



SURFACE VEHICLE RECOMMENDED PRACTICE

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Application Layer - Diagnostics

RATIONALE

This document has been revised with the following changes:

- Additional diagnostic message and special instructions FMI.
- Additions to document for China IV non road and OBD MY2024 regulations.
- Correction of the MIL activation mode for WWH and EURO VI implementations.

FOREWORD

The SAE J1939 communications network is defined using a collection of individual SAE J1939 documents based upon the layers of the Open System Interconnect (OSI) model for computer communications architecture. The SAE J1939-73 document defines the SAE J1939 messages for diagnostic services for diagnostic information reporting and diagnostic repair, including services to satisfy regulated OBD requirements.

The SAE J1939 communications network is a high-speed ISO 11898-1 CAN-based communications network that supports real-time closed loop control functions, simple information exchanges, and diagnostic data exchanges between electronic control units (ECUs) physically distributed throughout the vehicle.

The SAE J1939 communications network is developed for use in heavy-duty environments and suitable for horizontally integrated vehicle industries. The SAE J1939 communications network is applicable for light-duty, medium-duty, and heavy-duty vehicles used on-road or off-road, and for appropriate stationary applications which use vehicle-derived components (e.g., generator sets). Vehicles of interest include, but are not limited to, on-highway and off-highway trucks and their trailers, construction equipment, and agricultural equipment and implements. The physical layer aspects of SAE J1939 reflect its design goal for use in heavy-duty environments. Horizontally integrated vehicles involve the integration of different combinations of loose package components, such as engines and transmissions that are sourced from many different component suppliers. The SAE J1939 common communication architecture strives to offer an open interconnect system that allows the ECUs associated with different component manufacturers to communicate with each other.

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Documents

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1. SCOPE

SAE J1939-73 defines the SAE J1939 messages to accomplish diagnostic services and identifies the diagnostic connector to be used for the vehicle service tool interface. Diagnostic messages (DMs) provide the utility needed when the vehicle is being repaired. Diagnostic messages are also used during vehicle operation by the networked electronic control modules to allow them to report diagnostic information and self-compensate as appropriate, based on information received. Diagnostic messages include services such as periodically broadcasting active diagnostic trouble codes, identifying operator diagnostic lamp status, reading or clearing diagnostic trouble codes, reading or writing control module memory, providing a security function, stopping/starting message broadcasts, reporting diagnostic readiness, monitoring engine parametric data, etc. California-, EPA-, or EU-regulated OBD requirements are satisfied with a subset of the specified connector and the defined messages.

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 J1587	Electronic Data Interchange Between Microcomputer Systems in Heavy-Duty Vehicle Applications
SAE J1939	Serial Control and Communications Heavy Duty Vehicle Network - Top Level Document
SAE J1939DA	SAE J1939 Digital Annex
SAE J1939-3	On-Board Diagnostics Implementation Guide
SAE J1939-13	Off-Board Diagnostic Connector
SAE J1939-21	Data Link Layer
SAE J1939-71	Vehicle Application Layer
SAE J1939-84	OBD Communications Compliance Test Cases for Heavy Duty Components and Vehicles
SAE J1979	E/E Diagnostic Test Modes

2.1.2 On-Board Diagnostics Regulations

California Code of Regulations, Title 13, Section 1956.8. California Standards and Test Procedures for New 2021 and Subsequent Model Heavy-Duty Zero-Emission Powertrains.

California Code of Regulations, Title 13, Section 1971, Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model-Year Heavy-Duty Engines.

California Code of Regulations, Title 13, Section 1971.1, On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD). Year 2005/6 rule making.

California Code of Regulations, Title 13, Section 1971.1, On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD). Year 2008/9 rule making.

California Code Regulations, Title 13, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) (California Air Resources Board (CARB) Publications are available from the, Air Resources Board, Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, CA 91731-2990).

California Code Regulations, Title 13, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) (California Air Resources Board (CARB) Publications are available from the, Air Resources Board, Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, CA 91731-2990). Year 2005/6 rule updates.

California Code Regulations, Title 13, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II) (California Air Resources Board (CARB) Publications are available from the, Air Resources Board, Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, CA 91731-2990). Year 2008/9 rule updates.

European Directive 2005/55/EC of the European Parliament and of the Council of 28 September 2005 as implemented by Commission Directive 2005/78/EC and amended by Commission Directive 2006/51/EC.

European Directive 98/69/EC as amended by 99/102/EC, 2001/1/EC, 2001/100/EC and 2002/80/EC (Vehicles <7600 pounds).

European Union EU Reg 595/2009 and its implementing regulations, including, Regulation 49, 06 Series of Amendments (these define EURO VI emissions and HD OBD, includes motor vehicles above 3500kg (i.e., M2, M3, N2, N3)).

European Union Heavy Duty OBD (Vehicles above 7600 pounds) 29 November 2005 (EC Directive 2005/78).

U.S. EPA, Title 40, CFR 86.005-17 On-Board Diagnostics, July 1, 2011 (OBD for Engines - for Vehicles 8500 to 14000 pounds).

U.S. EPA, Title 40, CFR 86.007-17 On-Board Diagnostics for Engines Used in Applications Less Than or Equal to 14000 pounds GVWR, July 1, 2011.

U.S. EPA, Title 40, CFR 86.010-18 On-Board Diagnostics for Engines Used in Applications Greater than 14000 pounds GVWR, July 1, 2011.

U.S. EPA, Title 40, CFR 86.1806-05 On-Board Diagnostics for Vehicles Less Than or Equal to 14000 pounds GVWR, July 1, 2011.

U.S. EPA, Title 40, CFR 86.1806-10 (OBD for Vehicles - 8500 to 14000 pounds), December 4, 2008.

World Wide Harmonized OBD proposed Global Technical Regulation Draft by the Economic Commission for Europe, reference ECE/TRANS/WP.29/GRPE/2006/8/Rev.1/27 March 2006.

China IV, HJ 1014-2020 Emissions Control Technical Requirements of Non-Road Diesel Mobile Machinery.

3. DEFINITIONS

Terms and definitions not found in this section are defined in SAE J1939 or in specific OBD regulations.

3.1 ACTIVE

The state used to indicate that a fault is currently occurring. A fault cannot be simultaneously transmitted as both “active” and “previously active.”

3.2 BROADCAST

Messages that are sent on a periodic basis without having to be solicited. In some cases, broadcasts may be normally off and solicited to come on, and then stay on until they are solicited to turn off (see DM13).

3.3 CALIBRATION

The software installed in a control module. This includes executable code and calibration data.

3.4 CONFIRMED

Confirmed is a term that is used in conjunction with DTC to identify the DTC as a malfunction that has been concluded to be true or false. For example, when a system declares a malfunction is present, then it declares it in DM1 as a confirmed and active DTC. When the system declares a malfunction is no longer present, then it declares it in DM2 as confirmed and previously active. To satisfy regulated OBD, there may be additional constraints. These additional regulated constraints led to the DM12 and DM23 being defined.

3.5 CONFIRMED AND ILLUMINATING THE MIL

This terminology applies to a DTC that has matured to the point that it illuminates the MIL. Regulations may require that a DTC that is no longer active remain in this state for a certain number of drive cycles after the fault condition becomes inactive. These DTCs are reported in the DM12, as well as in DM1.

3.6 CONTINUOUSLY MONITORED SYSTEMS

Continuously monitored systems are those which are sampled at least two times per second. Note that some continuous monitors may require many conditions to be true before monitoring can be performed.

3.7 DIAGNOSTIC TROUBLE CODE

A 4-byte value that identifies the condition, the associated failure mode indicator (FMI) and its occurrence count.

3.8 DISCRIMINATORY

Discriminatory is a term used to differentiate the type of OBD operator illumination scheme that is used by the vehicle when controlling the malfunction indicator lamp (MIL or MI). Discriminatory and non-discriminatory operator illumination schemes for the MIL are defined in the WWH OBD global technical regulation. A non-discriminatory scheme will have the MIL-On continuously for all OBD malfunctions while the discriminatory MIL scheme will only have the MIL-On continuous for malfunctions thought to cause the emissions to exceed the OBD emissions threshold.

3.9 FREEZE FRAME

A snapshot of a group of data stream signals based on the occurrence of a diagnostic trouble code.

3.10 KEY

The result of a set of mathematical operations performed upon a seed to provide a device with a means of authenticating a tool's request.

3.11 MALFUNCTION INDICATOR LAMP

The MIL is used to report trouble codes that are emissions related. Trouble codes that are not emissions related shall not illuminate the MIL.

3.12 MEMORY ACCESS

This defines a set of messages (DM14 through DM18) and outlines the operational procedures for a tool (or device) wishing to read or write the memory, or storage space, of a device with or without data security.

3.13 NON-CONTINUOUSLY MONITORED SYSTEMS

System monitors that run once a trip or whenever conditions exist. Trip, in this context, is as defined by OBD regulations. It should be noted that there will be monitors that won't run every trip; e.g., cold-start aid monitors may only run when the ambient temperature is below 10 °C (50 °F).

3.14 OBD DEVICE

This is a device that has declared in DM5 an OBD compliance value that indicates it satisfies OBD requirements. An OBD device can be a primary or secondary device. See Appendix H, Table H1.

3.15 OBJECT

Some entity within a memory and/or a space.

3.16 PASSWORD

The number sent when using a simple authentication technique wherein both the device and tool have a prior knowledge of the specific number and usually use equality as the verification.

3.17 PENDING

Pending is a term used to specify the type of DTC. Pending DTC means a DTC that is stored by the OBD system, or diagnostic system, because a monitor has detected a situation where a malfunction may be present during the current or last completed driving cycle. For regulated systems, the definition of a pending DTC may vary according to the regulatory guidance.

3.18 PERMANENT

Permanent is a term used to label a confirmed and active (MIL-On) DTC that is recorded in memory and is not allowed to be erased by the OBD system until the monitoring algorithm has fully executed (i.e., has executed the minimum number of checks necessary for MIL illumination) and determined the malfunction is no longer present. Refer to California Code of Regulation 1971.1.

3.19 POINTER

A term used to label a device that identifies the memory location which should be read or written. Types of pointers include: direct memory address and directed spatial addressing (suspect parameter number (SPN) space, OEM proprietary space, and reserved to be assigned).

3.20 POTENTIAL

See pending.

3.21 PORT

Physical connection point(s) from a control module to a specific communications link (see DM13).

3.22 PREVIOUSLY ACTIVE

The state used to indicate that a fault has occurred but is not presently occurring. A fault cannot be simultaneously transmitted as both “active” and “previously active.”

3.23 RATIONALITY

Rationality fault diagnostic for an input component means verification of the accuracy of the input signal while in the range of what is physically possible (see Appendix A, region b versus regions f and g) when compared to all other available information. This is a term that the California Air Resources Board has defined in their OBD rules.

3.24 READINESS CODE

The readiness code status bits (i.e., those in DM5) are used in part or in whole to ensure a vehicle (engine) is ready for an emission system inspection. The definition of the complete or incomplete status is provided in regulation(s), including the impact of specific service actions on readiness status. If a status bit for a particular component or system is set to complete, then the OBD system has had the opportunity to run all of the diagnostics relevant to that particular component or system.

For example, on engine start up, it is likely that an EGR monitor might require operation at speed and torque points beyond the idle condition. Therefore, if the system had its diagnostic trouble codes erased and then the engine was restarted, the readiness code for EGR would not be set until the condition for the EGR monitor tests had been executed and a pass/fail determination has been made. It is also expected that other tests, not just the EGR monitors, would need to be performed before the readiness code could be set. Once set to complete, the readiness code status bits shall not change to incomplete each time the vehicle (engine) is powered down.

Please see Appendix J for more detail.

3.25 SEED

A number sent by a device to a tool to obtain authentication of the tool's right to access the device.

3.26 SPACE

A memory region containing a collection of objects.

3.27 USER_LEVEL

A number sent by a tool to a device along with an initial request to inform the device of some specific level of access that the tool wishes to gain.

4. ABBREVIATIONS

CARB	California Air Resources Board
CAL ID	Calibration Identification
CM	SPN Conversion Method
CVN	Calibration Verification Number
DM1	Diagnostic Message 1, Active Diagnostic Trouble Codes (DTCs)
DM2	Diagnostic Message 2, Previously Active Diagnostic Trouble Codes (DTCs)
DM3	Diagnostic Message 3, Diagnostic Data Clear/Reset for Previously Active DTCs
DM4	Diagnostic Message 4, Freeze Frame Parameters
DM5	Diagnostic Message 5, Diagnostic Readiness 1
DM6	Diagnostic Message 6, Emission-Related Pending Diagnostic Trouble Codes
DM7	Diagnostic Message 7, Command Non-Continuously Monitored Test
DM8	Diagnostic Message 8, Test Results for Non-Continuously Monitored Systems
DM9	Diagnostic Message 9, Oxygen Sensor Test Results
DM10	Diagnostic Message 10, Non-Continuously Monitored Systems Test Identifiers Support
DM11	Diagnostic Message 11, Diagnostic Data Clear/Reset for Active DTCs
DM12	Diagnostic Message 12, Emission-Related MIL-On Diagnostic Trouble Codes
DM13	Diagnostic Message 13, Stop-Start Broadcast
DM14	Diagnostic Message 14, Memory Access Request
DM15	Diagnostic Message 15, Memory Access Response
DM16	Diagnostic Message 16, Binary Data Transfer
DM17	Diagnostic Message 17, Boot Load Data
DM18	Diagnostic Message 18, Data Security
DM19	Diagnostic Message 19, Calibration Information

DM20	Diagnostic Message 20, Monitor Performance Ratio
DM21	Diagnostic Message 21, Diagnostic Readiness 2
DM22	Diagnostic Message 22, Individual Clear/Reset of Active and Previously Active DTC
DM23	Diagnostic Message 23, Emission Related Previously MIL-On DTCs
DM24	Diagnostic Message 24, SPN Support
DM25	Diagnostic Message 25, Expanded Freeze Frame
DM26	Diagnostic Message 26, Diagnostic Readiness 3
DM27	Diagnostic Message 27, All Pending DTCs
DM28	Diagnostic Message 28, Emission-Related Permanent Diagnostic Trouble Codes
DM29	Diagnostic Message 29, DTC Counts
DM30	Diagnostic Message 30, Scaled Test Results
DM31	Diagnostic Message 31, DTC to Lamp Association
DM32	Diagnostic Message 32, Regulated Exhaust Emission Level Exceedance
DM33	Diagnostic Message 33, Emission Increasing Auxiliary Emission Control Device Active Time
DM34	Diagnostic Message 34, NTE Status
DM35	Diagnostic Message 35, Immediate Fault Status
DM36	Diagnostic Message 36, Harmonized Roadworthiness - Vehicle (HRVV)
DM37	Diagnostic Message 37, Harmonized Roadworthiness - System (HRWS)
DM38	Diagnostic Message 38, Harmonized Global Regulation Description (HGRD)
DM39	Diagnostic Message 39, Harmonized Cumulative Continuous Malfunction Indicator - System (HCMI)
DM40	Diagnostic Message 40, Harmonized B1 Failure Counts (HB1C)
DM41	Diagnostic Message 41, DTCs- A, Pending
DM42	Diagnostic Message 42, DTCs- A Confirmed and Active
DM43	Diagnostic Message 43, DTCs- A, Previously Active
DM44	Diagnostic Message 44, DTCs- B1, Pending
DM45	Diagnostic Message 45, DTCs- B1, Confirmed and Active
DM46	Diagnostic Message 46, DTCs- B1, Previously Active
DM47	Diagnostic Message 47, DTCs- B2, Pending
DM48	Diagnostic Message 48, DTCs- B2, Confirmed and Active
DM49	Diagnostic Message 49, DTCs- B2, Previously Active
DM50	Diagnostic Message 50, DTCs- C, Pending
DM51	Diagnostic Message 51, DTCs- C, Confirmed and Active
DM52	Diagnostic Message 52, DTCs- C, Previously Active
DM53	Diagnostic Message 53, Active Service Only DTCs
DM54	Diagnostic Message 54, Previously Active Service Only DTCs
DM55	Diagnostic Message 55, Diagnostic Data Clear/Reset for All Service Only DTCs
DM56	Diagnostic Message 56, Model Year and Certification Engine Family
DM57	Diagnostic Message 57, OBD Information
DM58	Diagnostic Message 58, Rationality Fault SP Data
DM59	Diagnostic Message 59, Diagnostic Readiness 4
DM60	Diagnostic Message 60, Extended DTC Information
DTC	Diagnostic Trouble Code
EDC	Error Detection and/or Correction
EDCP	Error Detection and/or Correction Parameter
FMI	Failure Mode Indicator
FTP	Federal Test Procedure
GHG	Greenhouse Gas
GTR	Global Technical Regulation

MA	Memory Access
MI	Malfunction Indicator
MIL	Malfunction Indicator Lamp
NA	Not Applicable
OBD	On-Board Diagnostics
OBD II	On-Board Diagnostics II
OC	Occurrence Count
PG	Parameter Group
PGN	Parameter Group Number
PID	Parameter Identifier (SAE J1587 or SAE J1979)
SPN	Suspect Parameter Number
TID	Test Identifier
VVT	Variable Valve Timing and/or Control
WWH	World Wide Harmonized
ZEP	Zero Emissions Powertrain

Refer to SAE J1939 for any terms and or definitions not found in this document.

5. TECHNICAL REQUIREMENTS

5.1 General

The diagnostic definitions provided herein are intended to satisfy the needs of all potential users of the SAE J1939 network. These definitions are intended to be suitable for applications in any of the industry groups defined within SAE J1939. A broad range of capabilities are provided with provision made for future growth. Additional features, parameter groups, and parameter definitions will be defined over time; it is anticipated that this document will continuously evolve as long as the SAE J1939 network is an active recommended practice. Such growth will be implemented in such a way as to ensure backward compatibility with earlier versions. At the time of initial publication, many of these growth areas are identified, but are yet to be defined. Such identification is provided so that the reader will be aware of those additions that are already planned for the document.

5.2 Overview of Diagnostic Requirements

The diagnostic requirements necessary to provide the type of capability our customers, our industry, and the regulatory bodies are demanding is outlined in 5.2.1. A description of the minimum requirements needed to satisfy regulatory requirements is contained in 5.2.2. A discussion of the general operating conditions for diagnostic procedures is defined in 5.2.3.

5.2.1 Diagnostic Capabilities Envisioned

The following capabilities will be defined in this and future publications of this document:

- Security:** Define a security scheme to be used on the serial data link that allows the industry standard service tools to be able to perform tasks that are necessary during service procedures. This will include accessing diagnostic information, accessing vehicle configuration information and recalibrating control modules.
- Connectors:** Define the connector to be used for connection to the vehicle SAE J1939 network for service tools. The diagnostic connector is defined in SAE J1939-13.
- Diagnostic Status Message Support:** Provide a set of messages that allows the reading of fault information, clearing of fault information, monitoring of vehicle parameters, access to vehicle and component configuration, and other related information.
- Diagnostic Test Support:** Provide a capability that allows the service tool to put the various controllers into specific test modes in order to determine proper sub-system operation.

5.2.2 Suggested Diagnostic Support

5.2.2.1 Emission Related Components

As a minimum capability, all controllers using SAE J1939 that must comply with regulated on-board diagnostics (OBD, OBD II, HD OBD, or EOBD, etc.) shall support the functions shown in Table 1. Additionally, these controllers must satisfy the requirements in SAE J1939-03 if required by the regional authority. See Table 2 for the legend defining the entries in the "Required by Regulation" column of Table 1.

Table 1 - Emission-related component PGN and SPN support

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
Diagnostic Services						
1	Read DTCs and Lamps (MIL, RSL, AWL, Protect)	65226	DM1		A, B, C, E, F, G, H, J, K, L, N, O, P	All active DTCs and some lamps (MIL, RSL, AWL, protect)
2	Read DTCs	65236	DM12		A, B, H, J, K, L, N, P	Emission-related MIL-On diagnostic trouble codes
3	Read DTCs	64949	DM23		B, H, J, K, L, N, P	Emission-related previously MIL-On diagnostic trouble codes
4	Read Pending DTCs	65231	DM6		A, B, E, F, G, H, J, K, L, N	Emission related pending DTCs
5	Read All Pending DTCs	64898	DM27			All pending DTCs inclusive of emissions and non-emissions related
6	Read Permanent DTCs	64896	DM28		H, J	Emission related permanent DTCs
7	Read DTC Counts	40448	DM29		H, J	Number of regulated DTC counts (pending, permanent, MIL-On, PMIL-On)
8	Read DTCs- A, Pending	64863	DM41		L, N	DTCs where emissions exceed OBD threshold
9	Read DTCs- A, Confirmed and Active	64862	DM42		L, N	DTCs where emissions exceed OBD threshold
10	Read DTCs- A, Previously Active	64861	DM43		L, N	DTCs where emissions exceed OBD threshold
11	Read DTCs- B1, Pending	64860	DM44		L, N	DTCs where emissions may exceed OBD threshold
12	Read DTCs- B1, Confirmed and Active	64859	DM45		L, N	DTCs where emissions may exceed OBD threshold
13	Read DTCs- B1, Previously Active	64858	DM46		L, N	DTCs where emissions may exceed OBD threshold
14	Read DTCs- B2, Pending	64857	DM47		L, N	DTCs where emissions do not exceed OBD threshold
15	Read DTCs- B2, Confirmed and Active	64856	DM48		L, N	DTCs where emissions do not exceed OBD threshold

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
16	Read DTCs- B2, Previously Active	64855	DM49		L, N	DTCs where emissions do not exceed OBD threshold
17	Read DTCs- C, Pending	64854	DM50		L, N	DTCs where emissions do not exceed emission standard
18	Read DTCs- C, Confirmed and Active	64853	DM51		L, N	DTCs where emissions do not exceed emission standard
19	Read DTCs- C, Previously Active	64852	DM52		L, N	DTCs where emissions do not exceed emission standard
20	Read DTCs- Immediate	40704	DM35			Instantaneous status of diagnostic results
21	Read DTCs and Timers-	41472	DM32		K, N, P	DTCs and timers where OBD emissions threshold exceeded (e.g., NOx exceedance)
22	Command Test	58112	DM7		H, J, K, L, N, P	Commanded Test; system, device, or component
22a	Unscaled Test Results	65232	DM8		A, C, E, F, G	Test results
22b	Scaled Test Results	41984	DM30		H, J, K, L, P	Test results scaled
23	DTC to Lamp Association	41728	DM31			Contains info supplementary to DM1 that can be requested in order to provide lamp info associated with each DTC
24	Clear DTCs	65235	DM11		A, B, C, E, F, G, H, J, K, L, N, O, P	Clear diagnostic information and active/previously active DTCs
25	Clear DTCs	65228	DM3		C	Clear diagnostic information and previously active DTCs
26	Freeze Frame Data	65229	DM4		A, C, E, F, G, K	Freeze frame definition and support (fixed format, DTC, and six specified parameters)
27	SPN Support	64950	DM24		B, H, J, L, N, O, P	SP support for data stream, expanded freeze frame, test results, and rationality fault SP data value
28	Expanded Freeze Frame	64951	DM25		B, H, J, L, N, P	Expanded freeze frame (format allows DTC and manufacturer-specified number parameters)
29	Diagnostic Readiness	65230	DM5		A, B, C, E, F, G, H, J, K, L, N, O, P	OBD compliance, previously active, active DTC count, monitors supported, and their status (diagnostic readiness)
30	Diagnostic Readiness for this Trip	64952	DM26		B, E, H, J, N ¹	Monitors supported and their status for this trip
31	Monitor Performance Ratio	49664	DM20		B, H, J, N	Indicates how often monitors complete compared to vehicle operation

¹ Only phases C and D of N.

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
32	Emission Increasing - AECD Active Time	41216	DM33		H, J	Engine emissions increasing AECDs and associated timers (not required HD EPA)
33	NTE Status	40960	DM34		H, J	Engine emissions not-to-exceed status
34	Harmonized Roadworthiness - Vehicle	64868	DM36		L, N	Vehicle road worthiness status
35	Harmonized Roadworthiness - System	64867	DM37		L, N	Engine emissions road worthiness status
36	Harmonized Global Regulation Description	64866	DM38		L, N	Text description of WWH OBD version
37	Harmonized Continuous Cumulative Continuous Malfunction Indicator - System	64865	DM39		L, N	Cumulative MIL time and DTC-B1 time (largest)
38	Harmonized B1 Failure Counts	64864	DM40		L, N	DTCs-B1 and individual timers
39	Rationality Fault SP Data	64475	DM58		H, J	SP data value for an SP with a rationality diagnostics fault
40	Diagnostic Readiness 4	64300	DM59		L, N	Continuous-MI time while engine operating, time elapsed since DTCs were erased

Communication Services

41	Communication	59904	RQST		A, B, C, E, F, G, H, J, K, L, N, O, P	Request PG
42	Communication	59392	ACKM		A, B, C, E, F, G, H, J, K, L, N, O, P	Acknowledgement message
43	Communication	60416	TP.CMxx		A, B, C, E, F, G, H, J, K, L, N, O, P	Transport protocol connection management
44	Communication	60160	TP.DT		A, B, C, E, F, G, H, J, K, L, N, O, P	Transport protocol data transfer

Data Stream

45	Data Stream	65260	VI	237	A, B, C, E, F, G, H, J, K, L, N, O, P	Vehicle identification number (VIN)
46	Data Stream	54016	DM19	1635 1634	A, B, C, E, F, G, H, J, K, L, N, O, P	Calibration identification and calibration verification number (CAL ID and CVN)
47	Data Stream	65262	ETI	110	A, B, C, E, F, G, H, J, K, L, N, P	Engine coolant temperature



Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
48	Data Stream	65265	CCVS	84	A, B, C, E, F, G, H, J, K, L, N, O, P	Wheel-based vehicle speed
49	Data Stream	65270	IC1	102	A, B, C, E, F, G, H, J, K, L, N, P	Engine intake manifold #1 pressure
50	Data Stream	65270	IC1	105	A, B, C, E, F, G, H, J, K, L, N, P	Engine intake manifold 1 temperature
51	Data Stream	61443	EEC2	91	A, B, C, E, F, G, H, J, K, L, N, O, P	Accelerator pedal position 1
52	Data Stream	61443	EEC2	92	A, B, C, E, F, G, H, J, K, L, N, P	Engine percent load at current speed
53	Data Stream	61444	EEC1	513	A, B, C, E, F, G, H, J, K, L, N, P	Actual engine - percent torque
54	Data Stream	61444	EEC1	190	A, B, C, E, F, G, H, J, K, L, N, P	Engine speed
55	Data Stream	61444	EEC1	899	A, B, C, E, F, G, H, J, K, L, N, P	Engine torque mode
56	Data Stream	65159	IT6	1436	A, B, E, F, G, H, J, K, L, N, P	Engine actual ignition timing
57	Data Stream	49408	DM21	3069	A, B, E, F, G, H, J, K, L, P	Distance traveled while MIL is activated
58	Data Stream	49408	DM21	3294	B, H, J, K, L, P	Distance since diagnostic trouble codes cleared
59	Data Stream	49408	DM21	3295	B, H, J, K, L, N, P	Minutes run by engine while MIL is activated
60	Data Stream	49408	DM21	3296	B, H, J, K, L, N, P	Time since diagnostic trouble codes cleared
61	Data Stream	64952	DM26	3301	B, H, J, K, L, N, P	Time since engine start
62	Data Stream	64952	DM26	3302	B, H, J, K, L, N, P	Number of warm-ups since diagnostic trouble codes cleared
63	Data Stream	64891	AT1S1	5466	H, J	Aftertreatment 1 diesel particulate filter soot load regeneration threshold
64	Data Stream	60928	AC	2848	H, J	Name of controller application
65	Data Stream	Various		5919	O	Additional data stream parameters are captured in SAE J1939DA Appendix D under the SPN reference of SPN 5919 - HVESS Voltage Level
Note: This and other SPNs are reported in DM24 to indicate the sets of SPNs to be supported by the HD ZEP.						

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
66	Data Stream	Various			B, H, J, K, L, N, P	Additional data stream parameters are required for OBD compliance, but they are dependent on the emission solution used for certification; these parameters are in SAE J1939 and/or SAE J1939-71 and/or SAE J1939DA
67	Data Stream	65279	OI	5825	P ²	Driver Warning System Indicator Status
68	Data Stream	64459	EEPCSI	8887	P	Exhaust Particulate Control System Diagnostic Time
69	Data Stream	64459	EEPCSI	8888	P	Exhaust Particulate Control System Diagnostic Count
70	Data Stream	65269	AMB	108	H ³ , J ³ , P	Barometric Pressure
Data Stream [2024MY]						
71	Data Stream	65214	EEC4	189	H, J	Engine Rated Speed
72	Data Stream	64711	DM56	5845	H, J	Certification Engine Family Name
73	Data Stream	64841	O2FT1	4236	H, J	Short term Fuel Trim - Bank 1
74	Data Stream	64841	O2FT1	4240	H ³ , J ³	Engine Exhaust Bank 1 O2 Sensor Closed Loop Operation
75	Data Stream	64841	O2FT1	4237	H ³ , J ³	Engine Exhaust Bank 1 O2 Sensor Closed Loop.
76	Data Stream	64706	HSS1	7315	H, J	Propulsion System Active
77	Data Stream	61450	EGF1	12758	H, J	Target Fresh Air Mass Flow
78	Data Stream	65263	EFL/P1	101	H, J	Engine Crankcase Pressure 1
79	Data Stream	64916	EEC7	5444	H, J	Engine Crankcase Breather Oil Separator Speed
80	Data Stream	64251	ESPC	12744	H, J	EVAP System Purge Pressure
81	Data Stream	64247	AT1HI3	12765	H, J	Aftertreatment 1 Total Engine Runtime With No DEF Delivery
82	Data Stream	64920	AT1HI1	3726	H, J	Aftertreatment 1 Diesel Particulate Filter Total Number of Passive Regenerations
83	Data Stream	64214	EEC4	166	H, J	Engine Rated Power
84	Data Stream	64247	AT1HI3	12766	H, J	Aftertreatment 1 Total Time SCR Inlet Below 200 Celsius
85	Data Stream	61691	A1SCRDS R3	8442	H, J	Aftertreatment 1 Diesel Exhaust Fluid Doser Valve 1 Command
86	Data Stream	64488	ASI2	12749	H, J	DEF Dosing Mode
87	Data Stream	61475	A1SCRDS 1	4331	H, J	Aftertreatment 1 Diesel Exhaust Fluid Actual Dosing Quantity
88	Data Stream	64488	ASI2	12748	H, J	Aftertreatment Diesel Exhaust Fluid Use This Operating Cycle
89	Data Stream	64250	ATNXMS1	12753	H, J	Aftertreatment 1 SCR 1 Target NH3 Storage Level
90	Data Stream	64250	ATNXMS1	12752	H, J	Aftertreatment 1 SCR 1 Modeled/Actual Storage Level
91	Data Stream	64830	A1SCRE GT1	4360	H, J	Aftertreatment 1 SCR Intake Temperature

² As an alternative to SP 1213.

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
92	Data Stream	64830	A1SCRE GT1	4363	H, J	Aftertreatment 1 SCR Outlet Temperature
93	Data Stream	61454	AT1IG1	3220	H, J	Engine Exhaust 1 NOx 1 Reading Stable
94	Data Stream	61457	AT2OG1	3269	H, J	Aftertreatment 2 Outlet NOx 1 Reading Stable
95	Data Stream	61450	EGF1	2659	H, J	Engine Exhaust Gas Recirculation 1 Mass Flow Rate
96	Data Stream	37376	HCDI1	5505	H, J	Requested Fuel Mass Rate
97	Data Stream	64488	ASI2	12743	H, J	Hydrocarbon Doser Duty Cycle
98	Data Stream	64929	AT1FC1	3480	H, J	Aftertreatment 1 Fuel Pressure 1
99	Data Stream	61450	EGF1	132	H ³ , J ³ , P	Engine Intake Air Mass Flow Rate
100	Data Stream	65110	AT1T1I1	1761	H ³ , J ³ , P	Aftertreatment 1 Diesel Exhaust Fluid Tank Volume
101	Data Stream	65266	LFE1	183	H, J, P	Engine Fuel Rate
102	Data Stream	64916	EEC7	27	H ³ , J ³ , P	Engine Exhaust Gas Recirculation 1 Valve Position
103	Data Stream	64981	EEC5	2791	H ³ , J ³ , P	Engine Exhaust Gas Recirculation 1 Valve 1 Control 1
104	Data Stream	61454	AT1IG1	3216	H ³ , J ³ , P	Engine Exhaust 1 NOx 1
105	Data Stream	61454	AT1IG1	3219	H ³ , J ³ , P	Aftertreatment 1 Intake Gas Sensor 1 at Temperature
106	Data Stream	64657	EEN	6579	H ³ , J ³ , P	Engine Exhaust NOx
107	Data Stream	61455	AT1OG1	3226	H ³ , J ³ , P	Aftertreatment 1 Outlet NOx 1
108	Data Stream	61674	AT1OG3	7660	H ³ , J ³ , P	Aftertreatment 1 Outlet NOx 2
109	Data Stream	64946	AT1IMG	3251	H, J, P	Aftertreatment 1 Diesel Particulate Filter Differential
110	Data Stream	64830	A1SCRE GT1	4360	H ³ , J ³ , P	Aftertreatment 1 SCR Intake Temperature
111	Data Stream	64830	A1SCRE GT1	4363	H ³ , J ³ , P	Aftertreatment 1 SCR Outlet Temperature
112	Data Stream	65247	EEC3	514	H, J, P	Nominal Friction - Percent Torque
113	Data Stream	65251	EC1	544	H, J, P	Engine Reference Torque
114	Data Stream	65279	OI	5825	P ⁴	Driver Warning System Indicator Status
115	Data Stream	64459	EEPCSI	8887	P	Exhaust Particulate Control System Diagnostic Time
116	Data Stream	64459	EEPCSI	8888	P	Exhaust Particulate Control System Diagnostic Count
117	Data Stream	65276	DD1	96	P, H ⁵ , J ⁵	Fuel Level 1
118	Data Stream	64247	AT1HI3	12759	H, J	Aftertreatment 1 DPF Regen Complete Starting Engine Vehicle Distance 1
119	Data Stream	64247	AT1HI3	12760	H, J	Aftertreatment 1 DPF Regen Complete Ending Engine Vehicle Distance 1

³ If equipped.⁴ As an alternative to SP 1213.⁵ Only if used to enable/disable other diagnostics.

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
120	Data Stream	64247	AT1HI3	12761	H, J	Aftertreatment 1 DPF Regen Complete Starting Engine Vehicle Distance 2
121	Data Stream	64247	AT1HI3	12762	H, J	Aftertreatment 1 DPF Regen Complete Ending Engine Vehicle Distance 2
122	Data Stream	64247	AT1HI3	12763	H, J	Aftertreatment 1 DPF Regen Complete Starting Engine Vehicle Distance 3
123	Data Stream	64247	AT1HI3	12764	H, J	Aftertreatment 1 DPF Regen Complete Ending Engine Vehicle Distance 3
124	Data Stream	64706	HSS1	7315	H	Propulsion System Active
125	Data Stream	64706	HSS1	7898	H	External Energy Source Connection Status
126	Data Stream	61584	HVESSD1	5919	H	HVESS Voltage Level
127	Data Stream	61584	HVESSD1	5920	H	HVESS Current
Data Stream - NOx Binning and GHG Tracking [2022 MY]						
128	Data Stream	64258, 64259, 64260, 64261, 64262, 64263, 64264, 64265, 64266, 64267, 64268, 64269, 64270, 64271, 64272, 64273, 64274, 64275, 64276, 64277, 64278, 64279	NTFCEA, NTEHEA, NTVMEA, NTEEEA, NTFCV, NTEHV, NTVMV, NTEEV, NTENV, NTSNV, NTFCS, NTEHS, NTVMS, NTEES, NTENS, NTSNS, NTFCA, NTEHA, NTVMA, NTEEA, NTENA, NTSNA	12675	H	NOx tracking
Note: SPN 12675 (NOx Tracking Engine Activity Lifetime Fuel Consumption Bin 1 - Total) shall be reported in "Supported Parameter SPN" in DM24 to indicate NOx bin tracking messages are supported.						
129	Data Stream	64255, 64256, 64257	GHGTTS, GHGTTA, GHGTTL	12691	H	Greenhouse gas (GHG) technology tracking
Note: Only SPN 12691 (GHG Tracking Lifetime Active Technology Index) shall be reported in "Supported Parameter SPN" in DM24 to indicate GHG technology tracking is supported.						
130	Data Stream	64252, 64253, 64254	GHGTL, GHGTS, GHGTA	12730	H	Greenhouse gas (GHG) tracking
Note: Only SPN 12730 (GHG Tracking Lifetime Engine Run Time) shall be reported in "Supported Parameter SPN" in DM24 to indicate GHG tracking is supported.						
131	Data Stream	64241, 64242, 64243	PSATL, PSATS, PSATA	12797	H	Greenhouse gas (GHG) tracking specific to hybrids
Note: Only SPN 12797 (Hybrid Lifetime Propulsion System Active Time) shall be reported in "Supported Parameter SPN" in DM24 to indicate GHG tracking for hybrids PSA PGs is supported.						

Row #	Function	PGN	Acronym	SPN #	Required by Regulation (see Table 2)	Description
132	Data Stream	64244, 64245, 64246	HCDIOL HCDIOS HCDIOA	12783	H	Greenhouse gas (GHG) tracking specific to hybrids
Note: Only SPN 12783 (Hybrid Lifetime Distance Traveled in Charge Depleting Operation with Engine off) shall be reported in "Supported Parameter SPN" in DM24 to indicate GHG tracking of hybrid plug-in PGs are supported.						

Table 2 - Regulation definition legend

Identifier	Regulating Body	OBD Compliance (SPN 1220) (Table 6)
A	CARB CCR 1968.1, (Vehicles <14000 pounds), April 21, 2003	01
B	CARB CCR 1968.2, (Vehicles <14000 pounds), April 21, 2003	01 or 03
C ⁶	CARB CCR 1971, Engine Manufacturer Diagnostics (EMD), (Vehicles >14000 pounds), August 2004, support recommended by manufacturers	17
D	EU (Directive 98/69/EC as amended by 99/102/EC, 2001/1/EC, 2001/100/EC and 2002/80/EC) (Vehicles <7600 pounds)	6 or 7 or 8 or 9
E	EU (July 2003 Planned Audit to Directive 88/77/EEC) (Vehicles >7600 pounds)	14 (Euro IV) 15 (Euro V)
F	EPA, Title 40, CFR 86.005-17, (Engines 8500 to 14000 pounds), December 28, 2000	02 or 03
G	EPA, Title 40, CFR 86.1806-05, (Vehicles 8500 to 14000 pounds), December 28, 2000	02 or 03
H	Title 13, California Code of Regulations, Section 1971.1, On-Board Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines (HD OBD) NOTE: The letter H covers the 2008, 2009, 2010, 2012, 2016, 2019, and 2021 updates by ARB, as well as EPA's 2008 and 2011 OBD updates to Title 40, CFR 86.1806-10, CFR 86.007-17, and CFR 86.010-18	18 ⁷ or 19 or 20 or 34 or 35
J	Title 13, California Code of Regulations, Section 1968.2, Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II): Additions in 2006, 2009, 2012, 2016, 2019, and 2021	22 or 34
K	Directive 2005/55/EC of the European Parliament and of the Council of 28 September 2005 as implemented by Commission Directive 2005/78/EC and amended by Commission Directive 2006/51/EC	23
L	World Wide Harmonized On-Board Diagnostics, refer to: ECE/TRANS/WP.29/GRPE/2006/8/Rev.1/27 March 2006	21
M	Refer to SAE J1939-05 for the specific regulation being complied to and the compliance details	25
N	EU Reg 595/2009 and its implementing regulations, including Regulation 49, 06 Series of Amendments (these define EURO VI emissions and HD OBD). Identifier covers Euro VI phases A, B, C, and D, except when indicated otherwise.	26
O	Title 13, California Code of Regulations, Section 1956.8. California standards and test procedures for new 2021 and subsequent model heavy-duty zero-emission powertrains.	27
P	China IV, HJ 1014-2020 Emissions control technical requirements of non-road diesel mobile machinery	50

5.2.2.2 Non-Emission Related Components

To be determined in later revisions of this document.

5.2.3 General Conditions for Diagnostic Procedures

These guidelines are necessary to ensure proper operation of both the test equipment and the vehicle during diagnostic procedures. Test equipment, when using messages defined in this document, should not affect normal operation of the vehicle, except when that is the express purpose of the message.

The off-board test equipment may request data without knowledge of which module on the vehicle will respond. In this case, the SAE J1939-21 request PG would be directed to the global destination address for the desired information. Additionally, there are times where the desired information may be known to only be available from a specific device. When this is the case, the information flow is better managed with a request to a specific address other than “global.” These guidelines should be followed in order to reduce network traffic. In some vehicles, multiple controllers may respond with the information requested. In addition, a single module may send multiple responses to a single request. Any test device requesting information must, therefore, have provisions for receiving multiple responses.

The on-board systems should respond to a request as defined in SAE J1939-21. With multiple responses possible from a single request, this allows as much time as is necessary for all modules to access the data link and transmit their response(s). If there is no response within this time period (i.e., 0.25 second), the tool can either assume no response will be received, or, if a response has already been received, that no more responses will be received.

A tool should always wait for a response from the previous request, or “no response” time-out before sending another request. In no case should a request be sent in less than the times specified in SAE J1939-21 after the previous request. There may be situations where the tool knows that it has received the desired information it needs and then it may proceed to its next operation.

Destination-specific requests require a response. If a parameter group is not supported by the control module and a destination-specific request was used to request it from the control module, a NACK is required (refer to SAE J1939-21 PGN 59392). If the request for the parameter group was sent to a global destination address and a given device does not support it, then that device must not NACK the request. Response criteria for retry logic is identified in SAE J1939-21. Response to DM3 and DM11 requests for products subject to ARB 13 CCR 1971.1 deviate from SAE J1939-21 requirements as noted in the respective PG descriptions.

A tool must expect that ECU resources may not permit an immediate response to a request for multi-packet PGs. In particular, when a BAM session is active, a second BAM cannot be sent until the first is completed. For CTS/RTS responses, the ECU may have limited ability to handle multiple sessions. The control byte value of three or “busy” is used in the ACKNOWLEDGEMENT PG, when resource contention occurs.

Unless otherwise specified in SAE J1939-73, parameter values should be formatted in accordance with the parameter ranges as defined by SAE J1939-71, 5.1.3 and 5.1.4. The specific parameter definitions come from SAE J1939DA.

In this document, hexadecimal numbers are represented by a subscript lowercase letter “h” (_h), binary numbers are represented by a subscript lowercase letter “b” (_b), and decimal numbers have no subscript. In cases where the number base is obvious, the subscript is not included.

⁶ EMD does not mandate or require the use of any SAE J1939 services. However, due to the lack of data link standardization requirements, the SAE J1939 Committee recommends support of these services for EMD.

⁷ For EMD-plus engines, the recommended services noted by letter H in Table 1 show a voluntary path for meeting service tool data link requirements.



5.3 Security

One of the purposes of this recommended practice is to provide a standard protocol (a set of capabilities or diagnostic services) to allow users to access and modify memory areas inside a controller on the network. For these tools to be supported by the manufacturers of the ECUs that will be designed to connect to the SAE J1939 network, sufficient protection against “unauthorized” modifications must be included. The messages described in 5.7.14 (DM14) through 5.7.18 (DM18) and their subsections are to be used for this purpose.

This security shall not be used to limit access to the capabilities defined in 5.7.1 (DM1) through 5.7.13 (DM13) and 5.7.19 (DM19), but is intended to allow manufacturers to limit the data that can be accessed by the user. The security systems outlined here represent a recommendation for ECU manufacturers and provide flexibility for them to tailor individual systems to their specific security needs. The vehicle modules addressed are those that are capable of having solid-state memory contents altered by an external command sent through this vehicle communication link. Improper memory content alteration could potentially damage the electronics, reduce the vehicle’s compliance to legislated requirements, or breach the vehicle manufacturer’s security interests.

Proper “unlocking” of the controller shall be a prerequisite to access certain critical on-board controller functions. Access to the on-board controller while in a “locked” mode is permitted only as determined by the controller’s manufacturer. This may require that the user obtain specific codes or passwords directly from the manufacturer’s representative and may only be possible when using product-specific software. This permits the controller to protect itself from unauthorized intrusion.

The messages in 5.7.14 (DM14) through 5.7.18 (DM18) do not attempt to define capability as a requirement for any controller or to specify what information should be subject to any specific security measures; these decisions are left to the controller manufacturer. Implementation of the security system shall not prevent basic diagnostic communications between an external tool and the on-board controller.

Appendices C, D, and E contain additional information that may help implementers understand the intended use of these security processes for gaining access to controller memory and the several different modes available for limiting access areas of that memory.

5.4 Diagnostic Connector

The diagnostic connector is defined in SAE J1939-13.

5.5 Parameter Monitoring Requirements

The parameter definitions shall be those of the referenced SAE J1939DA. Any parameter that has been defined in an applications layer document and is included in a parameter group (PG) shall be used for diagnostics. Therefore, if a parameter has already been defined, it will not be redefined for diagnostic purposes. In some cases, it will be necessary to identify a closely related parameter, such as the value of the accelerator pedal sensor reading when the failure occurred rather than the current reading of the accelerator pedal sensor.

5.6 Diagnostic Trouble Code Definition

A diagnostic trouble code (DTC) is made up of four independent fields, as follows:

- a. Suspect Parameter Number (SPN): 19 bits
- b. Failure Mode Identifier (FMI): 5 bits
- c. Occurrence Count (OC): 7 bits
- d. SPN Conversion Method (CM): 1 bit

These independent parameters are not used together to form a number. They are merely a set of information that helps in understanding the failure that is being reported.

A diagnostic tool may also want to use the controller source address and the name to determine which controller is reporting the diagnostic information. This information is not needed to interpret the SPN, but may be beneficial to have during the diagnostic process. Refer to SAE J1939 for the source address and name definitions.

Diagnostic trouble codes are transmitted as 4 bytes per trouble code. Those 4 bytes are interpreted as defined in 5.7.1. In an effort to provide continuity between the diagnostics defined in SAE J1587 to that of SAE J1939-73, the fault encoding format remains very similar. When possible, SAE J1587 PID numbers have been mapped one for one as SPNs.

Examples of diagnostic trouble codes (see Table 3):

EXAMPLE 1: This is an SAE J1587 parameter.

SPN=91	Suspect parameter is accelerator pedal position
FMI=3	Failure mode is identified as voltage above normal
OC=5	Occurrence count indicates trouble has occurred five times
CM= 0 _b	(1 bit)

EXAMPLE 2: This is not a parameter communicated as an SAE J1587 PID. Therefore, it is assigned a number above 511.

SPN=656	Suspect parameter is engine injector number six
FMI=3	Failure mode is identified as voltage above normal
OC=2	Occurrence count indicates trouble has occurred two times
CM= 0 _b	(1 bit)

EXAMPLE 3: Diagnostic trouble code as transmitted in diagnostic messages (e.g., DM1).

Given:
 Parameter "pre-filter oil pressure," suspect parameter number 1208
 Failure mode identifier of three
 Occurrence count of 10
 SPN conversion method of zero
 All fields of DTC sent in intel format (least significant byte first)

	Decimal	Hexadecimal	Binary
SPN	1208	= 4B8 _h	= 000 00000100 10111000 _b (19 bits)
FMI	3	= 3 _h	= 00011 _b (5 bits)
OC	10	= A _h	= 0001010 _b (7 bits)
CM			= 0 _b (1 bit)

Table 3 - DTC representation in CAN data frame for DM1 (byte 3 closer to CAN identifier)

J1939 Frame Format	DTC																															
	Byte 3 8 least significant bits of SPN (bit 8 most significant)								Byte 4 second byte of SPN (bit 8 most significant)								Byte 5 3 most significant bits of SPN and the FMI (bit 8 SPN msb and bit 5 FMI msb)								Byte 6							
	SPN																FMI				CM	OC										
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
	1	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0

J1939 Frame Format

5.7 Diagnostic Parameter Group Definitions

This section contains definitions of those parameter groups that will be used specifically for diagnostics. The format is a little different than SAE J1939-71 in that the parameter definitions will follow each parameter group definition as a sub-section under that parameter group.

Parameter groups specified in SAE J1939-73 shall set the CAN data length code to 8 bytes. Unused bytes shall be set to 255 (FF_h).

One of the goals of this diagnostic document is to satisfy the OBD requirements. One of the documents that contains many of the OBD requirements is SAE J1979. For that reason, Table 4 was created as a way of identifying how SAE J1939 satisfies the SAE J1979 requirements.

A summary listing of all diagnostic modes and PIDs from SAE J1979 and their corresponding SAE J1939 PGs is provided (see Table 4).

Table 4 - Summary of diagnostic mode assignments

Row #	SAE Motor Vehicle Council SAE J1979 Functions			SAE Truck and Bus Council SAE J1939 Support of Those Functions	
	SAE J1979 Description	SAE J1979 Mode	SAE J1979 PID	SAE J1939 DM (PGN)	PG Description
1	Supported PIDs	01 _h request 41 _h response	00	DM24 (64950)	Systems supporting DM24 declare their emissions-related support for parametric data and the DM25 freeze frame. SAE J1939-21 and SAE J1939-71 discuss methods to NACK data requests and to indicate non-supported data for systems that do not support DM24.
2	Number of DTCs, MIL status, and diagnostic monitors supported and their status	01 _h request 41 _h response	01	DM5 (65230)	OBD compliance, previously active and active DTC count, monitors supported, and their status (diagnostic readiness).
3	Parameters related to the engine operation	01 _h request 41 _h response	3 to 1B _h	Various PGs	Normally provided PGs will be used to retrieve these parameters; for example, SAE J1939DA PGN 61444 contains engine speed.
4	Determine OBD type supported (OBD II-CARB, OBD-Federal, OBD and OBD II, OBD 1, other)	01 _h request 41 _h response	1C _h	DM5 (65230)	Tells which OBD support is provided.
5	PIDs supported in freeze frame	02 _h request 42 _h response	00	DM4 (65229)	Freeze frame definition and support covered in DM4.
6	DTC that caused freeze frame	02 _h request 42 _h response	02	DM4 (65229)	Freeze frame PG tells what DTC caused it.
7	PID data value in freeze frame record	02 _h request 42 _h response	03 to FF _h	DM4 (65229)	Freeze frame PG contains all parameters (more than one freeze frame can be supported).
8	Emission-related diagnostic trouble codes (SAE J1979 service 03 _h provides the union of DM12 and DM23 results)	03 _h request 43 _h response	01	DM12 (65236)	Emission-related MIL-On diagnostic trouble codes and lamp status information.

Row #	SAE Motor Vehicle Council SAE J1979 Functions			SAE Truck and Bus Council SAE J1939 Support of Those Functions	
	SAE J1979 Description	SAE J1979 Mode	SAE J1979 PID	SAE J1939 DM (PGN)	PG Description
9				DM1 (65226) or DM12 (65236)	Active DTCs and lamp status information with DM1 or with DM12 when required.
10				DM2 (65227) or DM23 (64949)	Previously active DTCs and lamp status information or with DM23 when required.
11	Clear/reset emission-related diagnostic information	04 _h request 44 _h response	NA	DM11 (65235)	Clear diagnostic information for active DTCs.
12				DM3 (62228)	Clear diagnostic information for previously active DTCs.
13	Oxygen sensor monitoring test results	05 _h request 45 _h response	NA	DM9 (65233)	No planned message format definition.
14	On-board monitoring test results for specific monitored systems	06 _h request 46 _h response	NA	DM10 (65234)	Test IDs supported.
15				DM7 (58112)	Invoke test.
16				DM8 (65232)	Test results (see DM30 for scaled test results).
17	Emission-related diagnostic trouble codes detected during current or last completed driving cycle	07 _h request 47 _h response	NA	DM6 (65231)	Test results for pending DTCs.
18	Request control of on-board system, test or component	08 _h request	NA	DM7 (58112)	Command on-board system, test, or component.
19		48 _h response		DM8 (65232)	Results commanded system, test, or component.
20	Calibration identification	09 _h request 49 _h response	Infotype \$04	DM19 (54016)	Calibration information (bytes 5 to 20 are CAL ID).
21	Calibration verification number	09 _h request 49 _h response	Infotype \$06	DM19 (54016)	Calibration information (bytes 1 to 4 are CVN).
22	Monitor performance ratio	09 _h request 49 _h response	Infotype \$08	DM20 (49664)	Indicates how often monitors complete compared to vehicle operation.
23	Distance traveled while MIL is activated, distance since DTCs cleared, engine run time while MIL is activated, engine run time since DTCs cleared	01 _h request 41 _h response	21 _h 31 _h 4D _h 4E _h	DM21 (49408)	Diagnostic readiness 2, reports the diagnostic information relevant to a second PG conveying diagnostic readiness.

Row #	SAE Motor Vehicle Council SAE J1979 Functions			SAE Truck and Bus Council SAE J1939 Support of Those Functions	
	SAE J1979 Description	SAE J1979 Mode	SAE J1979 PID	SAE J1939 DM (PGN)	PG Description
24	Previously active emission related faults (SAE J1979 service 03 _h provides the union of DM12 and DM23 results)	03 _h request 43 _h response		DM23 (64949)	This DM contains DTCs that are confirmed but for which the MIL is off.
25	SPN support	01 _h request 41 _h response	00 _h	DM24 (64950)	This message is used to identify those SPNs supported by the product for test results, freeze frames, and data stream messages.
26	Freeze frame data; DTC, and PID data values in freeze frame record	02 _h request 42 _h response	02 _h to FF _h	DM25 (64951)	Freeze frame message providing more parameter support than the existing DM4.
27	Continuously monitored systems enabled/completed status: time since engine start, number of warm-ups since diagnostic trouble codes cleared, non-continuously monitored systems enabled status, non-continuously monitored systems completed status	01 _h request 41 _h response	41 _h 1F _h 30 _h	DM26 (64952)	Diagnostic readiness 3, conveys the pending status of OBD system monitors for the current drive cycle.
28	All pending DTCs	None	None	DM27 (64898)	This DM conveys all pending DTCs inclusive of emissions and non-emissions related.
29	Emission-related diagnostic trouble codes with permanent status	0A _h request 4A _h response		DM28 (64896)	This DM conveys the number of permanent DTCs currently in this category.
30	Regulated DTC counts	Count included in individual DTC service responses		DM29 (40448)	This DM conveys the number of regulated DTC counts (pending, permanent, MIL-On, PMIL-On).
31	Scaled test results	05 _h request 4A _h response		DM30 (41984)	This DM conveys test results scaling.
32	DTC to lamp association	None	None	DM31 (41728)	This message provides added capability of sharing information about the lamp color associated with each DTC being transmitted in a multiple DTC scenario.

5.7.1 Active Diagnostic Trouble Codes (DM1)

DM1 provides diagnostic lamp status and diagnostic trouble codes (DTCs). Together, the lamp and DTC information convey the diagnostic condition of the transmitting electronic component to other components on the network. Occurrence counts may be provided as described in 5.7.1.15. Section 5.7.1.3 provides some additional requirements regarding the lamp status values reported in DM1.

Requirements for DM1 reporting information vary based on whether the DM1 is from an OBD-regulated product. These requirements are further explained in 5.7.1.1 and 5.7.1.2.

Transmission Rate: A DM1 message shall be transmitted, regardless of the presence or absence of any DTC, once every second and on state change. To prevent a high message rate due to intermittent faults that have a very high frequency, it is recommended that no more than one state change per DTC per second be transmitted. For example, if a fault has been active for 1 second or longer, and then becomes inactive, a DM1 message shall be transmitted to reflect this state change. If a different DTC changes state within the 1 second update period, a new DM1 message is transmitted to reflect this new DTC.

Thus a DTC that becomes active/inactive twice within a 1 second interval, such as shown in Example Case 1, would have one message identifying the DTC becoming active, and one at the next periodic transmission identifying it being inactive. This message shall be sent every second or in response to a request. Note that this parameter group will require using the “multipacket transport” parameter group (refer to SAE J1939-21) when more than one active DTC exists.

DM1 shall be broadcast at 1.0 Hz rate, even when there are no active faults. This permits instrumentation to detect the loss of the lamp information and take appropriate action.

Data Length: Variable
Extended Data Page: 0
Data Page: 0
PDU Format: 254
PDU Specific: 202
Default Priority: 6 (note that per SAE J1939-21 requirements, priority should be seven when transport protocol is used)

Parameter Group Number:

65226 (00FECA_h)

Byte: 1	bits 8-7	Malfunction indicator lamp	see 5.7.1.4
		Red stop lamp	see 5.7.1.5
		Amber warning lamp	see 5.7.1.6
		Protect lamp	see 5.7.1.7
Byte: 2	bits 8-7	Flash malfunction indicator lamp	see 5.7.1.8
		Flash red stop lamp	see 5.7.1.9
		Flash amber warning lamp	see 5.7.1.10
		Flash protect lamp	see 5.7.1.11
Byte: 3	bits 8-1	SPN, 8 least significant bits of SPN	see 5.7.1.12
		(most significant at bit 8)	
Byte: 4	bits 8-1	SPN, second byte of SPN	see 5.7.1.12
		(most significant at bit 8)	
Byte: 5	bits 8-6	SPN, 3 most significant bits	see 5.7.1.12
		(most significant at bit 8)	
Byte: 6	bits 5-1	FMI (most significant at bit 5)	see 5.7.1.13
	bit 8	SPN conversion method	see 5.7.1.14
	bits 7-1	Occurrence count	see 5.7.1.15

NOTE: When the occurrence count is not available, it should be set to all ones which is a value of 127.

NOTE: When there is zero or one DTC to report, then unused bytes 7 and 8 of the CAN frame shall be set to 255 (as per SAE J1939-71).

NOTE: When there are no DTCs to report, each of bytes 3 through 6 shall be set to zero.

EXAMPLE 1: The following illustrates the message format for when there is more than one diagnostic trouble code.

Given:

a = lamp status
b = SPN
c = FMI
d = CM and OC

Message form will be as follows: a,b,c,d,b,c,d,b,c,d,b,c,d....etc. In this example, the transport protocol of SAE J1939-21 will have to be used to send the information because it requires more than 8 data bytes. Actually, any time there is more than one fault the services of the transport protocol will have to be used.

EXAMPLE 2: The following illustrates the message format for when a request of the DM1 is made and there are zero active faults, or when there are zero active faults and the message is being transmitted at its regular 1-second interval. The currently defined lamps (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) should reflect the present state of the transmitting electronic component.

The recommended setting for bytes 3 through 6 is shown below. The required setting shall be used for engines and vehicles complying with government regulated requirements (e.g., OBD, OBD II, EOBD, or HD OBD) and for any post-2006 product. The original publication of this recommended practice defined that bytes 3 through 6 should be set to all ones when there are zero faults. This particular implementation is no longer permitted. It provides context for existing implementations prior to the adoption of the recommended setting (March 2004). Use of all ones is shown as the legacy setting below but are no longer permitted.

Given:

Byte: 1	bits 8-7	= 00 (example of reporting off)	
	bits 6-5	= 00 (example of reporting "off")	
	bits 4-3	= 00 (example of reporting off)	
	bits 2-1	= 00 (example of reporting off)	
Byte: 2	bits 8-7	= 11 (example of reporting not available/don't care)	
	bits 6-5	= 11 (example of reporting not available/don't care)	
	bits 4-3	= 11 (example of reporting not available/don't care)	
	bits 2-1	= 11 (example of reporting not available/don't care)	
		Legacy Setting⁸	Post 2004 Setting⁹
Bytes: 3-6		SPN = 524,287 - Indicates not available	= 0
		FMI = 31 - Indicates not available	= 0
		OC = 127 - Indicates not available	= 0
		CM = 1 - Indicates not available	= 0
Byte: 7		= 255	= 255
Byte: 8		= 255	= 255

Bytes 7 and 8 are shown set to 255 to demonstrate padding a 6-byte message with 2 bytes. Bytes 7 and 8, in this example, are not part of the repeating sequence for multiple diagnostic trouble codes.

EXAMPLE 3: Three cases are enumerated as follows to define the transmission rate requirements (see Figure 1). These diagrams are not intended to show how an OBD malfunction is to be handled (e.g., pending, confirmed, permanent, etc.), but does show the DM1 transmission rate requirements. See Appendix H for more signal charts related to DM6, DM12, DM23, and DM28 display sequencing.

⁸ Note that the recommendation that the legacy setting is no longer permitted has been documented in SAE J1939-73 since at least March 2004. As a result, no controller developed since 2006 is expected to use the legacy setting.

⁹ Required for post-2006 products. Preferred for post-2004 products.

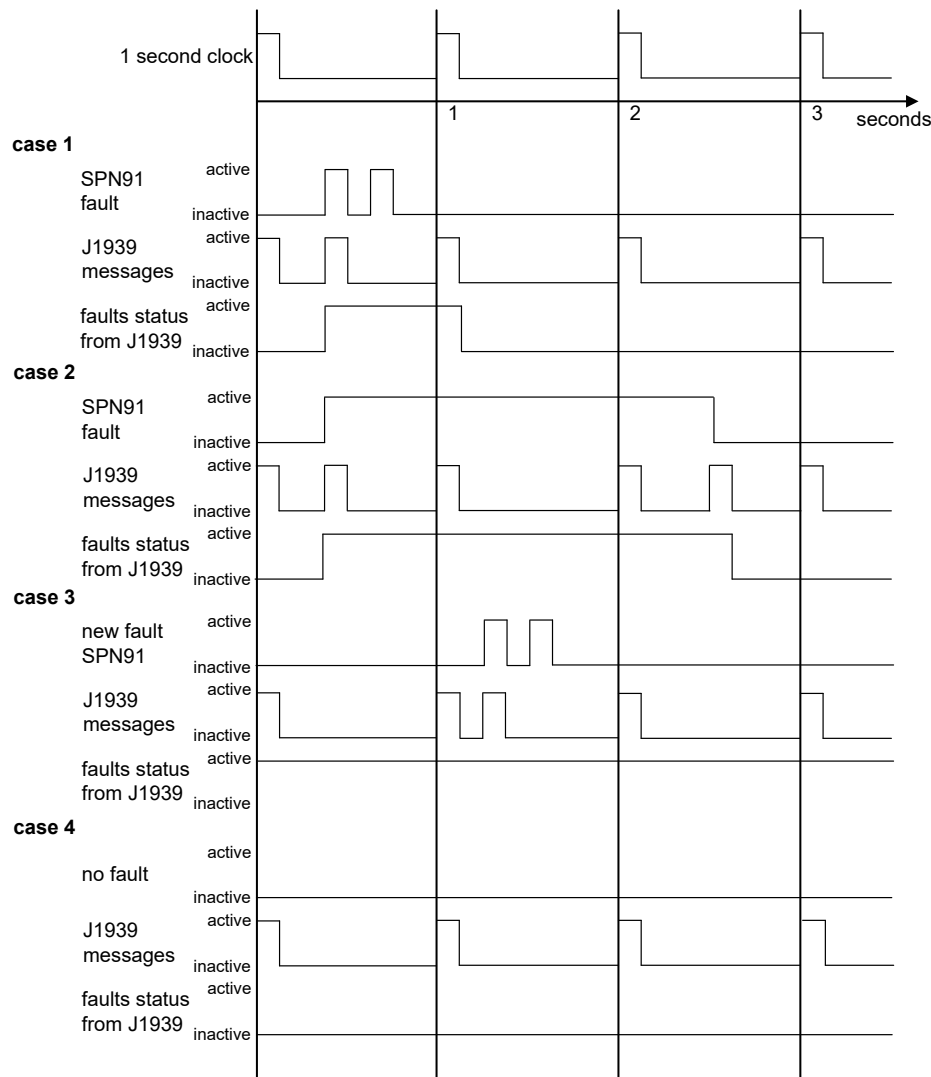


Figure 1 - Defining the transmission rate requirements

Case 1 illustrates that not every transition of a fault (active to inactive or inactive to active) results in a SAE J1939 message being sent. In this case, there are no other faults active when the example SPN 91 fault occurs. The SPN 91 fault is the accelerator pedal position parameter which has an update faster than once a second. Therefore, the “SAE J1939 message” (DM1 message) will be sent every 1 second while this fault is active. Three observations should be made. First, note that the first SAE J1939 message is sent when the “SPN 91 fault” becomes active on the first occurrence and not when it goes inactive for the first occurrence or active/inactive for the second occurrence. The inactive state is sent once at the next normal 1-second update ($T=1$ second). The second observation is that the “SAE J1939 message” (DM1) is required to be sent at the 1-second interval even though the fault is no longer active and the actual DM1 message will contain no active faults. This is done as the action to show the fault went away. The way this is done for this specific case (where there are no longer any active faults) is as shown in the preceding Example 2. If there were other active faults, they would have been sent in this message. The third observation is that if the second SPN 91 would have been a different SPN it would have been sent prior to the 1 second in a DM1 sent in between normal 1-second updates. The 1-second interval message would not contain this new SPN or SPN 91, assuming they both transitioned on and off before the 1-second message. Therefore, the 1-second DM1 message would still contain no faults.

Case 2 illustrates that the transition states can occur between the normal 1-second intervals. Therefore, a “SAE J1939 message” is sent in between time equals 0 and time equals 1 to indicate that the SPN 91 fault has gone active. It is sent per the normal 1-second update at the 1-second and 2-second points. It is sent at the time between 2 seconds and 3 seconds to convey the transition to the inactive state. To do this, the “SAE J1939 message” (DM1) is sent as shown in the preceding Example 2.

Case 3 shows the situation where there are already active faults in existence when SPN 91 becomes active. Note that the transition of SPN 91 to active state is sent between the 1-second and 2-second points. The message contains all active faults, not just the new one. The transition to the inactive state is sent during the normal 2-second update. This message would contain all active faults and since SPN 91 went inactive it would not be in this message.

Case 4 shows the situation where there are no faults in existence. The “SAE J1939 Message” is sent at the 1-second interval.

5.7.1.1 DM1 DTC Information from Non-OBD-Regulated Devices

The information communicated by non-OBD-regulated systems is limited to the appropriate diagnostic lamp status and the currently active diagnostic trouble codes (DTCs). SPN 3038 and SPN 1213 should be set to Not Available (11_b) for non-OBD-regulated systems. Non-OBD-regulated systems that are currently transmitting 00_b for SPN 3038 and SPN 1213 should transmit 11_b in future software updates.

5.7.1.2 DM1 DTC Information from OBD-Regulated Devices

The information communicated is limited to diagnostic lamp status, the MIL-On emissions-related DTCs, and optionally the non-emissions-related currently active DTCs. The MIL-On emissions-related OBD DTCs for DM1 should match the content in the DM12 message. It is not required that MIL-On emissions-related DTCs precede non-emissions-related DTCs.

5.7.1.3 DM1 Lamp Status

The defined lamps (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) comprise a component's lamp status, and the lamp status shall be conveyed at all times. Typically, when one of the lamps is indicated as on, DM1 will contain a DTC that explains the lamp. In some cases, the DTC may be reported by another DM instead of DM1. However, the component controlling the actual lamp illumination must consider the status from all components that provide these lamps before changing the display to the operator. The lamp information (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) should reflect the present state of the transmitting electronic component. DM1 shall not convey temporary signals to provide for lamp test illumination, DTC numeric displays, or OBD readiness indication at key-on. When there are multiple DTCs with different lamp command requirements (e.g., SPN1213 is for the MIL) and lamp flash (e.g., SPN3038 is for the flash MIL), then the DTC with the MIL and fast flash takes priority over, MIL with slow flash, which takes priority over the short MIL, which takes priority over the class C.

There are uses for additional lamp definitions to accomplish specific functions (e.g., a lamp that indicates when cruise control is actively controlling would require a separate lamp in another PG).

5.7.1.4 Malfunction Indicator Lamp

A lamp used to relay only emissions-related trouble code information. This lamp is only illuminated when there is an emission-related trouble code active.

Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

In order to perform a lamp test or OBD readiness indication at key-on, the direct lamp control PG can be used. Refer to SAE J1939DA, PGN 64775, and SPN 5080.

00	Lamp off
01	Lamp on (see Table 5 and Appendix I for additional explanation)
10	Short MIL for WWH OBD (for WWH OBD discriminatory display systems, not applicable for other OBD non-discriminatory display systems)
Type:	Status
Suspect Parameter Number:	1213
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

Table 5 - Lamp command and lamp flash dependency definition

Possible Commanded Conditions		Required Lamp Output Operation			
Lamp SPNs: 1213, 623, 624, 987	Flash SPNs: 3038, 3039, 3040, 3041	MIL SPN 1213	RSL SPN 623	AWL SPN 624	Protect SPN 987
00	00	Off, don't flash	Off	Off	Off
00	01	Off	Off	Off	Off
00	10	Off, class C previously active [1]	SAE Reserved	SAE Reserved	SAE Reserved
00	11	Off	Off	Off	Off
01	00	On, slow flash	On, slow flash	On, slow flash	On, slow flash
01	01	On, fast flash	On, fast flash	On, fast flash	On, fast flash
01	10	On, class C active [2]	SAE Reserved	SAE Reserved	SAE Reserved
01	11	On, don't flash	On, don't flash	On, don't flash	On, don't flash
10	00	Short MI previously active [1]	SAE Reserved	SAE Reserved	SAE Reserved
10	01	Short MI active	SAE Reserved	SAE Reserved	SAE Reserved
10	10	SAE Reserved	SAE Reserved	SAE Reserved	SAE Reserved
10	11	SAE Reserved	SAE Reserved	SAE Reserved	SAE Reserved
11	00	SAE Reserved	SAE Reserved	SAE Reserved	SAE Reserved
11	01	SAE Reserved	SAE Reserved	SAE Reserved	SAE Reserved
11	10	SAE Reserved	SAE Reserved	SAE Reserved	SAE Reserved
11	11	Don't Care	Don't Care	Don't Care	Don't Care

[1] The values indicated for “class C not active” and “short MI not active” show optional values that are not required for compliance with Euro VI [UN ECR R49 Annex 9B] MI activation modes. If observed, they imply MI Activation Mode 1. See Appendices I and K for additional discussion of SPN 1213 and Euro VI MI activation modes.

[2] MI Activation Mode 2.

5.7.1.5 Red Stop Lamp

This lamp is used to relay trouble code information that is of a severe-enough condition that it warrants stopping the vehicle. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

00 Lamp off
 01 Lamp on
 Type: Status
 Suspect Parameter Number: 623
 Reference: 5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.6 Amber Warning Lamp

This lamp is used to relay trouble code information that is reporting a problem with the vehicle system but the vehicle need not be immediately stopped. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

00 Lamp off
 01 Lamp on
 Type: Status
 Suspect Parameter Number: 624
 Reference: 5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.7 Protect Lamp

This lamp is used to relay trouble code information that is reporting a problem with a vehicle system that is most probably not electronic sub-system related. For instance, engine coolant temperature is exceeding its prescribed temperature range. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

00	Lamp off
01	Lamp on
Type:	Status
Suspect Parameter Number:	987
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.8 Flash Malfunction Indicator Lamp

This parameter provides the capability to flash the MIL. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs. For OBD systems which are required to flash, the SPN for specific malfunctions shall use the “slow flash” rate.

00	Slow flash (1 Hz, 50% duty cycle)
01	Fast flash (2 Hz or faster, 50% duty cycle)
10	Class C DTC (for WWH OBD discriminatory display systems, not applicable for other OBD non-discriminatory display systems)
11	Unavailable/do not flash
Type:	Status
Suspect Parameter Number:	3038
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.9 Flash Red Stop Lamp

This parameter provides the capability to flash the RSL. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

00	Slow flash (1 Hz, 50% duty cycle)
01	Fast flash (2 Hz or faster, 50% duty cycle)
10	SAE Reserved
11	Unavailable/do not flash
Type:	Status
Suspect Parameter Number:	3039
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.10 Flash Amber Warning Lamp

This parameter provides the capability to flash the AWL. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

00	Slow flash (1 Hz, 50% duty cycle)
01	Fast flash (2 Hz or faster, 50% duty cycle)
10	SAE Reserved
11	Unavailable/do not flash
Type:	Status
Suspect Parameter Number:	3040
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.11 Flash Protect Lamp

This parameter provides the capability to flash the protect lamp. Also see Table 5 for the specified operation of the applicable lamp and flash SPNs.

00	Slow flash (1 Hz, 50% duty cycle)
01	Fast flash (2 Hz or faster, 50% duty cycle)
10	SAE Reserved
11	Unavailable/do not flash
Type:	Status
Suspect Parameter Number:	3041
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.12 Suspect Parameter Number

This 19-bit number is used to identify the item for which diagnostics are being reported. The SPN is used for multiple purposes, some of those that are specific to diagnostics are: (1) to identify a least-repairable sub-system that has failed; (2) to identify sub-systems and or assemblies that may not have hard failures but may be exhibiting abnormal operating performance; (3) to identify a particular event or condition that will be reported; and (4) to report a component and non-standard failure mode. SPNs are assigned to each individual parameter in a parameter group and to items that are relevant to diagnostics, but are not a parameter in a parameter group. SPNs are independent of the source address for the message. However, the source address may be necessary to determine which controller on the network performed the diagnosis.

The first 511 SPNs are reserved and will be assigned the exact same number as the parameter identifier (PID) used in SAE J1587. That is, the SPN for an accelerator problem will be reported as SPN 91 which is SAE J1587 PID 91. All other SPNs will be numbered sequentially starting at 512 and incrementing by one for each new assignment. Refer to the "SPs and PGs" worksheet in SAE J1939DA.

Proprietary suspect parameter numbers have been established to allow the reporting of manufacturer specific diagnostics. The interpretation of the diagnostic trouble codes using proprietary SPNs varies by manufacturer and possibly by source address. As a result, it is possible, or even likely, that two (or more) manufacturers might use the same proprietary SPN to identify a component unique to their product. Thus, to completely interpret a DTC that uses a proprietary SPN, the source address and its associated manufacturer code from its SAE J1939 NAME are required. There are 8192 suspect parameter numbers defined for proprietary diagnostics. The SPNs for proprietary diagnostics cover the range 516096 to 524287. See Appendix F for the list of restrictions for the SPNs for proprietary diagnostics.

Data Length:	19 bits
Resolution:	1 SPN/bit
Data Range:	0 to 524287
Type:	Status
Suspect Parameter Number:	1214
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.13 Failure Mode Identifier

The FMI defines the type of failure detected in the sub-system identified by an SPN. Note that the failure may not be an electrical failure but may instead be a sub-system failure or condition needing to be reported to the service technician and maybe also to the operator. Conditions can include system events or status that need to be reported. The FMI, SPN, and SPN conversion method and occurrence count fields combine to form a given diagnostic trouble code. The “Reserved to be Assigned by SAE” FMIs will be assigned by the SAE J1939 Truck and Bus Control and Communications Network Committee if additional failure modes become necessary. The currently defined FMIs are listed in Appendix A.

Data Length:	5 bits
Resolution:	1 FMI/bit
Data Range:	0 to 31
Type:	Status
Suspect Parameter Number:	1215
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.1.14 SPN Conversion Method

When this 1-bit field is equal to a zero, the SPN should be converted as it is defined in this document (see definition below for Version 4). The February 1996 version of SAE J1939-73 contained inadequate definitions to assure consistent implementations. Products implementing to February 1996 version of the document will always have this bit set to a one. When this is the case, the SPN is in either Version 1, 2, or 3 format. The original publication of this recommended practice defined that this bit be set to one. This particular implementation is no longer permitted. It provides context for some implementations prior to the adoption of the recommended setting as zero (version 4 definition).

To clarify the ordering of bits and bytes within the SPN parameter (which is 19 bits long) and to keep that ordering consistent with other parameters in SAE J1939DA and SAE J1939-73, the bit order has been respecified. See Version 4 below for the recommended formatting. Version 4 is required for any device complying with 5.2.2.1 for emissions-related components.

To reduce problems in interpretation of the SPNs, the bit between the FMI field, and the occurrence count field, previously reserved, will be cleared to zero to identify use of the currently specified SPN bit pattern. This bit now comprises an SPN conversion method for the purpose of maintaining usability of those implementations that are already in use.

Data Length:	1 bit
Resolution:	Not applicable
Data Range:	0 means convert SPNs per the Version 4 definition below 1 means convert SPNs per Version 1, 2, or 3 specified below The four versions of interpretation are: 1. SPN assumed to be sent most significant bit first 2. SPN represented as Intel format for most significant 16 bits with 3 least significant bits of 19 bits in with FMI value 3. SPN represented as Intel format for all 19 bits (least significant sent first) 4. SPN represented as intel format for all 19 bits with the SPN conversion method set to 0
Type:	Status
Suspect Parameter Number:	1706
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

Given:

SPN 1208	= 4B8 _h	= 000 00000100 10111000 _b (19 bits)
FMI 3	= 3 _h	= 00011 _b (5 bits)
OC 10	= A _h	= 0001010 _b (7 bits)
CM		= 0 _b (1 bit)

Version 1.

J1939 Frame Format

DTC																															
Byte 3								Byte 4								Byte 5								Byte 6							
8 most significant bits of 16 most significant bits of SPN (bit 8 most significant)								8 least significant bits of 16 most significant bits of SPN (bit 8 most significant)								3 least significant bits of SPN and the FMI (bit 8 SPN msb and bit 5 FMI msb)															
SPN																FMI				CM	OC										
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	1	0	1	0

Version 2.

J1939 Frame Format

DTC																															
Byte 3 8 least significant bits of 16 most significant bits of SPN (bit 8 most significant)								Byte 4 8 most significant bits of 16 most significant bits of SPN (bit 8 most significant)								Byte 5 3 least significant bits of SPN and the FMI (bit 8 SPN msb and bit 5 FMI msb)								Byte 6							
SPN																FMI				CM	OC										
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	1	0

Version 3.

J1939 Frame Format

DTC																															
Byte 3 8 least significant bits of SPN (bit 8 most significant)								Byte 4 second byte of SPN (bit 8 most significant)								Byte 5 3 most significant bits of SPN and the FMI (bit 8 SPN msb and bit 5 FMI msb)								Byte 6							
SPN																FMI				CM	OC										
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	1	0

Version 4.***Recommended
Version**

*Effective 1996, Version 4
shall be used for all future
OBD applications.

J1939 Frame Format

DTC																															
Byte 3 8 least significant bits of SPN (bit 8 most significant)								Byte 4 second byte of SPN (bit 8 most significant)								Byte 5 3 most significant bits of SPN and the FMI (bit 8 SPN msb and bit 5 FMI msb)								Byte 6							
SPN																FMI						CM	OC								
8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0

5.7.1.15 Occurrence Count

The 7-bit occurrence count field contains the number of times a fault has been independently detected. The occurrence count is reported as one the first time the DTC is detected. The occurrence count will increment after the DTC has gone inactive and the same DTC subsequently returns to the active state. At this point, the occurrence count would be reported as two. This continues until the DTC has been independently detected 126 times. The occurrence count shall not be incremented from 126 to 127; it shall remain at 126 until cleared by DM3 or DM11. If an occurrence count is not available, then this field should be set to all binary ones (127). The occurrence count is not incremented just due to an ignition key-off and ignition key-on. The diagnostic system shall have monitored the system or component (e.g., DTC) to see that it is no longer malfunctioning in order to declare it previously active.

Data length:	7 bits
Resolution:	1 occurrence count/bit
Data range:	0 to 126 (the value 127 is reserved for indicating not available)
Type:	status
Suspect parameter number:	1216
Reference:	5.7.1, 5.7.2, 5.7.6, 5.7.12, 5.7.23, 5.7.27, 5.7.28, 5.7.35, 5.7.41, 5.7.42, 5.7.43, 5.7.44, 5.7.45, 5.7.46, 5.7.47, 5.7.48, 5.7.49, 5.7.50, 5.7.51, 5.7.52, 5.7.53, and 5.7.54

5.7.2 Previously Active Diagnostic Trouble Codes (DM2)

When supported, DM2 provides a list of all previously active (previously detected) DTCs. The list of DTCs must include all the emissions-related previously active DTCs provided in the device's DM23 for an HD OBD-compliant device, as well as all non-emissions related previously active DTCs.

DM2 is provided using the "multipacket transport" facilities defined in SAE J1939-21 when there is more than one DTC to report. SPN conversion method 4 as described in 5.7.1.14 must be used by HD OBD devices, and is recommended for all new designs.

The lamp information (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) should reflect the present state of the transmitting electronic component. The lamp information shall not convey temporary signals to provide for lamp test illumination, DTC numeric displays, or OBD readiness indication at key-on.

Transmission Rate:	On request using PGN 59904 (refer to SAE J1939-21 PGN 59904) A NACK is required if PG is not supported and it was a destination-specific request (refer to SAE J1939-21 PGN 59392)		
Data Length:	Variable		
Extended Data Page:	0		
Data Page:	0		
PDU Format:	254		
PDU Specific:	203		
Default Priority:	6 (note that per SAE J1939-21 requirements, priority should be seven when transport protocol is used)		
Parameter Group Number:	65227 (00FECB _h)		
Byte: 1	bits 8-7	Malfunction indicator lamp	see 5.7.1.4
	bits 6-5	Red stop lamp	see 5.7.1.5
	bits 4-3	Amber warning lamp	see 5.7.1.6
	bits 2-1	Protect lamp	see 5.7.1.7
Byte: 2	bits 8-7	Flash malfunction indicator lamp	see 5.7.1.8
	bits 6-5	Flash red stop lamp	see 5.7.1.9
	bits 4-3	Flash amber warning lamp	see 5.7.1.10
	bits 2-1	Flash protect lamp	see 5.7.1.11
Byte: 3	bits 8-1	SPN, 8 least significant bits of SPN (most significant at bit 8)	see 5.7.1.12
Byte: 4	bits 8-1	SPN, second byte of SPN (most significant at bit 8)	see 5.7.1.12

Byte: 5	bits 8-6	SPN, 3 most significant bits (most significant at bit 8)	see 5.7.1.12
	bits 5-1	FMI (most significant at bit 5)	see 5.7.1.13
Byte: 6	bit 8	SPN conversion method	see 5.7.1.14
	bits 7-1	Occurrence count	see 5.7.1.15

NOTE: When the occurrence count is not available, it should be set to all ones which is a value of 127.

NOTE: When there is zero or one DTC to report, then unused bytes 7 and 8 of the CAN frame shall be set to 255 (as per SAE J1939-71).

NOTE: When there are no DTCs to report, each of bytes 3 through 6 shall be set to zero.

EXAMPLE 1: The following illustrates the message format for when there is more than one diagnostic trouble code.

Given:

- a = lamp status (LS)
- b = SPN
- c = FMI
- d = CM and OC

Message form will be as follows: a,b,c,d,b,c,d,b,c,d....etc. In this example, the transport protocol of SAE J1939-21 will have to be used to send the information because it requires more than 8 data bytes. Actually any time there is more than one fault the services of the transport protocol will have to be used.

EXAMPLE 2: The following illustrates the message format for when a request of the DM2 is made and there are zero previously active faults. The currently defined lamps (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) should reflect the present state of the transmitting electronic component. In this example, the amber lamp is identified as being on.

The original publication of this recommended practice defined that bytes 3 through 6 should be set to all ones when there are zero faults. This particular implementation is no longer permitted.

Given:

Byte: 1	bits 8-7	= 00 (example of reporting off)
	bits 6-5	= 00 (example of reporting off)
	bits 4-3	= 01 (example of reporting on)
	bits 2-1	= 00 (example of reporting off)
Byte: 2	bits 8-7	= 11 (example of reporting not available/don't care)
	bits 6-5	= 11 (example of reporting not available/don't care)
	bits 4-3	= 11 (example of reporting not available/don't care)
	bits 2-1	= 11 (example of reporting not available/don't care)
Bytes: 3-6	SPN = 0 (required setting for reporting no diagnostic trouble code)	
	FMI = 0 (required setting for reporting no diagnostic trouble code)	
	OC = 0 (required setting for reporting no diagnostic trouble code)	
	CM = 0 (required setting for reporting no diagnostic trouble code)	
Byte: 7	= 255	
Byte: 8	= 255	

5.7.3 Diagnostic Data Clear/Reset of Previously Active DTCs (DM3)

5.7.3.1 DM3 for Non-OBD Regulated Devices or Diagnostics

Products not subject to ARB 13 CCR 1971.1 may choose to support DM3. When supported, all diagnostic information pertaining to the previously active trouble codes should be erased when this PG is requested. The diagnostic data associated with active trouble codes will not be affected.

If the request is destination-specific (refer to SAE J1939-21 PGN 59392), upon completion of this operation or if there are no faults to clear, a positive acknowledgment shall be sent. If for some reason a device cannot perform the requested action when a destination-specific request is received, it is required to send a negative acknowledgement.

A positive or negative acknowledgement is not required in response to a global request.

Some applications may have a need to provide a positive or negative acknowledgement to indicate the success or failure of a global request. (This is an exception, as discussed in Note 4 of Table 5 in SAE J1939-21.)

ECUs shall clear the DTCs with ignition ON and with the engine not running. A manufacturer may allow DTC clearing with the engine running.

5.7.3.2 DM3 for OBD Regulated Devices or Diagnostics

For products subject to ARB 13 CCR 1971.1, the DM3 service shall not be supported. As a result, the only acceptable response to a destination-specific DM3 request, for these products, shall be an acknowledgement PG (refer to SAE J1939-21 PGN 59392) with the control byte set to 1 (negative acknowledgement). Products should either provide no response to a globally addressed DM3 request, or, to provide positive confirmation of the ARB requirement, an acknowledgement PG with the control byte set to 1 (negative acknowledgement).

Finally, for these products, no DTCs or related diagnostic information shall be cleared. DM3 shall not be used for other manufacturer-specific purposes.

5.7.3.3 Message Definition

Tool suppliers should be aware that it may take as long as 5 seconds to complete the clearing action.

Transmission Rate:	On request using PGN 59904 (refer to SAE J1939-21 PGN 59904) A NACK is required if PG is not supported and it was a destination-specific request (refer to SAE J1939-21 PGN 59392)
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Data Length:	0
Extended Data Page:	0
Data Page:	0
PDU Format:	254
PDU Specific:	204
Default Priority:	6
Parameter Group Number:	65228 (00FECC _h)
Example:	

Given:

1. A tool desires to clear the diagnostic data of the engine.
2. The engine is able to perform the requested action.

The tool shall send the request PGN 59904 directed specifically to the engine controller with the PGN 65228 as the requested PGN. The engine controller shall respond with the acknowledgement PGN 59392 indicating that the action was successfully completed for PGN 65228.

5.7.4 Freeze Frame Parameters (DM4)

A freeze frame is defined as the list of recorded parameters at the time a diagnostic trouble code was captured. The freeze frame recorded for each diagnostic trouble code will contain the required parameters first, and then any manufacturer-specific information. It is possible that controllers will have more than one freeze frame available, and each may have some manufacturer-specific information. A freeze frame is specific to one diagnostic trouble code and one diagnostic trouble code only has one freeze frame. This then limits the amount of freeze frame data per fault and for all faults that are included in this message to 1785 bytes (refer to SAE J1939-21 transport protocol).

This diagnostic message is best suited for systems which may impact emissions and or be powertrain related. However, the use of this message is not limited to just emission-related failures or just powertrain devices. It can be used to report non-emission related or non-powertrain related failures.

Implementers should refer to the applicable regulation for potential additional freeze frame requirements. For instance, some regulations might require the OBD freeze frame to have priority over non-OBD freeze frames.

Transmission Rate:	On request using PGN 59904 (refer to SAE J1939-21 PGN 59904) A NACK is required if PG is not supported and it was a destination-specific request (refer to SAE J1939-21 PGN 59392)		
Data Length:	Variable		
Extended Data Page:	0		
Data Page:	0		
PDU Format:	254		
PDU Specific:	205		
Default Priority:	6 (note that per SAE J1939-21 requirements, priority should be seven when transport protocol is used)		
Parameter Group Number:	65229 (00FEC D _h)		
Byte: 1		Freeze frame length	See 5.7.4.1
Byte: 2	bits 8-1	SPN, 8 least significant bits of SPN (most significant at bit 8)	See 5.7.1.12
Byte: 3	bits 8-1	SPN, second byte of SPN (most significant at bit 8)	See 5.7.1.12
Byte: 4	bits 8-6	SPN, 3 most significant bits (most significant at bit 8)	See 5.7.1.12
	bits 5-1	FMI (most significant at bit 5)	See 5.7.1.13
Byte: 5	bit 8	SPN conversion method	See 5.7.1.14
	bits 7-1	Occurrence count	See 5.7.1.15
Byte: 6		Engine torque mode (SPN 899)	Refer to SAE J1939DA
Byte: 7		Engine intake manifold #1 pressure (SPN 102)	Refer to SAE J1939DA
Byte: 8		Engine speed (SPN 190) (LSB)	Refer to SAE J1939DA
Byte: 9		Engine speed (SPN 190) (MSB)	
Byte: 10		Engine percent load at current speed (SPN 92)	Refer to SAE J1939DA
Byte: 11		Engine coolant temperature (SPN 110)	Refer to SAE J1939DA
Byte: 12		Wheel-based vehicle speed (SPN 84) (LSB)	Refer to SAE J1939DA
Byte: 13		Wheel-based vehicle speed (SPN 84) (MSB)	
Byte: 14-n		Manufacture-specific information	See 5.7.4.3

NOTE: When the occurrence count is not available, it should be set to all ones which is a value of 127.

NOTE: If no DTCs (active or previously active) have been accumulated, then the response will be:

PGN = 65229		
Byte: 1		= 0
	5-2	= 0
	6	= 255
	7	= 255
	8	= 255

When byte 1 is equal to zero, it identifies to the receiver that the other parameters in the message should not be interpreted. Also notice that the values of the information put in bytes 1 through 5 are zero even though some of the parameters may have normally been set to all ones (binary) to indicate not available.

EXAMPLE: The following illustrates the message format for when there are more than one freeze frame.

Given:

- a = freeze frame length
- b = required parameters (bytes 2 through 13 for the first DTC, and the corresponding bytes for each of the remaining DTCs)
- c = manufacturer specific freeze frame information

Message form will be as follows: a,b,c,a,b,c,a,b,c,a,b,c....etc. The transport protocol of SAE J1939-21 will have to be used to send freeze frames because they are more than 8 data bytes.

5.7.4.1 Freeze Frame Length

The freeze frame length shall be equal to the number of bytes in the required parameters (that is bytes 2 through 13), plus the number of bytes in the manufacturer specific parameters. That is: $a = b + c$.

Data Length:	8 bits
Resolution:	1 byte/bit
Data Range:	0 to 255
Type:	Status
Suspect Parameter Number:	1217
Reference:	5.7.4

EXAMPLE:

- b = 12
- c = 2.....oil pressure, intake manifold temperature
- a = b + c
- a = 12 + 2 = 14

5.7.4.2 Freeze Frame Parameters

The parameters collected in the freeze frame shall use the same scaling as is defined in the SAE J1939DA document. Freeze frame parameters consist of engine torque mode (SPN 899), engine intake manifold #1 pressure (SPN 102), engine speed (SPN 190), engine percent load at current speed (SPN 92), engine coolant temperature (SPN 110), and wheel-based vehicle speed (SPN 84) as recorded at the time of the failure.

5.7.4.3 Manufacturer-Specified Information

Manufacturer-specified information consists of additional parameters recorded at the time of the failure that may be useful in troubleshooting. The number of parameters is determined by each manufacturer.

Data Length:	Varies per manufacturer-selected parameter
Resolution:	Varies per manufacturer-selected parameter
Data Range:	Varies per manufacturer-selected parameter
Type:	Varies per manufacturer-selected parameter
Suspect Parameter Number:	4263
Reference:	5.7.4

5.7.5 Diagnostic Readiness 1 (DM5)

Reports the diagnostics information that relates to diagnostic readiness. When an HD OBD device (OBD compliance, SPN 1220, value is other than 05_h or FF_h) supports DM5, but does not provide any monitor support or monitoring status bits (SPN 1221, 1222, and 1223), the monitoring support and monitoring status bits are defined such that all bits are to be provided as binary zeros. Historically non-OBD devices (OBD compliance, SPN 1220, is equal to 05_h or FF_h) have provided binary ones to indicate not available (per SAE J1939-71, Table 1) for SPN 1221, 1222, and 1223, when only SPNs 1218 and 1219 are supported.

Transmission Rate:	On request using PGN 59904 (refer to SAE J1939-21 PGN 59904) A NACK is required if PG is not supported and it was a destination-specific request (refer to SAE J1939-21 PGN 59392)	
Data Length:	8	
Extended Data Page:	0	
Data Page:	0	
PDU Format:	254	
PDU Specific:	206	
Default Priority:	6	
Parameter Group Number:	65230 (00FECE _h)	
Byte:	1	Active Diagnostic Trouble Code Count see 5.7.5.1
	2	Previously Active Diagnostic Trouble Code Count see 5.7.5.2
	3	OBD Compliance see 5.7.5.3
	4	Continuously Monitored Systems Support/Status see 5.7.5.4
	5-6	Non-Continuously Monitored Systems Support see 5.7.5.5
	7-8	Non-Continuously Monitored Systems Status see 5.7.5.6

5.7.5.1 Active Diagnostic Trouble Code Count

Identifies the number of active trouble codes that are present in a specific controller. If no DTCs are active, this field should be set to zero. The number of DTCs reported shall be equal to the count of DTCs reported in DM1. This count includes both emissions-related and non-emissions-related DTCs.

Data Length:	1 byte
Resolution:	1 trouble code/bit
Data Range:	0 to 250
Type:	Measured
Suspect Parameter Number:	1218
Reference:	5.7.5

5.7.5.2 Previously Active Diagnostic Trouble Code Count

Identifies the number of previously active trouble codes that are present in a specific controller. If no DTCs have been previously active, this field should be set to zero. The number of DTCs reported shall be equal to the count of DTCs reported in DM2. This count includes both emissions-related and non-emissions-related DTCs.

Data Length:	1 byte
Resolution:	1 trouble code/bit
Data Range:	0 to 250
Type:	Measured
Suspect Parameter Number:	1219
Reference:	5.7.5

5.7.5.3 OBD Compliance

Identifies the OBD compliance capability of the responding controller. Identifies the requirements level to which the controller was built. The OBD Compliance assignments are shown in Table 6. The acronym column in Table 6 provides a recommended content for limited display devices. Non-regulated OBD products shall report the OBD compliance (SPN 1220) as a value of 05_h. A value of FF_h shall also be interpreted as a non-regulated OBD product. Devices reporting an OBD compliance code that indicates it satisfies OBD requirements are considered to be an OBD device (see 3.14). These OBD devices shall be evaluated in an OBD scan tool interface test.

Data Length:	1 byte
Resolution:	See below
Data Range:	0 to 250
Type:	Measured
Suspect Parameter Number:	1220
Reference:	5.7.5

Table 6 - OBD Compliance Assignments

Value	Decimal	Acronym	Description
00 _h	0		Reserved for assignment by SAE
01 _h	1	OBD II	OBD II (California Air Resources Board)
02 _h	2	OBD	OBD (Federal, EPA)
03 _h	3	OBD and OBD II	OBD and OBD II
04 _h	4	OBD I	OBD I
05 _h	5		Not intended to meet OBD II requirements
06 _h	6	EOBD	EOBD
07 _h	7	EOBD and OBD II	EOBD and OBD II
08 _h	8	EOBD and OBD	EOBD and OBD
09 _h	9	EOBD, OBD, and OBD II	EOBD, OBD, and OBD II
0A _h	10	JOBD	JOBD
0B _h	11	JOBD and OBD II	JOBD and OBD II
0C _h	12	JOBD and EOBD	JOBD and EOBD
0D _h	13	JOBD, EOBD, and OBD II	JOBD, EOBD, and OBD II
0E _h	14		Heavy duty vehicles (EURO IV) B1
0F _h	15		Heavy duty vehicles (EURO V) B2
10 _h	16		Heavy duty vehicles (EURO EEC) C (gas engines)
11 _h	17	EMD	Engine manufacturer diagnostics (EMD)
12 _h	18	EMD+	Engine manufacturer diagnostics enhanced (EMD+), ARB and EPA engine families that do not have to satisfy the more complicated OBD requirements
13 _h	19	HD OBD P	Heavy duty/on-board diagnostics partial (CARB CCR 1971.1 and EPA 86.010-18)
14 _h	20	HD OBD	Heavy duty/on-board diagnostics (CARB CCR 1971.1 and EPA 86.010-18)
15 _h	21	WWH OBD	World-wide harmonized OBD
16 _h	22	OBD II	OBD II (California Air Resources Board, CCR 1968.2, 2007/2008/2009/2010 revisions)
17 _h	23	HD EOBD	Heavy duty vehicles (EURO IV/V, revisions specified in 2005 and 2006)
18 _h	24		Reserved for assignment by SAE
19 _h	25	OBD-M (SI-SD/I)	OBD-M compliance for spark-ignition sterndrive and inboard engines
1A _h	26	EURO VI	Heavy duty vehicles EURO VI (as described in UN ECE R49 Annex 9)
1B _h	27	HD-ZEP	California Air Resources Board, CCR 1956.8, 2019
1C _h	28	OBDBr-1	Brazil OBD Phase 1
1D _h	29	OBDBr-2	Brazil OBD Phase 2 and Phase 2+
1E _h	30	KOBD	Korean OBD
1F _h	31	IOBD I	India OBD I
20 _h	32	IOBD II	India OBD II
21 _h	33	HD EOBD-VI	Heavy Duty Euro OBD Stage VI
22 _h	34	OBD, OBD II, HD OBD	OBD, OBD II, and heavy duty/on-board diagnostics (CARB CCR 1971.1 and EPA 86.010-18) [Compliance codes 3 and 20]
23 _h	35	OBD, OBD II, HD OBD P	OBD, OBD II, and heavy duty/on-board diagnostics Partial (CARB CCR 1971.1 and EPA 86.010-18) [Compliance codes 3 and 19]
24 _h to 28 _h	36 to 40	Reserved for SAE	Reserved for SAE J1979 assignment

5.7.5.4 Continuously Monitored Systems Support/Status

Data Length:	1 byte
Resolution:	See below
Data Range:	Bit mapped, see below
Type:	Measured
Suspect Parameter Number:	1221
Reference:	5.7.5
Byte:	Bit:
4	8
	7
	6
	5
	Where each status bit (bits 7, 6, 5) is interpreted:
	0 = test complete, not supported
	1 = test not complete
	4
	3
	2
	1
	Where each supported bit (bits 3, 2, 1) is interpreted:
	0 = test not supported by this controller
	1 = test supported by this controller

Data in SPN 1221 shall be ignored when OBD compliance, SPN 1220, is equal to 05_h or FF_h (which indicates a non-OBD device). SPN 1221 may be set to FF_h to indicate not available (per SAE J1939-71, Table 1) when OBD compliance, SPN 1220, is equal to 05_h or FF_h (which indicates a non-OBD device).

5.7.5.5 Non-Continuously Monitored Systems Support

Identifies the non-continuously monitored systems support.

Data Length: 2 bytes (PG placement of data is specified below)
Resolution: See below
Data Range: Bit mapped, see below
Type: Measured
Suspect Parameter Number: 1222
Reference: 5.7.5

Byte:	Bit:	Description:
5	8	EGR/VVT system monitoring support
	7	Exhaust Gas Sensor heater monitoring support (see footnote ¹⁰)
	6	Exhaust Gas Sensor monitoring support (see footnote ¹⁰)
	5	A/C system refrigerant monitoring support
	4	Secondary air system monitoring support
	3	Engine evaporative system monitoring support
	2	Heated catalyst monitoring support
	1	Catalyst monitoring support
6	8-6	Reserved for assignment by SAE (shall be reported as 0)
	5	NMHC converting catalyst monitoring support
	4	NOx converting catalyst and/or NOx adsorber monitoring support
	3	Diesel particulate filter (DPF) monitoring support
	2	Boost pressure control system monitoring support
	1	Cold start aid system monitoring support

Where each bit is interpreted:

0 = test not supported by this controller

1 = test supported by this controller

NOTE: A bit set to zero means test not supported. Controllers that do not support SPN 1222 should provide these bits as zeros. This is different than the typical SAE J1939 use of the value 1 to indicate not available. Any bits that are "Reserved for assignment by SAE" shall be reported as 0.

NOTE: Data in SPN 1222 shall be ignored when OBD compliance, SPN 1220, is equal to 05_h or FF_h (these indicate a non-OBD device). SPN 1222 may be set to FF_h to indicate not available (per SAE J1939-71, Table 1) when OBD compliance, SPN 1220, is equal to 05_h or FF_h (which indicates a non-OBD device).

¹⁰ Exhaust gas sensor heater monitoring and exhaust gas sensor monitoring are names assigned to cover any and all of the following types of sensors: oxygen, NOx, particulate matter, individual instances of these sensors for upstream and downstream measurements, and uses of any and all of these sensors for bank 1 or bank 2.

5.7.5.6 Non-Continuously Monitored Systems Status

Identifies the non-continuously monitored systems status. Each bit identifies whether a particular test (or readiness group) is complete for a given controller.

Data Length: 2 bytes (PG placement of data is specified below)
 Resolution: See below
 Data Range: Bit mapped, see below
 Type: Measured
 Suspect Parameter Number: 1223
 Reference: 5.7.5

Byte:	Bit:	Description:
7	8	EGR/VVT system monitoring status
	7	Exhaust gas sensor heater monitoring status (see footnote ¹⁰)
	6	Exhaust gas sensor monitoring status (see footnote ¹⁰)
	5	A/C system refrigerant monitoring status
	4	Secondary air system monitoring status
	3	Engine evaporative system monitoring status
	2	Heated catalyst monitoring status
8	1	Catalyst monitoring status
	8-6	Reserved for assignment by SAE (shall be reported as 0)
	5	NMHC converting catalyst monitoring status
	4	NOx converting catalyst and/or NOx adsorber monitoring status
	3	Diesel particulate filter (DPF) monitoring status
	2	Boost pressure control system monitoring status
	1	Cold start aid system monitoring status

Where each bit is interpreted:

- 0 = test complete, or not supported
- 1 = test not complete

NOTE: A bit set to zero can mean test not supported. Controllers that do not support SPN 1223 should provide these bits as zeros. This is different than the typical SAE J1939 use of the value 1 to indicate not available. Any bits that are "Reserved for assignment by SAE" shall be reported as 0.

NOTE: Data in SPN 1223 shall be ignored when OBD compliance, SPN 1220, is equal to 05_h or FF_h (these indicate a non-OBD device). SPN 1223 may be set to FF_h to indicate not available (per SAE J1939-71, Table 1) when OBD compliance, SPN 1220, is equal to 05_h or FF_h (which indicates a non-OBD device).

5.7.6 Emission-Related Pending Diagnostic Trouble Codes (DM6)

The purpose of this DM is to enable the external test equipment to obtain "pending" diagnostic trouble codes. The definition of a pending DTC varies according to the applicable regulatory guidance. Some regulations define pending to be a DTC detected during current or last completed driving cycle for emission-related components/systems. Other regulations define a pending DTC as one that is stored upon the initial detection of a malfunction (e.g., typically on a single driving cycle) prior to illumination of the MIL. Regulations may allow a DTC to be simultaneously pending and confirmed while others forbid this. DM6 is required for all emission OBD regulations. The intended use of this data is to assist the service technician after a vehicle repair, and after clearing diagnostic information, by reporting test results after a single driving cycle.

Reporting the pending DTCs is done using the same format as is used to report active DTCs.

The lamp information (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) should reflect the present state of the transmitting electronic component. The lamp information shall not convey temporary signals to provide for lamp test illumination, DTC numeric displays, or OBD readiness indication at key-on.

Transmission Rate:	On request using PGN 59904 (refer to SAE J1939-21 PGN 59904) A NACK is required if PG is not supported and it was a destination-specific request (refer to SAE J1939-21 PGN 59392)		
Data Length:	Variable		
Extended Data Page:	0		
Data Page:	0		
PDU Format:	254		
PDU Specific:	207		
Default Priority:	6 (note that per SAE J1939-21 requirements, priority should be seven when transport protocol is used)		
Parameter Group Number:	65231 (00FECF _h)		
Byte: 1	bits 8-7	Malfunction indicator lamp	see 5.7.1.4
	bits 6-5	Red stop lamp	see 5.7.1.5
	bits 4-3	Amber warning lamp	see 5.7.1.6
	bits 2-1	Protect lamp	see 5.7.1.7
Byte: 2	bits 8-7	Flash malfunction indicator lamp	see 5.7.1.8
	bits 6-5	Flash red stop lamp	see 5.7.1.9
	bits 4-3	Flash amber warning lamp	see 5.7.1.10
	bits 2-1	Flash protect lamp	see 5.7.1.11
Byte: 3	bits 8-1	SPN, 8 least significant bits of SPN (most significant at bit 8)	see 5.7.1.12
Byte: 4	bits 8-1	SPN, second byte of SPN (most significant at bit 8)	see 5.7.1.12
Byte: 5	bits 8-6	SPN, 3 most significant bits (most significant at bit 8)	see 5.7.1.12
Byte: 6	bits 5-1	FMI (most significant at bit 5)	see 5.7.1.13
	bit 8	SPN conversion method	see 5.7.1.14
	bits 7-1	Occurrence count	see 5.7.1.15

NOTE: When the occurrence count is not available, it should be set to all ones which is a value of 127.

NOTE: When there is zero or one DTC to report then unused bytes 7 and 8 of the CAN frame shall be set to 255 (as per SAE J1939-71).

NOTE: When there are no DTCs to report, each of bytes 3 through 6 shall be set to zero.

EXAMPLE 1: The following illustrates the message format for when there is more than one diagnostic trouble code.

Given:

- a = lamp status (LS)
- b = SPN
- c = FMI
- d = CM and OC

Message form is as follows: a,b,c,d,b,c,d,b,c,d,b,c,d....etc. In this example, the transport protocol of SAE J1939-21 has to be used to send the information because it requires more than 8 data bytes. Actually, any time there is more than one fault, the services of the transport protocol have to be used.

EXAMPLE 2: The following illustrates the message format for when a request of the DM6 is made and all test results indicate no trouble information. The currently defined lamps (malfunction indicator lamp, red stop lamp, amber warning lamp, and protect lamp) should reflect the present state of the transmitting electronic component. In this example, the amber lamp is identified as being on.

The original publication of this recommended practice defined that bytes 3 through 6 should be set to all ones when there are zero faults. This particular implementation is no longer permitted.

Given:

Byte: 1	bits 8-7 =	00 (example of reporting off)
	bits 6-5 =	00 (example of reporting off)
	bits 4-3 =	01 (example of reporting on)
	bits 2-1 =	00 (example of reporting off)
Byte: 2	bits 8-7 =	11 (example of reporting not available/don't care)
	bits 6-5 =	11 (example of reporting not available/don't care)
	bits 4-3 =	11 (example of reporting not available/don't care)
	bits 2-1 =	11 (example of reporting not available/don't care)

Bytes: 3-6 SPN = 0 (required setting for reporting no diagnostic trouble code)

 FMI = 0 (required setting for reporting no diagnostic trouble code)

 OC = 0 (required setting for reporting no diagnostic trouble code)

 CM = 0 (required setting for reporting no diagnostic trouble code)

Byte: 7 = 255

Byte: 8 = 255

5.7.7 Command Non-Continuously Monitored Test (DM7)

The purpose of this command in the diagnostic process is to: (1) Command manufacturer specific tests, (2) Command standard tests (if applicable), or (3) Command to return last measured scaled results. In all cases, either DM8 or DM30 response is required. For 2013 model year and subsequent engines, a DM30 response is recommended for all responses. The component manufacturer is responsible to assign test identifiers (TID) and component identifiers for tests of different systems and components. PGN 58112 (DM7) is used to invoke one of the manufacturer defined test identifiers or invoke a standard test or request last measured results. Test results are reported, by test identifier, using PGN 65232 (DM8) for non-scaled test results. For test results that utilize standard scaling, see DM 30. DM7 also requests HD OBD rationality fault information which is provided using PGN 64475 (DM58). If DM7 or the specific test identifier or the SPN and FMI is not supported, then a NACK is required (refer to SAE J1939-21 PGN 59392) to be returned.

Transmission Rate:	Sent to a specific destination address whenever a test is desired		
Data Length:	8		
Extended Data Page:	0		
Data Page:	0		
PDU Format:	227		
PDU Specific:	Destination address (see note below)		
Default Priority:	6		
Parameter Group Number:	58112 (00E300 _h)		
Byte: 1		Test identifier	see 5.7.7.1
Byte: 2	bits 8-1	SPN identifying component/system-specific test	
		8 least significant bits of SPN (most significant at bit 8)	see 5.7.7.2
Byte: 3	bits 8-1	SPN identifying component/system-specific test	
		second byte of SPN (most significant at bit 8)	see 5.7.7.2
Byte: 4	bits 8-6	SPN identifying component/system-specific test	
		3 most significant bits (most significant at bit 8)	see 5.7.7.2
	bits 5-1	FMI identifying component/system-specific test	
		(most significant at bit 5)	see 5.7.7.3
Bytes: 5-8	Reserved for assignment by SAE		

NOTE: DM7 shall be sent to a specific address, not the global destination address. The DM8 or DM30 response shall be sent using RTS/CTS (refer to SAE J1939-21).

5.7.7.1 Test Identifier

The TID has two methods to designate the test to be run. The first method uses the TID alone, and these test identifiers are manufacturer-defined test identifiers. For this first use, there are 64 valid test identifiers, 1 to 64. The second method uses the TID and the SPN/FMI to identify the test.

See Table 7 for values that are available to be used.

Data Length: 1 byte
 Resolution: See 5.7.8, 5.7.30, or 5.7.58
 Data Range: 0 to 255 per table below
 Type: Status
 Suspect Parameter Number: 1224
 Reference: 5.7.8, 5.7.30, or 5.7.58

Table 7 - Test identifier assignments

Test Identifier Value	Name	Response PG	Test Results
0	Reserved for SAE assignment	NA	NA
1 to 64	Command manufacturer specific test	DM8	Non-standard scaling
65 to 244	Reserved for SAE assignment	TBA	NA
245	Return rationality fault SP data value	DM58	Standard scaling
246	Return all scaled test results for all SPNs ⁽³⁾	DM30	Standard scaling
247	Return all scaled test results for one SPN ⁽¹⁾	DM30	Standard scaling
248	Command manufacturer specific test	DM30	Standard scaling
249	Command standard test ⁽²⁾	DM30	Standard scaling
250	Return last measured scaled results	DM30	Standard scaling
251 to 255	Reserved for SAE assignment	NA	NA

TID NOTES:

⁽¹⁾ Test Identifier 247 shall return all the test results for the SPN given in 5.7.7.2. An FMI value of 31 shall be used in 5.7.7.3 by scan tools to query for test results with TID 247. With the FMI value of 31 is used, the test results provided shall comprise all test results for the SPN given in 5.7.7.2 regardless of their assigned FMIs including FMI 31. When there is no information regarding what specific FMIs are supported, the individual SPNs, indicated by DM24 as having test results, may therefore be queried using Test Identifier 247, the SPN displayed, and FMI 31.

Test Identifier 250 is used when the results for only one test is desired where the test is defined by the SPN given in 5.7.7.2 and the FMI given in 5.7.7.3.

⁽²⁾ SPN 4175 (Diesel Particulate Filter Active Regeneration Forced Status) with an FMI of 31 shall be used with TID 249 to provide a common means for scan-tool user requests to regenerate a DPF PM aftertreatment system. This capability is not required for OBD compliance.

⁽³⁾ TID 246 - SPN 5846 (OBD test results) with an FMI of 31 shall be used with TID 246 to provide a common means for scan-tool user request for all test results. This method of request could require more than 200 bytes to report all results for all OBD test results. This capability is not required for OBD compliance.

5.7.7.2 SPN Identifying Component/System-Specific Test

This parameter identifies the component/system that will be tested.

Data Length: 19 bits
 Resolution: See below
 Data Range: Bit mapped, see below
 Type: Status
 Suspect Parameter Number: 4148
 Reference: 5.7.7

5.7.7.3 FMI Identifying Component/System-Specific Test

This parameter identifies the failure mode identifier which represents the test(s) that shall be run on the component/system that will be tested.

TID 247 FMI 31 shall result in the return of all test results associated with the SPN given in 5.7.7.2, including the results for a DTC which has an FMI of 31. When the TID is 250, only the test results associated with the SPN given in 5.7.7.2 and the provided FMI is returned. When the TID is 245, the FMI is not used and should be set to 31.

Data Length:	5 bits
Resolution:	See below
Data Range:	Bit mapped, see below
Type:	Status
Suspect Parameter Number:	4149
Reference:	5.7.7

5.7.8 Test Results for Non-Continuously Monitored Systems (DM8)

The purpose of this response PG is to report the test results for one of the non-continuously monitored tests invoked using DM7. The component manufacturer is responsible to assign test identifiers and component identifiers for tests of different systems and components. PGN 58112 (DM7) is used to invoke one of the manufacturer defined test identifiers. Test results are reported by test identifier using PGN 65232 (DM8).

Transmission Rate:	Sent in response to PGN 58112 when the results are available A NACK is required if PG is not supported (refer to SAE J1939-21 PGN 59392)	
Data Length:	Variable but sent in 8-byte sets (see example)	
Extended Data Page:	0	
Data Page:	0	
PDU Format:	254	
PDU Specific:	208	
Default Priority:	6 (note that per SAE J1939-21 requirements, priority should be seven when transport protocol is used)	
Parameter Group Number:	65232 (00FED0 _h)	
Byte:	1	Test identifier
	2	Test type/component identifier
	4-3	Test value
	6-5	Test limit maximum
	8-7	Test limit minimum

Further guidelines for the use of the test value, test limit maximum, and the test limit minimum to convey results for tests are enumerated in Table 8. For example, with a test where there is not a test limit maximum or test limit minimum, the results are determined from the test value alone (cases 1 to 4).

Table 8 - Test results

Case #	Test Value	Test Maximum	Test Minimum	Interpretation
1	0000 _h to FAFF _h	FFFF _h	FFFF _h	Test Pass
2	FE00 _h (Error)	FFFF _h	FFFF _h	Test Fail
3	FB00 _h	FFFF _h	FFFF _h	Test Not Complete ⁽¹⁾
4	FB01 _h	FFFF _h	FFFF _h	Test Cannot Be Performed
5	0003 _h	0004 _h	0001 _h	Test Pass
6	0000 _h	0004 _h	0001 _h	Test Fail
7	0005 _h	0004 _h	0001 _h	Test Fail
8	0000 _h	FFFF _h	0001 _h	Test Fail
9	0002 _h	FFFF _h	0001 _h	Test Pass
10	FAFF _h	FAFE _h	FFFF _h	Test Fail
11	AF57 _h	AF59 _h	FFFF _h	Test Pass
12	0100 _h	FAFE _h	0100 _h	Test Pass
13	FAFE _h	FAFE _h	0100 _h	Test Pass

⁽¹⁾ Case 3 is required when an OBD test result is initialized and has not made a pass/fail decision.

Another observation is that if there are more than one test value to report on a given test then the results will be sent using the transport protocol defined in SAE J1939-21. See the following example. If multiple test results are reported, then the component identifier parameter is used to distinguish the different result values. All test identifier values must be the same when multiple test results are reported in one DM8 response.

If the test performed does not have both a test limit minimum and maximum, then the appropriate limit value (maximum or minimum) should be set to all ones. SAE J1939-71 defines this to mean not available.

EXAMPLE:

Given: Assume three separate test values are desired to be communicated.
Where: a = Test identifier, b = Test type/component identifier, c = Test value,
d = Test limit maximum, e = Test limit minimum

Message form will be as follows: a,b,c,d,e,a,b,c,d,e,a,b,c,d,e

The transport protocol of SAE J1939-21 will have to be used when there is more than one test value to send because 16 or more data bytes would be required. In this example 24 bytes of data would need sent for three test values.

5.7.8.1 Test Type/Component Identifier

This parameter identifies the non-continuously monitored component identifier that was tested. These component identifiers are defined by the manufacturer. They are necessary when multiple components or systems are present on the vehicle and have the same definition of test identifier.

Data Length: 1 byte
Resolution: See DM10 below
Data Range: 1 to 64 (Note: 0 and 65 to 250 are reserved)
Type: Measured
Suspect Parameter Number: 1225
Reference: 5.7.8

5.7.8.2 Test Value

The test value collected during the test. If the test performed does not have both a test limit minimum and maximum, then the appropriate limit value (maximum or minimum) should be set to all ones. SAE J1939-71 defines this to mean not available.

Data Length:	2 bytes
Resolution:	Not defined
Data Range:	0 to 64255 (Also see Table 8 for use of FB00 _h , FB01 _h , and FE00 _h)
Type:	Measured
Suspect Parameter Number:	1226
Reference:	5.7.8

5.7.8.3 Test Limit Maximum

The test value must be less than or equal to test limit maximum in order for the test to pass. If the test performed does not have a test limit maximum, then the test limit maximum shall be set to all ones which is defined by SAE J1939-71 to mean not available. The test limit maximum shall be scaled according to the SLOT definition in SAE J1939DA. The test limit maximum shall follow the conventions of Table 8.

Data Length:	2 bytes
Resolution:	Not defined
Data Range:	0 to 64255 (Also see Table 8 for use of FFFF _h)
Type:	Measured
Suspect Parameter Number:	1227
Reference:	5.7.8

5.7.8.4 Test Limit Minimum

The test value must be greater than or equal to test limit minimum in order for the test to pass. If the test performed does not have a test limit minimum, then the test limit minimum shall be set to all ones which is defined by SAE J1939-71 to mean not available. The test limit minimum shall be scaled according to the SLOT definition in SAE J1939DA. The test limit minimum shall follow the conventions of Table 8.

Data Length:	2 bytes
Resolution:	Not defined
Data Range:	0 to 64255 (Also see Table 8 for use of FFFF _h)
Type:	Measured
Suspect Parameter Number:	1228
Reference:	5.7.8

5.7.9 Oxygen Sensor Test Results (DM9)

SAE J1939 will not specify an implementation for this DM. Oxygen sensor test and results should be communicated using DM7 and DM8.

5.7.10 Non-Continuously Monitored Systems Test Identifiers Support (DM10)

The purpose of this PG is to report the list of non-continuously monitored systems tests supported by the controller. The component manufacturer is responsible to assign test identifiers and component identifiers for tests of different systems and components. PGN 58112 (DM7) is used to invoke one of the manufacturer-defined test identifiers. Test results are reported by test identifier using PGN 65232 (DM8). Service tools can determine the supported tests by requesting PGN 65234 (DM10).