



SURFACE VEHICLE STANDARD

J1979™-3**OCT2023**Issued 2022-12
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Superseding SAE J1979-3 DEC2022

E/E Diagnostic Test Modes:
Zero Emission Vehicle Propulsion Systems on UDS (ZEVonUDS)

RATIONALE

Due to regulatory adoption of OBDonUDS, SAE J1979 now becomes a multiple-part document series:

1. SAE J1979, which defines diagnostic test modes for OBDonEDS used for emissions OBD.
2. SAE J1979-2, which defines the diagnostic services for OBDonUDS used for emissions OBD.
3. SAE J1979-3 (ZEVonUDS), which defines the diagnostic services for electric, fuel cell, and other zero emissions propulsion systems.

Market regulations specify which data links are allowed for sale in a given market.

FOREWORD

SAE J1979-3 specifies diagnostic services required to be supported by motor vehicles and external test equipment for diagnostic purposes which pertain to zero emission vehicle (ZEV) propulsion related data. These messages are intended to be used by any external test equipment meeting the requirements of SAE J1978 for retrieval of OBD information from a vehicle.

ZEVonUDS provides an implementation guidance based on the principles of ISO 14229, focusing on standardization of data to ensure access to important repair information by independent repair facilities. Other requirements such as SAE J1979-2 include many functions that are unnecessary for ZEVs. The purpose of this standard is to focus on providing the necessary content and performance requirements for ZEV powertrain communications. ZEVonUDS diagnostic requirements can be satisfied over either CAN or Ethernet datalinks. SAE J1979-3 provides references to ISO 14229-1 and SAE J1979-2 services. Unreferenced UDS features are optional provided they do not interfere with required services specified in this document.

This requirement applies to all electronic control units (ECUs) that provide operational data and diagnoses those components that are integral to provide propulsion on a ZEV. In general, if an ECU monitors a component whose failure directly affects the ZEV propulsion system, it shall be reported using SAE J1979-3 standardization.

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Full document details: SAE J1979-3_202310

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Examples of SAE J1979-3 covered subsystems are:

- Traction drive motors and their inverters.
- Energy storage systems.
- High voltage charging systems (including components whose failures impact regenerative braking).
- Thermal control systems supporting propulsion (i.e., battery cooling pumps and sensors).

A government agency may have policy reasons for specifically tracking ZEV componentry (i.e., unique warranty requirements). In order to track the linkage between a diagnostic trouble code and a covered repair under a ZEV component warranty, provisions are made in this document to highlight those failures that are ZEV propulsion related. These linkages can be thought of analogously to emissions related failures requiring emissions related warranty repair. The service used to highlight failures that are propulsion related is UDS Service 0x19 Subfunction 0x42.

When referencing other documents to fulfil this set of requirements, the reader should substitute “emissions related” for “ZEV propulsion related.” Global regulations may vary in the definition of ZEV propulsion componentry; therefore, the applicability of this document to various components may vary from region to region.

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1. SCOPE

1.1 Introduction

SAE J1979-3 describes the communication between the zero emissions propulsion systems and test equipment required by government regulations. Standardization 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 J1979-3 is based on the Open Systems Interconnection (OSI) Basic Refer to 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:

- Application (layer 7), specified in:
 - ISO 14229-1, ISO 14229-3 UDSonCAN, or ISO 14229-5 UDSonIP
 - SAE J1979-3 ZEVonUDS
- 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, -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, -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
 - ISO 13400-4 Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 4: Ethernet-based high-speed data link connector
 - SAE J1962 Diagnostic Connector

NOTE: SAE J1979-3 provides a standard to satisfy known country-specific certification regulations. SAE J1979-3 is not considered a final authority for interpretation of the certification regulations, so users of this document should determine the applicability of capabilities defined in this document for their specific OBD regulatory requirements

Table 1 - Regulated diagnostic specifications applicable to the OSI layers

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

1.1.1 SAE Document Reference Concept

SAE J1979-3 references several SAE documents which contain all terms, data, and 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 PIDs, Test IDs, Monitor IDs, and InfoType IDs. 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).

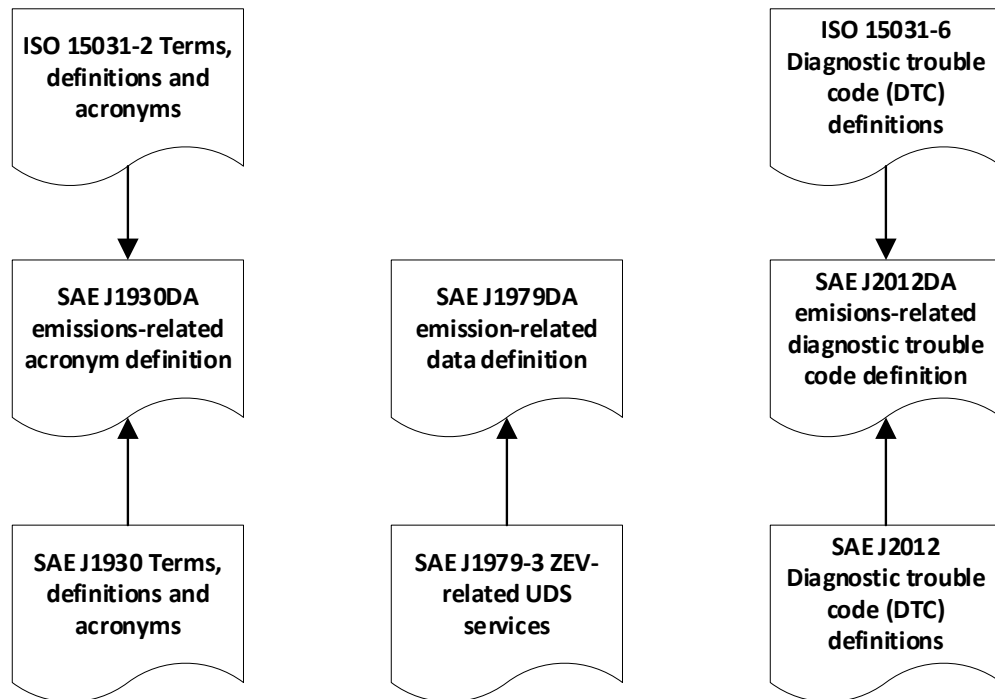


Figure 1 - SAE digital annex document reference

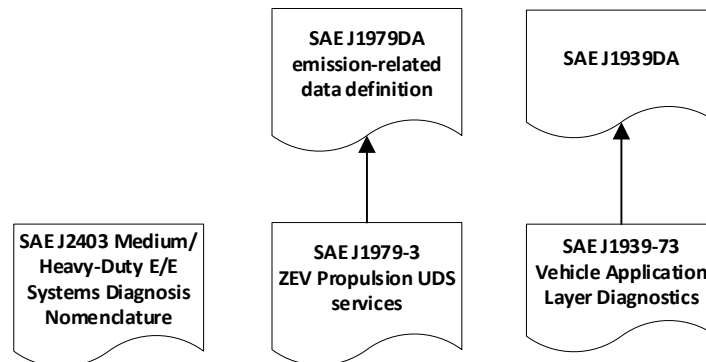


Figure 2 - SAE J1979-3 SAE document reference for MDV/HDV utilizing SAE J1939

1.1.2 SAE J1979DA (Digital Annex)

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

- Data Identifiers (DIDs)
 - Parameter Identifiers (PIDs)
 - Info Types (ITIDs)
- Routine Identifiers (RIDs)

1.1.3 SAE Digital Annex Revision Procedure

New ZEV regulatory requirements require monitoring of the componentry that facilitates zero emission transportation. New ZEV technology parameters 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 who are represented by members of the appropriate SAE task force.

SAE J1979-3 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 the SAE J1979DA. Once the information has been balloted and approved, the documents will be published on the SAE Store Web Site.

The revision request form and instructions for SAE J1979-3 can be obtained on the Registration Authority's website at: <https://standardsworks.sae.org/standards-committees/j1979-review-task-force>.

Located within the overview tab in the public resources section, a document with the title [J1979DA Revision Request Form](#) is available for change requests. Click on the name to download the document.

Fill out the revision request form with your request.

Please send an email with the completed revision request form as an attachment to: 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. Request forms are available to the public at the committee's SAE Standards Works webpage. The webpage, which can be found at <https://standardsworks.sae.org/standards-committees/truck-bus-control-communications-network-committee>, provides the following forms:

- Request Processing Guidelines
- General Request Form
- Bulk Request Form

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 standardization regulations in the United States and 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.
- e. Standardized source and target addresses for clients and vehicle.

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 J1979-3 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 which 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 ZEV propulsion-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 J1979-3 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. When applicable, a reference to respective sections in SAE J1979-2 is made in this document.

SAE J1979-3 references SAE J1979DA, which includes all Data Identifiers and Routine Identifiers.

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 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1930DA	Digital Annex of Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms
SAE J1939	Serial Control and Communications Heavy-Duty Vehicle Network - Top-Level Document
SAE J1939DA	Digital Annex of Serial Control and Communications Heavy-Duty Vehicle Network
SAE J1939-71	Vehicle Application Layer
SAE J1939-73	Application Layer - Diagnostics
SAE J1962	Diagnostic Connector
SAE J1978	OBD-II Scan Tool
SAE J1979DA	Digital Annex of E/E Diagnostic Test Modes
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 <https://webstore.ansi.org/>.

ISO 7498-1	Information processing systems - Open systems interconnection - Basic reference model
ISO/IEC 10731	Information technology - Open Systems Interconnection - Basic Refer to Model - Conventions for the definition of OSI services
ISO 14229-1	Road vehicles - Unified diagnostic services (UDS) - Part 1: Application layer
ISO 14229-2	Road vehicles - Unified diagnostic services (UDS) - Part 2: Session layer services

ISO 14229-3	Road vehicles - Unified diagnostic services (UDS) - Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)
ISO 14229-5	Road vehicles - Unified diagnostic services (UDS) - Part 5: Unified diagnostic services on Internet Protocol implementation (UDSonIP)
ISO 15765-2	Road vehicles - Diagnostic communication 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 13400-2	Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 2: Transport protocol and network layer services
ISO 13400-3	Road vehicles - Diagnostic communication over Internet Protocol (DoIP) - Part 3: Wired vehicle interface based on IEEE 802.3
ISO 13400-4	Road vehicles - Diagnostic communication over Internet Protocol (DoIP) — Part 4: Ethernet-based high-speed data link connector
ISO 27145-4	Road vehicles - Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements - Part 4: Connection between vehicle and test equipment

3. TERMS, DEFINITIONS, SYMBOLS, AND ABBREVIATED TERMS

For the purposes of this document, the terms and definitions given in SAE J1979-2, SAE J1930, SAE J2403, ISO 14229-2, ISO 14229-1, ISO 15765-2, and the following apply.

3.1 Terms and Definitions

CLIENT: Defines the node performing an initial request to a server. Usually a diagnostic application within semipermanent attached device to the vehicle SAE J1962 data link connector and responsible for requesting diagnostic information. Client could also be internal to the vehicle. May also be referred to as a tester client.

DoIP SERVER: A DoIP Server is an IP node that can be publicly addressable and do support the DoIP protocol.

ECU SERVER: Diagnostic application responsible for serving diagnostic information.

OBDOnUDS ECU: An ECU that meets the functionality defined in the SAE J1979-2 recommended practice.

SERVER: Defines the node responding to a client request. Usually a diagnostic application within a vehicle mounted ECU and responsible for handling a client's request for diagnostic information. May also be referred to as an ECU server.

ZEVonUDS ECU: An ECU that meets the functionality defined in the SAE J1979-3 recommended practice.

3.2 Abbreviated Terms

BECM	Battery Energy Control Module
CALID	Calibration Identifier
CAN	Controller Area Network
DID	Data Identifier
DoCAN	Diagnostic Communication Over Controller Area Network
DoIP	Diagnostic Communication Over Internet Protocol

DTC	Diagnostic Trouble Code
DTCSM	DTC Status Mask
DTCSVM	DTC Severity Mask
EBCM	Electronic Brake Control Module
ECM	Engine Control Module
ECU	Electronic Control Unit
FTB	Failure Type Byte
FGID	Functional Group Identifier
GHG	Green House Gas
GODTC	Group of DTC
HB	High Byte
HEX	Hexadecimal Numbering System
ITID	Infotype Identifier
ISO	International Organization for Standardization
LB	Low Byte
MIL	Malfunction Indicator Light
NRC	Negative Response Code
OBD	On-Board Diagnostics
PID	Parameter Identifier
PWM	Pulse Width Modulated
RDCM	Rear Diagnostic Control Module
RID	Routine Identifier
SID	Service Identifier
SPN	Suspect Parameter Number
TCM	Transmission Control Module
UDS	Unified Diagnostic Services
VIN	Vehicle Identification Number
VPW	Variable Pulse Width
ZEV	Zero Emission Vehicle

For additional abbreviated terms, also refer to SAE J1930 and SAE J1979-2.

3.3 Symbols

\$	Hexadecimal Numbering System
%	Percentage
ms	Milliseconds

For additional symbols, also refer to SAE J1930.

4. CONVENTIONS

SAE J1979-3 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 J1979-3 references the standards as an applicable data link for ZEV standardized communications.

5. DOCUMENT OVERVIEW

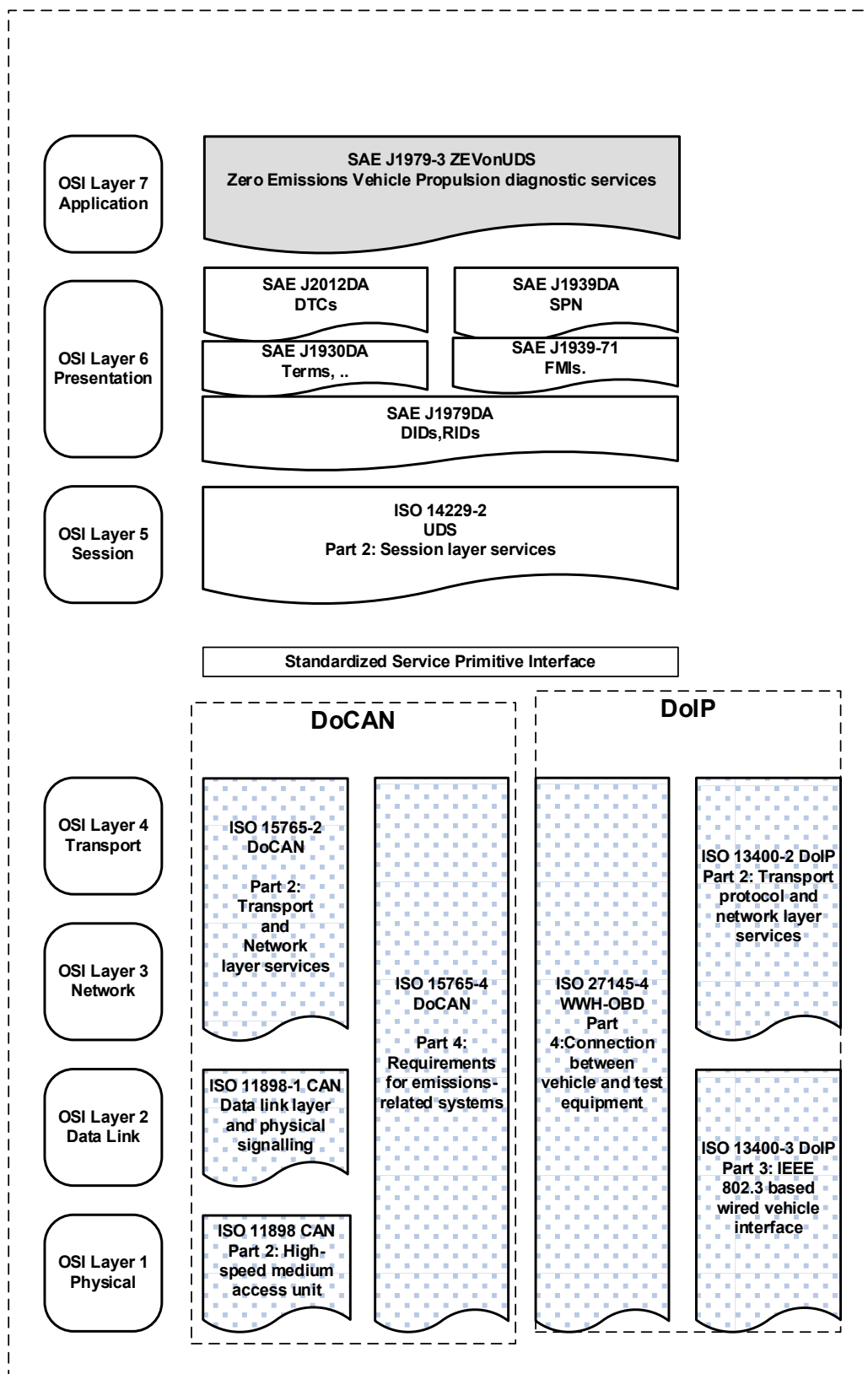


Figure 3 - Regulated ZEV propulsion system communication standards

6. TECHNICAL REQUIREMENTS

6.1 DTCStatusMask/DTC Status Byte and DTCStatusAvailabilityMask

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

Each of the 8 bits in the statusOfDTC has a meaning that is defined in ISO 14229-1, but for ZEV Propulsion related DTCs only Bits 0, 1, 2, 3, 4, and 6 are evaluated. For compliance to this standard, user optional bits (U) shall not be evaluated for conformance.

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.

Table 2 - 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 for ZEVonUDS.	U	TFSLC
#6	testNotCompletedThisOperationCycle	M	TNCTOC
#7	warningIndicatorRequested This bit is optional for the vehicle manufacturer to support and is not used for ZEVonUDS.	U	WIR

M = Mandatory, shall be evaluated for conformance.

U = User Optional, shall not be evaluated for conformance.

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

The combination of DTC Status Bits #4 and #6 may comprise the complete set of DTCs. The act of combining these bits could result in a long response message.

Refer to ISO 14229-1 for status bit definitions.

6.2 DTCSeverityMask and DTCSeverityAvailabilityMask

Each of the 8 bits in the DTC Severity Mask has a precise meaning that is defined in ISO 14229-1. The following definitions in [Tables 6](#) and [4](#) show an overview. Bits in the DTCSeverityAvailabilityMask that are not supported by the server are set to “0.”

Table 3 - 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 4 - DTC severity and DTC class bit definition

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

M = Mandatory, shall be evaluated for conformance.

N/A = Not Applicable, shall not be evaluated for conformance.

ZEVs shall support DTCClass_1 to allow reuse of existing PHEV modules and generic scan tools.

Refer to ISO 14229-1 for more information of the DTCClass/SeverityMask.

6.3 FunctionalGroupIdentifier

ZEVs shall support FunctionalGroupIdentifier \$33.

6.4 GroupOfDTCIdentifier

ZEVs shall support GroupOfDTCIdentifier \$FFFF33 and \$FFFFFF.

Refer to ISO 14229-1 for the definition of all GroupOfDTCIdentifier. The following definition in [Table 5](#) shows an excerpt.

Table 5 - GroupOfDTCIdentifier definition

Byte Value (Hex)	Description	Cvt	mnemonic
FFFF33	ZEV propulsion systems Group	M	ZPSYSGRP
FFFFFF	All Groups (all DTCs)	M	AG

6.5 DTCFormatIdentifierDTCFormatIdentifier

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 J1979-3:

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.

Refer to ISO 14229-1.

6.5.1 SPN Interpretation for SAE J1939-73_DTCFormat

Refer to SAE J1939-73 and SAE J1939DA.

6.6 SAE J1979-3 Diagnostic Service Requirements

6.6.1 Protocol Detection

The following ZEV propulsion systems protocol check (SAE J1979-3) is performed in conjunction with existing ISO 15765-4 (SAE J1979-1) and ISO 14229-1 (SAE J1979-2) protocol checks.

The ZEV propulsion systems protocol check confirmation is done by:

1. First, perform a functional request of DID 0xF810 on DoCAN using the ISO 14229-1 protocol. If one or more positive responses are made, then the vehicle is confirmed to be regulated DoCAN (ISO 14229-2) protocol compliant.
 - a. After a positive response to DID 0xF810, perform a physical request of DID 0xF41C to determine the regulated ZEV market (for example, Heavy Duty ZEV = 0x1B).
2. Then, if no positive responses from step one are received, then further confirmation is accomplished by:
 - a. Performing the DoIP activation line process to determine which DoIP option the vehicle Ethernet line supports.
 - b. Once determined, perform functional request of DID 0xF810 on DoIP using the ISO 13400-2 protocol. If one or more positive responses are made, then the vehicle is confirmed to be regulated DoIP (ISO 13400-2) protocol compliant.
 - c. After a positive response to DID 0xF810, perform a physical request of DID 0xF41C to determine the regulated ZEV market (for example, Heavy Duty ZEV = 0x1B).

Notes:

1. The tool will stop further protocol determination checks when it gets a first positive response from the vehicle's ZEV propulsion system.
2. This specification requires that all ZEV ECU Servers must support the same datalink, which is specified as either DoCAN (ISO 14229-1) or DoIP (ISO 13400-1).
3. A ZEV propulsion system compliant vehicle shall not acknowledge support of ZEVonUDS using a mix of communications using both DoCAN and DoIP protocols. The vehicle shall only respond to DID 0xF810 on the DoCAN (ISO 14229-2) protocol or the DoIP (ISO 13400-2) protocol. After vehicle identification, the tool will only seek information from a vehicle either on the DoCAN or the DoIP protocols. Furthermore, once the tool establishes communication to the vehicle using ZEVonUDS, the supported services on other protocols becomes outside the scope of this document.
4. If multiple vehicles are available on a subnet, the tool shall ensure each server is paired to the appropriate vehicle on the network. Each DoIP server shall have a VIN in the Vehicle Identification response that accurately represents the responding vehicle. Refer to ISO 13400-2 for guidance.

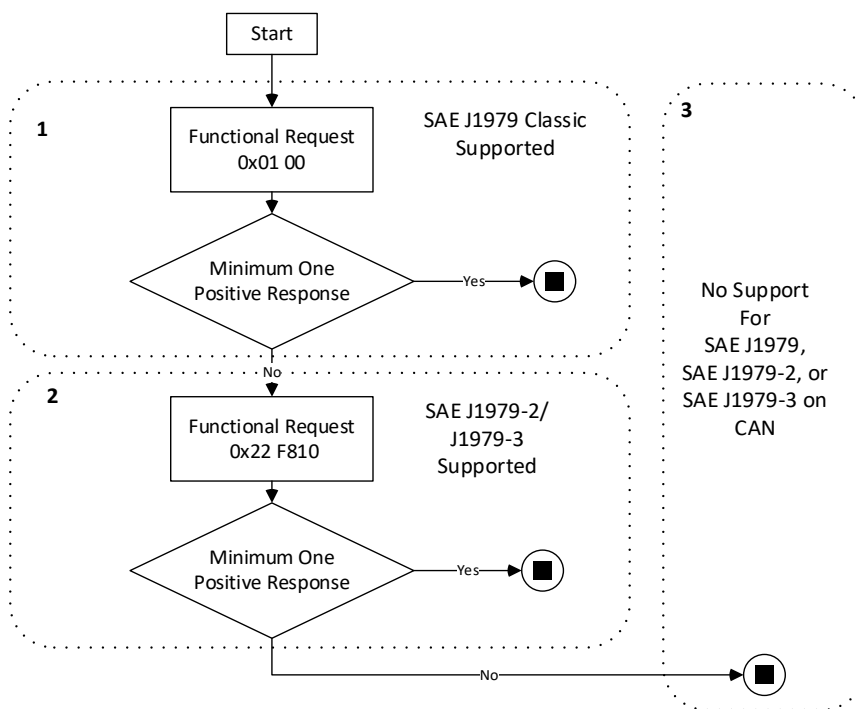


Figure 4 - Protocol detection over CAN

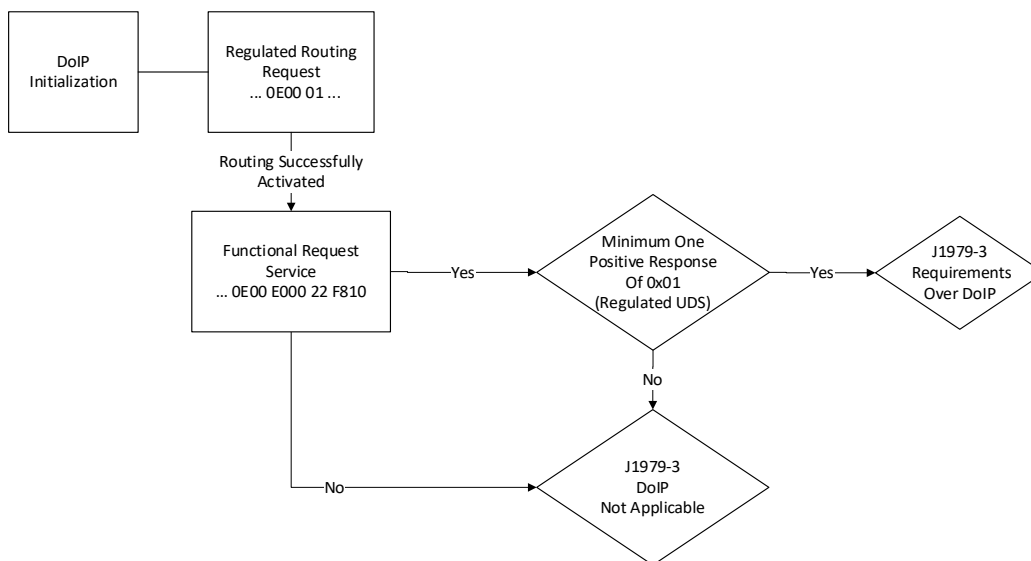


Figure 5 - Protocol detection over DoIP

6.6.2 Multiple Responses to a Single Data Request

For the DoCAN protocol, refer to SAE J1979-2.

For the DoIP protocol, the only functional request required is during the protocol identification and shall be handled with reference to ISO 13400-2.