

ISO 14229-1:2020-02 (E)

Road vehicles - Unified diagnostic services (UDS) - Part 1: Application layer

Contents		Page
Foreword.....		ix
Introduction.....		x
1 Scope		1
2 Normative references		1
3 Terms and definitions.....		2
4 Symbols and abbreviated terms.....		5
5 Conventions		5
6 Document overview		6
7 Application layer services		7
7.1 General		7
7.2 Format description of application layer services		9
7.3 Format description of service primitives		9
7.3.1 General definition.....		9
7.3.2 Service request and service indication primitives		10
7.3.3 Service response and service confirm primitives.....		11
7.3.4 Service request-confirm and service response-confirm primitives		11
7.4 Service data unit specification		12
7.4.1 Mandatory parameters.....		12
7.4.2 Vehicle system requirements.....		14
7.4.3 Optional parameters - A_AE, application layer remote address.....		15
8 Application layer protocol.....		15
8.1 General definition.....		15
8.2 A_PDU, application protocol data unit		16
8.3 A_PCI, application protocol control information		16
8.4 SI, service identifier		17
8.5 A_NR_SI, Negative response service identifier		17
8.6 Negative response/confirmation service primitive.....		18
8.7 Server response implementation rules.....		18
8.7.1 General definitions.....		18
8.7.2 General server response behaviour		19
8.7.3 Request message with SubFunction parameter and server response behaviour.....		21
8.7.4 Request message without SubFunction parameter and server response behaviour		25
8.7.5 Pseudo code example of server response behaviour		27
8.7.6 Multiple concurrent request messages with physical and functional addressing.....		29
9 Service description conventions		29
9.1 Service description		29
9.2 Request message.....		30
9.2.1 Request message definition		30
9.2.2 Request message SubFunction parameter \$Level (LEV_) definition		31
9.2.3 Request message data-parameter definition		33
9.3 Positive response message.....		33
9.3.1 Positive response message definition.....		33
9.3.2 Positive response message data-parameter definition		34

9.4	Supported negative response codes (NRC_)	34
9.5	Message flow examples	35
10	Diagnostic and communication management functional unit	36
10.1	Overview	36
10.2	DiagnosticSessionControl (10 ₁₆) service	36
10.2.1	Service description	36
10.2.2	Request message	40
10.2.3	Positive response message	41
10.2.4	Supported negative response codes (NRC_)	42
10.2.5	Message flow example(s) DiagnosticSessionControl – Start programmingSession	43
10.3	ECUReset (11 ₁₆) service	43
10.3.1	Service description	43
10.3.2	Request message	44
10.3.3	Positive response message	45
10.3.4	Supported negative response codes (NRC_)	46
10.3.5	Message flow example ECUReset	47
10.4	SecurityAccess (27 ₁₆) service	47
10.4.1	Service description	47
10.4.2	Request message	49
10.4.3	Positive response message	51
10.4.4	Supported negative response codes (NRC_)	51
10.4.5	Message flow example(s) SecurityAccess	52
10.5	CommunicationControl (28 ₁₆) service	54
10.5.1	Service description	54
10.5.2	Request message	54
10.5.3	Positive response message	56
10.5.4	Supported negative response codes (NRC_)	56
10.5.5	Message flow example CommunicationControl (disable transmission of network management messages)	57
10.5.6	Message flow example CommunicationControl (switch a remote network into the diagnostic-only scheduling mode where the node with address 000A ₁₆ is connected to)	57
10.5.7	Message flow example CommunicationControl (switch to application scheduling mode with enhanced address information, the node 000A ₁₆ , which is connected to a sub-network, is addressed)	58
10.6	Authentication (29 ₁₆) service	59
10.6.1	Service overview	59
10.6.2	Authentication with PKI Certificate Exchange (APCE)	60
10.6.3	Authentication with Challenge-Response (ACR)	65
10.6.4	Common requirements	69
10.6.5	Request message	71
10.6.6	Positive response message	78
10.6.7	Supported negative response codes (NRC_)	85
10.6.8	Message flow example(s) Authentication	86
10.7	TesterPresent (3E ₁₆) service	108
10.7.1	Service description	108
10.7.2	Request message	108
10.7.3	Positive response message	108
10.7.4	Supported negative response codes (NRC_)	109
10.7.5	Message flow example(s) TesterPresent	109
10.8	ControlDTCSetting (85 ₁₆) service	110
10.8.1	Service description	110
10.8.2	Request message	111

10.8.3	Positive response message.....	112
10.8.4	Supported negative response codes (NRC_).....	112
10.8.5	Message flow example(s) ControlDTCSetting	113
10.9	ResponseOnEvent (86 ₁₆) service	114
10.9.1	Service description	114
10.9.2	Request message.....	121
10.9.3	Positive response message.....	127
10.9.4	Supported negative response codes (NRC_).....	130
10.9.5	Message flow example(s) ResponseOnEvent.....	131
10.10	LinkControl (87 ₁₆) service.....	146
10.10.1	Service description	146
10.10.2	Request message	147
10.10.3	Positive response message	149
10.10.4	Supported negative response codes (NRC_)	149
10.10.5	Message flow example(s) LinkControl	150
11	Data transmission functional unit.....	152
11.1	Overview.....	152
11.2	ReadDataByIdentifier (22 ₁₆) service.....	153
11.2.1	Service description	153
11.2.2	Request message.....	153
11.2.3	Positive response message.....	154
11.2.4	Supported negative response codes (NRC_).....	155
11.2.5	Message flow example ReadDataByIdentifier.....	157
11.3	ReadMemoryByAddress (23 ₁₆) service	159
11.3.1	Service description	159
11.3.2	Request message.....	159
11.3.3	Positive response message.....	161
11.3.4	Supported negative response codes (NRC_).....	161
11.3.5	Message flow example ReadMemoryByAddress.....	163
11.4	ReadScalingDataByIdentifier (24 ₁₆) service.....	166
11.4.1	Service description	166
11.4.2	Request message.....	166
11.4.3	Positive response message.....	166
11.4.4	Supported negative response codes (NRC_).....	167
11.4.5	Message flow example ReadScalingDataByIdentifier	169
11.5	ReadDataByPeriodicIdentifier (2A ₁₆) service.....	172
11.5.1	Service description	172
11.5.2	Request message.....	176
11.5.3	Positive response message.....	176
11.5.4	Supported negative response codes (NRC_).....	177
11.5.5	Message flow example ReadDataByPeriodicIdentifier.....	180
11.6	DynamicallyDefineDataIdentifier (2C ₁₆) service	191
11.6.1	Service description	191
11.6.2	Request message.....	192
11.6.3	Positive response message.....	195
11.6.4	Supported negative response codes (NRC_).....	196
11.6.5	Message flow examples DynamicallyDefineDataIdentifier.....	197
11.7	WriteDataByIdentifier (2E ₁₆) service.....	212
11.7.1	Service description	212
11.7.2	Request message.....	212
11.7.3	Positive response message.....	213
11.7.4	Supported negative response codes (NRC_).....	214
11.7.5	Message flow example WriteDataByIdentifier	215

11.8	WriteMemoryByAddress (3D ₁₆) service	216
11.8.1	Service description	216
11.8.2	Request message	217
11.8.3	Positive response message	218
11.8.4	Supported negative response codes (NRC_)	219
11.8.5	Message flow example WriteMemoryByAddress	221
12	Stored data transmission functional unit.....	223
12.1	Overview	223
12.2	ClearDiagnosticInformation (14 ₁₆) service	223
12.2.1	Service description	223
12.2.2	Request message	224
12.2.3	Positive response message	225
12.2.4	Supported negative response codes (NRC_)	225
12.2.5	Message flow example ClearDiagnosticInformation.....	226
12.3	ReadDTCInformation (19 ₁₆) service	227
12.3.1	Service description	227
12.3.2	Request message	238
12.3.3	Positive response message	249
12.3.4	Supported negative response codes (NRC_)	263
12.3.5	Message flow examples – ReadDTCInformation	264
13	InputOutput control functional unit	297
13.1	Overview	297
13.2	InputOutputControlByIdentifier (2F ₁₆) service	297
13.2.1	Service description	297
13.2.2	Request message	298
13.2.3	Positive response message	299
13.2.4	Supported negative response codes (NRC_)	300
13.2.5	Message flow example(s) InputOutputControlByIdentifier	301
14	Routine functional unit	310
14.1	Overview	310
14.2	RoutineControl (31 ₁₆) service	311
14.2.1	Service description	311
14.2.2	Request message	312
14.2.3	Positive response message	314
14.2.4	Supported negative response codes (NRC_)	315
14.2.5	Message flow example(s) RoutineControl	317
15	Upload download functional unit.....	321
15.1	Overview	321
15.2	RequestDownload (34 ₁₆) service.....	321
15.2.1	Service description	321
15.2.2	Request message	322
15.2.3	Positive response message	323
15.2.4	Supported negative response codes (NRC_)	324
15.2.5	Message flow example(s) RequestDownload.....	325
15.3	RequestUpload (35 ₁₆) service.....	325
15.3.1	Service description	325
15.3.2	Request message	326
15.3.3	Positive response message	327
15.3.4	Supported negative response codes (NRC_)	328
15.3.5	Message flow example(s) RequestUpload.....	329
15.4	TransferData (36 ₁₆) service	330
15.4.1	Service description	330

15.4.2	Request message.....	330
15.4.3	Positive response message.....	331
15.4.4	Supported negative response codes (NRC_).....	332
15.4.5	Message flow example(s) TransferData.....	334
15.5	RequestTransferExit (37 ₁₆) service.....	334
15.5.1	Service description.....	334
15.5.2	Request message.....	335
15.5.3	Positive response message.....	335
15.5.4	Supported negative response codes (NRC_).....	336
15.5.5	Message flow example(s) for downloading/uploading data.....	337
15.6	RequestFileTransfer (38 ₁₆) service.....	344
15.6.1	Service description.....	344
15.6.2	Request message.....	344
15.6.3	Positive response message.....	346
15.6.4	Supported negative response codes (NRC_).....	348
15.6.5	Message flow example(s) RequestFileTransfer.....	350
16	Security sub-layer definition.....	353
16.1	General.....	353
16.1.1	Purpose.....	353
16.1.2	Security sub-layer description.....	353
16.1.3	Security sub-layer access.....	354
16.1.4	General server response behaviour.....	356
16.2	SecuredDataTransmission (84 ₁₆) service.....	358
16.2.1	Service description.....	358
16.2.2	Request message.....	358
16.2.3	Positive response message for successful internal message.....	360
16.2.4	Supported negative response codes (NRC_).....	362
16.2.5	Message flow example SecuredDataTransmission.....	363
17	Non-volatile server memory programming process.....	366
17.1	General information.....	366
17.2	Detailed programming sequence.....	370
17.2.1	Programming phase #1 — Download of application software and/or application data.....	370
17.3	Server reprogramming requirements.....	379
17.3.1	Requirements for servers to support programming.....	379
17.3.2	Software, data identification and fingerprints.....	382
17.3.3	Server routine access.....	383
17.4	Non-volatile server memory programming message flow examples.....	383
17.4.1	General information.....	383
17.4.2	Programming phase #1 — Pre-Programming step.....	383
17.4.3	Programming phase #1 — Programming step.....	384
17.4.4	Programming phase #1 — Post-Programming step.....	389
Annex A (normative)	Global parameter definitions.....	390
Annex B (normative)	Diagnostic and communication management functional unit data-parameter definitions.....	400
Annex C (normative)	Data transmission functional unit data-parameter definitions.....	405
Annex D (normative)	Stored data transmission functional unit data-parameter definitions....	422
Annex E (normative)	Input output control functional unit data-parameter definitions.....	444
Annex F (normative)	Routine functional unit data-parameter definitions.....	445
Annex G (normative)	Upload and download functional unit data-parameter.....	447
Annex H (informative)	Examples for addressAndLengthFormatIdentifier parameter values..	448
Annex I (normative)	Security access state chart.....	450
Annex J (informative)	Recommended implementation for multiple client environments.....	458
Bibliography.....		464