUReset	No UDSonCAN-specific requirements	—
	SecurityAccess	No UDSonCAN-specific requirements	—
	CommunicationControl	UDSonCAN-specific requirements	see 11.2
	TesterPresent	No UDSonCAN-specific requirements	—
	Authentication	Not supported	—
	SecuredDataTransmission	No UDSonCAN-specific requirements	—
	ControlDTCSetting	No UDSonCAN-specific requirements	—
	ResponseOnEvent	Not supported	—
	LinkControl	Not supported	—
Data transmission	ReadDataByIdentifier	UDSonCAN-specific requirements	see 11.3
	ReadMemoryByAddress	No UDSonCAN-specific requirements	—
	ReadScalingDataByIdentifier	No UDSonCAN-specific requirements	—
	ReadDataByPeriodicIdentifier	Not supported	—
	DynamicallyDefineDataIdentifier	No UDSonCAN-specific requirements	—
	WriteDataByIdentifier	No UDSonCAN-specific requirements	—
	WriteMemoryByAddress	No UDSonCAN-specific requirements	—
Stored data transmission	ReadDTCInformation	UDSonCAN-specific requirements	see 11.4
	ClearDiagnosticInformation	UDSonCAN-specific requirements	—
Input/output control	InputOutputControlByIdentifier	No UDSonCAN-specific requirements	—
Remote activation of routine	RoutineControl	No UDSonCAN-specific requirements	—
Upload/download	RequestDownload	No UDSonCAN-specific requirements	—
	RequestUpload	No UDSonCAN-specific requirements	—
	TransferData	No UDSonCAN-specific requirements	—
	RequestTransferExit	No UDSonCAN-specific requirements	—
	RequestFileTransfer	No UDSonCAN-specific requirements	—

11.2 AL – CommunicationControl

The CommunicationControl service is used to enable/disable normal communication on the network.

REQ	7.4 AL – CommunicationControl
The disabling of normal communication on the ISO 11992-2 network during normal operating conditions, e.g. driving, between towing and towed vehicles shall not be permitted.	

11.3 AL – ReadDataByIdentifier

The ReadDataByIdentifier service is used to retrieve static and dynamic data for diagnostic purposes.

REQ	7.5 AL – ReadDataByIdentifier
The number of dataIdentifiers (DIDs) in a ReadDataByIdentifier request message shall be limited to one DID.	

11.4 AL – ReadDtcInformation

11.4.1 AL – General

The ReadDtcInformation service allows a client to read the status of the server's resident DTC information from any server or group of servers on a vehicle's network, as specified in ISO 14229-1.

11.4.2 AL – Applicable ReadDtcInformation service subFunctions

The ReadDtcInformation service supports the following subFunctions.

REQ	7.6 AL – Applicable ReadDtcInformation service subFunctions

Each client and server shall support the ReadDtcInformation service with the following subFunctions, as specified in ISO 14229-1:
 	
— retrieve the number of DTCs matching a client-defined severity mask:
    reportType = reportNumberOfDTCBySeverityMaskRecord;
 	
— retrieve the list of DTCs matching a client-defined severity mask record:
    reportType = reportDTCBySeverityMaskRecord;
 	
— retrieve the severity information for a client-defined DTC:
    reportType = reportSeverityInformationOfDTC.	

Other subFunctions, as specified in ISO 14229-1, can be supported.

11.5 AL – Application layer communication profile (ComProfile)

REQ	7.7 AL – Application layer communication profile (ComProfile)
The application layer in the server/ECU utilizing the ISO 11992 network shall follow the application layer timing parameters as specified in Table 12.	

Table 12 — Application layer timing ComProfile parameters

Parameter	Definition	Minimum value ms	Maximum value ms
t_{P2_Server}	see ISO 14229-2	0	5 200

12 Presentation layer

The presentation layer specification is not in the scope of this document.

13 Session layer

13.1 SL – Service primitive interface parameter definition

REQ	5.1 SL – Service primitive interface parameter definition
The SL service primitive interface parameters shall follow ISO 14229-2.	

13.2 SL – S_Data.req, S_Data.ind, and S_Data.con service interface

REQ	5.2 SL – S_Data.req, S_Data.ind, and S_Data.con service interface
The S_Data.req, S_Data.ind, and S_Data.con service interface shall follow ISO 14229-2.	

13.3 SL – Service primitive interface AL to SL parameter mapping

REQ	5.3 SL – Service primitive interface AL to SL parameter mapping
The parameter mapping of the service primitive interface shall be implemented as specified in Table 13.	

Table 13 — Service primitive interface AL to SL parameter mapping

Service primitive interface AL parameter	Service primitive interface SL parameter
`A_Mtype[RDiagMixAddr]`	`S_Mtype[RDiagMixAddr]`
`A_TAtype#5[physical]`[a]	`S_TAtype#5[physical]`[a]
`A_TAtype#6[functional]`[a]	`S_TAtype#6[functional]`[a]
`A_AI[SA]`	`S_AI[SA]`[b]
`A_AI[TA]`	`S_AI[TA]`[c]
`A_AI[AE]`	`S_AI[AE]`[d]
`A_Data[ ]`	`S_Data[ ]`
`A_Length`	`S_Length`
`A_Result`	`S_Result`

[a] See definition in ISO 15765-5.

[b] See Table A.1.

[c] See Table A.1 and Table A.2.

[d] See Table A.3 and Table A.4.

13.4 SL – Session layer communication profile (ComProfile)

REQ	5.4 SL – Session layer communication profile (ComProfile)
The session layer in the server/ECU utilizing the ISO 11992 network shall follow the session layer timing parameters as specified in Table 14 and the parameter as specified in Table 9.	

Table 14 — Session layer timing ComProfile parameters

Parameter	Definition	Minimum value [ms]	Maximum value [ms]
t_{S3_Server}	see ISO 14229-2: all non-default sessions	0	5 200

14 Transport layer

14.1 TL – USDT service primitive interface parameter definition

REQ	4.1 TL – USDT service primitive interface parameter definition
The service primitive interface parameters shall follow ISO 15765-5.	

14.2 TL – T_Data.req, T_Data.ind, and T_Data.con service interface

This document supports the service interface definition as specified in ISO 15765-5.

REQ	4.2 TL – T_Data.req, T_Data.ind, and T_Data.con service interface
The `T_Data.req`, `T_Data.ind`, and `T_Data.con` service interface implementation shall follow ISO 15765-5.	

14.3 TL – Service primitive interface SL to TL parameter mapping

REQ	4.3 TL – Service primitive interface SL to TL parameter mapping
The parameter mapping of the service primitive interface shall be implemented as specified in Table 15.	

Table 15 — Service primitive interface SL to TL parameter mapping

Service primitive interface SL parameter	Service primitive interface TL parameter
S_Mtype[RDiagMixAddr]	T_Ptype[RDiagMixAddr]
S_TAtype#5[physical][a]	T_TAtype#5[physical][a]
S_TAtype#6[functional][a]	T_TAtype#6[functional][a]
S_AI[SA]	T_AI[SA][b]
S_AI[TA]	T_AI[TA][c]
S_AI[AE]	T_AI[AE][d]
S_Data[ ]	T_Data[ ]
S_Length	T_Length
S_Result	T_Result

[a] See definition in ISO 15765-5.

[b] See Table A.1.

[c] See Table A.1 and Table A.2.

[d] See Table A.3 and Table A.4.

14.4 TL – Transport protocol

REQ	4.4 TL – Transport protocol
The transport protocol shall follow ISO 15765-2.	

14.5 TL – Transport layer communication profile (ComProfile)

The transport layer communication profile specifies the parameter values of the transport protocol as specified in ISO 15765-2.

REQ	4.5 TL – Transport layer communication profile (ComProfile)
The transport layer communication profile shall follow the specification in Table 16.	

The parameters specified in Table 16 follow ISO 15765-2.

Table 16 — Transport layer ComProfile parameters

Name	Value range	Description
C_{SF_DL}	0_{16} to 06_{16}	single segment data length parameter value range
C_{FF_DL}	7_{16} to FF_{16}	first segment data length parameter value range
C_{BS}	1_{16} to $0F_{16}$	BlockSize, number of segments until next FlowControl

15 Network layer

15.1 NL – Service primitive interface parameter definition

This document specifies the implementation of the network layer of the ISO 15765 DoCAN series and therefore, the service primitive parameter implementation follows the ISO 15765-5 specification.

REQ	3.1 NL – Service primitive interface parameter definition
The service primitive interface parameters shall follow ISO 15765-5.	

15.2 NL – N_Data.req, N_Data.ind, and N_Data.con service interface

This document follows the service interface definition as specified in ISO 15765-5.

REQ	3.2 NL – N_Data.req, N_Data.ind, and N_Data.con service interface
The `N_Data.req`, `N_Data.ind`, and `N_Data.con` service interface implementation shall follow ISO 15765-5.	

15.3 NL – Service primitive interface TL to NL parameter mapping

REQ	3.3 NL – Service primitive interface TL to NL parameter mapping
The parameter mapping of the service primitive interface shall be implemented as specified in Table 17.	

Table 17 — Service primitive interface TL to NL parameter mapping

Service primitive interface TL parameter	Service primitive interface SL parameter
`T_Ptype[RDiagMixAddr]`	`N_Ptype[RDiagMixAddr]`
`T_TAtype#5[physical]`[a]	`N_TAtype#5[physical]`[a]
`T_TAtype#6[functional]`[a]	`N_TAtype#6[functional]`[a]
`T_AI[SA]`	`N_AI[SA]`[b]
`T_AI[TA]`	`N_AI[TA]`[c]
`T_AI[AE]`	`N_AI[AE]`[d]
`T_Data[ ]`	`N_Data[ ]`
`T_Length`	`N_Length`
`T_Result`	`N_Result`

[a] See definition in ISO 15765-5.
[b] See Table A.1.
[c] See Table A.1 and Table A.2.
[d] See Table A.3 and Table A.4.

15.4 NL – Network layer services

REQ	3.4 NL – Network layer services
The network layer services shall follow ISO 15765-5.	

15.5 NL – Network layer communication profile (ComProfile)

The network layer communication profile specifies the parameter values of the network layer services as specified in ISO 15765-2.

REQ	3.5 NL – Network layer communication profile (ComProfile)
The network layer communication profile shall follow the specification in Table 18.	

The parameters specified in Table 18 follow ISO 15765-2.

Table 18 — Network layer ComProfile parameters

Name	Value	Description
C_{FS_CTS}	0000_2	FlowStatus continues to send

Table 18 *(continued)*

Name	Value	Description
c_{FS_WT}	0001_2	FlowStatus wait
$c_{FS\_Overflow}$	0010_2	FlowStatus overflow
$c_{FC\_WFT\_max}$	$0A_{16}$	FlowControl wait frame transmission maximum value

Table 19 specifies the network layer timing ComProfile parameters.

Table 19 — Network layer timing ComProfile parameters

Name	Timeout value ms	Performance value ms	Description
t_{STmin}	$0A_{16}$ to $7F_{16}$	—	segment SeparationTime in ms
$t_{CP\_N\_As}$	1 000	—	Time for transmission of the CAN segment (any N_PDU) on the sender side
$t_{CP\_N\_Ar}$	1 000	—	Time for transmission of the CAN segment (any N_PDU) on the receiver side
$t_{CP\_N\_Bs}$	1 000	—	Time until reception of the next FlowControl N_PDU
$t_{CP\_N\_Br}$	N/A	see ISO 15765-2	Time until transmission of the next FlowControl N_PDU
$t_{CP\_N\_Cs}$	N/A	see ISO 15765-2	Time until transmission of the next Consecutive-Frame N_PDU
$t_{CP\_N\_Cr}$	1 000	—	Time until reception of the next ConsecutiveFrame N_PDU

15.6 NL – Diagnostic CAN identifier configuration

This requirement specifies the diagnostic CAN identifier configuration for simultaneous communication of ISO 11992-2, ISO 11992-3 communication based on SAE J1939-21 and ISO 11992-4-based diagnostic communication utilizing the ISO 14229-3 UDSonCAN A_PDUs implementation on the ISO 15765-2 defined network layer.

REQ	3.6 NL – Diagnostic CAN identifier configuration
	The network layer diagnostic CAN identifier configuration shall be according to SAE J1939-21 and follow the illustration in Figure 5 with the following parameter settings:

P = 111_2;

EDP = set value as specified in ISO 15765-2;

DP = set value as specified in ISO 15765-2;

PF = set value for `functional` or `physical` addressing as specified in ISO 15765-2;

DA = N_AI[TA];

SA = N_AI[SA];

N_PDU[1] = N_AI[AE];

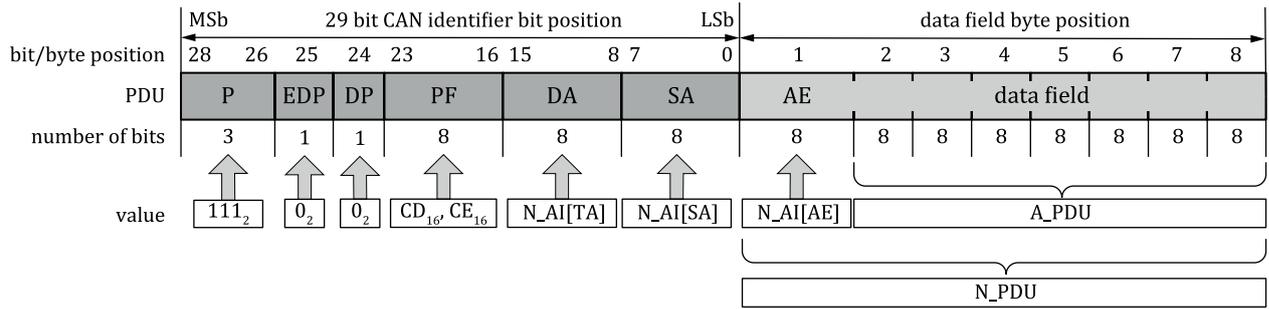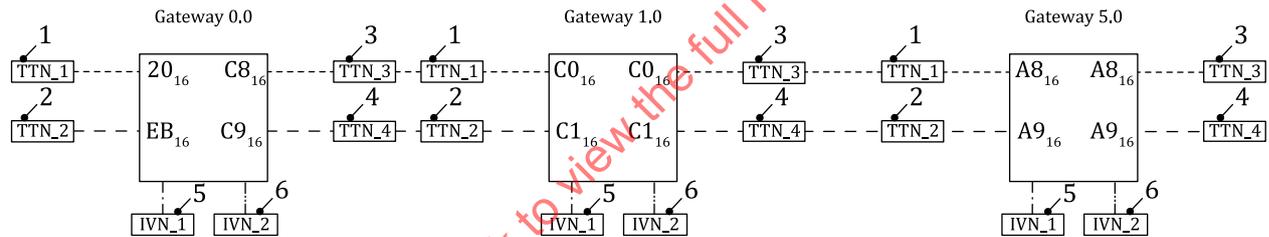Figure 5 illustrates the diagnostic CAN identifier configuration.

Figure 5 — Diagnostic CAN identifier configuration

15.7 NL – Dynamic network address assignment

15.7.1 NL – General

All gateways (0.0 to 5.0) of the towing and towed vehicles have the same address-based N_PDU routing implementation. The gateway either performs an N_PDU routing to the towed/towing vehicle gateway or to/from an in-vehicle network (IVN) with connected server(s).

Figure 6 shows gateways 0.0 to 5.0 of the towing and towed vehicles with IVNs.

Key

1 ISO 11992-2 brakes and running gear equipment and ISO 11992-4 (this document) diagnostic communication

2 ISO 11992-3 equipment other than brakes and running gear and ISO 11992-4 (this document) diagnostic communication

3 ISO 11992-2 brakes and running gear equipment and ISO 11992-4 (this document) diagnostic communication

4 ISO 11992-3 equipment other than brakes and running gear and ISO 11992-4 (this document) diagnostic communication

5 in-vehicle network 1: e.g. ISO 11992-2, ISO 11992-3, the ISO 17987 series, the ISO 20794 series, ISO/IEC/IEEE 8802.3, discrete connection

6 in-vehicle network 2: e.g. ISO 11992-2, ISO 11992-3, the ISO 17987 series, the ISO 20794 series, ISO/IEC/IEEE 8802.3, discrete connection

Figure 6 — Gateway 0.0 to 5.0 network interfaces

15.7.2 NL – Address assignment of TTN_1 and TTN_3

The following requirements specify the dynamic address assignment of the TTN_1/TTN_3.

REQ	3.7 NL – Dynamic network address assignment – NL – Address assignment of TTN_1 and TTN_3
The dynamic network address assignment of TTN_1 and TTN_3 (see Figure 6 keys 1 and 3) shall follow the specification in ISO 11992-2:2023, 8.3 and 8.4.	

Table A.1 and Table A.2 specify the towing and towed vehicle network connected gateway physical and functional address values.

15.7.3 NL – Address assignment of TTN_2 and TTN_4

The following requirements specify the dynamic address assignment of the TTN_2/TTN_4.

REQ	3.8 NL – Dynamic network address assignment – NL – Address assignment of TTN_2 and TTN_4
The dynamic network address assignment of TTN_2 and TTN_4 (see Figure 6 keys 2 and 4) shall follow the specification in ISO 11992-3:2021, 7.3 and 7.4.	

Table A.3 and Table A.4 specify the in-vehicle network connected server(s)/ECU(s) physical and functional addresses.

15.8 NL – Static network address assignment

15.8.1 NL – General

The gateways (0.0 to 5.0) of the towing and towed vehicles have IVNs and/or discrete connections to server(s)/ECU(s). In case an application is installed in the gateway, it can be reached with a fixed address assignment. The in-vehicle network(s) or alternative connections are not in scope of this document.

15.8.2 NL – Address assignment of gateway application, IVN_1, and IVN_2

The following requirement specifies the static address assignment of the gateway application, IVN_1 and IVN_2.

REQ	3.9 NL – Static network address assignment – NL – Address assignment of gateway application, IVN_1, and IVN_2
The static address assignment of the gateway application, IVN_1 and IVN_2 shall follow the specification of addresses of IVN_1 and IVN2 (see Figure 6, keys 5 and 6) in A.2.	

15.8.3 NL – Server address assignment of IVN_1 and IVN_2

The server address assignment of IVN_1 and IVN_2 or discrete connections depends on the architectural design of the towing and towed vehicles.

REQ	3.10 NL – Static network address assignment – NL – Server address assignment of IVN_1 and IVN_2
The address assignment of the server(s) connected to the gateway 0.0 to 5.0 shall be the responsibility of the vehicle manufacturer.	

The server address range 08_{16} to EF_{16} may be shared uniquely between in-vehicle network servers/ECUs.

Annex A specifies the towing and towed vehicle network connected server/ECU physical and functional addresses.

15.9 NL – Gateway N_PDU routing

### 15.9.1 NL – General

The gateway 0.0 to gateway 5.0 (see Figure 7) of the towing and towed vehicles support the same N_PDU routing between

— TTN_1 to TTN_3 and vice versa,

— TTN_2 to TTN_4 and vice versa,

— TTN_1 to gateway application and vice versa,

— TTN_2 to gateway application and vice versa,

— TTN_1 to IVN_1 or IVN_2 and vice versa, and

— TTN_2 to IVN_1 or IVN_2 and vice versa.

Figure 7 shows the typical network configuration of a road train utilizing ISO 11992-1 communication links.
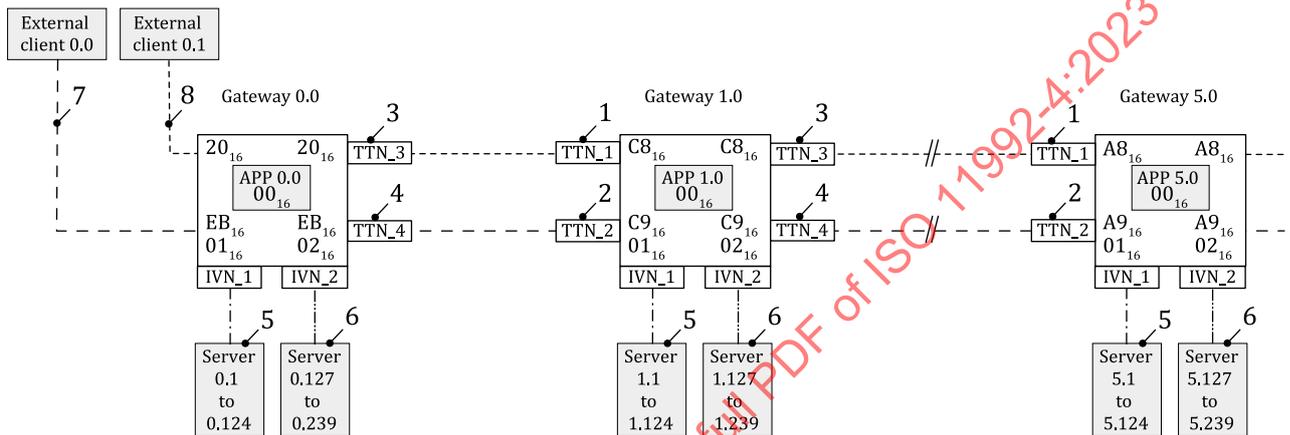
Key

1   ISO 11992-2 brakes and running gear equipment and ISO 11992-4 (this document) diagnostic communication

2   ISO 11992-3 equipment other than brakes and running gear and ISO 11992-4 (this document) diagnostic communication

3   ISO 11992-2 brakes and running gear equipment and ISO 11992-4 (this document) diagnostic communication

4   ISO 11992-3 equipment other than brakes and running gear and ISO 11992-4 diagnostic communication

5   in-vehicle network 1: e.g. ISO 11992-2, ISO 11992-3, the ISO 17987 series, the ISO 20794 series, ISO/IEC/IEEE 8802.3, discrete connection

6   in-vehicle network 2: e.g. ISO 11992-2, ISO 11992-3, the ISO 17987 series, the ISO 20794 series, ISO/IEC/IEEE 8802.3, discrete connection

7   ISO 11898-1 or ISO 13400-3 connection to external client 0.0: e.g. diagnostic test equipment

8   ISO 11898-1 or ISO 13400-3 connection to external client 0.1: e.g. diagnostic test equipment

NOTE 1   If external client 0.0 is connected then external client 0.1 is disconnected and vice versa.

NOTE 2   Hexadecimal values in this figure represent address information.

Figure 7 — Road train network configuration

15.9.2   NL – Network address translation

The network address translation (NAT) rules of gateway 0.0 to gateway 5.0 are specified in the following requirements. The physical connection of an in-vehicle network connected server(s) is out of scope of this document.

Figure 8 shows a diagnostic request and response message routing example from the external client 0.0 to the server 2.1 connected to gateway 1.0.
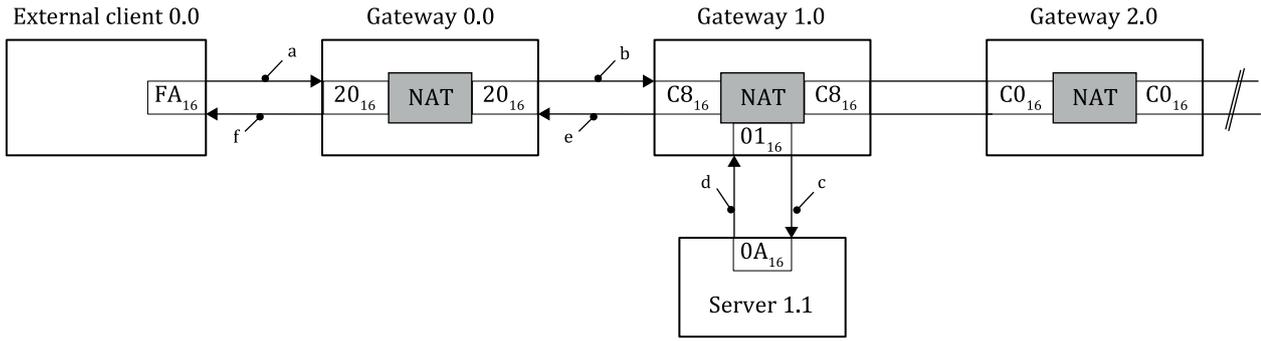
^a The external client 0.0, e.g. test equipment, sends a diagnostic request message to the gateway 0.0.

^b The gateway 0.0 compares its own address with the target address of the diagnostic request message. Because there is no match the gateway 0.0 forwards the diagnostic request message to the gateway 1.0.

^c The gateway 1.0 compares its own address with the target address of the diagnostic request message. Because there is a match the gateway forwards the diagnostic request message to the server 1.1.

^d The server 1.1 processes the diagnostic request message and as a result transmits a diagnostic response message to the gateway 1.0 with the address extension of the external client 0.0.

^e The gateway 1.0 compares its own address with the target address of the diagnostic response message. Because there is a match the gateway 1.0 forwards the diagnostic response message to the gateway 0.0.

^f The gateway 0.0 compares its own address with the target address of the diagnostic response message. Because there is no match the gateway 0.0 forwards the diagnostic response message to the external client 0.0.

Figure 8 — Network routing example

Figure 9 shows the diagnostic request and response routing example across several networks based on Figure 8.
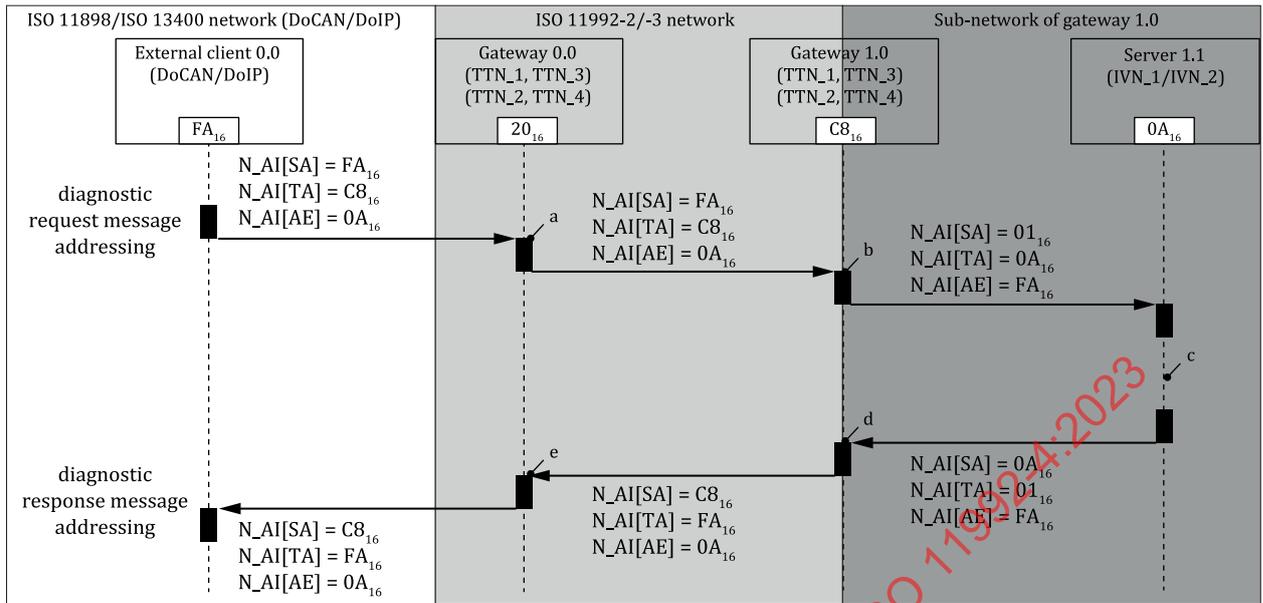
a   See REQ 3.11 NL – Network address translation – From GW TTN_1 to GW TTN_3 and GW TTN_2 to GW TTN_4.

b   See REQ 3.12 NL – Network address translation – From GW TTN_1/TTN_2 to server on IVN_1/IVN_2.

c   See REQ 3.13 NL – Network address translation – Server address mapping.

d   See REQ 3.14 NL – Network address translation – From GW IVN_1/IVN_2 to GW TTN_1/TTN_2.

e   See REQ 3.15 NL – Network address translation – From GW TTN_3 to GW TTN_1 and GW TTN_4 to GW TTN_2.

Figure 9 — Diagnostic request and response message routing example

REQ	3.11 NL – Network address translation – From GW TTN_1 to GW TTN_3 and GW TTN_2 to GW TTN_4

The gateway 0.0 to 5.0 shall perform message routing from TTN_1 to TTN_3 and TTN_2 to TTN_4 if the target address of the received message on TTN_1/TTN_2 N_AI[TA] **does not match** its own source address. The following mapping and network address translation shall be performed:

N_Ptype = RDiagMixAddr;

N_TAtype = physical; diagnostic request message

IF (TTN_1/2(N_AI[TA])) ≠ (GW TTN_1/2(SA)) THEN

   TTN_3/4(N_AI[SA] = TTN_1/2(N_AI[SA]);

   TTN_3/4(N_AI[TA] = TTN_1/2(N_AI[TA]);

   TTN_3/4(N_AI[AE] = TTN_1/2(N_AI[AE]).

REQ	3.12 NL – Network address translation – From GW TTN_1/TTN_2 to server on IVN_1/IVN_2

The gateway 0.0 to 5.0 shall perform message routing from TTN_1/TTN_2 to the IVN_1/IVN_2 if the target address of the received message on TTN_1/TTN_2 `N_AI[TA]` **matches** its own source address. The following mapping and network address translation shall be performed:

```
N_Ptype = RDiagMixAddr;

N_TAtype = physical; diagnostic request message

IF (TTN_1/2(N_AI[TA])) = (GW TTN_1/2(SA)) THEN

   IF (TTN_1/2(N_AI[AE]) = 00₁₆) THEN

      SEND N_PDU to GW internal APP;

   IF (TTN_1/2(N_AI[AE]) < 80₁₆) THEN

      IVN_1(N_AI[SA]) = 01₁₆

   ELSE IVN_2(N_AI[SA]) = 02₁₆;

   IVN_1/2(N_AI[TA]) = TTN_1/2(N_AI[AE]);

   IVN_1/2(N_AI[AE]) = TTN_1/2(N_AI[SA]).
```

REQ	3.13 NL – Network address translation – Server address mapping

The server on IVN_1/IVN_2 or GW-internal application shall perform address mapping as follows:

```
N_Ptype = RDiagMixAddr;

N_TAtype = physical; diagnostic response message

IVN_1/2(N_AI[SA] = IVN_1/2(N_AI[TA];

IVN_1/2(N_AI[TA] = IVN_1/2(N_AI[SA];

IVN_1/2(N_AI[AE] = IVN_1/2(N_AI[AE].
```

REQ	3.14 NL – Network address translation – From GW IVN_1/IVN_2 to GW TTN_1/TTN_2

The server on IVN_1/IVN_2 or GW-internal application shall perform message routing from IVN_1/IVN_2 to the TTN_1/TTN_2 if the target address of the received message on IVN_1/IVN_2 `N_AI[TA]` **matches** its own source address of IVN_1/IVN_2. The following mapping and network address translation shall be performed:

```
N_Ptype = RDiagMixAddr;

N_TAtype = physical; diagnostic response message

TTN_1/TTN_2(N_AI[SA] = GW TTN_1/TTN_2 own address;

TTN_1/TTN_2(N_AI[TA] = IVN_1/2(N_AI[AE];

TTN_1/TTN_2(N_AI[AE] = IVN_1/2(N_AI[SA].
```

REQ	3.15 NL – Network address translation – From GW TTN_3 to GW TTN_1 and GW TTN_4 to GW TTN_2