
**Road vehicles — Diagnostic
communication over Internet Protocol
(DoIP) —**

**Part 2:
Transport protocol and network layer
services**

AMENDMENT 1

*Véhicules routiers — Communication de diagnostic au travers du
protocole internet (DoIP) —*

Partie 2: Protocole de transport et services de la couche réseau

AMENDEMENT 1





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

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Road vehicles — Diagnostic communication over Internet Protocol (DoIP) —

Part 2: Transport protocol and network layer services

AMENDMENT 1

6.2.5

Replace description with this text.

For a secured TCP connection, the TLS dedicated TCP_DATA port is used. As for the unsecured DoIP session case, the first step in order to initiate a secure TLS connection between the client DoIP entity and the DoIP entity, is to open a TLS socket (destination port is TLS TCP_DATA). This is done prior to any message exchange. Therefore, a DoIP entity provides the resources to handle the incoming communication request (e.g. socket resources). The DoIP entity provides sufficient resources to handle the specified number of concurrently supported DoIP sessions secured with TLS (<k>) (see [DoIP-159]). If more than <k> connection attempts arrive at the same time, it is possible that no more resources are available and the <k + 1st> connection attempt is refused (because there are no longer any sockets in the listening state because of DoIP protocol handling).

A vehicle manufacturer may choose to implement k+1 TLS data sockets, where the additional socket is used to reject a routing activation with routing activation response code 01₁₆.

If a k+1 TLS data socket is not implemented, no DoIP routing activation response code 01₁₆ can be responded when all k concurrently supported DoIP sessions are already in use. In this case, the additional connection will be rejected on the TCP level already.

7.7, Table 12

Replace Table 12 with this table.

Table 12 — DoIP timing and communication parameters

Timing parameter	Description	Client	Server
$t_{A_DoIP_Ctrl}$	This timeout specifies the time that the client DoIP entity waits for a response to a previously sent UDP message. This includes the time to wait and collect multiple responses to a previous broadcast (UDP only).	Minimum timeout: 2 s	Recommended ECU Performance Response time: 1 600 ms
$t_{A_DoIP_Routing_Activation}$	This timeout specifies the time that the client DoIP entity waits for a response to a previously sent routing activation request on a TCP_DATA socket.	Minimum timeout: 2 s	Recommended ECU Performance Response time: 1 600 ms

Table 12 (continued)

Timing parameter	Description	Client	Server
$t_{A_DoIP_Announce_Wait}$	This timing parameter specifies the initial time that a DoIP entity waits until it responds to a vehicle identification request and the time that a DoIP entity waits until it transmits a vehicle announcement message after a valid IP address is configured. The value of this timing parameter shall be determined randomly between the minimum and the maximum value.	N/A	Random time: 0 to 500 ms
$t_{A_DoIP_Announce_Interval}$	This timing parameter specifies the time between the vehicle announcement messages that are sent by the DoIP entities after a valid IP address has been configured.	N/A	Delay time: 500 ms
$t_{A_DoIP_Announce_Num}$	This parameter specifies the number of vehicle-announcement messages, which are sent by the DoIP entity, after the configuration of a valid IP address.	N/A	Repetition: 3 times
$t_{A_DoIP_Diagnostic_Message}$	This is the time between receipt of the last byte of a DoIP diagnostic message and the transmission of the confirmation ACK or NACK. After the timeout has elapsed, the request or the response shall be considered lost and the request may be repeated.	Minimum timeout: 2 s	ECU performance response time: 50 ms
$t_{T_TCP_General_Inactivity}$	This timeout specifies the time of inactivity on a TCP_DATA socket (no data received or sent) before it is closed by the DoIP entity.	N/A	Timeout: 300 s
$t_{T_TCP_Initial_Inactivity}$	This timeout specifies the time of inactivity directly after a TCP_DATA socket is established. After the specified time without routing activation, the TCP_DATA socket is closed by the DoIP entity.	N/A	Timeout: 2 s
$t_{T_TCP_Alive_Check}$	This timeout specifies the time that a DoIP entity waits for an alive check response after having written an alive check request on the TCP_DATA socket. Thus, the timer elapses if the underlying TCP stack is unable to deliver the alive check request message.	Client performance time: 300 ms	Timeout: 500 ms
$t_{A_Processing_Time}$	This timeout is defined as the time between transmission from the client DoIP entity of DoIP messages that require no response message but may need some time to be processed. Thus, the client DoIP entity shall wait for at least $A_Processing_Time$ before sending another request to the same DoIP entity.	Timeout: 2 s	N/A
$t_{A_Vehicle_Discovery_Timer}$	This is a per vehicle offboard sided timer. This timer specifies the time a vehicle can take to perform the VIN/GID synchronization between all DoIP entities. The vehicle discovery timer may only be started when a vehicle announcement/ vehicle identification response message containing a VIN/GID sync status code "incomplete" (10_{16}) and a valid VIN or GID is received by the client DoIP entity.	Timeout: 5 s	N/A

9.2, Table 16

Replace Table 16 with this table.

Table 16 — Generic DoIP header structure

Item	Pos.	Len.	Description	Values
Protocol version	0	1	Identifies the protocol version of DoIP packets.	00_{16} : reserved 01_{16} : ISO/DIS 13400-2:2010 02_{16} : ISO 13400-2:2012 03_{16} : ISO 13400-2:2019 04_{16} : ISO 13400-2:2019/Amd1 05_{16} to FE_{16} : reserved by this document FF_{16} : default value for vehicle identification request messages
Inverse protocol version	1	1	Contains the bit-wise inverse value of the protocol version, which is used in conjunction with the DoIP protocol version as a protocol verification pattern to ensure that a correctly formatted DoIP message is received.	Equals the <Protocol_Version> XOR FF_{16} (e.g. FE_{16} for protocol version 01_{16}).
Payload type (GH_PT)	2	2	Contains information about how to interpret the data following the generic DoIP header (e.g. gateway command, diagnostic message, etc.).	See Table 17 for a complete list of currently specified payload type values.
Payload length (GH_PL)	4	4	Contains the length of the DoIP message payload in bytes (i.e. excluding the generic DoIP header bytes). Some payload types do not require any additional parameters (payload length is 0), some require a fixed DoIP message length while others allow for dynamic length DoIP messages.	0 to 4 294 967 295 bytes
Payload type specific message content	8	...	The payload type specific message content starts here. This implies that, for example, byte position 0 of the payload type-specific part of the message means byte position 8 in the context of the overall DoIP message.	—

9.2, Table 17

Replace Table 17 with this table.

Table 17 — Overview of DoIP application layer payload types

value	Payload type	See	Support DoIP		Port and protocol
	name		GW	nodes	
0000_{16}	Generic DoIP header negative acknowledge	9.3	M	M	UDP_DISCOVERY UDP_TEST_EQUIPMENT_REQUEST TCP_DATA
0001_{16}	Vehicle identification request message	7.4	M	M	UDP_DISCOVERY

Table 17 (continued)

value	Payload type name	See	Support DoIP		Port and protocol
			GW	nodes	
0002 ₁₆	Vehicle identification request message with EID	7.4	O	O	UDP_DISCOVERY
0003 ₁₆	Vehicle identification request message with VIN	7.4	M	M	UDP_DISCOVERY
0004 ₁₆	Vehicle announcement message/ vehicle identification response message	7.4	M	M	UDP_DISCOVERY UDP_TEST_EQUIPMENT_REQUEST
0005 ₁₆	Routing activation request	12.5	M	M	TCP_DATA
0006 ₁₆	Routing activation response	12.5	M	M	TCP_DATA
0007 ₁₆	Alive check request	9.6	M	M	TCP_DATA
0008 ₁₆	Alive check response	9.6	M	M	TCP_DATA
0009 ₁₆ to 4000 ₁₆	reserved by this document				
4001 ₁₆	DoIP entity status request	7.6	O	O	UDP_DISCOVERY
4002 ₁₆	DoIP entity status response	7.6	O	O	UDP_TEST_EQUIPMENT_REQUEST
4003 ₁₆	Diagnostic power mode information request	7.5	M	M	UDP_DISCOVERY
4004 ₁₆	Diagnostic power mode information response	7.5	M	M	UDP_TEST_EQUIPMENT_REQUEST
4005 ₁₆ to 8000 ₁₆	reserved by this document				
8001 ₁₆	Diagnostic message	9.5	M	M	TCP_DATA
8002 ₁₆	Diagnostic message positive acknowledgement	9.5	M	M	TCP_DATA
8003 ₁₆	Diagnostic message negative acknowledgement	9.5	M	M	TCP_DATA
8004 ₁₆	Periodic diagnostic message	9.7	O	O	TCP_DATA
8005 ₁₆ to 8FFF ₁₆	reserved by this document				
9000 ₁₆ to 9FFF ₁₆	see 11.4				
A000 ₁₆ to EFFF ₁₆	reserved by this document				
F000 ₁₆ to FFFF ₁₆	Reserved for manufacturer-specific use	—	O	O	—

9.2, Figure 16

Replace Figure 16 with this figure.

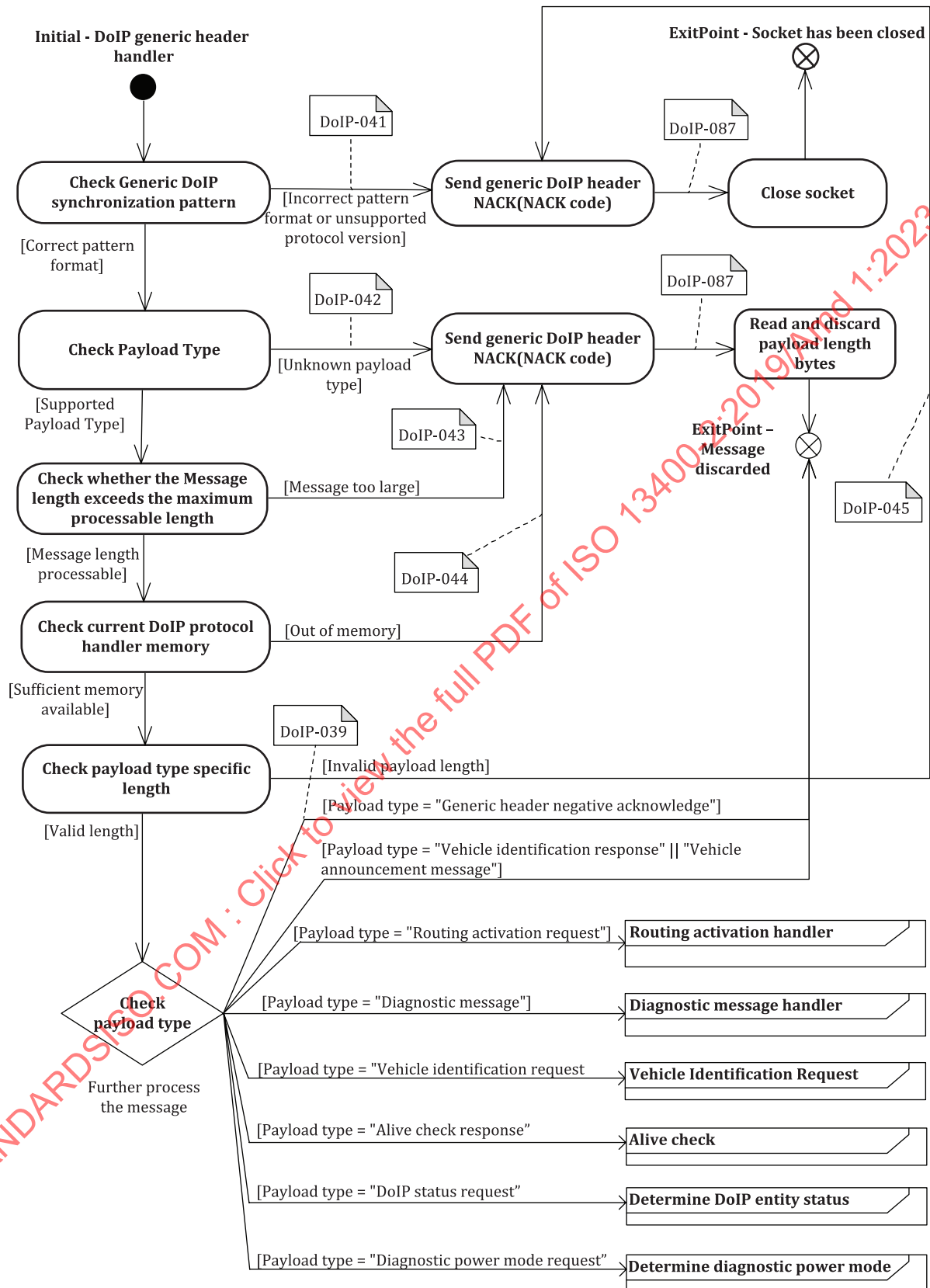


Figure 16 — DoIP generic header handler

Replace REQ 7.DoIP-041 AL with the following.

REQ	7.DoIP-041 AL – DoIP entity does not match generic DoIP header structure
Each DoIP entity shall send a generic DoIP header negative acknowledge message with NACK code set to 00 ₁₆ if the protocol version or inverse protocol version (synchronization pattern) does not match the format specified in Table 16 or if the protocol version is not supported by the DoIP entity.	

9.4, NOTE 1

Replace NOTE 1 with the following:

NOTE 1 Table 20 shows the IPv6 variant. For IPv4, Limited Broadcast is used instead of Multicast.

9.5, title

Replace "AL diagnostic message and diagnostic message acknowledgement" with "AL – Payload type definition and acknowledgement".

9.5, first paragraph

Replace with the following:

This subclause specifies the message format that allows for the optional transmission of internal transport layer status service primitive information to a DoIP client. This transport layer status message covers the standard transport layer services primitives useful to the DoIP client including T_Data.confirm, T_DataSOM.indication, and T_Data.indication. If this payload type is utilized, a DoIP client has the ability to determine when a gatewayed message has completed transmission on the target network (or aborted due to an error), when a segmented response has started on the target network, and when a segmented response has aborted due to an error on the target network. DoIP clients are not required to process this payload type if supported by a DoIP entity. If a DoIP client does support processing this payload type, it may implement substantially faster timeouts depending upon the details of the target network.

9.5

Replace REQ 7.DoIP-064 AL with the following:

REQ	7.DoIP-064 AL – DoIP entity status message structure
Each DoIP entity shall support the status message structure as specified in Table 21 for incoming (i.e. requests) and outgoing (i.e. responses) diagnostic messages.	

9.7

Add the following new subclause.

9.7 AL – Periodic response message

This subclause specifies the periodic response message structure of the DoIP message that is used. The periodic response messages are utilized by the TCP_DATA socket handler.

REQ	7.DoIP-189 AL – DoIP periodic response message structure
For DoIP entities that use payload type 8004 ₁₆ , each DoIP entity shall support the periodic response message structure as specified in Table 31.	

Insert new Tables 29-31.

Table 29 — Payload type periodic response message structure

Item	Pos.	Len.	Description	Values	Cvt
Protocol version	0	1	see Table 16	see Table 16	M
Inverse protocol version	1	1	see Table 16	see Table 16	M
Payload type (GH_PT)	2	2	see Table 16	see Table 16	M
Payload length (GH_PL)	4	4	see Table 16	see Table 16	M
Source address (SA)	8	2	Contains the logical address of the sender of a diagnostic message (e.g. the client DoIP entity address).	see Table 13	M
Target address (TA)	10	2	Contains the logical address of the receiver of a diagnostic message (e.g. a specific server DoIP entity on the vehicle's networks).	see Table 13	M
User data 1 to 9	12	9	Contains the actual timestamp of the user data 12 to 12 + k.	See Table 30	M
User data 10	21	2	Contains the periodic response payload length	0002 ₁₆ to FFFF ₁₆	M
User data 12	23	1	Contains the periodicDataIdentifier	00 ₁₆ to FF ₁₆	M
User data 13 to user data (12 + k)	24	k	Contains the dataRecord[] = [] data#1 : data#k]	00 ₁₆ to FF ₁₆ : 00 ₁₆ to FF ₁₆	M
:	:	:	:	:	:
User data t to t + 8	t	9	Contains the actual timestamp of the user data t to t + k.	See Table 30	C ^a
User data t + 9	t + 9	2	Contains the periodic response payload length	(p + 1) 0002 ₁₆ to FFFF ₁₆	C ^a
User data t + 11	t + 11	1	Contains the periodicDataIdentifier	00 ₁₆ to FF ₁₆	C ^a
User data t + 12 to user data (t + 11+p)	t + 12	p	Contains the dataRecord[] = [] data#1 : data#p]	00 ₁₆ to FF ₁₆ : 00 ₁₆ to FF ₁₆	C ^a

^a Present, if more periodic responses are available to be reported from the same source address.

Table 30 — Timestamp format definition

Item	Pos.	Len.	Description	Type	Values	Cvt
Time base status	1	1	Synchronization state of the ECU's local time base with the vehicle's global time base.	see Table 31	see Table 31	M

Table 30 (continued)

Item	Pos.	Len.	Description	Type	Values	Cvt
Nanoseconds part of time	2	4	Minimum value Maximum value Least Significant bits below the resolution of the Local Time Base shall be padded with 0. Content of timestamp is not in the scope of this document.	UINT32	00000000 ₁₆ 3B9AC9FF ₁₆	M
32-bit LSB of 48-bit seconds part of time	7	4	Date: 1970-01-01 (YYYY-MM-DD) Content of timestamp is not in the scope of this document.	UINT32	00000000 ₁₆	M

Table 31 — Time Base Status definition

Item	Bit	Len.	Description	Type	Values	Cvt
TIMEOUT	0	1	Timeout while waiting for time synchronization message. Synchronization message was received on time. Synchronization message was not received.	BOOL	0 ₂ 1 ₂	M
reserved by document	1	1	n/a	n/a	—	M
SYNC_TO_GATEWAY	2	1	Synchronization with time gateway. Local Time Base is synchronized with the Global Time Base. Local Time Base is synchronized with time gateway.	BOOL	0 ₂ 1 ₂	M
GLOBAL_TIME_BASE	3	1	Synchronization with Global Time Base. Local Time Base was never synchronized with the Global Time Base Local Time Base was synchronized with the Global Time Base.	BOOL	0 ₂ 1 ₂	M
TIMELEAP_FUTURE	4	1	Synchronization required a leap forward in time. Leap into the future within Time Base does not exceed threshold. Leap into the future within Time Base exceeds threshold.	BOOL	0 ₂ 1 ₂	M
TIMELEAP_PAST	5	1	Synchronization required a leap backwards in time. Leap into the past within Time Base does not exceed threshold. Leap into the past within Time Base exceeds threshold.	BOOL	0 ₂ 1 ₂	M
reserved by document	6	1	n/a	n/a	—	M
reserved by document	7	1	n/a	n/a	—	M

10.1

Former Table 29 is renumbered to Table 32.

All references to Table 29 are renumbered accordingly.

10.2.3

Former Table 30 is renumbered to Table 33.

Former Table 31 is renumbered to Table 34.

All references to Tables 30 and 31 are renumbered accordingly.

10.2.4

Former Table 32 is renumbered to Table 35.

Former Table 33 is renumbered to Table 36.

Former Table 34 is renumbered to Table 37.

Former Table 35 is renumbered to Table 38.

Former Table 36 is renumbered to Table 39.

Former Table 37 is renumbered to Table 40.

All references to Tables 32 to 37 are renumbered accordingly.

11.1

Former Table 38 is renumbered to Table 41.

Former Table 39 is renumbered to Table 42.

All references to Table 38 and 39 are renumbered accordingly.

11.2

Former Table 40 is renumbered to Table 43.

Former Table 41 is renumbered to Table 44.

All references to Table 40 and 41 are renumbered accordingly.

11.4

Add the following new subclause.

11.4 TL

11.4.1 TL – General

This subclause specifies the message format that allows for the optional transmission of internal transport protocol status service primitive information to a DoIP client. This transport protocol status covers the standard transport layer service primitives used by the DoIP client including `T_DATA.confirm`, `T_DATASOM.indication`, and `T_DATA.indication`. If this payload type is utilized, a DoIP client has the ability to determine when a gatewayed message has completed transmission on the target network (or aborted due to an error), when a segmented response has started on the target network, and when a segmented response has aborted due to an error on the target network.

DoIP clients are not required to process this payload type if supported by a DoIP entity. If a DoIP client does support processing this payload type, it may implement substantially faster timeouts depending upon the details of the target network.

11.4.2 TL – DoIP entity status message structure

REQ	4.DoIP-064 TL – DoIP entity status message structure
Each DoIP entity shall support the transport layer payload type message structure as specified in Table 44 for incoming (i.e. requests) and outgoing (i.e. responses) messages.	

Insert new Tables 45-48.

Table 45 — Overview of DoIP transport layer payload types

value	Payload type	Specified in	Support DoIP		Port and protocol
	name		gateways	nodes	
9000 ₁₆	reserved by this document	—	—	—	—
9001 ₁₆	transport layer payload type message structure	Table 44	0	0	TCP_DATA
9002 ₁₆ to 9FFF ₁₆	reserved by this document	—	—	—	—

Table 46 — Transport layer payload type message structure

Item	Pos.	Len.	Description	Value	Cvt
Protocol version	0	1	see Table 16	see Table 16	M
Inverse protocol version	1	1	see Table 16	see Table 16	M
Payload type (GH_PT)	2	2	see Table 16	see Table 16	M
Payload length (GH_PL)	4	4	see Table 16	see Table 16	M
Source address (SA)	8	2	Contains the logical address of the sender of the transport layer status message (e.g., the target ECU entity address).	see Table 13	M
Target address (TA)	10	2	Contains the logical address of the receiver of the transport layer status message (e.g., the DoIP client which initiated the request)	see Table 13	M
TP status type value	12	1	The ISO 14229-2 ^[4] transport layer status type being conveyed.	see Table 41c	M
TP status code value	13	1	The transport layer status code related to any error information associated with the transport protocol status type.	see Table 41d	M

Table 46 (continued)

Item	Pos.	Len.	Description	Value	Cvt
Application layer service	14	1	The application layer service that the transport layer status message corresponds to.	ISO 14229-1 ^[3] service identifier or 00 ₁₆ if not available or not applicable.	M

Table 47 — Transport layer status type values

Value	Symbol name	Description	Definition	Cvt
00 ₁₆	—	reserved by this document	—	M
01 ₁₆	TX_ST_TYPE	transmission confirmation with result	ISO 14229-2 ^[4] T_DATA.conf [confirmation status with result of a transmitted message e.g. DoIP edge node to an internal Ethernet gateway to a server connected to the sub-network]	M
02 ₁₆	RX_ST_TYPE	reception indication with result	ISO 14229-2 ^[4] T_DATA.ind [final indication status with result (non-zero code, see Table 46) about the abortion of message reception from a server on the sub-network]	M
03 ₁₆	SOM_ST_TYPE	StartOfMessage (SOM) indication with result	ISO 14229-2 ^[4] T_DATASOM.ind [indication of start of message reception with result e.g., to the DoIP gateway from the sub-network server]	M
04 ₁₆ to FF ₁₆	—	reserved by this document	—	M

Table 48 — Transport layer status code values

Value	Symbol name	Description	Sub-network confirmation			Cvt
			TX_ST_TYPE	RX_ST_TYPE	SOM_ST_TYPE	
00 ₁₆	T_OK	service execution successful	a ^a	n/a ^b	a ^a	M
01 ₁₆ to FE ₁₆	T_RESULT	result code mapping from sub-network T_DATA protocol interface	—	—	—	—
FF ₁₆	T_ERROR	general error	a ^a	a ^a	n/a ^b	M
^a applicable ^b not applicable						

11.4.2

Add the following new Figure 22.

Former Figure 22 is renumbered to Figure 23.

Former Figure 23 is renumbered to Figure 24.

Former Figure 24 is renumbered to Figure 25.

Former Figure 25 is renumbered to Figure 26.

Former Figure 26 is renumbered to Figure 27.

Former Figure 27 is renumbered to Figure 28.

Former Figure 28 is renumbered to Figure 29.

All references to Figures 22 to 28 are renumbered accordingly.

Figure 22 shows the DoIP transport protocol status message.

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