<table>
<thead>
<tr>
<th>Document</th>
<th>Abbreviated Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1939-01</td>
<td>Truck and Bus Specific</td>
</tr>
<tr>
<td>J1939-02</td>
<td>Construction and Agriculture Specific (same as ISO 11783-1)</td>
</tr>
<tr>
<td>J1939-03</td>
<td>On Board Diagnostics Implementation Guide</td>
</tr>
<tr>
<td>J1939-05</td>
<td>OBD for Marine Spark-Ignition Sterndrive and Inboard Engines</td>
</tr>
<tr>
<td>J1939-11</td>
<td>Physical Layer – Shielded Twisted Pair with Drain</td>
</tr>
<tr>
<td>J1939-12</td>
<td>Physical Layer – Twisted Quad, Active Terminators (ISO 11783-2)</td>
</tr>
<tr>
<td>J1939-13</td>
<td>Diagnostic Connector (9 Pins)</td>
</tr>
<tr>
<td>J1939-15</td>
<td>Physical Layer – Twisted Pair</td>
</tr>
<tr>
<td>J1939-21</td>
<td>Data Link Layer</td>
</tr>
<tr>
<td>J1939-31</td>
<td>Network Layer</td>
</tr>
<tr>
<td>J1939-71</td>
<td>Applications Layer</td>
</tr>
<tr>
<td>J1939-73</td>
<td>Application Layer, Diagnostics</td>
</tr>
<tr>
<td>J1939-74</td>
<td>Application – Configurable Messaging</td>
</tr>
<tr>
<td>J1939-75</td>
<td>Application Layer—Generator Sets and Industrial</td>
</tr>
<tr>
<td>J1939-81</td>
<td>Network Management</td>
</tr>
<tr>
<td>J1939-84</td>
<td>OBD Communications Compliance Test Cases For Heavy Duty Veh.</td>
</tr>
</tbody>
</table>

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Definition of Terms

- **PDU** – Protocol Data Unit
  - **PDUF** – PDU Format
  - **PDUS** – PDU Specific
  - **GE** – Group Extension
- **PGN** – Parameter Group Number
- **DM** – Diagnostic Message
- **DTC** – Diagnostic Trouble Code
  - **SPN** – Suspect Parameter Number
  - **FMI** – Failure Mode Identifier
  - **OC** – Occurrence Count
  - **CM** – Conversion Method
- **SLOT** – Scaling, Limits, Offset and Transfer Function
# J1939 Physical Layer

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>J1939-11</th>
<th>J1939-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network arbitration access</td>
<td>Bit wide</td>
<td>Random</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nondestructive</td>
</tr>
<tr>
<td>Bits / second</td>
<td></td>
<td>250,000</td>
</tr>
<tr>
<td>Maximum nodes</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Topology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus Length</td>
<td>Linear Bus</td>
<td>40 meters (inc stub length)</td>
</tr>
<tr>
<td>Stub Length</td>
<td>40 meters (131 feet)</td>
<td>3 meter</td>
</tr>
<tr>
<td>Stub Connector</td>
<td>1 meter (3.3 feet)</td>
<td>2-pin</td>
</tr>
<tr>
<td>Termination</td>
<td>3-pin</td>
<td>2 required: passive resistors</td>
</tr>
<tr>
<td></td>
<td>2 required: passive resistors (optional internal to ECU)</td>
<td>(optional internal to ECU)</td>
</tr>
<tr>
<td>Cabling</td>
<td>Shielded twisted pair with drain</td>
<td>Twisted pair</td>
</tr>
<tr>
<td>Diagnostic Connector</td>
<td>9 pins</td>
<td></td>
</tr>
</tbody>
</table>
## J1939 Diagnostic Connector

### Heavy Duty 9 Pin Connector

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Circuit Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/A</td>
<td>Battery (-)</td>
</tr>
<tr>
<td>2/B</td>
<td>Battery (+) (allows 12 and 24 volt systems)</td>
</tr>
<tr>
<td>3/C</td>
<td>CAN_H Tractor Bus (J1939)</td>
</tr>
<tr>
<td>4/D</td>
<td>CAN_L Tractor Bus (J1939)</td>
</tr>
<tr>
<td>5/E</td>
<td>CAN_SHLD (J1939-11) or No Connect (J1939-12)</td>
</tr>
<tr>
<td>6/F</td>
<td>J1708 (+)</td>
</tr>
<tr>
<td>7/G</td>
<td>J1708 (-)</td>
</tr>
<tr>
<td>8/H</td>
<td>Proprietary OEM Use or Implement Bus CAN_H</td>
</tr>
<tr>
<td>9/J</td>
<td>Proprietary OEM Use or Implement Bus CAN_L</td>
</tr>
</tbody>
</table>
OBD MIL, Connectors and Scan Tool

- MIL
- OBD Connector (SAE J1939-13)
- OBD Connector (ISO 15031-3)
- Installed OBD Connector
- Scan Tool
## Synopsis of Data Link Layer

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>J1939-21</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Message / PDU format</strong></td>
<td></td>
</tr>
<tr>
<td>Priority</td>
<td>3 bits</td>
</tr>
<tr>
<td>PGN</td>
<td>18 (10) bits</td>
</tr>
<tr>
<td>DA</td>
<td>(8) bits</td>
</tr>
<tr>
<td>SA</td>
<td>8 bits</td>
</tr>
<tr>
<td>Data</td>
<td>0 - 64 bits</td>
</tr>
<tr>
<td>CRC</td>
<td>15 bits</td>
</tr>
<tr>
<td>Labels per message</td>
<td>1</td>
</tr>
<tr>
<td>Labels / messages available</td>
<td>8672</td>
</tr>
<tr>
<td>Parameters per label/message</td>
<td>6</td>
</tr>
<tr>
<td>(min to max)</td>
<td>(1-32)</td>
</tr>
<tr>
<td>Message length</td>
<td>8 to 18 bytes</td>
</tr>
<tr>
<td></td>
<td>(~64 to 150 bits)</td>
</tr>
</tbody>
</table>

*22-24 September 2009*
**CAN Extended Data Frame as Defined by J1939-21 (CAN Data Link Layer)**

<table>
<thead>
<tr>
<th>CAN Extended Data Frame</th>
<th>J1939</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbitration Field</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Identifier</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Identifier Ext.</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Control Field</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Field</td>
<td></td>
<td>0 - 64</td>
</tr>
<tr>
<td>CRC</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>ACK</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>EOF</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Source Address</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Field</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDU Format</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDU Specific = DA or GE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PGN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priority</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Extended Data Page</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Extended Data Page</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Source Address</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Data Field</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Data Field</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Data Field</td>
<td></td>
<td>0 - 64</td>
</tr>
</tbody>
</table>

**Legend:**
- **CAN**
- **J1939**
- **SOF**
- **RR**
- **ID**
- **RT**
- **REC**
- **DL**
- **LC**

*22-24 September 2009*
## Synopsis of Application Layers

<table>
<thead>
<tr>
<th>Subject Area</th>
<th>J1939-71, J1939-73, J1939-75, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application categories</td>
<td>Control, multiplexing, information sharing, diagnostics and proprietary</td>
</tr>
<tr>
<td>Engine’s main control message</td>
<td>5 – 35 ms</td>
</tr>
<tr>
<td>Labels / messages assigned and (available)</td>
<td>1018,973 PGNs  9357,9028 SPNs  (8676)  (524,288)</td>
</tr>
<tr>
<td>Addresses assigned and (available)</td>
<td>Dynamic: 0 / (39)  Other: 168 / (215)</td>
</tr>
<tr>
<td>Network utilization allowed and (used)</td>
<td>100% / ~65%</td>
</tr>
</tbody>
</table>
Application Layer Messages

- **Control** ............................................ found in J1939-71
  - Transmission commands engine to 0% torque
  - ABS commands retarder to -100% torque
    - *Shift or brake assist*

- **Multiplexing** ................................. found in J1939-71
  - Cab controller reads cruise control switches
    - *Sends on network*
  - Engine performs cruise control
    - *Uses switch values from network*
Application Layer Messages (cont.)

Information Sharing . . . . . . . found in J1939-71
- Engine coolant temperature = 175 °F
- MPH = 63 mph
- Fuel economy = 8.2 mpg

Diagnostics / Service. . . . . . . . found in J1939-73
- Injector 1 voltage above normal (SPN / FMI)
- Boost sensor voltage below normal
- Oil filter replacement needed
- Read or clear DTCs

Proprietary . . . . . . . . . . . . found in J1939-21
- Change engine and or vehicle configuration
- Change engine rating calibration
J1939 Signal Range Model for FMIs

Region a - Total signal input range possible that can be seen by an electronic module

Region b - Total signal range physically possible as defined by an application. **CARB defined Rationality faults fall in this region**

Region c - Range defined as **normal** for a given real-world measurement

Region d - Range defined as **below normal, most severe level**, of what is considered normal for the given real-world measurement

Region e - Range defined as **above normal, most severe level**, of what is considered normal for the given real-world measurement

Region f - Range which is **low**, outside the range of what is considered **physically possible** for a given system, indicating that a short-to-low source has occurred
Region g - Range which is **high, outside the range of what is considered physically possible** for a given system, indicating a short-to-high source has occurred.

Region h - Range defined as **below normal - Least Severe Level** - of what is considered normal for a given real-world measurement.

Region i - Range defined as **above normal - Least Severe Level** - of what is considered normal for a given real-world measurement.

Region j - Range defined as **below normal - Moderately Severe Level** - of what is considered normal for a given real-world measurement.

Region k - Range defined as **above normal - Moderately Severe Level** - of what is considered normal for a given real-world measurement.
Failure Mode Identifiers

FMI=0  -  Data Valid but Above Normal Operational Range, Most Severe Level
FMI=1  -  Data Valid but Below Normal Operational Range, Most Severe Level
FMI=2  -  Data Erratic, Intermittent or Incorrect (rationality)
FMI=3  -  Voltage Above Normal, or Shorted to High Source
FMI=4  -  Voltage Below Normal, or Shorted to High Source
FMI=5  -  Current Below Normal, or Open Circuit
FMI=6  -  Current Above Normal, or Grounded Circuit
FMI=7  -  Mechanical System not Responding or Out of Adjustment
<table>
<thead>
<tr>
<th>FMI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Abnormal Frequency or Pulse Width or Period</td>
</tr>
<tr>
<td>9</td>
<td>Abnormal Update Rate</td>
</tr>
<tr>
<td>10</td>
<td>Abnormal Rate of Change</td>
</tr>
<tr>
<td>11</td>
<td>Failure Code not Identifiable</td>
</tr>
<tr>
<td>12</td>
<td>Bad Intelligent Device or Component</td>
</tr>
<tr>
<td>13</td>
<td>Out of Calibration</td>
</tr>
<tr>
<td>14</td>
<td>Special Instructions</td>
</tr>
<tr>
<td>15</td>
<td>Data Valid but Above Normal Range: Least Severe Level</td>
</tr>
</tbody>
</table>
Failure Mode Identifiers

FMI=16  -  Data Valid but Above Normal Range: Moderately Severe Level
FMI=17  -  Data Valid but Below Normal Range: Least Severe Level
FMI=18  -  Data Valid but Below Normal Range: Moderately Severe Level
FMI=19  -  Received Network Data in Error: (Multiplexed Data)
FMI=20  -  Data Drifted High (rationality high)
FMI=21  -  Data Drifted Low (rationality low)
FMI=22 to 30  -  Reserved for SAE Assignment
FMI=31  -  Condition Exists
FMI used = function (Monitor Type, Applicable Range)

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
<th>j</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors / Actuators A / D or D / A</td>
<td>9</td>
<td></td>
<td>2, 7, 10, 20, 21</td>
<td>1</td>
<td>0</td>
<td>4, 5</td>
<td>3, 6</td>
<td>17</td>
<td>15</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Sensors / Actuators Freq. / PWM</td>
<td>9</td>
<td></td>
<td>2, 7, 10, 20, 21</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td>17</td>
<td>15</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Sensors / Actuators Datalink Provided</td>
<td>9</td>
<td></td>
<td>2, 7, 10, 20, 21</td>
<td>1</td>
<td>0</td>
<td>19</td>
<td>19</td>
<td>17</td>
<td>15</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>OBD Threshold Monitors (catalyst, DPF, DOC)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1, 31</td>
<td>0, 31</td>
<td>NA</td>
<td>NA</td>
<td>17</td>
<td>15</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>OBD System Monitors (Cooling System, etc)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1, 31</td>
<td>0, 31</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>System Monitors (lube, charging, brake, etc)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1, 31</td>
<td>0, 31</td>
<td>NA</td>
<td>NA</td>
<td>17</td>
<td>15</td>
<td>18</td>
<td>16</td>
</tr>
</tbody>
</table>

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## FMIs Not Directly Applicable To Range Model

<table>
<thead>
<tr>
<th>FMI</th>
<th>FMI Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Failure Code not Identifiable</td>
</tr>
<tr>
<td>12</td>
<td>Bad Intelligent Device or Component</td>
</tr>
<tr>
<td>13</td>
<td>Out of Calibration</td>
</tr>
<tr>
<td>14</td>
<td>Special Instructions</td>
</tr>
<tr>
<td>31</td>
<td>Condition Exists</td>
</tr>
</tbody>
</table>
## FMIs Used for OBD Defined Feedback Control Malfunctions

<table>
<thead>
<tr>
<th>Regulatory Requirement</th>
<th>FMI</th>
<th>FMI Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to Closed Loop</td>
<td>10</td>
<td>Abnormal Rate of Change</td>
</tr>
<tr>
<td>Default, or Open Loop</td>
<td>13</td>
<td>Out of Calibration</td>
</tr>
<tr>
<td>Used up all adjustment</td>
<td>7</td>
<td>Mechanical System not Responding or Out of Adjustment</td>
</tr>
</tbody>
</table>

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## FMIs Recommended for Threshold Monitor Malfunctions

<table>
<thead>
<tr>
<th>Regulatory Requirement</th>
<th>FMI</th>
<th>FMI Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold monitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above Threshold</td>
<td>16</td>
<td>Data Valid but Above Normal Range: Moderately Severe Level</td>
</tr>
<tr>
<td>Below Threshold</td>
<td>18</td>
<td>Data Valid but Below Normal Range: Moderately Severe Level</td>
</tr>
</tbody>
</table>

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Report DTCs

**PGN:**

**Transmission Rate:** DM1 = 1 sec, the rest are On Request

**Data Length:** 8 to n

<table>
<thead>
<tr>
<th>Byte 1</th>
<th>Lamps: MIL, Red, Amber, Protect (8 bits)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lamp Flash and WWH support (8 bits)</td>
</tr>
<tr>
<td></td>
<td>Suspect Parameter Number (19 bits)</td>
</tr>
<tr>
<td>Byte 8</td>
<td>Failure Mode Identifier (5 bits)</td>
</tr>
<tr>
<td></td>
<td>Occurrence Count (7 bits)</td>
</tr>
</tbody>
</table>

32 bits per DTC

<table>
<thead>
<tr>
<th>Byte 14</th>
<th></th>
</tr>
</thead>
</table>

32 bits per DTC

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Diagnostic Data Clear/Reset

- **PGN:** 65228 DM3 (PA)
- **Transmission Rate:** On Request
- **Data Length:** 0

- Only used in Request PGN or Acknowledgement PGN data fields.

- In Request PGN, devices honoring request will clear relevant diagnostic information.

- In Acknowledgement PGN, indicates either success or failure of requested action.
Diagnostic Data Clear/Reset

- **PGN:** 65228  DM11 (A)
- **Transmission Rate:** On Request
  - For OBD regulated products, DM11 is used to clear all applicable diagnostic data. Emission related components shall clear/reset diagnostic data for all active, pending, and previously active DTCs.
- **Data Length:** 0
  - Only used in Request PGN or Acknowledgement PGN data fields.
  - In Request PGN, devices honoring request will clear relevant diagnostic information.
  - In Acknowledgement PGN, indicates either success or failure of requested action.
### Clear Diagnostic Information Services – DM22

- **PGN:** 49664
- **Transmission Rate:** As Needed
- **Data Length:** 8

<table>
<thead>
<tr>
<th>CAN Data Field</th>
<th>Description</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
<td>Individual DTC Clear/Reset Control Byte</td>
<td>8 bits</td>
</tr>
<tr>
<td>Byte 2</td>
<td>Ctrl Byte Specific Indicator for Individual DTC Clear</td>
<td>8 bits</td>
</tr>
<tr>
<td>Byte 3</td>
<td>Reserved for Assignment by SAE</td>
<td>24 bits</td>
</tr>
<tr>
<td>Byte 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 6</td>
<td>SPN</td>
<td>19 bits</td>
</tr>
<tr>
<td>Byte 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 8</td>
<td>FMI</td>
<td>5 bits</td>
</tr>
</tbody>
</table>
Freeze Frames - DM4

- **PGN:** 65229
- **Transmission Rate:** On Request
- **Data Length:** Variable

**Fields Repeat for Each DTC Freeze Frame**

<table>
<thead>
<tr>
<th>Byte 1</th>
<th>Freeze Frame Length</th>
<th>8 bits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suspect Parameter Number</td>
<td>19 bits</td>
</tr>
<tr>
<td></td>
<td>Failure Mode Identifier</td>
<td>5 bits</td>
</tr>
<tr>
<td></td>
<td>Occurrence Count</td>
<td>7 bits</td>
</tr>
<tr>
<td></td>
<td>Torque Mode</td>
<td>5 bits</td>
</tr>
<tr>
<td></td>
<td>Boost</td>
<td>8 bits</td>
</tr>
<tr>
<td>Byte 8</td>
<td>RPM</td>
<td>16 bits</td>
</tr>
<tr>
<td></td>
<td>% Load</td>
<td>8 bits</td>
</tr>
<tr>
<td></td>
<td>Coolant Temp</td>
<td>8 bits</td>
</tr>
<tr>
<td></td>
<td>MPH</td>
<td>16 bits</td>
</tr>
<tr>
<td>Byte 14</td>
<td>Manufacturer Specific</td>
<td></td>
</tr>
<tr>
<td>Byte n</td>
<td>n can be as large as 1785 bytes</td>
<td></td>
</tr>
</tbody>
</table>
# Diagnostic Readiness - DM5

- **PGN:** 65230
- **Transmission Rate:** On Request
- **Data Length:** 8

<table>
<thead>
<tr>
<th>CAN Data Field</th>
<th>Description</th>
<th>Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
<td>Active DTCs</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Previously Active DTCs</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>OBD Compliance</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Continuously Monitored System Support / Status</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Non-Continuously Monitored System Support</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Non-Continuously Monitored System Status</td>
<td>16</td>
</tr>
</tbody>
</table>

- **22-24 September 2009**
## Diagnostic Readiness – DM5 (cont.)
### OBD Compliance Values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>SAE Reserved</td>
<td>13</td>
<td>JOBD, EOBD and OBD II</td>
</tr>
<tr>
<td>1</td>
<td>OBD II (CARB)</td>
<td>14</td>
<td>Heavy Duty (HD) Vehicles (EURO IV) B1</td>
</tr>
<tr>
<td>2</td>
<td>OBD (Federal, EPA)</td>
<td>15</td>
<td>HD Vehicles (EURO V) B2</td>
</tr>
<tr>
<td>3</td>
<td>OBD and OBD II</td>
<td>16</td>
<td>HD Vehicles (EURO EEC) C (gas engines)</td>
</tr>
<tr>
<td>4</td>
<td>OBD I</td>
<td>17</td>
<td>Engine Manufacturer Diagnostics (EMD)</td>
</tr>
<tr>
<td>5</td>
<td>Not intended to meet OBD II req.</td>
<td>18</td>
<td>EMB Enhanced (EMD+)</td>
</tr>
<tr>
<td>6</td>
<td>EOBD</td>
<td>19</td>
<td>HD/OBD Partial (CARB CCR 1971.1)</td>
</tr>
<tr>
<td>7</td>
<td>EOBD and OBD II</td>
<td>20</td>
<td>Heavy Duty/OBD (CARB CCR 1971.1)</td>
</tr>
<tr>
<td>8</td>
<td>EOBD and OBD</td>
<td>21</td>
<td>World Wide Harmonized OBD</td>
</tr>
<tr>
<td>9</td>
<td>EOBD, OBD and OBD II</td>
<td>22</td>
<td>OBD II (CARB 2007/2008 revisions)</td>
</tr>
<tr>
<td>10</td>
<td>JOBD</td>
<td>23</td>
<td>HD Vehicles (EURO IV / V, revs 2005 &amp; 2006)</td>
</tr>
<tr>
<td>11</td>
<td>JOBD and OBD II</td>
<td>24</td>
<td>SAE Reserved</td>
</tr>
<tr>
<td>12</td>
<td>JOBD and EOBD</td>
<td>25</td>
<td>OBD-Marine (SI-SD/I)</td>
</tr>
</tbody>
</table>
Continuously Monitored System Support / Status (8 bits)

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>8</td>
<td>Reserved for assignment by SAE</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Comprehensive component monitoring status</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Fuel system monitoring status</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Misfire monitoring status</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Reserved for assignment by SAE</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Comprehensive component monitoring support</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Fuel system monitoring support</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Misfire monitoring support</td>
</tr>
</tbody>
</table>

Where each status bit is interpreted:
0 = test complete, not supported
1 = test not complete

Where each supported bit is interpreted:
0 = test not supported by this controller
1 = test supported by this controller
Non-Continuously Monitored System Support (16 bits)

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>8</td>
<td>EGR/VVT system monitoring Support</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Exhaust Gas Sensor heater monitoring Support</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Exhaust Gas Sensor monitoring Support</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>A/C system refrigerant monitoring Support</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Secondary air system monitoring Support</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Evaporative system monitoring Support</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Heat catalyst monitoring Support</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Catalyst monitoring Support</td>
</tr>
<tr>
<td>8-6</td>
<td></td>
<td>Reserved for assignment by SAE</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>NMHC converting catalyst monitoring Support</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>NOx converting catalyst and/or NOx adsorber monitoring Support</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Diesel Particulate Filter (DPF) monitoring Support</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Boost pres. control system monitoring Support</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Cold start aid system monitoring Support</td>
</tr>
</tbody>
</table>

Where each *bit* is interpreted:

- 0 = test not supported
- 1 = test supported
## Non-Continuously Monitored System Status (16 bits)

<table>
<thead>
<tr>
<th>Byte</th>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>8</td>
<td>EGR/VVT system monitoring Status</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Exhaust Gas Sensor heater monitoring Status</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Exhaust Gas Sensor heater monitoring Status</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>A/C system refrigerant monitoring Status</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Secondary air system monitoring Status</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Evaporative system monitoring Status</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Heat catalyst monitoring Status</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Catalyst monitoring Status</td>
</tr>
<tr>
<td>6</td>
<td>8-6</td>
<td>Reserved for assignment by SAE</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>NMHC converting catalyst monitoring Status</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>NOx converting catalyst and/or NOx adsorber monitoring Status</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Diesel Particulate Filter (DPF) monitoring Status</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Boost pressure control system monitoring Status</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Cold start aid system monitoring Status</td>
</tr>
</tbody>
</table>

Where each bit is interpreted:
- 0 = test complete, or not supported
- 1 = test not complete
Command Test Service – DM7

- PGN: 58112
- Transmission Rate: As needed
- Data Length: 8

<table>
<thead>
<tr>
<th>CAN Data Field</th>
<th>Byte 1</th>
<th>Byte 2</th>
<th>Byte 3</th>
<th>Byte 4</th>
<th>Byte 5</th>
<th>Byte 6</th>
<th>Byte 7</th>
<th>Byte 8</th>
</tr>
</thead>
</table>

Test Identifier (TID) 8 bits
SPN 19 bits
FMI 5 bits
SAE Reserved 40 bits

- 0=Reserved
- 1-64=Component Mfr Defined ➔ DM8 Resp
- 65-246=Reserved
- 247=Return all scaled test results for one SPN
- 248=Cmd Mfr Test ➔ DM30 Response
- 249=Cmd Std Test ➔ DM30 Response
- 250=Rtn Last Scaled Results ➔ DM30 Resp

Identifies the component / system that will be tested (when TID=248-250).

Identifies the FMI representing the test(s) to be run on the component / system that will be tested (when TID=248-250).
Command Test Service – DM7

- **PGN:** 58112
- **Transmission Rate:** As needed
- **Data Length:** 8

<table>
<thead>
<tr>
<th>CAN</th>
<th>Byte 1</th>
<th>Test Identifier (TID)</th>
<th>8 bits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Byte 2</td>
<td>SPN</td>
<td>19 bits</td>
</tr>
<tr>
<td></td>
<td>Byte 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Byte 4</td>
<td>FMI</td>
<td>5 bits</td>
</tr>
</tbody>
</table>

TID notes:

[1] TID 247 shall return all the test results for the SPN. When 247 is provided as the TID the FMI shall be 31. Scan tools can query for test results without knowledge of the specific FMI used by a given manufacturers system. The SPNs indicated by DM24, as having test results, may therefore be queried using Test Identifier 247.

[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.
Report Test Results Services – DM8
Non-Continuously Monitored Systems

- PGN: 65232
- Transmission Rate: In response to DM7
- Data Length: Variable (sent in 8 byte sets)

<table>
<thead>
<tr>
<th>CAN Data Field</th>
<th>Byte 1</th>
<th>Byte 2</th>
<th>Byte 3</th>
<th>Byte 4</th>
<th>Byte 5</th>
<th>Byte 6</th>
<th>Byte 7</th>
<th>Byte 8</th>
<th>Byte 9 to x</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test Identifier (valid values are 1 to 64)</td>
<td>Test Type / Component ID</td>
<td>Test Value</td>
<td>Test Limit Maximum</td>
<td>Test Limit Minimum</td>
<td>Second through n test results</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 bits</td>
<td>8 bits</td>
<td>16 bits</td>
<td>16 bits</td>
<td>16 bits</td>
<td>64 bits per test</td>
<td></td>
<td></td>
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</table>

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Report Test Results Services – DM8
(Continued)

<table>
<thead>
<tr>
<th>CASE #</th>
<th>TEST VALUE</th>
<th>TEST MAXIMUM</th>
<th>TEST MINIMUM</th>
<th>INTERPRETATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0000₁₆ to FAFF₁₆</td>
<td>FFFF₁₆</td>
<td>FFFF₁₆</td>
<td>Test Pass</td>
</tr>
<tr>
<td>2.</td>
<td>FE00₁₆ (Error)</td>
<td>FFFF₁₆</td>
<td>FFFF₁₆</td>
<td>Test Fail</td>
</tr>
<tr>
<td>3.</td>
<td>FB00₁₆</td>
<td>FFFF₁₆</td>
<td>FFFF₁₆</td>
<td>Test Not Complete</td>
</tr>
<tr>
<td>4.</td>
<td>FB01₁₆</td>
<td>FFFF₁₆</td>
<td>FFFF₁₆</td>
<td>Test Can Not Be Performed</td>
</tr>
<tr>
<td>5.</td>
<td>0003₁₆</td>
<td>0004₁₆</td>
<td>0001₁₆</td>
<td>Test Pass</td>
</tr>
<tr>
<td>6.</td>
<td>0000₁₆</td>
<td>0004₁₆</td>
<td>0001₁₆</td>
<td>Test Fail</td>
</tr>
<tr>
<td>7.</td>
<td>0005₁₆</td>
<td>0004₁₆</td>
<td>0001₁₆</td>
<td>Test Fail</td>
</tr>
<tr>
<td>8.</td>
<td>0000₁₆</td>
<td>FFFF₁₆</td>
<td>0001₁₆</td>
<td>Test Fail</td>
</tr>
<tr>
<td>9.</td>
<td>0002₁₆</td>
<td>FFFF₁₆</td>
<td>0001₁₆</td>
<td>Test Pass</td>
</tr>
<tr>
<td>10.</td>
<td>FAFF₁₆</td>
<td>FAFE₁₆</td>
<td>FFFF₁₆</td>
<td>Test Fail</td>
</tr>
<tr>
<td>11.</td>
<td>AF57₁₆</td>
<td>AF59₁₆</td>
<td>FFFF₁₆</td>
<td>Test Pass</td>
</tr>
<tr>
<td>12.</td>
<td>0100₁₆</td>
<td>FAFE₁₆</td>
<td>0100₁₆</td>
<td>Test Pass</td>
</tr>
<tr>
<td>13.</td>
<td>FAFE₁₆</td>
<td>FAFE₁₆</td>
<td>0100₁₆</td>
<td>Test Pass</td>
</tr>
</tbody>
</table>
# Calibration Information - DM19

- **PGN:** 54016
- **Transmission Rate:** On Request
- **Data Length:** 20 to n (multiple CID & CVN support)

<table>
<thead>
<tr>
<th>Data Sent with Transport Protocol</th>
<th>Byte 1</th>
<th>Calibration Verification Number (CVN) (32 bits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVN &amp; CID n</td>
<td>Bytes 21 to n</td>
<td>CVN &amp; CID n (20 bytes / pair)</td>
</tr>
<tr>
<td></td>
<td>Bytes 5-20</td>
<td>Calibration Identifier (CID is ASCII) (128 bits)</td>
</tr>
</tbody>
</table>

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## Monitor Performance Ratio - DM20

- **PGN:** 49664
- **Transmission Rate:** On Request
- **Data Length:** Variable

<table>
<thead>
<tr>
<th>Ratio 1</th>
<th>Bytes 1-2</th>
<th>Ignition Cycle Counter</th>
<th>16 bits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bytes 3-4</td>
<td>OBD Monitoring Conditions Encountered</td>
<td>16 bits</td>
</tr>
<tr>
<td></td>
<td>Bytes 5-7</td>
<td>SPN of System Monitor</td>
<td>19/24 bits</td>
</tr>
<tr>
<td></td>
<td>Bytes 8-9</td>
<td>Ratio 1 System Monitor Numerator</td>
<td>16 bits</td>
</tr>
<tr>
<td></td>
<td>Bytes 10-11</td>
<td>Ratio 1 System Monitor Denominator</td>
<td>16 bits</td>
</tr>
<tr>
<td></td>
<td>Bytes x to z</td>
<td>7 bytes per additional ratio</td>
<td>56 bits</td>
</tr>
</tbody>
</table>