ISO14229 (UDS) Specification

Content

ISO 14229 (UDS) – Summary

ISO 14229 specifies data link independent requirements of diagnostic services, which allow a diagnostic tester (client) to control diagnostic functions in an on-vehicle Electronic Control Unit (ECU, server) such as an electronic fuel injection, automatic gear box, anti-lock braking system, etc. connected to a serial data link embedded in a road vehicle.

It specifies generic services, which allow the diagnostic tester (client) to stop or to resume non-diagnostic message transmission on the data link.

General Rules

- Every non-default session, if the tester does not send **Tester Present (0x3E)** or any other request, will returns to default session after 5000 ms.
- The time between request message and TCU (Transmission Control Unit) response cannot be more than 50ms. In this case a timeout happens, and the request is thrown away by the TCU.
- **NRC (Negative Response Code) 0x78** *(request Correctly Received – Response Pending* (*RCRRP))* means no error, it is to be sent by TCU when the request is valid, but cannot answer immediately.
- If a request is received during a response to a previous request it shall be ignored

General Syntax

If the effective length of message is <=7 (number of bytes in the message except the length information)	
Byte 0	Effective length of message
Byte 1-7	Request or response content
Example	
(Tx) 03 22 01 00 00 00 00 00	

If the effective length of message is >7	
Transmit First Frame	
Byte 0	First Frame Indicator
Byte 1	Effective length of message
Byte 2-7	Message content
Receive Flow Control	
Byte 0	0x30 (The slave is capable of receiving the remaining message contents)
Byte 1-7	00 00 00 00 00 00 00
Transmit Consecutive Frame	
Byte 0	21..2F (continuously increased, after 2F set back to 20)
Byte 1-7	Message content
Example	
(Tx) 10 13 62 01 00 FF 00 C8	
(Rx) 30 00 00 00 00 00 00 00	
(Tx) 21 00 00 00 00 00 00 00	
(Tx) 22 00 00 00 00 00 00 AA	

Service Specifications

Diagnostic Session Control (0x10) service

Request Message definition		
#	Parameter name	Byte value
#1	DiagnosticSessionControl Request Service Identifier (SID)	0x10
#2	sub-function = [diagnosticSessionType]	0x00…0xFF
Available sub-functions		
0x01	**Default Session:** This diagnostic session enables the default diagnostic session in the server(s) and does not support any diagnostic application timeout handling provisions (e.g. no TesterPresent service is necessary to keep the session active).	
0x02	**Programming session** This diagnosticSession enables all diagnostic services required to support the memory programing of a server.	
0x03	**Extended diagnostic session** This diagnosticSession can be used to enable all diagnostic services required to support the adjustment of functions like "Idle Speed, CO Value, etc." in the server's memory. It can also be used to enable diagnostic services, which are not specifically tied to the adjustment of functions	

Positive Response Message definition		
#	Parameter name	Byte value
#1	DiagnosticSessionControl Response SID	0x50
#2	sub-function = [diagnosticSessionType]	0x00…0xFF
#3	sessionParameterRecord[]#1 = [data#1	0x00…0xFF
:	:	:
#6	data#4]	0x00…0xFF

Negative Response Message definition		
#	Parameter name	Byte value
#1	Negative Response Service ID	0x7F
#2	DiagnosticSessionControl Response SID	0x10
#3	Negative response code	0x00… 0xFF

Supported Negative Response codes		
0x12	**sub-function Not Supported** This NRC shall be sent if the sub-function parameter is not supported.	SFNS
0x13	**Incorrect Message Length Or Invalid Format** This NRC shall be sent if the length of the message is wrong.	IMLOIF
0x22	**Conditions Not Correct** This NRC shall be returned if the criteria for the request DiagnosticSessionControl are not met.	CNC
0x7E	**sub-function Not Supported In Active Session** This NRC indicates that the requested action will not be taken because the server does not support the requested sub-function in the session currently active. This NRC shall only be used when the requested sub-function is known to be supported in another session	SFNSIAS

ECU Reset (0x11) service

Request Message definition

#	Parameter name	Byte value
#1	ECUReset Request SID	0x11
#2	sub-function = [resetType]	0x00…0xFF

Available sub-functions

0x01	Hard reset:
	This value identifies a "hard reset" condition, which simulates the power-on / start-up sequence typically performed after a server has been previously disconnected from its power supply (i.e. battery).

Positive Response Message definition

#	Parameter name	Byte value
#1	ECUReset Response SID	0x51
#2	sub-function = [resetType]	0x00…0xFF

Negative Response Message definition

#	Parameter name	Byte value
#1	Negative Response Service ID	0x7F
#2	DiagnosticSessionControl Response SID	0x11
#3	Negative response code	0x00… 0xFF

Supported Negative Response codes

0x12	**sub-function Not Supported**	SFNS
	This NRC shall be sent if the sub-function parameter is not supported.	
0x13	**Incorrect Message Length Or Invalid Format**	IMLOIF
	This NRC shall be sent if the length of the message is wrong.	
0x22	**Conditions Not Correct**	CNC
	This NRC shall be returned if the criteria for the request DiagnosticSessionControl are not met.	
0x7E	**sub-function Not Supported In Active Session**	SFNSIAS
	This NRC indicates that the requested action will not be taken because the server does not support the requested sub-function in the session currently active. This NRC shall only be used when the requested sub-function is known to be supported in another session	

Read Data By Identifier (0x22) service

#	Parameter name	Byte value
Request Message definition		
#	**Parameter name**	**Byte value**
#1	ReadDataByIdentifier Request SID	0x22
	dataIdentifier[]#1 = [	
#2	byte#1 (MSB)	0x00…0xFF
#3	byte#2]	0x00…0xFF
:	:	:
	dataIdentifier[]#m = [	
#n-1	byte#1 (MSB)	0x00…0xFF
#n	byte#2]	0x00…0xFF

Available sub-functions
This service does not use a sub-function parameter.

#	Parameter name	Byte value
Positive Response Message definition		
#	**Parameter name**	**Byte value**
#1	ReadDataByIdentifier Response SID	0x62
	dataIdentifier[]#1 = [	
#2	byte#1 (MSB)	0x00…0xFF
#3	byte#2]	0x00…0xFF
	dataRecord[]#1 = [	
#4	data#1	0x00…0xFF
:	:	:
#(k-1)+4	data#k]	0x00…0xFF

#	Parameter name	Byte value
Negative Response Message definition		
#	**Parameter name**	**Byte value**
#1	Negative Response Service ID	0x7F
#2	DiagnosticSessionControl Response SID	0x22
#3	Negative response code	0x00… 0xFF

Supported Negative Response codes		
0x13	**Incorrect Message Length Or Invalid Format** *This NRC shall be sent if the length of the message is wrong.*	IMLOIF
0x14	**Response Too Long** *This NRC shall be sent if the total length of the response message exceeds the limit of the underlying transport protocol (e.g., when multiple DIDs are requested in a single request).*	RTL
0x22	**Conditions Not Correct** *This NRC shall be returned if the criteria for the request DiagnosticSessionControl are not met.*	CNC
0x31	**Request Out Of Range** This NRC shall be sent if • none of the requested dataIdentifier values are supported by the device;	ROOR
0x33	**Security Access Denied** This NRC shall be sent if at least one of the dataIdentifiers is secured and the server is not in an unlocked state.	SAD
0x7E	**sub-function Not Supported In Active Session** *This NRC indicates that the requested action will not be taken because the server does not support the requested sub-function in the session currently active. This NRC shall only be used when the requested sub-function is known to be supported in another session*	SFNSIAS

Security Access (0x27) service

A typical example of the use of this service is as follows
1 client requests the "Seed",
2 server sends the "Seed",
3 client sends the "Key" (appropriate for the Seed received),
4 server responds that the "Key" was valid and that it will unlock itself.

Request message definition - sub-function = requestSeed		
#	**Parameter name**	**Byte value**
#1	SecurityAcces Request SID	0x27
#2	sub-function = [securityAccessType = requestSeed]	 0x01
#3 #4	securityAccessDataRecord[] = [parameter#1 parameter#2]	 0x00...0xFF 0x00...0xFF

Request message definition - sub-function = sendKey		
#	**Parameter name**	**Byte value**
#1	SecurityAcces Request SID	0x27
#2	sub-function = [securityAccessType = sendKey]	0x02
#3 : #6	securityKey[] = [key#1 (high byte) : key#m (low byte)]	 0x00...0xFF : 0x00...0xFF

Request message sub-function parameter definition	
0x01	**requestSeed** *RequestSeed with the level of security defined by the vehicle manufacturer.*
0x02	**sendKey** *SendKey with the level of security defined by the vehicle manufacturer.*

Positive Response Message definition – requestSeed		
#	**Parameter name**	**Byte value**
#1	SecurityAccess Response SID	0x67
#2	sub-function = [securityAccessType]	0x01
#3 : #6	securitySeed[] = [seed#1 (high byte) : seed#m (low byte)]	 0x00...0xFF : 0x00...0xFF

Positive Response Message definition – sendKey		
#	**Parameter name**	**Byte value**
#1	SecurityAccess Response SID	0x67
#2	securityAccessType = sendKey	0x02

Negative Response Message definition		
#	**Parameter name**	**Byte value**
#1	Negative Response Service ID	0x7F
#2	SecurityAccess Response SID	0x27
#3	Negative response code	0x00... 0xFF

Supported Negative Response codes		
0x12	**sub-function Not Supported** *This NRC shall be sent if the sub-function parameter is not supported.*	SFNS
0x13	**Incorrect Message Length Or Invalid Format** *This NRC shall be sent if the length of the message is wrong.*	IMLOIF
0x22	**Conditions Not Correct** *This NRC shall be returned if the criteria for the request DiagnosticSessionControl are not met.*	CNC
0x24	**Request Sequence Error** *Send if the 'sendKey' sub-function is received without first receiving a 'requestSeed' request message.*	RSE
0x31	**Request Out Of Range** *This NRC shall be sent if the user optional securityAccessDataRecord contains invalid data.*	ROOR
0x35	**Invalid Key** *Send if an expected 'sendKey' sub-function value is received and the value of the key does not match the server's internally stored/calculated key.*	IK
0x36	**Exceeded Number Of Attempts** *Send if the delay timer is active due to exceeding the maximum number of allowed false access attempts.*	ENOA
0x37	**Required Time Delay Not Expired** *Send if the delay timer is active and a request is transmitted.*	RTDNE
0x7E	**sub-function Not Supported In Active Session** *This NRC indicates that the requested action will not be taken because the server does not support the requested sub-function in the session currently active. This NRC shall only be used when the requested sub-function is known to be supported in another session*	SFNSIAS

Communication Control (0x28) service

Request Message definition

#	Parameter name	Byte value
#1	CommunicationControl Request SID	0x28
#2	sub-function = [controlType]	0x00...0xFF
#3	communicationType	0x00...0xFF

Available sub-functions

0x00	**Enable Rx And Tx**
	This value indicates that the reception and transmission of messages shall be enabled for the specified communicationType.
0x03	**Disable Rx And Tx**
	This value indicates that the reception and transmission of messages shall be disabled for the specified communicationType.

Positive Response Message definition

#	Parameter name	Byte value
#1	CommunicationControl Response SID	0x68
#2	sub-function = [controlType]	0x00...0xFF

Negative Response Message definition

#	Parameter name	Byte value
#1	Negative Response Service ID	0x7F
#2	DiagnosticSessionControl Response SID	0x28
#3	Negative response code	0x00... 0xFF

Supported Negative Response codes

0x12	**sub-function Not Supported**	SFNS
	This NRC shall be sent if the sub-function parameter is not supported.	
0x13	**Incorrect Message Length Or Invalid Format**	IMLOIF
	This NRC shall be sent if the length of the message is wrong.	
0x22	**Conditions Not Correct**	CNC
	This NRC shall be returned if the criteria for the request DiagnosticSessionControl are not met.	
0x31	**Request Out Of Range**	ROOR
	This NRC shall be sent if the user optional securityAccessDataRecord contains invalid data.	
0x7E	**sub-function Not Supported In Active Session**	SFNSIAS
	This NRC indicates that the requested action will not be taken because the server does not support the requested sub-function in the session currently active. This NRC shall only be used when the requested sub-function is known to be supported in another session	

Tester Present (0x3E) service

Request Message definition		
#	**Parameter name**	**Byte value**
#1	TesterPresent Request SID	0x3E
#2	sub-function = [zeroSubFunction]	0x00

Available sub-functions	
0x00	**zeroSubFunction**
	This parameter value is used to indicate that no sub-function value supported by this service.

Positive Response Message definition		
#	**Parameter name**	**Byte value**
#1	TesterPresent Response SID	0x7E
#2	sub-function = [zeroSubFunction]	0x00

Negative Response Message definition		
#	**Parameter name**	**Byte value**
#1	Negative Response Service ID	0x7F
#2	DiagnosticSessionControl Response SID	0x3E
#3	Negative response code	0x00… 0xFF

Supported Negative Response codes		
0x12	**sub-function Not Supported**	SFNS
	This NRC shall be sent if the sub-function parameter is not supported.	
0x13	**Incorrect Message Length Or Invalid Format**	IMLOIF
	This NRC shall be sent if the length of the message is wrong.	

Example How to Interpret a Request-Response

Positive Response		
Request		**02 10 01 00 00 00 00 00**
Byte 0	Effective length of message	02
Byte 1	Request SID	10 (Diagnostic Session Control)
Byte 2	Sub-Function	01 (default diagnostic session)
Byte 3-7	Do not care	00 00 00 00 00
Response		**06 50 01 00 32 00 C8 AA**
Byte 0	Effective length of message	06
Byte 1	Response SID	50 (DiagnosticSessionControl Response)
Byte 2	Sub-Function	01 (default diagnostic session)
Byte 3-6	Parameters	00 32 00 C8 (sessionParameterRecord)
Byte 7	Do not care	00

Negative Response		
Request		**02 10 01 00 00 00 00 00**
Byte 0	Effective length of message	02
Byte 1	Request SID	10 (Diagnostic Session Control)
Byte 2	Sub-Function	01 (default diagnostic session)
Byte 3-7	Do not care	00 00 00 00 00
Response		**03 7F 10 12 00 00 00 00**

Byte 0	Effective length of message	03
Byte 1	Negative Response	7F
Byte 2	Request SID	10
Byte 3	Negative Response Code	12 (sub-function Not Supported)
Byte 4-7	Do not care	00 00 00 00