



SURFACE VEHICLE STANDARD	J1979™-2	APR2026
	Issued	2021-04
	Revised	2026-04
Superseding J1979-2 APR2021		
(R) E/E Diagnostic Test Modes: OBDonUDS		

RATIONALE

This document has been revised to address needed corrections and clarifications.

FOREWORD

SAE J1979-2 specifies diagnostic services and functionally addressed request/response messages required to be supported by motor vehicles and external test equipment for diagnostic purposes that pertain to motor vehicle emission-related data. These messages are intended to be used by any external test equipment meeting the requirements of SAE J1978 for retrieval of on-board diagnostic (OBD) information from a vehicle.

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1. SCOPE

1.1 Introduction

SAE J1979-2 describes the communication between the vehicle's OBD systems and test equipment required by OBD regulations. OBD regulations require passenger cars and light-, medium-, and heavy-duty trucks to support a minimum set of diagnostic information to external (off-board) "generic" test equipment.

To achieve this, SAE J1979-2 is based on 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 services specified are broken into:

- Diagnostic services (layer 7), specified in:
 - ISO 14229-1
 - SAE J1979-2 OBDOnUDS
- Presentation layer (layer 6), specified in:
 - SAE J1930, SAE J1930DA
 - SAE J1979DA
 - SAE J2012, SAE J2012DA
 - SAE J1939DA, SAE J1939-73
- Session layer services (layer 5), specified in:
 - ISO 14229-2
- Transport layer services (layer 4), specified in:
 - DoCAN: ISO 15765-2 Transport protocol and network layer services
 - ISO 15765-4 Requirements for emissions related systems
 - DoIP: ISO 13400-2 Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 2: Transport protocol and network layer services
- Network layer services (layer 3), specified in:
 - DoCAN: ISO 15765-2 Transport protocol and network layer services
 - ISO 15765-4 Requirements for emissions related systems
 - DoIP: ISO 13400-2 Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 2: Transport protocol and network layer services
- Data link layer (layer 2), specified in:
 - DoCAN: ISO 15765-4, ISO 11898-1, ISO 11898-2
 - DoIP: ISO 13400-3 Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 3: Wired vehicle interface based on IEEE 802.3

- Physical layer (layer 1), specified in:
 - DoCAN: ISO 15765-4, ISO 11898-1, ISO 11898-2, in accordance with Table 1
 - DoIP: ISO 13400-3 Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 3: Wired vehicle interface based on IEEE 802.3

NOTE: SAE J1979-2 provides a STANDARD to satisfy known country-specific OBD regulations. SAE J1979-2 is not considered a final authority for interpretation of the OBD regulations, so users of this document should determine the applicability of capabilities defined in this document for their specific OBD regulatory requirements.

Table 1 - Legislated emissions-related OBD diagnostic specifications applicable to the OSI layers

Applicability	OSI 7 Layers	Emissions-Related OBD Communication Requirements		Emissions-Related OBD Communication Requirements Based on UDS			
Seven layers according to ISO/IEC 7498-1 and ISO/IEC 10731	Application (layer 7)	ISO 15031-5, SAE J1979		ISO 14229-1 SAE J1979-2			
	Presentation (layer 6)	SAE J1930DA, SAE J1979DA, SAE J2012DA		SAE J1930DA, SAE J1979DA, SAE J2012DA, SAE J1939DA			
	Session (layer 5)	ISO 14229-2		ISO 14229-2			
	Transport (layer 4)	ISO 15765-2	ISO 15765-4	ISO 15765-2	ISO 15765-4	ISO 13400-2	
	Network (layer 3)						
	Data link (layer 2)	ISO 11898-1, ISO 11898-2		ISO 11898-1, ISO 11898-2			ISO 13400-3
	Physical (layer 1)						

1.1.1 SAE Document Reference Concept

SAE J1979-2 references several SAE documents that contain all terms, data, and diagnostic trouble code (DTC) definitions.

See [Figure 1](#) with the following definitions:

- SAE J1930 defines a procedure for naming objects and systems and with the set of words from which names are built. It references SAE J1930DA, which contains all standardized naming objects, terms, and abbreviations.
- SAE J1979DA contains all standardized data items for OBD diagnostics communications, including Data Identifiers, InfoTypes, Readiness Group Identifiers, and Routine Identifiers. Many data items are augmented with user notes for calculation and display. Usage notes for clearing fault codes and combining diagnostic events are also provided for diagnostic executive design.
- SAE J2012 defines the procedure for defining emissions-related diagnostic trouble codes. It references SAE J2012DA, which contains all standardized data items like DTCs and FTBs.
- SAE J1939DA contains all standardized SPNs, which can be used as DTCs for HDV/MDV applications.
- SAE J1939-73 Appendix A defines Failure Mode Indicators (FMIs).
- SAE J2403 defines a procedure for naming objects and systems and with the set of words from which names are built for vehicles where SAE J1939 is used for fault codes. It references SAE J1930DA, which contains all standardized naming objects, terms, and abbreviations.

Key:

1. SAE digital annexes

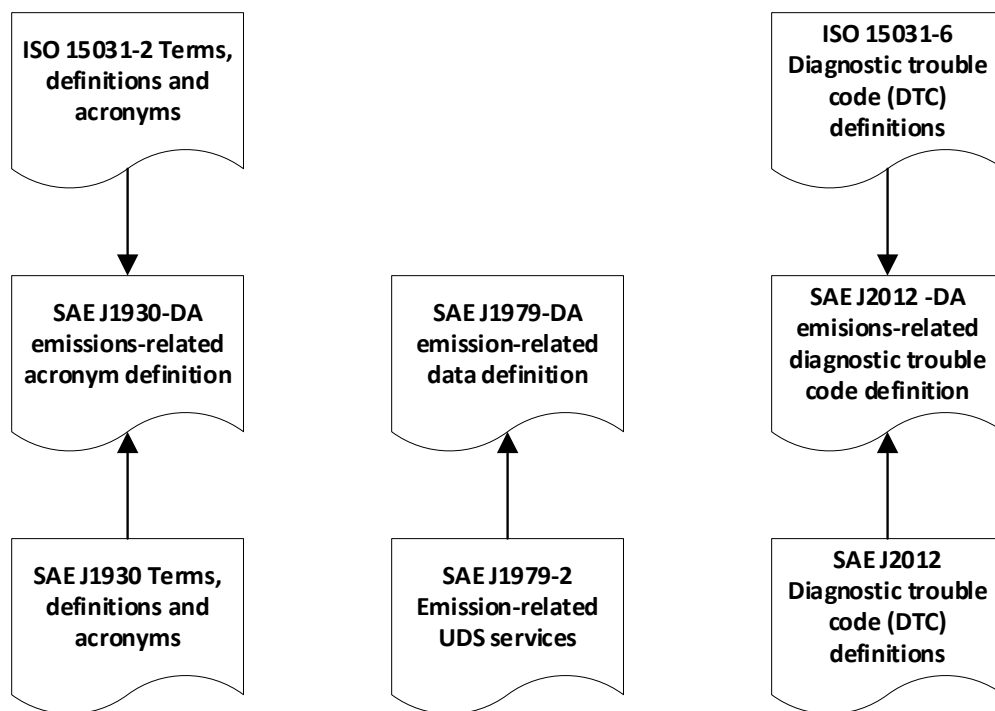


Figure 1 - SAE digital annex document reference

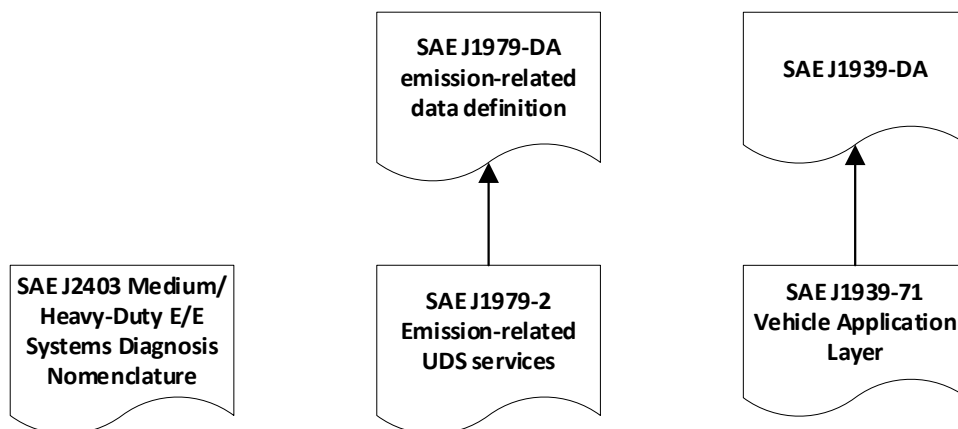


Figure 2 - SAE document reference for MDV/HDV utilizing SAE J1939

1.1.2 SAE J1979DA (Digital Annex)

This document references SAE J1979DA. SAE J1979DA is concerned with the definition of:

- DataIdentifiers (DID)
- ReadinessGroupIdentifiers (RGID)
- ExtendedDataRecords (EDR)

- Routine Identifiers (RID)
- Unit and Scaling Identifiers (UASID)
- Info Types (ITID)

1.1.3 SAE Digital Annex Revision Procedure

New emissions-related regulatory requirements drive new in-vehicle technology to lower emissions. New technology-related OBD monitor data and diagnostic trouble codes need to be standardized to support the external (off-board) “generic” test equipment. All relevant information is proposed by the automotive industry represented by members of the appropriate SAE task force.

SAE J1979-2 references a “Change Request Form” to be used for new data items to be defined by the SAE task force for standardization. The standardized data items will be defined in SAE J1979DA. Once the information has been balloted and approved, the documents will be published on the SAE Store website.

The revision request form for SAE J1979-2 can be obtained on the Registration Authority’s website at <http://www.SAE.org/servlets/works/committeeHome.do?comtID=TEVDS14>.

Fill out the “SAE_J1979DA_Revision_Request_Form.doc” with your request and send an email with completed revision request form as attachment to email: SAEj1979@SAE.org.

Those users who use SAE_J1939-73_DTCFormat to communicate DTCs may also request new Suspect Parameter Number (SPN) values from the SAE Truck and Bus Control and Communications Network Committee. Instructions and request forms are available to the public on the committee’s SAE Standards Works website at <https://www.SAE.org/servlets/works/committeeHome.do?comtID=TETES7#>.

The index of SPN assignments is published quarterly in SAE J1939DA. SAE J1939DA includes all the SPN labels defined in SAE J2403 and SAE J2403DA. SAE J1939DA also defines a range of manufacturer proprietary SPNs that are occasionally used for diagnostic conditions that do not map unambiguously into the standardized list of SPNs.

1.2 Document Scope

This document is intended to satisfy the data reporting requirements of OBD regulations in the United States, Europe, and any other market that may adopt similar requirements in the future. This document specifies:

- a. Message formats for request and response messages.
- b. Timing requirements between request messages from external test equipment and response messages from vehicles and between those messages and subsequent request messages.
- c. Behavior of both the vehicle and external test equipment if data is not available.
- d. A set of diagnostic services, with corresponding content of request and response messages, to satisfy OBD regulations.

This document includes capabilities required to satisfy OBD requirements for multiple regions, model years, engine types, and vehicle types. At the time of publication, many regional regulations are not yet final and are expected to change in the future. This document makes no attempt to interpret the regulations and does not include applicability of the included diagnostic services and data parameters for various vehicle applications. The user of this document is responsible to verify the applicability of each section of this document for a specific vehicle, engine, model year, and region.

SAE J1979-2 specifies diagnostic services and both functionally addressed and physically addressed request/response messages required to be supported by motor vehicles and external test equipment for diagnostic purposes that pertain to motor vehicle emission-related data. Any external test equipment meeting the requirements of SAE J1978 is intended to be able to use these messages to retrieve emissions-related information from the vehicle.

The structure of this document is based on the structure of SAE J1979 for the convenience of users familiar with SAE J1979. Each section of this part of SAE J1979-2, which specifies additional detail to existing sections of ISO 15765-4 and SAE J1979, supersedes those specifications for their use under the scope of SAE J1979-2.

This part of SAE J1979-2 references SAE J1979DA (Digital Annex), which includes all definitions of DIDs.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), www.sae.org.

SAE J1930	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms - Equivalent to ISO 15031-2
SAE J1930DA	J1930 Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet
SAE J1939	Serial Control and Communications Heavy-Duty Vehicle Network - Top-Level Document
SAE J1939-71	Vehicle Application Layer
SAE J1939-73	Application Layer - Diagnostics
SAE J1939DA	J1939 Digital Annex
SAE J1978	OBD-II Scan Tool
SAE J1979	E/E Diagnostic Test Modes
SAE J1979DA	Digital Annex of E/E Diagnostic Test Modes
SAE J2012	Diagnostic Trouble Code Definitions
SAE J2012DA	Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions
SAE J2403	Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature

2.1.2 ISO Publications

Copies of these documents are available online at www.iso.org/store.

ISO 7498-1	Information processing systems - Open systems interconnection - Basic reference model
ISO 11898-1	Road vehicles - Controller area network (CAN) - Part 1: Data link layer and physical coding sublayer
ISO 11898-2	Road vehicles - Controller area network (CAN) - Part 2: High-speed physical medium attachment (PMA) sublayer
ISO 13400-2	Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 2: Transport protocol and network layer services

ISO 13400-3	DoIP: Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 3: Wired vehicle interface based on IEEE 802.3
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 15031-5	Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics - Part 5: Emissions-related diagnostic services
ISO 15031-6	Road vehicles - Communication between vehicle and external equipment for emissions-related diagnostics - Part 6: Diagnostic trouble code definitions
ISO 15765-2	Road vehicles - Diagnostics over Controller Area Network (DoCAN) - Part 2: Transport protocol and network layer services
ISO 15765-4	Road vehicles - Diagnostic communication over Controller Area Network (DoCAN) - Part 4: Requirements for emissions-related systems
ISO/IEC 10731	Information technology - Open Systems Interconnection - Basic Reference Model - Conventions for the definition of OSI services

3. DEFINITIONS

For the purposes of this document, the terms and definitions given in SAE J1930, SAE J2403, ISO 14229-2, and ISO 15765-2 and the following apply.

Basic principles

The reaction of the vehicle to requests which are not specified in this standard or which are not compliant to this standard is outside the scope of this document.

External test equipment (ETE) should rely only on what is specified as “required by this standard.”

The protocol test part of conformance tests/test plans should be derived only from the requirements given in this standard.

3.1 CLIENT

Function that is part of the tester and that makes use of the diagnostic services.

NOTE: A tester normally makes use of other functions such as database management, specific interpretation, and man-machine interface.

3.2 CONTINUOUS MONITORING

Sampling at a rate no less than two samples per second. If for control purposes a computer input is sampled less frequently, the signal of the component may instead be evaluated each time sampling occurs.

3.3 CONVENTION (Cvt)

A column that is integrated in each message table marks each parameter included in the table with the following values:

C = Conditional: The parameter marked “C” in a request/response message is present only under a condition specified in the bottom row of the message table.

M = Mandatory: The parameter marked “M” in a request/response message table is always present.

U = User optional: The parameter marked “U” in a request/response message table is or is not supplied, depending on dynamic usage by the manufacturer. The convention recommends a mnemonic, which might be used for implementation. In no case is the specified mnemonic a mandatory requirement for any implementation.

3.4 ELECTRONIC CONTROL UNIT (ECU)

Generic term for any electronic control unit. Usually an ECU is an embedded system which supports software updates or diagnostics, supports communication over DoCAN or DoIP, and has more capabilities than a smart device.

3.5 EMISSIONS-RELATED DTC

A DTC that is set when a malfunction causes vehicle emissions to exceed legislated emission thresholds or is otherwise required to be set as specified by OBD regulations (e.g., disables another part of the diagnostic system). Normally, the malfunction indicator light (MIL) is illuminated at the same time as the emissions-related DTC is set. The determination of which DTCs are emissions-related is made by the vehicle manufacturer for each vehicle, as specified by OBD regulations.

3.6 FIRST FRAME ESCAPE SEQUENCE (FF_ES)

First frame escape sequence is a method in ISO 15765-2 (DoCAN transport protocol) to transmit messages longer than 4KB on CAN.

It is theoretically possible to support up to 4GB in a single message, but for OBD the messages are much shorter. The longest message is for service \$19 and some of its subfunctions where the size is a function of number of supported DTCs in one ECU.

3.7 FREEZE FRAME (FF)

Data stream information that is stored upon detection of a DTC. The UDS term is “Snapshot.”

3.8 NEGATIVE NUMBERS

Signed binary, the most significant bit (MSB) of the binary number used to indicate positive (0)/negative (1) values. Twos complement presentation shall be used for negative numbers unless otherwise specified.

NOTE 1: 2s complement: Negative numbers are represented by complementing the binary number and then adding 1.

EXAMPLE: - 0.99 = 8001 hex = 1000 0000 0000 0001 binary

0 = 0000 hex = 0000 0000 0000 0000 binary

+0.99 = 7FFF hex = 0111 1111 1111 1111 binary

NOTE 2: (- 0.99) + (+ 0.99) = 0.

3.9 NUMBER

Expressed by this symbol “#.”

3.10 P2Client TIMING PARAMETER

Application timing parameter with the maximum value for the ECU(s) and the external test equipment to indicate a response message.

3.11 P2reload TIMING PARAMETER

Application timing parameter with the maximum value ($P2_{max}$) for external test equipment only.

P2reload just affects functional addressing.

The advantage of P2reload is that it scales automatically with the number of ECUs and will safely prevent the client from a timeout if every ECU by its own respects the P2 timing parameter (with considering of the routing time).

3.12 SERVER

Function that is part of an ECU that provides the diagnostic services.

NOTE: This document differentiates between the server (i.e., the function) and the ECU so that this document remains independent from the implementation.

3.13 SERVICE

Information exchange initiated by a client (external test equipment) in order to retrieve diagnostic information from a server (ECU) and/or to modify its behavior for diagnostic purpose.

NOTE: This is also the equivalent of test mode or mode cited in SAE J1979.

3.14 SUBFUNCTION

Subfunctions are defined for UDS in ISO 14229-1 to create complex services with different functionalities (e.g., Service \$19 with subfunction \$42).

3.15 OBD CLASSIC

OBD Classic refers to OBD communications that use the services \$01 through \$0A.

3.16 OBDOnUDS

OBDOnUDS is a subset of UDS services that are defined in ISO 14229-1 that offers equivalent functionality as SAE J1979 services and defines additional features for new OBD regulation requirements.

3.17 DTCStatusMask/DTC STATUS BYTE

In UDS, each DTC is provided with a status byte that provides additional information about the DTC, including when the DTC failed, when the DTC was last evaluated, and if any warning indication has been requested. Each of the 8 bits in the status byte has a precise meaning that is defined in ISO 14229-1.

NOTE: The DTC status byte is only available for OBDOnUDS ECUs. In a request of service \$19 subfunction \$42, the DTCStatusMask works as a filter. In a response, the actual state of the DTC is transmitted (DTC status byte).

See [7.1.1](#) for more information.

3.18 DTCStatusAvailabilityMask

A byte whose bits are defined the same as statusOfDTC and represents the status bits that are supported by the server.

3.19 DTCSeverityMask

The DTCSeverityMask/DTCSeverity byte contains DTC severity and DTC class information.

See [7.1.1](#) for more information.

3.20 DTCSeverityAvailabilityMask

A byte whose bits are defined the same as the DTCSeverity and represents the severity bits that are supported by the server.

See [7.1.1](#) for more information.

3.21 FunctionalGroupIdentifier

A one byte identifier that contains the functional system group the DTC(s) are related to, e.g., Brakes, Emissions, Occupant Restraints, Tire Inflation, Forward/External lighting, etc. The identifier is defined in ISO 14229-1.

See [7.1.1](#) for more information.

3.22 ReadinessGroupIdentifier

A one byte identifier that describes a readiness group.

The identifier is defined in ISO 14229-1 but is specified in SAE J1979DA for the OBD context (emission-system group \$33).

3.23 DTCFormatIdentifier

A one byte identifier that specifies the format of DTCs. Passenger cars/light-duty trucks shall use SAE_J2012DA_DTCFormat_04. Medium-/heavy-duty vehicles may as an alternative support SAE_J1939-73_DTCFormat. The ECU shall only support one DTCFormat.

3.24 SNAPSHOT

A set of parameters that values are recorded upon detection of a malfunction. The term has, in earlier versions of SAE J1979, been called “freeze frame.”

3.25 CombineEvents

If there is a need to combine different independent monitors to one single 3-Byte-DTC in OBDonUDS, this should be done with a central mechanism.

Detail description/Usage Notes could be found in SAE J1979DA.

3.26 RoutineInfo

The RoutineInfo byte encoding is vehicle manufacturer specific and provides a mechanism for the vehicle manufacturer to support generic external test equipment handling of all implemented routines.

3.27 OBD THRESHOLD LIMIT

Limit for a given exhaust gas species specified by local regulation where the malfunction should be detected.

3.28 OperationCycle

A cycle consists of two events that are defined by regulations during which a malfunction can be detected. OperationCycle is used for handling the life cycle of a DTC or to turn on or off MIL. The most common OperationCycle is Ignition cycle, which is specified by regulations. Engine start to engine start is another definition that is commonly used in regulations.

4. ABBREVIATIONS

AMCC	Active Monitor Completion Counts
CVN	Calibration Verification Number
DEM	Diagnostic Event Manager
DTC	Diagnostic Trouble Code
DTCEDRN	DTCEstDataRecordNumber
DTCMREC	DTCMaskRecord
DTCSM	DTCStatusMask
DTCSSRN	DTCSnapshotRecordNumber
DTCSVM	DTCSeverityMask
ECM	Engine Control Module
EI-AECD	Emission Increasing Auxiliary Emission Control Device
ERR	Error Detection Byte
FGID	Functional Group Identifier
GODTC	Group Of DTC
I/M	Inspection and Maintenance
ISR	Interrupt Service Routine
IUMPR	In-Use Monitor Performance Ratio
LSB	Least Significant Bit
MI	Malfunction Indicator
MIL	Malfunction Indicator Light
MSB	Most Significant Bit
RDCM	Reductant Control Module
N/A	Not Applicable
NRC	Negative Response Code
NTE	Not to Exceed
PCM	Powertrain Control Module
SMCC	Stored Monitor Completion Counts
SI	International System of Units
TCM	Transmission Control Module

Table 2 - Abbreviations for identifiers used in this document

Abbreviation	Description	Example
DID	Data Identifier	\$F501
RID	Routine Identifier	\$E001
ITID	InfoTypeIdentifier	\$F810
RGID	Readinessgroup Identifier	\$01
EDR	ExtendedDataRecord	\$91
SSR	SnapshotRecordNumber	\$00 or \$F0

NOTE 1: DID is a general term that includes PID/ITID. The DID has a size of 2-Bytes. The high byte is a Prefix (i.e., F4/F5/F7/F8). PID/ ITID means the low byte of selected DID ranges. The low byte uses common values between SAE J1979 and SAE J1979-2. Where 16-bit values are referred to as a PID and ITID in SAE J1979-2, it is implied that the high (or most significant) byte provides the prefix defined in ISO 14229-1 and documented in SAE J1979DA, and the low byte contains a PID/ITID appropriate to the prefix.

NOTE 2: The range of values for RID includes a subset range for TID. An RID has a size of 2-Bytes. The high byte is a Prefix (E0/E1). TID means the low byte of values in the subset range of RID.

5. CONVENTIONS

SAE J1979-2 is based on the conventions specified in the OSI Service Conventions (ISO/IEC 10731) as they apply for diagnostic services.

Figures [1](#), [2](#), and [3](#) illustrate the document references.

The protocol initialization identifies the data link layers supported by the vehicle. SAE J1979-2 references the standards as an applicable data link for emissions-related OBD.

SAE J1979-2 specifies the applicable emissions-related diagnostic services. SAE J1979-2 specifies the data record structures and references SAE J1930DA, SAE J1979DA, and SAE J2012DA, which include all emissions-related OBD data definitions.

6. DOCUMENT OVERVIEW

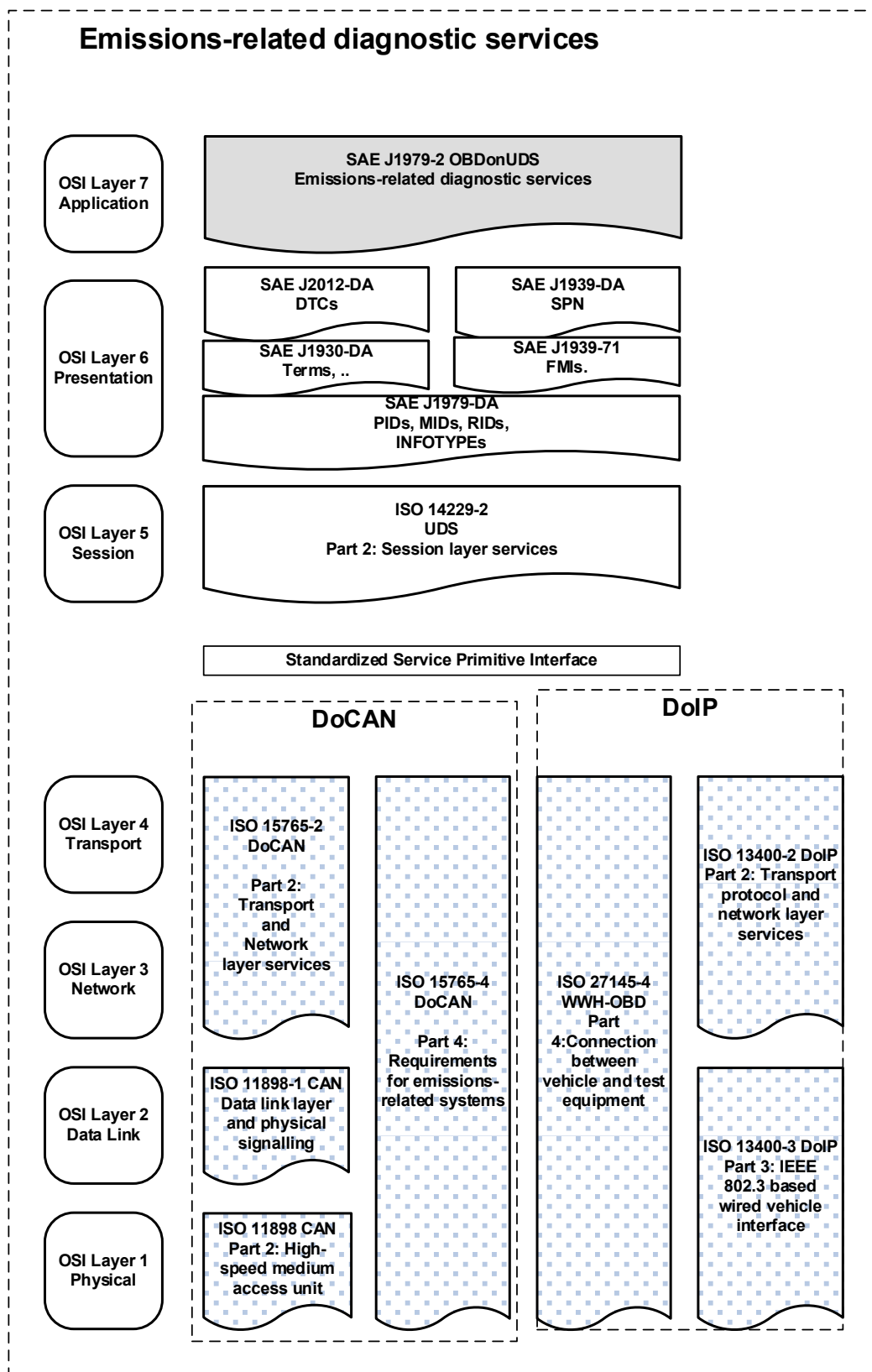


Figure 3 - Emissions-related OBD document reference according to OSI model

7. TECHNICAL REQUIREMENTS

7.1 General Requirements

The requirements specified in this clause are necessary to ensure proper operation of both the external test equipment and the vehicle during diagnostic procedures. External test equipment, when using messages specified, shall not affect normal operation of the emission control system.

This document describes the OBDOnUDS services from the ISO 14229-1 standard for OBD communications. Tables 3 and 4 show the equivalent services and the data ranges between SAE J1979 and SAE J1979-2.

Table 3 - Mapping of applicable SAE J1979 services to ISO 14229-1/SAE J1979-2 UDS services

Service	ISO 15031-5/ SAE J1979	SAE J1979-2
ReadDataStream	Service \$01 PID xx	Service \$22 DID \$F400 - \$F5FF and \$F700 - \$F7FF
ReadFreezeFrame	Service \$02 PID Frame	Service \$19 \$04 DTCMREC DTCSnapshotRecordNumber = \$00 (first occurrence) or \$F0 (latest occurrence)
ReadConfirmedDTCs	Service \$03 DTC (2 bytes)	Service \$19 \$42 \$33 \$08 \$02 DTC (2 bytes) + Failure Type Byte + Status Byte
ClearDTCs	Service \$04	Service \$14 \$FF \$FF \$33
ReadDiagnosticTestResults	Service \$06 MID xx	Service \$19 \$06 DTC \$92
ReadPendingDTCs	Service \$07 DTC (2 bytes)	Service \$19 \$42 \$33 \$04 \$02 DTC (2 bytes) + Failure Type Byte + Status Byte
RequestTest	Service \$08 TID xx	Service \$31 \$01 TID \$E000 - \$E1FF
ReadVehicleInformation	Service \$09 ITID xx	Service \$22 ITID \$F800 - \$F8FF
ReadPermanentDTCs	Service \$0A DTC (2 bytes)	Service \$19 \$55 \$33 DTC (2 bytes) + Failure Type Byte + Status Byte
ReadDTCExtDataRecords	Not available	Service \$19 \$06 DTCMREC DTCExtDataRecordNumber
ReadDTCReadinessByReadinessGroup	Not available	Service \$19 \$56 \$33 RGID
ReadSupportedDTCExtDataRecords	Not available	Service \$19 \$1A DTCExtDataRecordNumber

The “low byte” of the 2-byte ISO 14229-1 data identifier is derived from the 1-byte SAE J1979DA defined identifiers. The “high byte” of the 2-byte ISO 14229-1 data identifier is defined in ISO 14229-1.

Table 4 - Mapping of ISO 15031-5/SAE J1979 data ranges to ISO 14229-1/SAE J1979-2 data ranges

ISO 15031-5/J1979			ISO 14229-1		
Data Para	Legacy Service	Value Range	Data Para	Service	Value Range
PID	\$01	\$00-\$FF	DataIdentifier	\$22	\$F400-\$F5FF ^(a) \$F700-\$F7FF
MID	\$06	\$00-\$FF	DTCEDRN	\$19 \$06/\$19 \$1A	\$92
			reserved	\$22	\$F600-\$F6FF ^(a)
ITID	\$09	\$00-\$FF	DataIdentifier	\$22	\$F800-\$F8FF ^(a)
DTC	\$02, \$03, \$07, \$0A	P0000-U3FFF	DTCs	\$19	P0000 00 – U3FFF FF (2byte DTC+ FTB)
TID	\$08	\$00-\$FF	RoutineIdentifier	\$31	\$E000-\$E1FF ^(a)
			RGID	\$19 \$56	\$00-\$FE
			DTCEDRN	\$19\$06/\$19\$1A	\$90-\$9F
			FGID	\$19 \$42/\$19 \$55/\$19 \$56	\$33
			DTCSnapshotRecordNumber	\$19 \$04	\$00/\$F0
			groupOfDTC	\$14	FFFFFF33/\$FFFFFFF
			severityMask	\$19 \$42/ \$19 \$55/ \$19 \$56	\$00-\$1F
			statusBitMask	\$19	00-FF

^(a) ISO 14229-1 defines the ranges from \$E000-\$E1FF, \$F400-\$F5FF, \$F600-\$F6FF, \$F700-\$F7FF, and \$F800-\$F8FF for use on legislated OBD diagnostics. Some examples in this document use the prefix value of \$F4 as an abstraction for all the prefix ranges that are defined in ISO 14229-1 for OBD diagnostics.

NOTE: DID-range \$F600-\$F6FF is reserved for legacy reasons; some vehicle manufacturers used that DID range to report SAE J1979 Classic Service \$06 OBDMIDs as DIDs. Those DIDs can still be used but are not required by this document.

7.1.1 OBD on UDS Enhanced Information

7.1.1.1 DTCStatusMask/DTC Status Byte and DTCStatusAvailabilityMask

The DTC status byte is part of the data from the UDS Service \$19 and offers status information about each DTC.

Each of the 8 bits in the DTC status byte has a meaning that is defined in ISO 14229-1, but for emission-related DTCs only bits 0, 1, 2, 3, 4, and 6 are used. The tool shall not use other bits of this DTC status byte for legislated/regulated purposes.

Bits in the StatusAvailabilityMask that are not supported by the server shall be set to “0.” Each supported bit (indicated by a value of “1”) shall be implemented for every DTC supported by the server. Refer to ISO 14229-1 Annex D.2 for the definition of the status bits.

The definitions in [Tables 5](#) and [6](#) show a quick overview.

Table 5 - DTC status byte definition

DTCStatus byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Table 6 - DTC status bit definition

Bit	Description	Cvt	Mnemonic
#0	TestFailed	M	TF
#1	TestFailedThisOperationCycle	M	TFTOC
#2	pendingDTC	M	PDTC
#3	confirmedDTC	M	CDTC
#4	testNotCompletedSinceLastClear	M	TNCSLC
#5	TestFailedSinceLastClear This bit is optional for the vehicle manufacturer to support and is not used for emissions OBD.	U	TFSLC
#6	testNotCompletedThisOperationCycle	M	TNCTOC
#7	warningIndicatorRequested This bit is optional for the vehicle manufacturer to support and is not used for emissions OBD.	U	WIR

The DTC Status Bits #0, #1, #2, and #3 are related as indicators for failed diagnostic monitors (DTCs).

The union of DTC Status Bits #4 and #6 comprise the complete set of DTCs. Long response may be observed when setting of these bits to 1 in DTCStatusMask as request parameter.

Valid DTCStatusAvailabilityMasks are listed in [Table 7](#). Six of the 8 bits are mandatory to accomplish emission-related requirements; the other 2 bits are optional and OEM-specific.

Table 7 - Valid DTCstatusavailabilitymasks

DTCStatusAvailabilityMask	Value
All DTCStatusBits are supported	\$FF
All DTCStatusBits, excluding Bit #5, are supported	\$DF
All DTCStatusBits, excluding Bit #5 and Bit #7, are supported	\$5F
All DTCStatusBits, excluding Bit #7, are supported	\$7F

7.1.1.2 DTCSeverityMask and DTCSeverityAvailabilityMask

Each of the 8 bits in the DTCSeverityMask has a precise meaning that is defined in ISO 14229-1. The definitions in [Tables 8](#) and [9](#) show a quick overview. Bits in the DTCSeverityAvailabilityMask that are not supported by the server are set to "0."

Refer to ISO 14229-1 Annex D.3 for the definition of the DTCSeverityMask.

Table 8 - DTC severity byte definition

DTCSeverity byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
DTC severity information				DTC class information			

Table 9 - DTC severity and DTC class bit definition

Bit	Description	Cvt	Mnemonic
DTC class bit definition			
#0	DTC Class_0	C	DTCClass_0
#1	DTCClass_1	C	DTCClass_1
#2	DTCClass_2	C	DTCClass_2
#3	DTCClass_3	C	DTCClass_3
#4	DTCClass_4	C	DTCClass_4
#5-7	Reserved by ISO 14229-1		

Which DTC classes are applicable for a specific market is a function of the market regulation. SAE J1979-2 provides additional recommendations on the use of these bits for listed markets. The summary below discusses the most common cases. All DTC classes utilize the same services and subfunctions for diagnostic communications. One key difference among the listed classes is when or how to illuminate MIL.

DTCClass_1 or Class A was initially defined for HDV UN ECE R49 regulation for DTCs that require the MIL. Class 1 is reused for emission-related DTCs for regulations that do not utilize different DTC classes but only have one class for emission-related DTCs. Classes 2 to 4 are also used by UN ECE R49.

Market regulations may require DTCs that do not illuminate MI but other lamps to also be reported as DTCClass_1 DTCs, or some DTCs that do not turn on MI but are emission-related can also be reported by DTCClass_1.

Market regulations that allow OBDOnUDS will most commonly use DTCClass_1. The ECU will do a bitwise AND between the requested mask and the DTCSeverity mask and respond with all DTCs where this AND operation results in a "1."

In this document, all examples are shown with SeverityMask set to \$02 (that means DTCClass_1), even if it is possible to utilize other values. The reason is that \$02 is the most commonly used value for regulated emissions OBD (i.e., used in several OBD regulations).

OBDOnUDS valid response from an OBD ECU will always have at least DTCSeverityAvailabilityMask bit set to 1.

The DTC Class is a static attribute, i.e., it is defined by the vehicle manufacturer before compilation of the firmware or by dataset parameters and will not be changed in runtime.

7.1.1.3 FunctionalGroupIdentifier

The main purpose is to be able to report/clear DTC information specific to a functional system group. An ECU may be part of several functional system groups, e.g., emissions system, brake system, etc. In case DTCs are reported for the brake system during an emissions I/M test, the vehicle shall not fail the emissions I/M test because the ECU, which is part of the emissions functional system, also reports brake functional system DTCs.

All FunctionalGroupIdentifier values are defined in ISO 14229-1. OBDOnUDS ECUs shall support the emissions-system group (\$33).

7.1.1.4 GroupOfDTCIdentifier

The main purpose of the functional group identifier is to segment vehicle DTC information into independent groups. This permits tools to report/clear DTC information specific to a functional system group. The emissions-system group (\$33) is used for OBD. An ECU may be part of several functional system groups, e.g., emissions system, brake system, etc. In case DTCs are reported for the brake system during an emissions I/M test, the vehicle shall not fail the emissions I/M test because the ECU, which is part of the emissions functional system, also reports brake functional system DTCs.

All groupOfDTCIdentifier are defined in ISO 14229-1. The definition in Table 10 shows an excerpt.

Table 10 - GroupOfDTCIdentifier definition

Byte Value (Hex)	Description	Cvt	mnemonic
33	Emissions-system Group	M	EMSYSGRP
FF	All Groups (all DTCs)	M	AG

OBDonUDS ECUs shall support the emissions-system group (\$33). Only requests directed to the emissions-system functional group (\$33) shall be capable of erasing an emissions-related DTC. Requests directed to other functional groups shall not change the status of an emissions-system group DTC, unless the request is made using all-groups (\$FF).

7.1.1.5 DTCFormatIdentifier

The main purpose of the DTCFormatIdentifier is to indicate to the Client which DTC list to use when presenting the DTC number and name. There are two DTCFormatIdentifiers allowed in SAE J1979-2:

1. SAE_J2012_DTCFormat_04 (value 4)
2. SAE_J1939-73_DTCFormat (value 2)

An ECU shall only support one DTCFormat, i.e., all DTCs in an ECU shall utilize the same DTCFormat.

A vehicle may utilize more than one DTCFormat in disparate ECUs, e.g., a truck may utilize one DTCFormat in the ECM and another in the RDCM.

7.1.1.5.1 SPN Interpretation for SAE J1939-73_DTCFormat

Where vehicles or engines use DTCs in the SAE J1939 format, the DTCs shall be encoded using SAE J1939 SPNs, which can be found in SAE J1939DA, and with FMIs defined to SAE J1939-73 Appendix A.

When DTCs are formatted according to SAE J1939-73 definitions: The DTCHighByte shall contain the 8 least significant bits of SPN. The DTCMiddleByte shall contain the second byte of SPN, and the DTCLowByte shall contain both the 3 most significant bits of SPN followed by 5 bits for the FMI. These principles are shown in Table 11.

Table 11 - SPN Interpretation for SAE J1939-73_DTCFormat

DTCHighByte		DTCMiddleByte		DTCLowByte			
8 least significant bits of SPN		Second byte of SPN		3 most significant bits of SPN		5-bit FMI	
MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB

7.2 Diagnostic Service Requirements

This document uses a subset of diagnostic services defined in ISO 14229-1 (UDS) to communicate between the vehicle's OBD systems and a generic scan tool. The requirements in this documents are only applicable to this defined subset of diagnostic services. An external test equipment sending diagnostic requests outside the subset of services defined by this document is out of scope for the requirements of this document. For the requests outside this subset, the manufacturer or ISO 14229-1 specific behavior applies. In particular the NRC handling or allowed request messages may be treated differently. A compliant SAE J1979-2 generic scan tool is expected to use only valid diagnostic requests defined by this document. The OBD system response behavior is defined only for these valid requests by this document.

7.2.1 Protocol Detection

The external test equipment shall use the detection sequence specified in [Figure 4](#).

The purpose of the external test equipment detection sequence is to automatically detect whether the vehicle supports OBD Classic or "OBDonUDS."

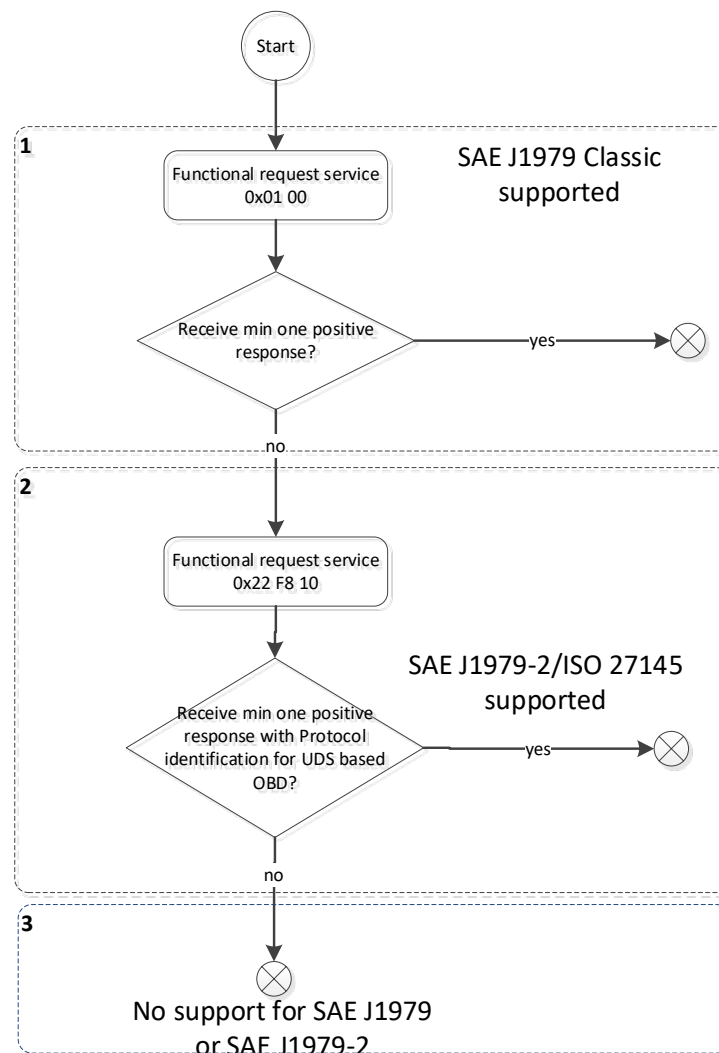


Figure 4 - Protocol detection

For more details, refer to ISO 15765-4 "External test equipment initialization sequence."

NOTE: The different OBD protocols SAE J1979 and SAE J1979-2 are exclusive, meaning that the vehicle can only support one OBD protocol. The same is true for supporting the OBD protocol utilizing 11-bit or 29-bit CAN-identifiers, where the vehicle can just support one type of the OBD CAN-identifiers.

All emissions-related OBDOnUDS ECUs that at least support one of the UDS services defined in this document shall support service \$22 ReadDataByIdentifier with DID \$F810 protocol identification with a value = 1.

Refer to SAE J1979DA Annex G for different options of \$F810 values. When \$F810 is not supported by an ECU using a service \$22 query, OBDOnUDS is not supported by the ECU.

This combination of service \$22 and ITID \$F810 is defined as the universal “initialization” message for all emissions-related OBDOnUDS ECUs.

7.2.2 Multiple Responses to a Single Data Request

The request messages commonly are functional messages, which means the external test equipment will request data without knowledge of which ECU(s) on the vehicle will respond. In some vehicles, multiple ECUs may respond with the information requested. Any external test equipment requesting information shall therefore have provisions for receiving multiple responses.

For OBDOnUDS ECUs, physical requests are also possible for some services. An external test equipment may request at first functional to get knowledge about the internal ECU network and the supported DIDs and is then able to address physical to increase performance. To see which services allow physical address, see Section [9](#).

7.2.3 Application Timing Parameter Definition

7.2.3.1 Overview

The definition of P2 is included in this clause. A subscript is added to each timing parameter to identify the protocol: - P2_{CAN_Client}: P2 for ISO 15765-4 protocol.

IMPORTANT: The vehicle manufacturer is responsible to specify a shorter P2 timing window than specified in this document for each emission-related server/ECU in the vehicle to make sure that network topology delays of the vehicle architecture are considered.

7.2.3.2 Definition for ISO 15765-4

For CAN bus systems based on ISO 15765-4, the (all) responding ECU(s) of the on-board system shall start the response message to a request message within P2_{CAN_Client}. Table 12 specifies the application timing parameter values for P2.

Table 12 - Definition of ISO 15765-4 application timing parameter values

Parameter	Min Value ms	Max Value ms	Description
P2 _{CAN_Client}	0	50	This is a system-wide parameter related to diagnostic response times. Each server (ECU) is required to respond to a request between P2_{CAN_min} and P2_{CAN_max}. P2_{client} also includes the transportation time from server to client. A client (tester) shall wait for at least P2_{CAN_max} for the single-frame (SF) or first-frame (FF) of a response. P2_{CAN_Client} is the time until the first indication of a multiple frame response message (FirstFrame). The client shall not process the response until the complete message (last ConsecutiveFrame) has been received. For clients (testers) that also support UDSONCAN for enhanced diagnostics or for OBDONUDS ECUs, a P2_{reload} mechanism is required. Upon receiving the SF or FF, the client (tester) shall reload its P2_{CAN} timer with a value of at least P2_{CAN_max} and restart the timer. Once the client's (tester's) P2_{CAN_Client} timer expires without receiving an SF or FF, the client (tester) may assume no more responses are forthcoming.
P2* _{CAN_Client}	0	5000	Time between the successful reception of a negative response message with NRC \$78 and the next response message (positive or negative message). See Table 13 for a list of which services support the use of NRC \$78.
P4 _{Server}	0*	600000*	The timing parameter P4_{Server} is the time between the reception of a request (T_Data.indication) and the start of transmission of the final response (T_Data.request). ISO 14229-2 only specifies P4 on the server side, but in this document it shall be read as the requirement for the vehicle, i.e., the maximum time before the client can receive the final response. This means that the ECU can send an NRC \$78 but must send the final response within the P4_{Server} timing specified for that specific service or data parameter. Examples: For most services, P4_{Server} is 0 ms, meaning that the ECU must respond within 50 ms. For clearing DTCs, the P4_{Server} is 5000 ms, meaning that the ECU shall be able to clear all OBD DTCs within 5 seconds, but it must send an NRC \$78 within P2 timing.

NOTE: The Network Layer timing parameters for the multiple frame response are not shown. Network Layer timing requirements for legislated diagnostic messages are specified in ISO 15765-4 or in ISO 14229-2.

7.2.4 Minimum Time Between Requests from External Test Equipment

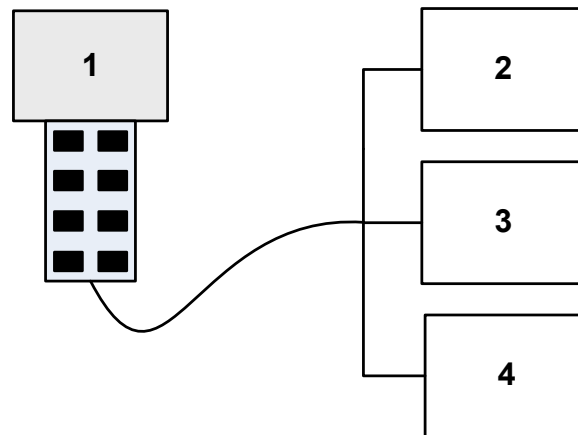
7.2.4.1 ISO 15765-4 - Minimum Time Between Requests from External Test Equipment

For ISO 15765-4 network interfaces, the external test equipment may send a new request message immediately after it has determined that all responses related to the previously sent request message have been received. If the external test equipment does not know whether it has received all response messages (e.g., after sending the initial OBD request message: Service \$22 with ITID \$F810 for OBDONUDS ECUs), it shall wait until P2 expires before sending another request. The timer P2_{CAN_Client} of the external test equipment starts with the confirmation of a successful transmission of the request message.

IMPORTANT: The P2_{CAN_reload} process is performed by the client to accommodate additional responses when more than one emissions-related OBD ECUs send a response message. The P2_{CAN_reload} is not defined to check whether the entire response message is sent within P2_{CAN_max} timing.

7.2.4.2 ECU Behavior to a Request for Supported/Non-Supported OBD Information

[Figure 5](#) shows an example of a typical vehicle OBD configuration.



Key:

- 1 External test equipment
- 2 ECM (Engine Control Module)
- 3 TCM (Transmission Control Module)
- 4 BECM (Battery Electric Control Module)

Figure 5 - Example of external test equipment connected to three OBD ECUs

Typically, the ECM supports DIDs, which the TCM and the BECM do not support. In case the external test equipment requests the DIDs supported by the ECM, the ECM sends a positive response message and the TCM and the BECM do not send a response message. The external test equipment knows that the TCM and the BECM will not send a positive response message based on the DID supported information retrieved prior to the latter request.

For an ECU network with OBDOnUDS ECUs, the external test equipment may send a physical request for a DID from the BECM (e.g., SoC - "state of charge") for performance reasons. The other ECUs will ignore the request because it was requested physically.

This shall be implemented to enhance the overall diagnostic communication performance between the external test equipment and the vehicle ECUs.

7.2.5 Data Not Available

There are five conditions for which data may not be available:

- a. **Request message is not supported:** The ECU(s) which does (do) not support the functional request message shall not send any response message.
- b. **Request message is supported but data is not supported:** The ECU(s) which does (do) support the functional request message but does (do) not support the requested data (e.g., DID, ITID) is (are) not allowed to send a negative response message because another ECU will send a positive response message. If the external test equipment sends a message including multiple DIDs and each emission-related ECU does not support all requested DIDs, then each ECU shall send a positive response message including the supported DID(s) and data values and shall not send a negative response message. If an ECU does not support any of the DIDs requested, it is not allowed to send a negative response message.

An OBDOnUDS ECU shall send a negative response when it receives a physical request message and the ECU does not support any of the requested data (i.e., DID /ITID).

- c. **Request message is supported but data is currently not available:** The ECU(s) which does (do) support the functional request message but does (do) not currently have the requested data available shall respond with a negative response message with response code \$22 - ConditionsNotCorrect (negative response message format is specified in 6.3.1.2). For OBDOnUDS ECUs UDS Service \$19 and \$22 with DID \$F4xx/\$F5xx/\$F7xx/\$F8xx, the use of a negative response message including response code \$22 is not permitted. For UDS-OBDD Services \$14 and \$31, the use of an NRC \$22 is allowed. For some Service \$22 \$F8xx requests, the use of NRC \$78 is allowed (refer to SAE J1979DA).
- d. **Request message is supported but data is not available within P2 timing:** The behavior of the ECU(s) and the external test equipment is specified in [7.2.5.1.1](#).
- e. **Request message is supported but service cannot be performed within P2 timing:** The behavior of the ECU(s) and the external test equipment is specified in [7.2.5.1.1](#).

For OBDOnUDS ECUs UDS Services ClearDTCInformation \$14 and ReadDataByIdentifier \$22 \$F8xx, the use of an NRC \$78 is allowed.

7.2.5.1 Data Not Available Within P2 Timing

7.2.5.1.1 Overview

The following sub-clauses specify the request/response message handling for each protocol if the data is not available within the P2 timing in the ECU(s).

7.2.5.1.2 ISO 15765-4 - Data Not Available Within P2 Timing or Service Cannot Be Performed Within P2 Timing

The ECU(s) which does (do) support the functional request message but does (do) not have the requested data available within P2 timing or cannot perform the requested service within P2 timing shall perform the following handling:

- The ECU(s) shall respond with a negative response message with response code \$78 - RequestCorrectlyReceived-ResponsePending within P2 timing (not allowed for Service \$22 with DID \$F4xx/\$F5xx/\$F7xx and \$31 requests).
- After correct reception of the negative response message with response code \$78, the $P2_{CAN_Client}$ parameter timing value shall be set to $P2^*_{CAN_Max}$ (5000 ms) by the external test equipment and the ECU that has sent the negative response message.
- If another ECU also sends a negative response message with response code \$78, the $P2_{CAN_Client}$ timing parameter value shall be reset to $P2^*_{CAN_Max}$.
- ECUs that require more than $P2^*_{CAN}$ to perform the requested action shall repeat the negative response message with response code \$78 prior to expiration of $P2^*_{CAN}$ until correct reception of the positive response message.
- After all positive response messages have been received or time out, $P2^*_{CAN_max}$ has occurred, the $P2_{CAN_max}$ timing parameter shall be reset to the values specified in Table 12.

For OBDOnUDS ECUs, the vehicle manufacturer is responsible to ensure the network architecture of the vehicle does not cause timing delays that exceed $P2_{CAN_max}$ timing when responding to Services \$22 with DID \$F4xx/\$F5xx/\$F7xx and \$31 requests because a negative response message with response code \$78 shall not be allowed.

7.2.5.1.3 Data Not Available Test Conditions on Functional and Physical Requests for Protocol: SAE J1979-2 OBDOnUDS on CAN

There are seven conditions for which data may not be available:

- Service is not supported.
- Service is supported but data is not supported.
- Service is supported but data is not available at the time that the request is made.

- Service is supported but data is not available within P2 timing.
- Service is supported but cannot be performed within P2 timing.
- Subfunction is not supported.
- Service is supported but request message has an invalid format.

Table 13 indicates the proper server/ECU response as detailed in [7.2.4.2](#).

Table 13 - Proper response from server/ECU on functional or physical requests for OBD on UDS ECUs

UDS Service	Sub-function	Data-Identifier	Condition	ISO 14229-1	Functional NRC	Physical NRC	P4Server
All	All	All	Service not supported	On physical request a negative response is required. On functional request no response is allowed.	N/A	\$11	P2CAN_max
All	All	All	Subfunction not supported	On physical request a negative response is required. On functional request no response is allowed.	N/A	\$12	P2CAN_max
All	All	All	Unsupported DID /RID requested	On physical request a negative response is required. On functional request no response is allowed.	N/A	\$31	P2CAN_max
\$22	N/A	\$F400 - \$F5FF and \$F700 - \$F7FF	Supported DID requested	Positive response is required (no negative response message with response code \$78 allowed).	N/A	N/A	P2CAN_max
\$19	\$04	N/A	Unsupported DTCSSRN Unsupported DTCMREC	On physical request a negative response is required. On functional request no response is allowed.	N/A	\$31	P2CAN_max
			Supported DTCMREC, DTCSSRN xx requested, no stored data record	The ECU shall respond within P2.	N/A	N/A	P2CAN_max
			Supported DTCMREC, DTCSSRN xx requested, data record stored	1.) The ECU shall respond to Service \$19 Subfunction \$04 within P2 timing. 2.) The ECU shall respond with supported DTC within P2 timing and shall respond to DTCSnapshotRecordNumber indicated as supported.	N/A	N/A	P2CAN_max
	\$06	\$90-\$9F	Supported DTCEDR	Positive response including the stored DTCEDR is required.	N/A	N/A	P2CAN_max
	\$06	All	Unsupported DTCEDRN Unsupported DTCMREC	On physical request a negative response is required. On functional request no response is allowed.	N/A	\$31	P2CAN_max
	\$1A	\$90-\$9F	Supported information DTCEDRN	Positive response including the DTCs which supported the requested DTCEDRN is required.	N/A	N/A	P2CAN_max
	\$1A	All	Unsupported information DTCEDRN	On physical request a negative response is required. On functional request no response is allowed.	N/A	\$31	P2CAN_max
	\$42	N/A	Unsupported DTCSM, DTCSVM	Positive response indicating no DTCs is required.	N/A	N/A	P2CAN_max

UDS Service	Sub-function	Data-Identifier	Condition	ISO 14229-1	Functional NRC	Physical NRC	P4Server
			Supported FGID/DTCSVM, no DTCs stored	Positive response indicating no DTCs is required.	N/A	N/A	P2CAN_max
			Supported FGID/DTCSVM, DTCs stored	Positive response including the stored DTCs is required.	N/A	N/A	P2CAN_max
	\$55	N/A	Supported FGID, no DTCs stored	Positive response indicating no DTCs is required.	N/A	N/A	P2CAN_max
			Supported FGID, DTCs stored	Positive response including the stored DTCs is required.	N/A	N/A	P2CAN_max
	\$42/\$55	N/A	Supported DTCSM/FGID/DTCSVM requested, data not available, conditions correct	Initial negative response message required within P2max (50 ms) and consecutive negative response message(s) is (are) required within P2*max (5.0 seconds) until positive response is sent.	\$78 ^(a,b)	\$78 ^(a,b)	5000ms
	\$56	\$00-\$FF	Supported RGID	Positive response including the stored DTCs is required.	N/A	N/A	P2CAN_max
	\$56	\$00-\$FF	Unsupported RGID	For functional request: No response. For physical request: Negative response with response code \$31.	N/A	\$31	P2CAN_max
	\$42/\$55/\$56	All	Unsupported FGID	For functional request: No response. For physical request: Negative response with response code \$31.	N/A	\$31	P2CAN_max
\$14	N/A	N/A	Conditions not correct	Negative response is required.	\$22	\$22	P2CAN_max
			Unsupported GODTC, unsupported addressing method	Negative response is required for an incorrect FGID or if physical code clear is prohibited.	N/A	\$31	P2CAN_max
			Supported GODTC, conditions correct	Positive response message required. Multiple negative response messages allowed within a maximum time of 5000 ms after request until positive response is required.	\$78 ^(a,b)	\$78 ^(a,b)	5000ms
			ClearDTC not possible due to corrupt NV memory	Negative response is required.	\$72	\$72	P2CAN_max
\$31	\$01	\$E000 - \$E1FF	Supported RID requested, conditions correct	Positive response is required.	N/A	N/A	P2CAN_max
			Supported RID requested, conditions not correct	Negative response is required.	\$22	\$22	P2CAN_max
			Routine is currently active and cannot be restarted	On physical or functional request a negative response is required.	\$24	\$24	P2CAN_max
\$22	N/A	\$F800 - \$F8FF	Supported ITID requested, data available (VIN, CVN, CALID)	Positive response is required.	N/A	N/A	P2CAN_max
			Supported ITID requested, data not available, conditions correct (refer to SAE J1979DA)	Initial negative response message required within P2max (50 ms) and consecutive negative response message(s) is (are) required within P2max (5.0 seconds) until positive response is sent.	\$78 ^(a,b)	\$78 ^(a,b)	5000ms
		\$F810	DID \$F810 requested during initialization	Positive response is required. Or Negative response for max of 5 times.	\$21	\$21	P2CAN_max

^(a) After an NRC \$78, every NRC is possible, also with functional addressing.

^(b) If NRC \$78 is allowed, P4Server is either 5000 ms or P4Server_max (CVN calculation only). In all other cases, P4Server is P2CAN_max. P4Server_max is defined by ISO 14229-2.

Other services or subfunctions may be supported for non-OBD purposes and therefore respond with different responses to physical request (e.g., NRC \$7F to SID \$31). This does not lead into a violation of OBD compliance.

All requests made by the client which do not comply with this document fall under the scope of ISO 14229-1.

NOTE: Negative response structure follows the scheme: \$7F, ServiceID, NRC (e.g., \$7F, \$01, \$11).

7.2.6 Maximum Values

If the data value exceeds the maximum value that is possible to be sent, the on-board system shall send the maximum value possible (\$FF or \$FFFF). The external test equipment shall display the maximum value or an indication of data too high. This is normally not critical for real-time diagnostics, but, for example, in the case of a misfire at high vehicle speed with resulting snapshot data stored, this will be very valuable diagnostic information.

7.2.7 Invalid Signals

In distributed network architectures, certain OBD devices may be hardwired to other ECUs or may be independent OBD mechatronic devices, e.g., smart sensor/actuator connected through a network from another ECU (both referred to as remote OBD devices). When remote OBD devices are not hardwired to the OBD ECU and the data is not received over the data bus from the specific remote OBD device, this may occur for two reasons: either the remote ECU is not functioning and sending any data, or the OBD device that is hardwired to the remote ECU has failed and the remote ECU is sending a message with invalid data for the OBD remote device. In either one of these cases, the primary OBD ECU shall report Service \$22 and Service \$19 \$04 data parameters as the minimum or maximum value to indicate that the signal has not been received. A PID that includes this invalid data (no signal) shall either be reported with a minimum value (\$00 or \$0000) or maximum value (\$FF or \$FFFF), e.g., PID \$F40D "Vehicle Speed Sensor" = \$FF = 255 km/h, PID \$F42F "Fuel Level Input" = \$00 = 0.0%. The reported value shall be determined by the manufacturer based on system design and network architecture to represent the least likely value to be expected under normal conditions.

7.3 Diagnostic Message Format

7.3.1 Maximum Message Length

7.3.1.1 ISO 15765-4 - Maximum Message Length

The maximum message length is specified in ISO 15765-4. For functional request messages, the message length is limited to 7 data bytes.

For physical request messages, the server must support at least six (6) DIDs supported data bytes. For OBDOnUDS, the server must support at least six (6) DIDs. The client shall not request more than one ITID per request except for those identifiers that have a fixed length (e.g., \$F802 for VIN). The reason is that servers will respond to the request by sending multiple ITIDs (except for those with fixed length). It is not possible for the client to decode the data if more than one ITID is received at the same time. If the client requests more than one ITID in a request, then the server shall send a positive response with the requested data.

7.3.1.2 ISO 14229-1 - Negative Response Message Format

This sub-clause includes additions, exceptions, and/or restrictions for the ISO standards that apply.

Table 14 specifies the format of the negative response message.

Table 14 - Negative response message format

Data Byte	Parameter Name	Cvt	Byte Value (Hex)	Mnemonic
#1	Negative Response Service Identifier	M	7F	NR
#2	Request Service Identifier	M	xx	SIDRQ
#3	Response Code	M	xx	RC_

7.3.2 Response Code Parameter Definition

Response codes shall be implemented in an ECU that support a service(s) not having valid data available at the time of a request or cannot respond with valid data available within P2CAN_Client timing.

Table 15 lists the allowed NRCs. Refer to ISO 14229-1 Annex A for definition of NRCs.

Table 15 - Negative response code for OBDOnUDS

Byte Value (Hex)	Definition of Response Code	Mnemonic
11	serviceNotSupported	SNS
12	subfunctionNotSupported	SFNS
21	busyRepeatRequest	BRR
22	conditionsNotCorrect	CNC
24	requestSequenceError	RSE
31	requestOutOfRange	ROOR
72	generalProgrammingFailure	GPF
78	requestCorrectlyReceived-ResponsePending	RCRRP

7.3.3 Header Byte Definition of ISO 15765-4

Each CAN frame is identified by a CAN Identifier. The size of the identifier is either 11 bit or 29 bit. The CAN Identifier shall always be followed by an 8-byte CAN frame data field (refer to ISO 15765-4; see section “Data length code (DLC)”). Depending on the message type, up to 3 bytes (FlowControl) are used for the protocol control information (PCI) prior to the Service Identifier (only included in single frame or first frame) and data bytes of the message. Table 16 defines the diagnostic message format for ISO 15765-4 protocol.

Table 16 - Diagnostic message format for ISO 15765-4

Header Bytes	CAN Frame Data Field							
CAN Identifier (11 or 29 bit)	#1	#2	#3	#4	#5	#6	#7	#8

7.3.4 Data Bytes Definition of ISO 15765-4

For the ISO 15765-4 protocol, the first data byte following the CAN Identifier in a single frame and first frame is the PCI (number of bytes varies, depending on frame type), then diagnostic Service Identifier, and the remaining data bytes vary, depending on the specific diagnostic service.

7.3.4.1 Bit Position Convention

Some data byte values include descriptions that are based on bit positions within the byte. The convention used is that the most significant bit (MSB) is referred to as “bit 7,” and the least significant bit (LSB) is referred to as “bit 0,” as shown in [Figure 6](#).