# 6 COMMUNICATION PROTOCOLS

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</tr>
</tbody>
</table>
6.1 OVERVIEW

Key components of the DDEC IV system are the serial communication links SAE J1587, SAE J1922, and SAE J1939. Using these communication links allows DDEC IV to offer the following functionality:

- Transmitting sensor information from the ECM via the data link at regular intervals and/or upon request to obtain data and to monitor for failures
- Sharing information between stand-alone modules used in the system via the data link
- Sharing engine data with electronic dashboard displays and vehicle management information systems via the data link
- Transmitting and performing diagnostic procedures from external instrumentation such as the hand-held diagnostic data readers or DDDL via the data link
- Transmitting customer requested changes to the ECM from external instrumentation via the data link
- Transmitting to the powertrain the messages assigned to both the engine and the transmission retarder.

The following industry standard Society of Automotive Engineers (SAE) documents can be used as a reference:

- SAE J1587, *Electronic Data Interchange Between Microcomputer Systems In Heavy Duty Vehicle Applications*
- SAE J1708, *Serial Data Communications Between Microcomputer Systems In Heavy Duty Vehicle Applications*
- SAE J1922, *Powertrain Control Interface For Electronic Controls Used In Medium And Heavy Duty Diesel On-highway Vehicle Applications*
- SAE J1939/71, *Vehicle Application Layer*
- SAE J1939, *Top Layer (Overview)*
- SAE J1939/01, *Truck and Bus Applications*
- SAE J1939/11, *Physical Layer*
- SAE J1939/21, *Data Link Layer*
- SAE J1939/73, *Application Layer Diagnostics*

To obtain a copy of the above documents contact the Society of Automotive Engineers (SAE).

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Phone: (412) 776-4970
www.sae.org
6.2 SAE J1587

SAE RP J1587 defines the recommended format of messages and data being communicated between microprocessors used in heavy-duty vehicle applications. Circuits 900 (Data Link +) and 901 (Data Link -) as shown on the Vehicle Interface Harness schematic are used as the J1587 communication link. These circuits also exist in the DDEC six-pin diagnostic connector for use with the DDR.

NOTE:
The maximum length for the SAE J1587 Data Link is 40 m (130 ft).

6.2.1 MESSAGE FORMAT

A complete description of the DDEC IV parameters is provided within this section of the manual. DDEC IV transmits parametric data at SAE J1587 recommended rates in packed message form. The first byte or character of each message is the Message Identification character (MID). The MID identifies which microcomputer on the serial communication link originated the information. Each device in the system originating messages must have a unique MID. The assignment of MIDs should be based on those listed in SAE RP J1587. The primary MID for DDEC IV is 128. Engines with 12 and 16 cylinders use MID 128 and MID 175. Engines with 20 cylinders use MID 128, MID 175 and MID 183.

The ProDriver display uses MID 171. Off-board diagnostic tools like hand-held readers should be identified by MID 172. Off-board programming stations like Vehicle Engine Programming Station (VEPS) should be identified by MID 182. Messages using MIDs as recommended by SAE RP J1587 will be responded to by the ECM.

Subsystems also require identifiers. The subsystem identifier character (SID) is a single byte character used to identify field-repairable or replaceable subsystems for which failures can be detected or isolated. SIDs are used in conjunction with SAE standard diagnostic codes defined in J1587 within PID194.

The identifiers used by DDEC are defined and listed in Table 6-1.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure Mode Identifier (FMI)</td>
<td>The FMI describes the type of failure detected in the subsystem and identified by the PID or SID.</td>
</tr>
<tr>
<td>Message Identification Character (MID)</td>
<td>The MID is the first byte or character of each message that identifies which microcomputer on DDEC 1587 serial communication link originated the information.</td>
</tr>
<tr>
<td>Parameter Identification Character (PID)</td>
<td>A PID is a single byte character used in DDEC 1587 messages to identify the data byte(s) that follow. PIDs identify the parameters transmitted.</td>
</tr>
<tr>
<td>Subsystem Identification Character (SID)</td>
<td>A SID is a single byte character used to identify field-repairable or replaceable subsystems for which failures can be detected or isolated.</td>
</tr>
</tbody>
</table>

Table 6-1 Identifiers Used by DDEC
6.2.2 1708/1587 MESSAGE PRIORITY

Each message sent by DDEC is assigned a priority on a scale of 1 to 8, in compliance with the message priority assignment specified in SAE RP J1708. The most critical message has a priority of one. The message assignments are listed in Table 6-2. All devices transmitting messages across DDEC’s 1708/1587 Data Link must be prioritized and transmitted in this manner.

<table>
<thead>
<tr>
<th>Priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 and 2</td>
<td>Reserved for messages that require immediate access to the bus.</td>
</tr>
<tr>
<td>3 and 4</td>
<td>Reserved for messages that require prompt access to the bus in order to prevent severe mechanical damage.</td>
</tr>
<tr>
<td>5 and 6</td>
<td>Reserved for messages that directly affect the economical or efficient operation of the vehicle.</td>
</tr>
<tr>
<td>7 and 8</td>
<td>All other messages not fitting into the previous priority categories.</td>
</tr>
</tbody>
</table>

Table 6-2 Message Priority Assignments

SAE J1587 Parameters Available with DDEC IV

DDEC IV supports the J1587 parameter identifiers (PIDs) listed in Table 6-3 and listed in Table 6-4.

NOTE:
Data is transmitted only if the source has been configured for the engine.

<table>
<thead>
<tr>
<th>PID</th>
<th>Description</th>
<th>PID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>147</td>
<td>Average Fuel Economy — Natural Gas</td>
<td>248</td>
<td>Total VSG Hours</td>
</tr>
<tr>
<td>148</td>
<td>Instantaneous Fuel Economy — Natural Gas</td>
<td>249</td>
<td>Total Engine Revolution</td>
</tr>
<tr>
<td>149</td>
<td>Mass Flow Rate — Natural Gas</td>
<td>250</td>
<td>Total Fuel Used</td>
</tr>
<tr>
<td>229</td>
<td>Total Fuel Used — Natural Gas</td>
<td>251</td>
<td>Clock</td>
</tr>
<tr>
<td>230</td>
<td>Total Idle Fuel Used — Natural Gas</td>
<td>252</td>
<td>Date</td>
</tr>
<tr>
<td>231</td>
<td>Trip Fuel — Natural Gas</td>
<td>351</td>
<td>Turbo Compressor Inlet Temperature</td>
</tr>
<tr>
<td>243</td>
<td>Device Identification</td>
<td>354</td>
<td>Relative Humidity</td>
</tr>
<tr>
<td>244</td>
<td>Trip Miles</td>
<td>404</td>
<td>Turbo Compressor Out Temperature</td>
</tr>
<tr>
<td>245</td>
<td>Total Miles</td>
<td>411</td>
<td>EGR Differential Pressure</td>
</tr>
<tr>
<td>247</td>
<td>Total Engine Hours</td>
<td>412</td>
<td>EGR Temperature</td>
</tr>
<tr>
<td>—</td>
<td>—</td>
<td>439</td>
<td>Extended Range Boost Pressure</td>
</tr>
</tbody>
</table>

Table 6-3 SAE J1587 PIDs Provided by DDEC IV
<table>
<thead>
<tr>
<th>PID</th>
<th>Description</th>
<th>PID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>109</td>
<td>Coolant Pressure</td>
</tr>
<tr>
<td>18</td>
<td>Extended Range Fuel Pressure</td>
<td>110</td>
<td>Coolant Temperature</td>
</tr>
<tr>
<td>19</td>
<td>Extended Range Oil Pressure</td>
<td>111</td>
<td>Coolant Level</td>
</tr>
<tr>
<td>20</td>
<td>Extended Range Coolant Pressure</td>
<td>113</td>
<td>Engine Governor Droop</td>
</tr>
<tr>
<td>44</td>
<td>Attention/Warning Indicator Lamps Status</td>
<td>121</td>
<td>Engine Retarder Status</td>
</tr>
<tr>
<td>48</td>
<td>Extended Range Barometric Pressure</td>
<td>122</td>
<td>Engine Retarder Percent</td>
</tr>
<tr>
<td>51</td>
<td>Throttle Position</td>
<td>153</td>
<td>High Range Crankcase Pressure</td>
</tr>
<tr>
<td>52</td>
<td>Engine Intercooler Temperature</td>
<td>154</td>
<td>Auxiliary Input &amp; Output Status #2</td>
</tr>
<tr>
<td>62</td>
<td>Retarder Inhibit Status</td>
<td>155</td>
<td>Auxiliary Input &amp; Output Status #1</td>
</tr>
<tr>
<td>65</td>
<td>Service Brake Switch Status</td>
<td>162</td>
<td>Transmission Range Selected</td>
</tr>
<tr>
<td>68</td>
<td>Torque Limiting Factor</td>
<td>163</td>
<td>Transmission Range Attained</td>
</tr>
<tr>
<td>70</td>
<td>Parking Brake Switch Status</td>
<td>164</td>
<td>Injection Control Pressure</td>
</tr>
<tr>
<td>71</td>
<td>Idle Shutdown Timer Status</td>
<td>166</td>
<td>Rated Engine Power</td>
</tr>
<tr>
<td>72</td>
<td>Blower Bypass Valve Position/Blower Bypass Door Position</td>
<td>168</td>
<td>Battery Potential (Voltage)</td>
</tr>
<tr>
<td>73</td>
<td>Auxiliary Water Pump Pressure</td>
<td>171</td>
<td>Ambient Air Temperature</td>
</tr>
<tr>
<td>74</td>
<td>Vehicle Speed Set Limit</td>
<td>172</td>
<td>Air Inlet Temperature</td>
</tr>
<tr>
<td>81</td>
<td>Exhaust Back Pressure</td>
<td>173</td>
<td>Exhaust Temperature</td>
</tr>
<tr>
<td>83</td>
<td>Vehicle Speed Limit Status</td>
<td>174</td>
<td>Fuel Temperature</td>
</tr>
<tr>
<td>84</td>
<td>Vehicle Speed</td>
<td>175</td>
<td>Engine Oil Temperature</td>
</tr>
<tr>
<td>85</td>
<td>Cruise Control Switch Status</td>
<td>182</td>
<td>Trip Fuel</td>
</tr>
<tr>
<td>86</td>
<td>Cruise Control Set Speed</td>
<td>183</td>
<td>Fuel Rate</td>
</tr>
<tr>
<td>87</td>
<td>Cruise Control High Limit</td>
<td>184</td>
<td>Instantaneous Fuel Economy, (mile/gal)</td>
</tr>
<tr>
<td>88</td>
<td>Cruise Control Low Limit</td>
<td>185</td>
<td>Average Fuel Economy, (mile/gal)</td>
</tr>
<tr>
<td>89</td>
<td>VSG Switch Status</td>
<td>187</td>
<td>PTO Set Speed</td>
</tr>
<tr>
<td>91</td>
<td>Percent Throttle</td>
<td>188</td>
<td>Idle Engine Speed</td>
</tr>
<tr>
<td>92</td>
<td>Percent Engine Load</td>
<td>189</td>
<td>Rated Engine Speed</td>
</tr>
<tr>
<td>93</td>
<td>Output Torque</td>
<td>190</td>
<td>Engine Speed</td>
</tr>
<tr>
<td>94</td>
<td>Fuel Delivery Pressure</td>
<td>191</td>
<td>Transmission Output Shaft Speed</td>
</tr>
<tr>
<td>95</td>
<td>Fuel Filter Differential Pressure</td>
<td>192</td>
<td>Multi-sectioned Parameter</td>
</tr>
<tr>
<td>98</td>
<td>Engine Oil Level</td>
<td>194</td>
<td>Transmitter System Diagnostic Code and Occurrence Count Table</td>
</tr>
<tr>
<td>99</td>
<td>Oil Filter Differential Pressure</td>
<td>196</td>
<td>Diagnostic Data/Count Clear Response</td>
</tr>
<tr>
<td>100</td>
<td>Engine Oil Pressure</td>
<td>222</td>
<td>Anti-Theft</td>
</tr>
<tr>
<td>101</td>
<td>Crankcase Pressure</td>
<td>228</td>
<td>Speed Sensor Calibration</td>
</tr>
<tr>
<td>102</td>
<td>Turbo Boost Pressure</td>
<td>233</td>
<td>Unit Number</td>
</tr>
<tr>
<td>103</td>
<td>Turbo Speed</td>
<td>234</td>
<td>Software Identification</td>
</tr>
<tr>
<td>105</td>
<td>Intake Manifold Temperature</td>
<td>235</td>
<td>Total Idle Hours</td>
</tr>
<tr>
<td>106</td>
<td>Air Inlet Pressure</td>
<td>236</td>
<td>Total Idle Fuel Used</td>
</tr>
<tr>
<td>107</td>
<td>Air Filter Differential Pressure</td>
<td>237</td>
<td>Vehicle Identification Number (VIN)</td>
</tr>
<tr>
<td>108</td>
<td>Barometric Pressure</td>
<td>240</td>
<td>Last Customer Calibration Change Hours</td>
</tr>
</tbody>
</table>

Table 6-4  SAE J1587 PIDs Provided by DDEC IV (continued)
6.2.3 SAE J1587 PIDS REQUIRING DDEC ACTION

DDEC will respond to data requests per the J1587 PID requests shown in the next sections.

Data Request

The format for a data request is shown below.

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>a</td>
<td>Parameter number of the requested parameter</td>
</tr>
</tbody>
</table>

Component Specific Request

The format for a component specific request is shown below.

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>128</td>
<td>a</td>
<td>Parameter number of the requested parameter</td>
</tr>
<tr>
<td></td>
<td>b</td>
<td>MID of the component from which the parameter data is requested</td>
</tr>
</tbody>
</table>

NOTE:
DDEC responds with the appropriate data provided the MID in byte (b) matches the MID stored in calibration. The primary MID for DDEC IV is 128. Engines with 12 and 16 cylinders use MID 128 and MID 175. Engines with 20 or 24 cylinders use MID 128, MID 175 and MID 183.

Retarder Status Request

Electronic transmissions may indicate the status of the transmission output retarder to DDEC by using the following message:

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>a</td>
<td>Transmission output retarder status</td>
</tr>
</tbody>
</table>

Bits 2-1 Output retarder status

<table>
<thead>
<tr>
<th>Bits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>off</td>
</tr>
<tr>
<td>01</td>
<td>on</td>
</tr>
<tr>
<td>10</td>
<td>error</td>
</tr>
</tbody>
</table>

Bits 8-3 Reserved, Bits set to 1

comments: This parameter is supported in Release 4.00 or later.
Transmitter Data Request / Clear Count

The format for a transmitter data request is shown below.

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>195</td>
<td>n a b c</td>
</tr>
<tr>
<td></td>
<td>n - Number of parameter data characters = 3</td>
</tr>
<tr>
<td></td>
<td>a - MID of the device to which the request is directed</td>
</tr>
<tr>
<td></td>
<td>b - SID or PID of a standard diagnostic code</td>
</tr>
<tr>
<td></td>
<td>c - Diagnostic code number</td>
</tr>
</tbody>
</table>

- Bits: 1 - 4 Failure mode identifier (FMI) of a standard diagnostic code
- Bit: 5 Byte (b) identifier
  - 1 - Byte (b) is a Subsystem Identifier (SID)
  - 0 - Byte (b) is a Parameter Identifier (PID)
- Bit: 6 Type of diagnostic code
  - 1 - Standard diagnostic code
  - 0 - Reserved for expansion diagnostic codes
- Bit: 7, 8 Request an ASCII descriptive message for the given diagnostic code.
  - 01 - Request count be cleared for the given diagnostic code on the device with the given MID.
  - 10 - Request counts be cleared for all diagnostic codes on the device with the given MID. The diagnostic code given in this transmission is ignored.
  - 11 - Request additional diagnostic information for the given diagnostic code, the content of which is defined under PID 196.

**NOTE:**
DDEC responds with the appropriate data using PID 196.

source: ECM calculated; outputs represent intended state

**PID 256 (255 0) Page 2 Data Request**

The format for Page 2 data requests is shown below.

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>a</td>
</tr>
<tr>
<td></td>
<td>a - Parameter number of the requested parameter from Page 2</td>
</tr>
</tbody>
</table>
J1587 Outputs - Single Byte Parameters

**PID 18 - Extended Range Fuel Pressure**
- update rate: 1 time/s
- resolution: 4 kPa/Bit (Uns/SI)
- source: Fuel Pressure Sensor
- comments: This PID is used to provide a wider range of pressure values than that provided with PID 94. This parameter is available with Release 24.00 software or later.

**PID 19 - Extended Range Engine Oil Pressure**
- update rate: 1 time/s
- resolution: 4 kPa/Bit (Uns/SI)
- source: Engine Oil Pressure Sensor
- sensor range: 0 to 145 psi
- comments: This PID is used to provide a wider range of pressure values than that provided with PID 100. This parameter is available with Release 24.00 software or later.

**PID 20 - Extended Range Coolant Pressure**
- update rate: 1 time/s
- resolution: 2 kPa/Bit (Uns/SI)
- source: Coolant Pressure Sensor
- comments: This PID is used to provide a wider range of pressure values than that provided with PID 109. This parameter is available with Release 24.00 software or later.
**PID 44** - Attention/Warning Indicator Lamps Status

update rate: 10 time/s or 1 time/s when changing

format:

Bit: 1,2 Stop Engine Light Status
00 - off
01 - on
10 - error
11 - Not Available

Bit: 3,4 Check Engine Light Status
00 - off
01 - on
10 - error
11 - Not Available

Bit: 5-8 Reserved, All Bits set to 1

**PID 48** - Extended Range Barometric Pressure

update rate: 1 time/s
resolution: 0.6 kPa/Bit (Uns/SI)
source: Barometric Pressure Sensor or Turbo Boost Pressure Sensor

**PID 51** - Throttle Position

update rate: 5 time/s
resolution: 0.4%/Bit (Uns/SI)
source: Throttle Position Sensor
comments: This parameter identifies the position of the value used to regulate the supply of a fluid, usually air or fuel/air mixture, to an engine - 0% represents no supply.

**PID 52** - Engine Intercooler Temperature

update rate: 1 time/s
resolution: 1 °F/Bit (Uns/SI)
source: Engine Intercooler Temperature Sensor
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**PID 62 - Retarder Inhibit Status**
- **update rate:** On request
- **format:**
  - Bits: 1, 2  Retarder Inhibit Status
    - 00 - Off (not Inhibited)
    - 01 - On (Inhibited)
  - Bits: 3-8  Uncommitted, all Bits set to 1
- **source:** Digital output for Engine Brake Enable
- **comments:** Used with the Engine Brake outputs.

**PID 65 - Service Brake Status**
- **update rate:** 1 time/s
- **format:**
  - Bits: 1, 2  Service Brake Status
    - 00 - off
    - 01 - on
  - Bits: 3-8  Uncommitted, all Bits set to 1
    - Bits 3-8 = 1
- **source:** Service Brake Switch

**PID 68 - Torque Limiting Factor**
- **update rate:** 1 time/s
- **resolution:** 0.5%/Bit (Uns/SI)
- **source:** ECM calculated.
- **comments:** This parameter indicates the amount of engine protection torque reduction that is in effect.

**PID 70 - Parking Brake Switch Status**
- **update rate:** 1 time/s
- **format:**
  - Bits: 8  Parking Brake Switch Status
    - 0 - off
    - 1 - on
  - Bits: 1-7  Uncommitted, all Bits set to 0
- **source:** Parking Brake Switch
**PID 71 - Idle Shutdown Timer Status**

update rate: 1 time/s

format:

Bit: 1  
   Idle Shutdown Override ("Driver Alert")  
   1 - Active

Bit: 2  
   Engine Has Shutdown by Idle Timer to  
   1 - Yes

Bit: 3  
   Idle Timer Shutdown Override  
   1 - Active (Idle Shutdown has been overridden)

Bit: 4  
   Idle shutdown timer function  
   1 - Enabled in calibration  
   0 - Disabled in calibration

Bit: 8  
   Idle Shutdown Timer Status  
   1 - Active

Bits: 5-7  
   All Bits set to 0

source: ECM calculated

**PID 72 - Blower Bypass Valve Position**

update rate: 2 times/s

resolution: 0.4%/Bit (Uns/SI)

source: Blower Bypass Valve Position sensor

comments: Electronically controlled blower bypass valves are used on Methanol engines.

**PID 73 - Auxiliary Water Pump Pressure**

update rate: 1 time/s

resolution: 2 psi/Bit (Uns/SI)

source: Water Pump Pressure Sensor

comments: The auxiliary Water Pump Pressure system is used on fire trucks with DDEC pressure control. The transmitted value is gage pressure.

**PID 74 - Vehicle Speed Set Limit (Road Speed Limiting)**

update rate: On request only

resolution: 0.5 mph/Bit (Uns/SI)

source: Calibration value (customer defined)

comments: Vehicle Speed Limiting is a customer option.

**PID 81 — Exhaust Back Pressure**

update rate: 1 time/sec.

resolution: 0.169 kPa/Bit (Uns/SI)

comments: Update rate is different than that specified by SAE (every 10 sec.)
**PID 83 - Vehicle Speed Limit Status**
update rate: 1 time/s
format:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Vehicle Speed Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1 - Active</td>
</tr>
<tr>
<td>Bits 1-7</td>
<td>All Bits set to 0</td>
</tr>
</tbody>
</table>

source: ECM calculated
comments: Vehicle Speed Limiting is a customer option.

**PID 84 - Vehicle Speed**
update rate: 10 times/s
resolution: 0.5 mph/Bit (Uns/SI)
source: Vehicle Speed Sensor input
comments: Transmitted only if the Vehicle Speed Sensor is configured.
**PID 85 - Cruise Control Switch Status**

update rate: 10 times/s

format:

On/Off Switch
Bit: 1
1-On
0-Off

Set Switch
Bit: 2
1-Off
0-On

Coast Switch
Bit: 3
1-Off
0-On

Resume Switch
Bit: 4
1-Off
0-On

Accel Switch
Bit: 5
1-Off
0-On

Brake Switch
Bit: 6
1-Off
0-On

Clutch Switch
Bit: 7
1-Off
0-On

Cruise Active
Bit: 8
1-On
0-Off

source: Cruise Control switch inputs

comments: Cruise Control status (Bit 8) is not cleared if Cruise Control is active but being overridden by the throttle.

**PID 86 - Cruise Control Set Speed**

update rate: 0.1 times/s, 5 times/s when the set speed is changing

resolution: 0.5 mph/Bit (Uns/SI)

source: Cruise Control switch inputs

comments: Transmitted if Vehicle Speed Cruise control is enabled.

**PID 87 - Cruise Control High Set Limit**

update rate: On request only

resolution: 0.5 mph/Bit (Uns/SI)

source: Calibration value (customer define)

comments: Transmitted if Vehicle Speed Cruise control is enabled.
**PID 88** - Cruise Control Low Set Limit
update rate: On request only
resolution: 0.5 mph/Bit (Uns/SI)
source: Calibration value
comments: Transmitted if Vehicle Speed Cruise control is enabled.

**PID 89** - VSG Switch Status
update rate: 1 time/s
format:

<table>
<thead>
<tr>
<th>Bit</th>
<th>On/off switch</th>
<th>Set switch</th>
<th>Coast switch</th>
<th>Resume switch</th>
<th>Accel switch</th>
<th>Brake</th>
<th>Clutch</th>
<th>VSG</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Off</td>
<td>0-Off</td>
<td>0-Off</td>
<td>0-Off</td>
<td>0-Off</td>
<td>0-Off</td>
<td>0-Off</td>
<td>0-Off</td>
</tr>
<tr>
<td>1</td>
<td>On</td>
<td>1-On</td>
<td>1-On</td>
<td>1-On</td>
<td>1-On</td>
<td>1-On</td>
<td>1-On</td>
<td>1-On</td>
</tr>
</tbody>
</table>

source: VSG switch inputs/ECM calculated
comments: Transmitted when either the Pressure Sensor Governor, Cruise-Switch VSG or analog VSG is configured.

**PID 91** - Percent Throttle
update rate: 10 times/s
resolution: 0.4%/Bit (Uns/SI)
source: Throttle Sensor input
**PID 92** - Percent Engine Load
update rate: 10 times/s
resolution: 0.5%/Bit (Uns/SI)
source: ECM calculated
comments: Percent engine load is the ratio of actual torque and the minimum of the requested torque and digital torque limit.

**PID 93** - Output Torque
update rate: 1 time/s
resolution: 20 ft-lb/Bit (S/SI)
source: ECM calculated

**PID 94** - Fuel Delivery Pressure
update rate: 1 time/s
resolution: 0.5 psi/Bit (Uns/SI)
source: Fuel Pressure Sensor

**PID 95** - Fuel Filter Differential Pressure
update rate: 0.1 time/s
resolution: 0.25 psi/Bit (Uns/SI)
source: Fuel Filter Differential Pressure Sensor
comments: This parameter is available with Release 24.00 software or later.

**PID 98** - Engine Oil Level
update rate: 0.1 time/s
resolution: 0.5%/Bit (Uns/SI)
source: Oil Level Sensor

**PID 99** - Oil Filter Differential Pressure
update rate: 0.1 time/s
resolution: 0.0625 psi/Bit (Uns/SI)
source: Oil Filter Differential Pressure Sensor
comments: This parameter is available with Release 24.00 software or later.

**PID 100** - Engine Oil Pressure
update rate: 1 time/s
resolution: 0.5 psi/Bit (Uns/SI)
source: Oil pressure sensor
sensor range: 0 to 65 psi
COMMUNICATION PROTOCOLS

**PID 101 - Crankcase Pressure**
- update rate: 1 time/s
- resolution: 0.125 psi/Bit (S/SI)
- source: Crankcase pressure sensor
- comments: Some engine applications use a discrete switch in place of a full range sensor. In these applications, the crankcase pressure data transmitted on the J1587 data link is not a true representation of crankcase pressure.

**PID 102 - Turbo Boost Pressure (Gage)**
- update rate: 2 times/s
- resolution: 0.125 psi/Bit (Uns/SI)
- source: Turbo Boost Pressure Sensor
- comments: Update rate is different than that specified by SAE (1 time/sec)

**PID 103 - Turbo Speed**
- update rate: 1 time/s
- resolution: 500 rpm/Bit (Uns/SI)
- source: Turbo Speed Sensor

**PID 105 - Intake Manifold Temperature**
- update rate: 1 time/s
- resolution: 1' F/Bit (Uns/SI)
- source: Intake Manifold Temperature Sensor

**PID 106 - Air Inlet Pressure**
- update rate: 1 time/s
- resolution: 0.25 psi/Bit (Uns/SI)
- source: Air Inlet Pressure Sensor or Boost Pressure Sensor (Series 2000 and Series 4000 only before Release 21.0, Series 50 and Series 60 beginning with Release 21.0)

**PID 107 - Air Filter Differential Pressure**
- update rate: 0.1 time/s
- resolution: 0.2 in.H₂O/Bit (Uns/SI)
- source: Air Filter Differential Pressure Sensor
- comments: This parameter is available with Release 24.00 software or later.

**PID 108 - Barometric Pressure**
- update rate: 1 time/s
- resolution: 0.0625 psi/Bit (Uns/SI)
- source: Barometric Pressure Sensor or ECM calculated
**PID 109 - Coolant Pressure**
update rate: 1 time/s
resolution: 0.125 psi/Bit (Uns/SI)
source: Coolant Pressure Sensor

**PID 110 - Coolant Temperature**
update rate: 1 time/s
resolution: 1 °F/Bit (Uns/SI)
source: Coolant Temperature Sensor
sensor range: 0 to 300 °F

**PID 111 - Coolant Level**
update rate: 10 times/s
resolution: 0.5%/Bit (Uns/SI) (or full = 100%, low = 0%)
source: Coolant Level Sensor
comments: If the Add Coolant Level Sensor (ACLS) is installed with the Engine Protection Coolant Level Sensor (CLS), the coolant level will be:
100% When both sensors are in coolant
50% When the ACLS is out of the coolant
0% When both sensors are out of the coolant
If only the CLS is configured:
100% Full
0% Low

**PID 113 - Engine Governor Droop**
update rate: On request only
resolution: 2 rpm/Bit (Uns/SI)
source: Calibration value

**PID 121 - Engine Retarder Status**
update rate: 1 time/s (5 times/s when changing)
format:
Bit: 1 1 - 2 cylinders active
Bit: 2 1 - 3 cylinders active
Bit: 3 1 - 4 cylinders active
Bit: 4 1 - 6 cylinders active
Bit: 5 1 - 8 cylinders active
Bit: 8 1 - Retarder active
comments: Transmitted only if engine brakes are configured.
**PID 122** - Engine Retarder Percent
update rate: 1 time/s
resolution: 0.5%Bit (Uns/SI)
source: ECM calculated
comments: This parameter is available with Release 5.00 or later

**PID 351** (255 95) - Turbo Compressor Inlet Temperature
update rate: 1 time/s
resolution: 1°F/Bit (Uns/SI)
comments: This parameter is available with Rel 33.0 software or later.

**PID 354** (255 98) - Relative Humidity
update rate: Every 10 seconds
resolution: 0.4%Bit (Uns/SI)
comments: This parameter is available with Rel 33.0 software or later.

**Double Byte Parameters**

**PID 147** - Average Fuel Economy — Natural Gas
update rate: every 10 seconds
resolution: 1/512 km/kg per bit (Uns/I)

**PID 148** - Instantaneous Fuel Economy — Natural Gas
update rate: 5 times/s
resolution: 1/512 km/kg per bit (Uns/I)

**PID 149** - Fuel Mass Flow Rate — Natural Gas
update rate: 5 times/s
resolution: 0.125 kg/hr per bit (Uns/I)

**PID 153** - Crankcase Pressure
update rate: 1 time/s
resolution: 0.0078125 kPa/Bit (S/I)
comments: Some engine applications use a discrete switch in place of a full range sensor. In these applications, the crankcase pressure data transmitted on the J1587 data link is not a true representation of crankcase pressure. This PID is used to provide crankcase pressure with better resolution than that provided with PID 101. This parameter is available with Release 3.00 software or later.
**PID 154 - Auxiliary Input and Output status #2**

_update rate:_ On request

_format:_

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>154</td>
<td>a b</td>
</tr>
</tbody>
</table>

**a - Auxiliary Input Status**

Bit: 1, 2  Torque/RPM Limiting Switch
00 - Off
01 - On
10 - Error Condition
11 - Not Available

Bit: 4-3  Stop Engine Override Switch
00 - Off
01 - On
10 - Error Condition
11 - Not Available

Bit: 5, 6  A/C Disengaged
00 - Off
01 - On
10 - Error Condition
11 - Not Available

Bit: 8-7  Reserved

**b - Auxiliary Output Status**

Bit: 1, 2  Fan Control #2
00 - Off
01 - On
10 - Error Condition
11 - Not Available

Bit: 3, 4  Reserved

Bit: 5, 6  Reserved

Bit: 7, 8  Reserved

**source:** ECM calculated; outputs represent intended state

**PID 155 - Auxiliary Input and Output status #1**

_update rate:_ On request

_format:_

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>154</td>
<td>a b</td>
</tr>
</tbody>
</table>

**a - Auxiliary Input Status**

Bit: 1, 2  Jake Brake Low Switch
00 - Off
01 - On
10 - Error Condition
11 - Not Available

Bit: 3, 4  Jake Brake Medium Switch
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

Bit: 5, 6  Idle Validation Switch
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

Bit: 7, 8  Throttle Inhibit Switch
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

b - Auxiliary Output Status

Bit: 1, 2  Vehicle Power Shutdown
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

Bit: 3, 4  Starter Lockout
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

Bit: 5, 6  Coolant Level Low Light
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

Bit: 7, 8  Fan Control #1
 00 - Off
 01 - On
 10 - Error Condition
 11 - Not Available

source: ECM calculated; outputs represent intended state
**PID 162** - Transmission Range Selected

update rate: 2 times/s  
format: aa - Transmission Range Selected (ASCII)  
comments: Transmitted only when the transmission type is a Meritor ESS (17-22). Characters sent will be 0, L, 1, 2, ..., 15. If only one character is required, the second character will be used and the first character will be a space. Whenever a target gear is not selected a "0" will be transmitted.

**PID 163** - Transmission Range Attained

update rate: 2 times/s  
format: aa - Transmission Range Attained (ASCII)  
comments: Transmitted only when the transmission type is a Meritor ESS (17-22). Characters sent will be 0, L, 1, 2, ..., 15. If only one character is required, the second character will be used and the first character will be a space. Whenever a target gear is not selected a "0" will be transmitted.

**PID 164** - Injection Control Pressure

update rate: 1 time/s  
resolution: 1/256 MPa (Uns/I)  
source: Injection Pressure Sensor

**PID 166** - Engine Horsepower Rating

update rate: On request only  
resolution: 1 bhp/Bit (Uns/I)  
source: Calibration value

**PID 168** - Battery Voltage

update rate: 1 time/s  
resolution: 0.05 volts/Bit (Uns/I)  
source: Battery voltage measured at input to ECM  
comments: The ECM input battery voltage does fluctuate as injectors fire and will require filtering if used for display purposes.

**PID 171** - Ambient Air Temperature

update rate: 1 time/s  
resolution: 0.25°F/Bit (S/I)  
source: ECM estimated
**PID 172** - Air Inlet Temperature
update rate: 1 time/s
resolution: 0.25°F/Bit (S/I)
source: Air Temperature Sensor
sensor range: -40 to 175°F

**PID 173** — Exhaust Temperature
update rate: 1 time/sec
resolution: 0.25°F/Bit (S/I)

**PID 174** - Fuel Temperature
update rate: 1 time/s
resolution: 0.25°F/Bit (S/I)
source: Fuel Temperature Sensor
sensor range: -40 to 175°F

**PID 175** - Engine Oil Temperature
update rate: 1 time/s
resolution: 0.25°F/Bit (S/I)
source: Oil temperature sensor
sensor range: -40 to 300°F

**PID 182** - Trip Fuel
update rate: 0.1 times/s
resolution: 0.125 gal/Bit (Uns/I)
source: ECM calculated

**PID 183** - Fuel Rate
update rate: 5 times/s
resolution: 1/64 gal/hour/Bit (Uns/I)
source: ECM calculated

**PID 184** - Instantaneous Fuel Economy (MPG)
update rate: 5 times/s
resolution: 1/256 mpg/Bit (Uns/I)
source: ECM calculated
comments: Transmitted only if the Vehicle Speed Sensor is configured.
**PID 185** - Average Fuel Economy (MPG)
update rate: 0.1 times/s
resolution: 1/256 mpg/Bit (Uns/I)
source: ECM calculated
comments: Trip information from DDEC requires that the Vehicle Speed Sensor is enabled.

**PID 187** - VSG Set Speed
update rate: 0.1 times/s, 5 times per s when the set speed is changing
resolution: 0.25 rpm/Bit (Uns/I)
source: VSG switch input
comments: Used to indicate the current set speed from:
- Analog VSG
- Cruise Switch VSG
- Engine Speed Cruise Control
- Pressure Governor Mode - RPM or pressure
- Engine Sync. Mode (marine applications)

**PID 188** - Idle Set Speed
update rate: On request only
resolution: 0.25 rpm/Bit (Uns/I)
source: Calibration value

**PID 189** - Rated Engine Speed
update rate: On request only
resolution: 0.25 rpm/Bit (Uns/I)
source: Calibration value

**PID 190** - Engine Speed
update rate: 10 times/s
resolution: 0.25 rpm/Bit (Uns/I)
source: ECM calculated

**PID 191** - Transmission Output Shaft Speed
update rate: 10 times/s
resolution: 0.25 rpm/Bit (Uns/I)
source: Transmitted when configured for Meritor ESS transmissions only.

**PID 404** (255 148) - Turbo Compressor Out Temperature
update rate: 1 times/s
resolution: 0.25°F/Bit (S/I)
**PID 411 (255 155) - EGR Delta Pressure**
update rate: 1 time/s  
resolution: 0.0078125 kPa/Bit (S/I)  
comments: This parameter is available with Rel 33.0 software or later.

**PID 412 (255 156) - EGR Temperature**
update rate: 1 time/s  
resolution: 0.25°F/Bit (S/I)  
comments: This parameter is available with Rel 33.0 software or later.

**PID 439 (255 183) - Extended Range Boost Pressure**
update rate: 1 time/s  
resolution: 0.125 kPa/Bit (UnS/I)  
comments: This parameter is available with Rel 36.0 software or later.
Variable Length Parameters

**PID 192** - Multi-Section Parameter

**update rate:** Used to transmit messages that are greater than 21 bytes in length.

**format:**

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>192</td>
<td>n a b c/d c c c c</td>
</tr>
</tbody>
</table>

- Byte count of data that follows this character. This excludes characters MID, PID 192 and n but it includes a, b, c, or d type character.
- PID specifying the parameter that has been sectioned.
  The last section number (total number of sections minus ONE) and the current section number. The upper nibble contains the current section number (1 to 15). The lower nibble contains the current section number and is limited to the range 0 to 15. Section numbers are assigned in ascending order.
- Data portion of the sectioned parameter. May be 1 to 14 characters in the first packet. May be 1 to 15 characters in the middle and ending packets.
- Byte count of the total data portion. This character is sent only in the first packet. The values are limited to 239 or less but must be greater than 17.

**comment:** PID 192 is used to section any DDEC message that exceeds 21 bytes while the engine is running, in particular PID 194, PID 196, and PID 243. If the engine is stopped, DDEC may transmit messages up to 40 bytes in length.
**PID 194 - Transmitter System Diagnostic Code / Occurrence Count Table**

update rate: On Request only

format:

**PID**

194

**Data**

n a b c a b c a b c a b c...

n - Byte count of data that follows this character. This excludes characters MID, PID 194 and n but includes a, b, c type characters.

a - SID or PID of a standard diagnostic code.

b - Diagnostic code character

**Bits: 1-4**

FMI of a standard diagnostic code

**Bit: 5**

Byte (a) Identifier

1 - Byte (a) is a SID

0 - Byte (a) is a PID

**Bit: 6**

Type of Diagnostic Code

1 - standard diagnostic code

0 - expansion diagnostic codes (PID/SID from page 2)

**Bit: 7**

Current Status of Fault

1 - fault is inactive

0 - fault is active

**Bit: 8**

Occurrence count

1 - count is included

0 - count is not included

c - Occurrence count for the diagnostic code defined by the preceding 2 characters. The maximum occurrence count is 255. Bit 8 of byte (b) of the diagnostic code is used to determine if it is included.

source: ECM calculated

comment: Diagnostic codes are transmitted periodically while active. When the active code becomes inactive, the code is transmitted once to indicate that the fault became inactive. Inactive diagnostic codes are available by request of PID 194. If more than 6 codes are active at any point, PID 194 is sectioned as described in PID 192.
**PID 196 - Diagnostic Data/count clear response**

**update rate:** On Request only

**format:**

```
<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>196</td>
<td>n a b c c c c c</td>
</tr>
</tbody>
</table>
```

Byte count of data that follows this character. This excludes characters MID, PID 194 and n but includes a, b, and c type characters.

- **n** - SID or PID of a standard diagnostic code
- **a** - Diagnostic Code Character
  - Bits 1-4 - FMI of a standard diagnostic code
  - Bit 5 - Byte (a) identifier
    - 1 - Byte (a) is a SID
    - 0 - Byte (a) is a PID
  - Bit 6 - Type of diagnostic code
    - 1 - standard diagnostic code
    - 0 - expansion diagnostic codes (PID/SID from page 2)
  - Bit 7-8 - Action
    - Message is an ASCII descriptive message for the given diagnostic code.
    - 01 - The count has been cleared for the given diagnostic code.
    - 10 - All clearable diagnostic counts have been cleared for this device.
    - Message is additional diagnostic information for the given diagnostic code, as defined below.

- **c** = Additional information (if applicable)
  - c1-c5 - ATA/VMRS (DTDSC)
  - c6, c7 - Engine hours the code was first logged (LSB first)
    - format: 1 h/Bit.
    - range - 0-65535 hours.
  - c8, c9 - Calendar date (Month, Day) the code was first logged, if available.
  - c10, c11 - Clock time the code was first logged (hours, minutes), if available.
  - c12, c13 - Engine hours the code last became active (LSB first).
  - c14, c15 - Calendar date (Month, Day) the code last became active, if available.
  - c16, c17 - Clock time the code last became active (hours, minutes), if available.

All information subject to change without notice. (Rev. 3/05)
**PID 196** - Diagnostic Data/count clear response  
update rate: On Request only  
format:  
PID | Data  
c18, c19 - Number of ss the code has been active (LSB first).  
format: $ss = 1 \text{s/Bit}$  
range = 0-65535 (18.2 hours)  
Value remains at 65535 ss once it has been reached.  
c20 - Number of Stop Engine Override Switch restarts while the code was active. The value remains at 255 once it has been reached.  
c21+ = Optional associated parameter value (scaled as defined in J1587)  
For temperatures, pressures, and voltages with FMI 0  
- Highest value achieved  
For temperatures, pressures, and voltages with FMI 1  
- Lowest value achieved  
For engine speed with FMI 0 - Highest speed achieved  
For vehicle speed with FMI 0 or 11 - Highest speed achieved  
Last byte = checksum  
source: ECM calculated  
comment: The date and time that the code last became inactive (bytes c14-c17) will be transmitted as zero if the code is currently active. This data may be sectioned using PID 192.

**PID 228** - Speed Sensor Calibration  
update rate: On Request only  
format:  
PID | Data  
228 | n a a a a  
n = number of bytes: 4  
a = Speed Sensor Calibration 1 pulse/mi (Uns/LI)  
source: Calculated from calibration values
**PID 229**- Total Fuel — Natural Gas  
update rate: On Request  
format:  
<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>229</td>
<td>n a a a a</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
  n = number of bytes: 4  
a = total fuel used  
resolution: 0.5 kg per bit (Uns/LI)

**PID 230**- Total Idle Fuel Used — Natural Gas  
update rate: On Request  
format:  
<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>230</td>
<td>n a a a a</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
  n = number of bytes: 4  
a = total fuel used  
resolution: 0.5 kg per bit (Uns/LI)

**PID 231**- Trip Fuel — Natural Gas  
update rate: Every 10 seconds  
format:  
<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>231</td>
<td>n a a a a</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
  n = number of bytes: 4  
a = trip fuel  
resolution: 0.5 kg per bit (Uns/LI)

**PID 233**- Unit Number (Power Unit)  
update rate: On Request only  
format:  
<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>231</td>
<td>n a a a . . .</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
  n = number of bytes: 10  
a = unit number in alphanumeric ASCII characters  
comment: This parameter is available with Release 20.00 software or later
**PID 234** - Software Identification
update rate: On Request only
format:

```
PID  234 n a a b c c
    n = number of bytes: 5
    a = Major software release level in ASCII
    b = ASCII "."
```
Example: "01.05" is interpreted as Major release 1, Minor release 5
source: ECM calculated
comment: This parameter is available with Release 3.00 software or later

**PID 235** - Total Idle Hours
update rate: On Request only
format:

```
PID  235 n a a a a
    n = number of bytes: 4
    a = Total idle hours; scaled 0.05 hours/Bit (Uns/LI)
```
source: ECM calculated
comment: Accumulates time while the engine is operating at idle.

**PID 236** - Total Idle Fuel Used
update rate: On Request only
format:

```
PID  236 n a a a a
    n = number of bytes: 4
    a = Idle fuel used; scaled 1/8 gallons/Bit (Uns/LI)
```
source: ECM calculated
comment: Accumulates while the engine is operating at idle.
**PID 237**- Vehicle Identification Number (VIN)
update rate: On Request only
format:

```
PID 237 n a a a ...  
n = number of bytes: up to 17
a = VIN in ASCII characters
```
source: Calibration value

**PID 240**- Last Customer Calibration Change Hours
update rate: On Request only
format:

```
PID 240 n a a a a  
n = number of bytes: 4
a = Last customer calibration change hours; scaled 0.05 h/Bit (Uns/LI)
```
source: ECM calculated
comment: Used to identify the last customer reprogramming occurrence, stored in engine hours.

**PID 243**- Device Identification
update rate: On Request only
format:

```
PID 243 n a b b b b c d d d d d d e f f f f f f f f  
n = number of bytes: 26
a = component ID = MID
b = ATA/VMRS manufacturer ID (5 bytes)
c = delimiter: ASCII ‘*’
d = engine model number (8 bytes)
e = delimiter: ASCII ‘*’
f = engine serial number (10 bytes)
```
source: Calibration value
comment: This parameter may be sectioned using PID 192.
**PID 244 - Trip Miles**

update rate: 0.1 times/s

format:

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>244</td>
<td>n a a a a</td>
</tr>
</tbody>
</table>

- **n** = number of bytes: 4
- **a** = trip miles 0.1 mile/Bit (Uns/LI)

source: ECM calculated

comment: Transmitted only if the vehicle speed sensor is configured.

---

**PID 245 - Total Miles**

update rate: 0.1 times/s

format:

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>245</td>
<td>n a a a a</td>
</tr>
</tbody>
</table>

- **n** = number of bytes: 4
- **a** = total miles, 0.1 mile/Bit (Uns/LI)

source: ECM calculated

comment: Transmitted only if the vehicle speed sensor is configured.

---

**PID 247 - Total Engine Hours**

update rate: On request only

format:

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>247</td>
<td>n a a a a</td>
</tr>
</tbody>
</table>

- **n** = number of bytes: 4
- **a** = total engine hours 0.05 hour/Bit (Uns/LI)

source: ECM calculated

comment: Used to identify the total hours that the engine is operating. Time accumulated while the engine speed is above 60 rpm.
**PID 248** - Total VSG Hours  
**update rate:** On request only  
**format:**  
```
  PID   Data  
248   n a a a a  
  n =   number of bytes: 4  
  b =   total VSG hours 0.05 hour/Bit (Uns/LI)  
**source:** ECM calculated  
**comment:** Used to identify total engine hours the engine is operating in the following modes:  
- Hand throttle VSG  
- High idle using cruise switches  
- Pressure governor mode: either RPM or pressure

**PID 249** - Total Engine Revolutions  
**update rate:** On request only  
**format:**  
```
  PID   Data  
249   n a a a a  
  n =   number of bytes: 4  
  a =   total engine revolutions 1000 revolutions/Bit (Uns/SI)  
**comment:** This parameter is available with Release 20.00 software or later

**PID 250** - Total Fuel Used  
**update rate:** On request only  
**format:**  
```
  PID   Data  
250   n a a a a  
  n =   number of bytes: 4  
  a =   total fuel used 0.125 gal/Bit (Uns/LI)  
**source:** ECM calculated

All information subject to change without notice. (Rev. 3/05)
**PID 251-** Clock

update rate: On request only

format:

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>251</td>
<td>n a b c</td>
</tr>
</tbody>
</table>

n = number of bytes: 3
a = Seconds 0.25 sec/Bit, range 0 to 59.75 seconds
b = Minutes 1.0 min/Bit, range 0 to 59 minutes
c = Hours 1.00 hour/Bit, range 0 to 23 hours

comment: Transmitted if clock data is considered valid. The time is broadcast in Greenwich Mean Time. This parameter is available with Release 20.00 software or later.

**PID 252-** Date

update rate: On request only

format:

<table>
<thead>
<tr>
<th>PID</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>252</td>
<td>n a b c</td>
</tr>
</tbody>
</table>

n = number of bytes: 3
a = Day 0.25 day/Bit, range 1 to 31.75 days
b = Month 1.0 month/Bit, range 1 to 12 months
c = Year - 1985 1.00 year/Bit, range 0 to 99

comment: Day of the month is scaled such that 0 is a null value, values 1, 2, 3, and 4 are the first day of the month, 5, 6, 7, 8, are the second day of the month, etc. Transmitted if clock data is considered valid. This parameter is available with Release 20.00 software or later.
6.3 SAE J1922

Circuits 800 (Data Link +) and 801 (Data Link-) as shown on the communications harness schematic are used as the J1922 communication link.

6.3.1 MESSAGE FORMAT

A complete description of the DDEC IV parameters is provided within this section of the manual. DDEC IV transmits parametric data at SAE J1922 recommended rates in packed message form. The first byte or character of each J1922 message is the Message Identification Character (MID). The MID is used to identify the source of a data transmission and identify the type of data being transmitted.

6.3.2 SAE J1922 PARAMETERS AVAILABLE WITH DDEC IV

DDEC IV supports the J1922 message identifiers (MIDs) listed in Table 6-5.

<table>
<thead>
<tr>
<th>MID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>Engine to powertrain message</td>
</tr>
<tr>
<td>70</td>
<td>Engine to powertrain initialization message</td>
</tr>
<tr>
<td>74</td>
<td>Transmission to powertrain message</td>
</tr>
<tr>
<td>76</td>
<td>Transmission to powertrain initialization request message</td>
</tr>
<tr>
<td>79</td>
<td>ABS/traction control to powertrain message</td>
</tr>
<tr>
<td>81</td>
<td>ABS/traction control to powertrain initialization request message</td>
</tr>
<tr>
<td>83</td>
<td>Retarder to powertrain message</td>
</tr>
<tr>
<td>84</td>
<td>Retarder to powertrain initialization message</td>
</tr>
</tbody>
</table>

Table 6-5  SAE J1922 MIDs Supported by DDEC

6.3.3 SAE J1922 MIDS

The following sections identify the MIDs supported by DDEC.
Engine to Powertrain

Byte 1 069  MID - Engine to powertrain
Byte 2 ---  Percent torque value scaled 1% of peak torque/Bit - S/SI
Byte 3 ---  Accelerator pedal position scaled 0.392%/Bit (100/255%/Bit) - Uns/SI
Byte 4 ---  Control/status byte
  Bit 1 Cruise control status
      1: cruise control active
      0: cruise control inactive
  Bit 2 VSG control status
      1: VSG active
      0: VSG inactive
  Bit 3 Road speed limit status
      1: road speed limit active
      0: road speed limit inactive
  Bit 4 Retarder control status
      1: engine retarder enabled
      0: engine retarder not enabled
  Bit 5 AP kickdown switch
      1: in kickdown position
      0: not in kickdown position
  Bit 6 AP low idle switch
      1: in low idle position
      0: not in low idle position
  Bit 7 Engine parameter change
  Bit 8 Reserved
      1: parameters have changed
      0: current parameters valid
Byte 5 ---  Engine's desired RPM scaled 16 rpm/Bit - Uns/SI
Byte 6 ---  Desired RPM asymmetry adjustment scaled as a ratio - Uns/SI
Byte 7 ---  Checksum

If either the transmission messages or the ABS messages are enabled, DDEC shall transmit this message 20 times per second.
### Engine Initialization Response

<table>
<thead>
<tr>
<th>Byte</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>070</td>
<td>MID - Engine initialization response</td>
</tr>
<tr>
<td>2,3</td>
<td>---</td>
<td>Engine speed at idle (warm condition) scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>4</td>
<td>---</td>
<td>Percent of peak torque at idle scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td>5,6</td>
<td>---</td>
<td>Rated engine speed scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>7</td>
<td>---</td>
<td>Percent of peak torque at rated engine speed scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td>8,9</td>
<td>---</td>
<td>Engine speed at point 3 scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>10</td>
<td>---</td>
<td>Percent of peak torque at point 3 scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td>11,12</td>
<td>---</td>
<td>Engine speed at point 4 scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>13</td>
<td>---</td>
<td>Percent of peak torque at point 4 scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td>14,15</td>
<td>---</td>
<td>Engine speed at point 5 scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>16</td>
<td>---</td>
<td>Percent of peak torque at point 5 scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td>17,18</td>
<td>---</td>
<td>Engine speed at peak torque scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>19</td>
<td>---</td>
<td>Peak torque of engine scaled 10 lb-ft/Bit - Uns/SI</td>
</tr>
<tr>
<td>20,21</td>
<td>---</td>
<td>Engine speed at high idle scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td>22</td>
<td>---</td>
<td>Maximum engine override speed scaled 16 rpm/Bit - Uns/SI</td>
</tr>
<tr>
<td>23</td>
<td>---</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

DDEC transmits this message in response to the initialization request messages defined in "Transmission Initialization Request" and "ABS/Traction Control Initialization Request."
### Transmission to Powertrain Message

<table>
<thead>
<tr>
<th>Byte</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
<td>074</td>
<td>MID - transmission to powertrain</td>
</tr>
<tr>
<td>Byte 2</td>
<td>---</td>
<td>Control/status byte</td>
</tr>
<tr>
<td>Bit 1,2</td>
<td></td>
<td>Override control mode</td>
</tr>
<tr>
<td></td>
<td>00:</td>
<td>override disabled</td>
</tr>
<tr>
<td></td>
<td>01:</td>
<td>engine speed control</td>
</tr>
<tr>
<td></td>
<td>10:</td>
<td>engine torque control</td>
</tr>
<tr>
<td></td>
<td>11:</td>
<td>engine speed/torque limit</td>
</tr>
<tr>
<td>Bit 3</td>
<td></td>
<td>Retarder enable</td>
</tr>
<tr>
<td></td>
<td>1:</td>
<td>enable retarder</td>
</tr>
<tr>
<td></td>
<td>0:</td>
<td>disable retarder</td>
</tr>
<tr>
<td>Bit 4</td>
<td></td>
<td>Momentary high idle enable</td>
</tr>
<tr>
<td></td>
<td>1:</td>
<td>override enabled</td>
</tr>
<tr>
<td></td>
<td>0:</td>
<td>override disabled</td>
</tr>
<tr>
<td>Bit 5</td>
<td></td>
<td>Driveline engaged (ignored by DDEC)</td>
</tr>
<tr>
<td></td>
<td>1:</td>
<td>driveline engaged</td>
</tr>
<tr>
<td></td>
<td>0:</td>
<td>driveline disengaged</td>
</tr>
<tr>
<td>Bit 6</td>
<td></td>
<td>Transmission retarder status (ignored by DDEC)</td>
</tr>
<tr>
<td></td>
<td>1:</td>
<td>retarder active</td>
</tr>
<tr>
<td></td>
<td>0:</td>
<td>retarder inactive</td>
</tr>
<tr>
<td>Bit 7,8</td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>Byte 3</td>
<td>---</td>
<td>When mode is as follows</td>
</tr>
<tr>
<td></td>
<td>00:</td>
<td>Not broadcast</td>
</tr>
<tr>
<td></td>
<td>01:</td>
<td>Desired engine speed (LSB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td></td>
<td>10:</td>
<td>Not broadcast</td>
</tr>
<tr>
<td></td>
<td>11:</td>
<td>Engine speed upper limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>scaled 16 rpm /Bit - Uns/SI</td>
</tr>
<tr>
<td>Byte 4</td>
<td>---</td>
<td>When mode</td>
</tr>
<tr>
<td></td>
<td>00:</td>
<td>Not broadcast</td>
</tr>
<tr>
<td></td>
<td>01:</td>
<td>Desired engine speed (MSB)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>scaled 0.0625 rpm/Bit - Uns/I</td>
</tr>
<tr>
<td></td>
<td>10:</td>
<td>Desired torque value scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td></td>
<td>11:</td>
<td>Percent torque upper limit scaled 1% of peak torque/Bit - S/SI</td>
</tr>
<tr>
<td>Byte 5</td>
<td>---</td>
<td>Output shaft speed scaled 16 rpm/Bit - Uns/SI</td>
</tr>
<tr>
<td>Byte 6</td>
<td>---</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

The desired speed request requires a zero droop operation, regardless of the droop calibrated for either the rated speed governor or the VSG governor. While the transmission is requesting an override control mode other than override disabled (00), the messages are expected to be repeated on a continuous basis. DDEC will maintain the most recent requested control mode until a request to disable override (00) is received or a timeout period has elapsed without any request from the transmission, at which point DDEC will revert to its normal (override disabled) state.
Requests to disable the retarder (Bit 3 of byte 2) and override momentary high idle (Bit 4 of byte 2) follow the same strategy. DDEC will maintain the most recent requested state until a new request is received or a timeout period has elapsed without any request from the transmission. The default state for the retarder is enabled and for override momentary high idle is disabled.

NOTE:
This message has a variable length.

Transmission Initialization Request

<table>
<thead>
<tr>
<th>Byte 1</th>
<th>076</th>
<th>MID - transmission initialization request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 2</td>
<td></td>
<td>Status/enable byte</td>
</tr>
<tr>
<td>Bit 1</td>
<td>1</td>
<td>= request engine initialization message</td>
</tr>
<tr>
<td>Bit 2</td>
<td></td>
<td>= request trans. initialization message (ignored by DDEC)</td>
</tr>
<tr>
<td>Bit 3</td>
<td></td>
<td>= request ABS initialization message (ignored by DDEC)</td>
</tr>
<tr>
<td>Bit 4</td>
<td></td>
<td>= request retarder initialization message</td>
</tr>
<tr>
<td>Bit 5-7</td>
<td></td>
<td>Reserved</td>
</tr>
<tr>
<td>Bit 8</td>
<td>1</td>
<td>= progressive shift disable</td>
</tr>
<tr>
<td>Byte 3</td>
<td>---</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

If enabled, DDEC responds to this request with the initialization messages defined in "Engine Initialization Response" and "Retarder Initialization Response" as appropriate. Once a progressive shift indication (allow or disallow) is transmitted, this state is maintained until a subsequent request from the transmission changes the state or a new ignition cycle begins.
ABS/Traction Control To Powertrain

Byte 1 079 MID - ABS/Traction control to powertrain
Byte 2 --- Control/status byte
Bit 1,2 Override control mode
  00: override disabled
  01: engine speed control
  10: engine torque control
  11: engine torque limit
Bit 3 Retarder or engine control select
  1: retarder control
  0: engine fueling control
Bit 4 Gear shift disable (ignored by DDEC)
  1: Inhibit gear shifts
  0: allow shifts
Bit 5 Retarder disable
  1: disable retarders
  0: enable retarders
Bit 6 Torque converter lock up disable (ignored by DDEC)
  1: disable lock up clutch
  0: enable lock up clutch
Bit 7 Request to neutral (ignored by DDEC)
  1: request de-clutch to neutral
  0: allow normal operation
Bit 8 Reserved
 Byte 3 --- When mode is as follows:
  00: Not broadcast
  01: Desired engine speed value scaled 16 rpm/Bit - Uns/SI
  10: Desired % peak torque value scaled 1% of peak torque/Bit - S/SI
  11: Percent torque upper limit scaled 1% of peak torque/Bit - S/SI
Byte 4 --- Checksum

While the traction control system is requesting a override control mode other than override disabled (00), the messages are expected to be repeated on a continuous basis. DDEC will maintain the most recent requested engine control mode and/or retarder control mode until a request to disable override (00) is received or a timeout period has elapsed without any request from the traction control system, at which point DDEC will revert to its normal (override disabled) state.
Requests to disable the retarder (Bit 5 of byte 2) follow the same strategy. DDEC will maintain the most recent requested state until a new request is received or a timeout period has elapsed without any request from the traction control system. The default state for the retarder is enabled. The retarder request is honored independent of the particular control select (Bit 3 of byte 2) in effect.

NOTE:
The retarder disable request applies to all retarder types; external engine retarder, DDEC controlled engine retarder, and transmission retarder.

DDEC will ignore requests from the ABS system when the transmission type is a Meritor ESS and the transmission is performing a shift.

DDEC will honor requests for both retarder control (Bit 3 of byte 2 = 1) and engine control (Bit 3 of byte 2 = 0). For retarder control, the percent of peak torque request will be translated into engine brake low, medium and high as follows:

- 0%: no braking or disable retarder
- 1% to 33%: low braking
- 34% to 66%: medium braking
- 67% to 100%: high braking

Low, medium and high braking modes only apply when DDEC controls the engine brake directly. A request of 0% torque may apply to either direct engine brake control by DDEC or indirect engine brake control.

NOTE:
This message has a variable length.

ABS/Traction Control Initialization Request

| Byte 1 | 081 | MID - ABS/Traction control initialization request |
| Byte 2 | --- | Status/enable byte |
| Bit 1  | 1  | request engine initialization message |
| Bit 2  | 1  | request transmission initialization message (ignored by DDEC) |
| Bit 3  | 1  | request ABS initialization message (ignored by DDEC) |
| Bit 4  | 1  | request retarder initialization message |
| Bit 5-8| Reserved |
| Byte 3 | --- | Checksum |

If enabled, DDEC responds to this request with the initialization messages defined in "Engine Initialization Response" and "Retarder Initialization Response" as appropriate.
Retarder to Powertrain

Byte 1  083  MID - Retarder to powertrain
Byte 2  ---  Retarder status byte
Bit 1  Retarder active/inactive
   1: retarder active
   0: retarder inactive
Bit 2  Retarder operational status
   1: retarder selected
   0: not selected
Bit 3,4 For future use
Bit 5-8 Retarding level status
   0000: Off
   0101: Active in low (33%)
   1010: Active in medium (66%)
   1111: Active in high (100%)
Byte 3  ---  Checksum

If either the transmission messages or the ABS/ASR messages are enabled and digital outputs are configured for DDEC controlled engine brake operation, DDEC shall transmit this message 10 times per second.

Retarder Initialization Response

Byte 1  084  MID - Retarder initialization response
Byte 2  ---  Type of retarder
Bit 1  Reserved - sent as 0
Bit 2  1 = Engine compression release
Bit 3-7 Not applicable for DDEC - sent as 0
Bit 8  Reserved - sent as 0
Byte 3  ---  Peak torque of retarder (10 lb·ft/Bit) - Uns/SI
Byte 4  ---  Checksum

If either the transmission messages or the ABS/ASR messages are enabled and digital outputs are configured for DDEC controlled engine brake operation, DDEC transmits this message in response to the initialization request messages defined in "Transmission Initialization Request" and "ABS/Traction Control Initialization Request."
6.4 SAE J1939

Circuits 925 (CAN_H/J1939 [+]), 926 (CAN_L/J1939 [-]) and 927 (CAN_SHLD/J1939 Shield) as shown on the communications harness schematic are used as the J1939 communication link. See Figure 6-1.

6.4.1 MESSAGE FORMAT

The message format uses the parameter group number as the label for a group of parameters. Each of the parameters within the group can be expressed in ASCII, as scaled data, or as function states consisting of one or more Bits. Alphanumeric data will be transmitted with the most significant byte first. Other parameters consisting of two or more data bytes shall be transmitted least significant byte first. The type of data is also identified for each parameter.

The following sections identify the parameters that are supported by DDEC, parameter group number response definitions (refer to section 6.4.2) and parameter group number command definitions (refer to section 6.4.3).

**Figure 6-1 Communication Harness**
6.4.2 SAE J1939/71 APPLICATION LAYER

The Application Layer Parameter Group Number (PGN) response definitions are described in the following sections.

Electronic Engine Controller #1 – EEC1

Transmission Rate: Engine Speed Dependent
Data Length: 8 bytes
Data Page: 0
PDU format: 240
PDU specific: 4
Default priority: 3
PGN: 61,444 (0x00F004)

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Status_EEC1</td>
</tr>
<tr>
<td></td>
<td>Bits: 8-5</td>
</tr>
<tr>
<td></td>
<td>Bits: 4-1</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Drivers Demand Engine - Pct Torque (SPN 512)</td>
</tr>
<tr>
<td></td>
<td>Resolution: 1% / Bit, -125% offset</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Actual Engine - Percent Torque (SPN 513)</td>
</tr>
<tr>
<td></td>
<td>Resolution: 1% / Bit, -125% offset</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bytes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,5</td>
<td>Engine Speed (SPN 190)</td>
</tr>
<tr>
<td></td>
<td>Resolution: 0.125 rpm / Bit, 0 rpm offset</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Source address of controlling device for engine control (SPN 1483)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Bits: 8–5</td>
</tr>
<tr>
<td></td>
<td>Bits: 1–4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Engine Demand–Percent Torque – N/A</td>
</tr>
</tbody>
</table>
Electronic Engine Controller #2 – EEC2

Transmission Rate: 50 ms
Data Length: 8 bytes
Data Page: 0
PDU format: 240
PDU specific: 3
Default priority: 3
PGN: 61,443 (0x00F003)

Byte: 1 Status_EEC2
   Bits: 8-5 Not Defined (Transmitted as 1111)
   Bits: 4-3 AP Kickdown Switch (SPN 559)
       00: Kickdown Passive
       01: Kickdown Active
       11: Not Configured
   Bits: 2,1 AP Low Idle Switch (SPN 558)
       00: Not In Low Idle Condition
       01: In Low Idle Condition
       10: Error Detected
       11: Not Configured

Byte: 2 Accelerator Pedal Position (TPS) (SPN 91)
Resolution: 0.4% / Bit, 0% offset

Byte: 3 Percent Load At Current Speed (SPN 92)
Resolution: 1% / Bit, 0% offset

Byte: 4 Remote Accelerator–N/A

Bytes: 5-8 Not Defined

Idle Operation — IO

Transmission Rate: On Request
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 220
Default priority: 6
PGN: 65,244 (0x00FEDC)

Bytes: 1-4 Total Idle Fuel Used (SPN 236)
Resolution: 0.5 L / Bit, 0 L offset

Bytes: 5-8 Total Idle Hours (SPN 235)
Resolution: 0.05 hr / Bit, 0 hr offset
**Turbocharger — TC**

Transmission Rate: 1 sec  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 221  
Default priority: 6  
PGN: 65, 245 (0x00FEDD)  

Byte: 1  Turbo Oil Pressure - N/A  
Bytes: 2,3  Turbo Speed (SPN 103)  
Resolution: 4 rpm / Bit, 0 rpm offset  
Byte: 4  Bits: 8–7  Turbo Oil Level Switch-N/A  
Bits: 6–1  Not Defined  
Bytes: 5-8  Not Defined

**Electronic Engine Controller #3 – EEC3**

Transmission Rate: 250 ms  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 253  
PDU specific: 211  
Default priority: 6  
PGN: 65,247 (0x00FEDF)  

Byte: 1  Nominal Friction - Percent Torque (SPN 514)  
Resolution: 1% / Bit, -125% offset  
Bytes: 2,3  Engine's Desired Operating Speed (SPN 515)  
Resolution: 0.125 rpm / Bit, 0 rpm offset  
Byte 4:  Engine's Desired Operating Speed Asymmetry Adjustment (SPN 519)  
  ratio 0 to 250  
Byte: 5  Engine Controlled Cooling Fan Losses — Percent Torque (SPN 2978)  
Resolution: 1%/Bit, -125% offset  
NOTE: Release 32.0 or later  
Bytes: 6–8  Not Defined
Vehicle Distance — VD

Transmission Rate: On Request
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 224
Default priority: 6
PGN: 65,248 (0x00FEE0)
Bytes: 1-4 Trip Distance (SPN 244)
   Resolution: 0.125 km / Bit, 0 km offset
Bytes: 5-8 Total Vehicle Distance (SPN 245)
   Resolution: 0.125 km / Bit, 0 km offset

Idle Shutdown — Shutdown

Transmission Rate: 1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 228
Default priority: 6
PGN: 65,252 (0x00FEE4)
Byte: 1 Idle shutdown_1
   Bits: 8,7 Idle Shutdown Timer State (SPN 590)
      00: Inactive
      01: Active
   Bits: 6,5 Idle Shutdown Timer Override (SPN 592)
      00: Inactive
      01: Active
   Bits: 4,3 Driver Alert Mode (SPN 594)
      00: Inactive
      01: Active
   Bits: 2,1 Engine Has Shutdown by Idle Shutdown (SPN 593)
      00: Engine has not shutdown by idle shutdown
      01: Engine has shutdown by idle shutdown

Byte: 2 Idle shutdown_2
   Bits: 8,7 Idle Shutdown Timer Function (SPN 591)
      00: Disabled in Calibration
      01: Enabled in Calibration
   Bits: 6-1 Not Defined

Byte: 3 Bits: 8,7 Not Defined

All information subject to change without notice. (Rev. 3/05)
Bits: 6,5 Refrigerant High Pressure Switch- N/A
Bits: 4,3 Refrigerant Low Pressure Switch- N/A
Bits: 2,1 A/C High Pressure Fan Switch-N/A

Byte: 4 Lamp_commands - N/A

Byte: 5 Engine Shutdown_1 (SPN 1107)

Bits: 8,7 Engine Protection Shutdown Timer State
  00:Timer not Active
  01:Timer Active

Bits: 6,5 Engine Protection Shutdown Override (SPN 1108)
  00:Override Off
  01:Override On

Bits: 4,3 Engine Shutdown Approaching - N/A

Bits: 2,1 Engine Has Shutdown By Engine Protection System (SPN 1110)
  00:Not Shutdown
  01:Has Shutdown

Byte: 6 Engine Shutdown_2

Bits: 8,7 Engine Protection System Configured (SPN 1111)
  00:Not Enabled In Calibration
  01:Enabled In Calibration

Bits: 6-1 Not Defined

Bytes: 7-8 Not Defined

---

**Engine Hours, Revolutions — Hours**

Transmission Rate: On Request
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 229
Default priority: 6
PGN: 65,253 (0x00FEE5)

Bytes: 1-4 Total Engine Hours (SPN 247)
Resolution: 0.05 h / Bit, 0 h offset

Bytes: 5-8 Total Engine Revolutions (SPN 249)
Resolution: 1000 revs / Bit, 0 revs offset
**Time/Date — TD**

Transmission Rate: On Request  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 230  
Default priority: 6  
PGN: 65,254 (0x00FEE6)  

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Resolution</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seconds (SPN 959)</td>
<td>0.25 sec / Bit</td>
<td>0 sec offset</td>
</tr>
<tr>
<td>2</td>
<td>Minutes (SPN 960)</td>
<td>1 min / Bit</td>
<td>0 min offset</td>
</tr>
<tr>
<td>3</td>
<td>Hours (SPN 961)</td>
<td>1 hour / Bit</td>
<td>0 h offset</td>
</tr>
<tr>
<td>4</td>
<td>Month (SPN 963)</td>
<td>1 month / Bit</td>
<td>0 month offset</td>
</tr>
<tr>
<td>5</td>
<td>Day (see Note) (SPN 962)</td>
<td>0.25 day / Bit</td>
<td>0 day offset</td>
</tr>
<tr>
<td>6</td>
<td>Year (SPN 964)</td>
<td>1 year / Bit</td>
<td>1985 year offset</td>
</tr>
<tr>
<td>7</td>
<td>Local Minute Offset</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Local Hour Offset</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**  
The Day field represents days elapsed (e.g. 1/1/98 at 12:00 am would be 0 for byte 5 (Day) and 1/1/98 at 1:00 pm would be 2 for byte 5 and 1/15/98 at 1:00 pm would be 62 for byte 5).

**Vehicle Hours — VH**

Transmission Rate: On Request  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 231  
Default priority: 6  
PGN: 65,255 (0x00FEE7)  

<table>
<thead>
<tr>
<th>Bytes</th>
<th>Description</th>
<th>Resolution</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>Total Vehicle Hours -N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-8</td>
<td>Total Power Takeoff Hours (SPN 248)</td>
<td>0.05 h / Bit</td>
<td>0 h offset</td>
</tr>
</tbody>
</table>
**Fuel Consumption (Liquid) — LFC**

Transmission Rate: On Request  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 233  
Default priority: 6  
PGN: 65,257 (0x00FEE9)  

- Byte: 1-4  Trip Fuel (SPN 182)  
  Resolution: 0.5 L / Bit, 0 L offset  
- Bytes: 5-8  Total Fuel Used (SPN 250)  
  Resolution: 0.5 L / Bit, 0 L offset

**Cruise Control / Vehicle Speed Setup — CCSS**

Transmission Rate: On Request  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 237  
Default priority: 6  
PGN: 65,261 (0x00FEED)  

- Byte: 1  Maximum Vehicle Speed Limit (SPN 74)  
  Resolution: 1 km/h / Bit, 0 km/h offset  
- Byte: 2  Cruise Control High Set Limit Speed (SPN 87)  
  Resolution: 1 km/h / Bit, 0 km/h offset  
- Byte: 3  Cruise Control Low Set Limit Speed (SPN 88)  
  Resolution: 1 km/h / Bit, 0 km/h offset  
- Bytes: 4-8  Not Defined
Engine Temperature #1—ET1

Transmission Rate: 1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 238
Default priority: 6
PGN: 65,262 (0x00FEEE)

Byte 1: Engine Coolant Temperature (SPN 110)
Resolution: 1°C / Bit, -40°C offset

Byte 2: Fuel Temperature (SPN 174)
Resolution: 1°C / Bit, -40°C offset

Bytes 3,4: Engine Oil Temperature (SPN 175)
Resolution: 0.03125°C / Bit, -273°C offset

Bytes 5,6: Turbo Oil Temperature—N/A

Byte 7: Engine Intercooler Temperature (SPN 52)
Resolution: 1°C / Bit, -40°C offset

Byte 8: Engine Intercooler Thermostat Opening—N/A

Engine Fluid Level/Pressure #1—EFL/P1

Transmission Rate: 0.5 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 239
Default priority: 6
PGN: 65,263 (0x00FEEF)

Byte 1: Fuel Delivery Pressure (SPN 94)
Resolution: 4 kPa / Bit, 0 kPa offset

Byte 2: Extended Crankcase Blowby Pressure—N/A

Byte 3: Engine Oil Level (SPN 98)
Resolution: 0.4% / Bit, 0% offset

Byte 4: Engine Oil Pressure (SPN 100)
Resolution: 4 kPa / Bit, 0 kPa offset

Byte 5,6: Crankcase Pressure (SPN 101)
Resolution: 0.0078125 kPa / Bit (1/128 kPa / Bit), -250 kPa offset

Byte 7: Coolant Pressure (SPN 109)
Resolution: 2 kPa / Bit, 0 kPa offset

Byte 8: Coolant Level (SPN 111)
Resolution: 0.4% / Bit, 0% offset
### Power Takeoff Information — PTO

Transmission Rate: 100 ms  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 240  
Default priority: 6  
PGN: 65,264 (0x00FEF0)  

**Byte: 1** Power Takeoff Oil Temperature - N/A  
**Byte: 2,3** Power Takeoff Speed - N/A  
**Byte: 4,5** Power Takeoff Set Speed (SPN 187)  
  - Resolution: 0.125 rpm / Bit, 0 rpm offset  
**Byte: 6** Measured_PTO_1  
  - Bits: 8,7 Not Defined  
  - Bits: 6,5 Remote PTO Variable Speed Control Switch - N/A  
  - Bits: 4,3 Remote PTO Preprogrammed Speed Control  
    - 00: Switch Off  
    - 01: Switch On  
    - 11: Not Configured  
**Byte: 7** Measured_PTO_2  
  - Bits: 8,7 PTO Accelerate Switch (SPN 981)  
    - 00: Switch Off  
    - 01: Switch On  
    - 11: Not Configured  
  - Bits: 6,5 PTO Resume Switch (SPN 982)  
    - 00: Switch Off  
    - 01: Switch On  
    - 11: Not Configured  
  - Bits: 4,3 PTO Coast/Decelerate Switch (SPN 983)  
    - 00: Switch Off  
    - 01: Switch On  
    - 11: Not Configured  
**Byte: 8** Not Defined
Cruise Control / Vehicle Speed — CCVS

Transmission Rate: 100 ms
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 241
Default priority: 6
PGN: 65,265 (0x00FEF1)

Byte: 1 Measured_SW1
Bits: 8,7 Not Defined
Bits: 6,5 Cruise Control Pause Switch—N/A
Bits: 4,3 Parking Brake Switch (SPN 70)
  00: Park Brake Not Set
  01: Park Brake Set
  11: Not Configured

Bits: 2,1 Two Speed Axle Switch - N/A.

Byte: 2,3 Wheel Based Vehicle Speed (SPN 84)
Resolution: 1/256 km/h / Bit, 0 km/h offset (1/412 mph / Bit, 0 mph offset)

Byte: 4 Measured_CC_SW1
Bits: 8,7 Clutch Switch (SPN 598)
  00: Clutch Pedal Released
  01: Clutch Pedal Depressed
  10: Error
  11: Not Configured

Bits: 6,5 Brake Switch (SPN 597)
  00: Brake Pedal Released
  01: Brake Pedal Depressed
  11: Not Configured

Bits: 4,3 Cruise Control Enable Switch (SPN 596)
  00: Cruise Control Disabled
  01: Cruise Control Enabled
  10: Error
  11: Not Configured

Bits: 2,1 Cruise Control Active(SPN 595)
  00: Cruise Control Off
  01: Cruise Control On
  11: Not Configured

Byte: 5 Measured_CC_SW2
Bits: 8,7 Cruise Control Accelerate Switch (SPN 602)
  00: Accelerate Switch Off
  01: Accelerate Switch On
Bits: 6,5  Cruise Control Resume Switch (SPN 601)
  00: Resume Switch Off
  01: Resume Switch On
  10: Error
  11: Not Configured

Bits: 4,3  Cruise Control Coast Switch (SPN 600)
  00: Coast Switch Off
  01: Coast Switch On
  10: Error
  11: Not Configured

Bits: 2,1  Cruise Control Set Switch (SPN 599)
  00: Set Switch Off
  01: Set Switch On
  10: Error
  11: Not Configured

Byte: 6  Cruise Control Set Speed (SPN 86)
Resolution: 1 km/h / Bit, 0 km/h offset

Byte: 7  State_CC

Bits: 8–6  Cruise Control State (SPN 527)
  000: Off/Disabled
  001: Hold
  010: Accelerate
  011: Decelerate/Coast
  100: Resume
  101: Set
  110: Accelerator Override
  111: Not Available

Bits: 5–1  PTO State (SPN 976)
  00000: Off/Disabled
  00001: Hold (PTO Mode is Active)
  Note: Rel 38.0 or later

Byte: 8  Measured_idle_SW1

Bits: 8,7  Engine Shutdown Override Switch (SPN 1237)
  00: Off
  01: On
  11: Not Configured
  Note: Rel 36.0 or later

Bits: 6,5  Engine Test Mode Switch - N/A

Bits: 4,3  Idle Decrement Switch - N/A

Bits: 2,1  Idle Increment Switch - N/A
Fuel Economy (Liquid) – LFE

Transmission Rate: 100 ms
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 242
Default priority: 6
PGN: 65,266 (0x00FEF2)

Bytes: 1,2 Fuel Rate (SPN 183)
Resolution: 0.05 L/h / Bit, 0 L/h offset

Bytes: 3,4 Instantaneous Fuel Economy (SPN 184)
Resolution: 1/512 km/L / Bit, 0 km/L offset

Bytes: 5,6 Average Fuel Economy (SPN 185)
Resolution: 1/512 km/L / Bit, 0 km/L offset

Bytes: 7 Throttle Plate Position (Natural Gas) (SPN 51)
Resolution: 0.4%/bit, 0% offset
Note: Rel 36.0 or later

Bytes: 8 Not Defined

Ambient Conditions – AMB

Transmission Rate: 1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 245
Default priority: 6
PGN: 65,269 (0x00FEF5)

Byte: 1 Barometric Pressure (SPN 108)
Resolution: 0.5 kPa / Bit, 0 kPa offset

Byte: 2 Cab Interior Temperature - N/A

Bytes: 4,5 Ambient Air Temperature (SPN 171)
Resolution: 0.03125°C / Bit, -273°C offset

Byte: 6 Air Inlet Temperature (SPN 172)
Resolution: 1°C / Bit, -40°C offset

Bytes: 7,8 Road Surface Temperature - N/A
**Inlet / Exhaust Conditions – IC**

Transmission Rate : 0.5 sec  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 246  
Default priority: 6  
PGN: 65,270 (0x00FEF6)  

- **Byte 1:** Particulate Trap Inlet Pressure - N/A  
- **Byte 2:** Boost Pressure (SPN 102)  
  Resolution: 2 kPa / Bit, 0 kPa offset  
- **Byte 3:** Intake Manifold Temperature (SPN 105)  
  Resolution: 1°C / Bit, -40°C offset  
- **Byte 4:** Air Inlet Pressure (SPN 106)  
  Resolution: 2 kPa / Bit, 0 kPa offset  
- **Byte 5:** Air Filter Differential Pressure (SPN 107)  
  Resolution: 0.05 kPa / Bit, 0 kPa offset  
- **Bytes 6,7:** Exhaust Gas Temperature (SPN 173)  
  Resolution: 0.03125°C / Bit, -273°C offset  
- **Byte 8:** Coolant Filter Differential Pressure - N/A

**Turbocharger Information #6 – TCI6**

Note: Rel 36.0 or later  
Transmission Rate : 1 sec  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 253  
PDU specific: 211  
Default priority: 6  
PGN: 64,979 (0x00FDD3)  

- **Bytes 1,2:** Turbocharger Compressor Outlet #1 Temperature (SPN 2629)  
  Resolution: 0.03125°C/bit, —273°C offset  
- **Bytes 3,4:** Turbocharger Compressor Outlet #2 Temperature – N/A  
- **Bytes 5,6:** Turbocharger Compressor Outlet #3 Temperature – N/A  
- **Bytes 7,8:** Turbocharger Compressor Outlet #4 Temperature – N/A
### Exhaust Port Temperature #1 – EPT1

- **Transmission Rate:** 1 sec
- **Data Length:** 8 bytes
- **Data Page:** 0
- **PDU Format:** 254
- **PDU Specific:** 163
- **Default Priority:** 7
- **PGN:** 65,187 (0x00FEA3)

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Resolution</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>Exhaust Gas Port 1 Temperature (SPN 1137)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
<tr>
<td>3, 4</td>
<td>Exhaust Gas Port 2 Temperature (SPN 1138)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
<tr>
<td>5, 6</td>
<td>Exhaust Gas Port 3 Temperature (SPN 1139)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
<tr>
<td>7, 8</td>
<td>Exhaust Gas Port 4 Temperature (SPN 1140)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
</tbody>
</table>

### Exhaust Port Temperature #2 – EPT2

- **Transmission Rate:** 1 sec
- **Data Length:** 8 bytes
- **Data Page:** 0
- **PDU Format:** 254
- **PDU Specific:** 162
- **Default Priority:** 7
- **PGN:** 65,186 (0x00FEA2)

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
<th>Resolution</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>Exhaust Gas Port 5 Temperature (SPN 1141)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
<tr>
<td>3, 4</td>
<td>Exhaust Gas Port 6 Temperature (SPN 1142)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
<tr>
<td>5, 6</td>
<td>Exhaust Gas Port 7 Temperature (SPN 1143)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
<tr>
<td>7, 8</td>
<td>Exhaust Gas Port 8 Temperature (SPN 1144)</td>
<td>0.03125°C/bit, –273°C offset</td>
<td></td>
</tr>
</tbody>
</table>
Exhaust Port Temperature #3 – EPT3

Transmission Rate: 1 sec
Data Length: 8 bytes
Data Page: 0
PDU Format: 254
PDU Specific: 161
Default Priority: 7
PGN: 65,185 (0x00FEA1)

- **Byte: 1, 2** Exhaust Gas Port 9 Temperature (SPN 1145)
  Resolution: 0.03125°C/bit, –273°C offset
- **Byte: 3, 4** Exhaust Gas Port 10 Temperature (SPN 1146)
  Resolution: 0.03125°C/bit, –273°C offset
- **Byte: 5, 6** Exhaust Gas Port 11 Temperature (SPN 1147)
  Resolution: 0.03125°C/bit, –273°C offset
- **Byte: 7, 8** Exhaust Gas Port 12 Temperature (SPN 1148)
  Resolution: 0.03125°C/bit, –273°C offset

Exhaust Port Temperature #4 – EPT4

Transmission Rate: 1 sec
Data Length: 8 bytes
Data Page: 0
PDU Format: 254
PDU Specific: 160
Default Priority: 7
PGN: 65, 184 (0x00FEA0)

- **Byte: 1, 2** Exhaust Gas Port 13 Temperature (SPN 1149)
  Resolution: 0.03125°C/bit, –273°C offset
- **Byte: 3, 4** Exhaust Gas Port 14 Temperature (SPN 1150)
  Resolution: 0.03125°C/bit, –273°C offset
- **Byte: 5, 6** Exhaust Gas Port 15 Temperature (SPN 1151)
  Resolution: 0.03125°C/bit, –273°C offset
- **Byte: 7, 8** Exhaust Gas Port 16 Temperature (SPN 1152)
  Resolution: 0.03125°C/bit, –273°C offset
Vehicle Electrical Power – VEP

Transmission Rate : 1 sec
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 247
Default priority: 6
PGN: 65,271 (0x00FEF7)
Byte: 1 Net Battery Current - N/A
Byte: 2 Alternator Current - N/A
Bytes: 3,4 Alternator Potential (voltage) - N/A
Bytes: 5,6 Electrical Potential (voltage) (SPN 168)
  Resolution: 0.05 V / Bit, 0 V offset
Bytes: 7,8 Battery Potential (Voltage), Switched - N/A

Alternate Fuel #1 – A1

Transmission Rate : 500 ms
Data Length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 253
Default priority: 6
PGN: 65,277 (0x00FEFD)
Byte: 1 Blower Bypass Valve Position (SPN 72)
  Resolution: 0.4% / Bit, 0% offset
Bytes: 2,3 Gas Supply Pressure (SPN 159)
  Resolution: 0.5 kPa/bit, 0 kPa offset
  Note: Rel 36.0 or later
Bytes: 4-8 Not Defined
COMMUNICATION PROTOCOLS

- **Auxiliary Water Pump Pressure – AWPP**
  - Transmission Rate: 1 sec
  - Data Length: 8 bytes
  - Data Page: 0
  - PDU format: 254
  - PDU specific: 254
  - Default priority: 6
  - PGN: 65,278 (0x00FEFE)
  - Byte: 1 Auxiliary Pump Pressure (SPN 73)
    - Resolution: 16 kPa / Bit, 0 kPa offset
  - Byte: 2-8 Not Defined

- **Engine Fluid Level/Pressure #2 – EFL/P2**
  - Transmission Rate: 500 ms
  - Data Length: 8 bytes
  - Data Page: 0
  - PDU format: 254
  - PDU specific: 219
  - Default priority: 6
  - PGN: 65,243 (0x00FEDB)
  - Bytes: 1,2 Injection Control Pressure - N/A
  - Bytes: 3,4 Injector Metering Rail Pressure (SPN 157)
    - Resolution: 1/256 MPa / Bit, 0 MPa offset
  - Bytes: 5,6 Injector Timing Rail 1 Pressure - N/A
  - Bytes: 7,8 Injector Metering Rail 2 Pressure - N/A

- **High Resolution Vehicle Distance – VDHR**
  - Transmission Rate: 1 sec
  - Data Length: 8 bytes
  - Data Page: 0
  - PDU format: 254
  - PDU specific: 193
  - Default priority: 6
  - PGN: 65,217 (0x00FEC1)
  - Bytes: 1-4 High Resolution Total Vehicle Distance (SPN 917)
    - Resolution: 5 m / Bit, 0 m offset (16.4 ft/Bit, 0 ft offset)
  - Bytes: 5-8 High Resolution Trip Distance (SPN 918)
    - Resolution: 5 m / Bit, 0 m offset (16.4 ft/Bit, 0 ft offset)
**Electronic Engine Controller #4 – EEC4**

<table>
<thead>
<tr>
<th>Transmission Rate</th>
<th>On Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Length:</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Data Page:</td>
<td>0</td>
</tr>
<tr>
<td>PDU format:</td>
<td>254</td>
</tr>
<tr>
<td>PDU specific:</td>
<td>190</td>
</tr>
<tr>
<td>Default priority:</td>
<td>6</td>
</tr>
<tr>
<td>PGN:</td>
<td>65,214 (0x00FEBE)</td>
</tr>
</tbody>
</table>

Bytes: 1,2  
**Rated Engine Power (SPN 166)**  
Resolution: 0.5 kW / Bit, 0 kW offset (0.67 hp / Bit, 0 hp offset)

Bytes: 3,4  
**Rated Engine Speed (SPN 189)**  
Resolution: 0.125 rpm / Bit, 0 rpm offset

Bytes: 5-8  
Not Defined
**Fan Drive – FD**

Transmission Rate : 1 sec  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 254  
PDU specific: 189  
Default priority: 6  
PGN: 65,213 (0x00FEBD)

**Byte: 1** Estimated Percent Fan Speed (SPN 975)  
Resolution: 0.4% / Bit, 0% offset

**Byte: 2** State_Fan_Drive  
Bits: 8-5 Not Defined  
Bits: 4-1 Fan Drive State (SPN 977)  
0000: Fan Off  
0001: Engine System - General  
0010: Excessive Engine Air Temperature  
0011: Excessive Engine Oil Temperature  
0100: Excessive Engine Coolant Temperature  
0101-1000: Not Defined  
1001: Manual Control  
1010: Transmission Retarder  
1011: A/C System  
1100: Timer  
1101: Engine Brake  
1110: Other  
1111: Not Available

**Bytes: 3,4** Fan Speed N/A  
**Bytes: 5-8** Not Defined
Electronic Retarder Controller #1 - ERC1

Transmission Rate: 100 ms
Data Length: 8 bytes
Data Page: 0
PDU format: 240
PDU specific: 0
Default priority: 6
PGN: 61,440 (0x00F000)

Byte: 1 Status ERC1
- Bits: 8,7 Retarder Enable - Shift Assist Switch - N/A
- Bits: 6,5 Retarder Enable - Brake Assist Switch - N/A
- Bits: 4-1 Engine/Retarder Torque Mode (SPN 900)
  0000: No Request (Default Mode)
  0001: Accelerator Pedal/Operator Selection
  0010: Cruise Control
  0011: PTO Governor
  0100: Road Speed Governor - N/A
  0101: ASR Control
  0110: Transmission Control
  0111: ABS Control
  1000: Torque Limiting - N/A
  1001: High Speed Governor - N/A
  1010: Braking System
  1011: Remote Accelerator - N/A
  1100: Not Defined
  1101: Not Defined
  1110: Other
  1111: Not Available

Byte: 2 Actual Retarder - Percent Torque (SPN 520)
Resolution: 1% / Bit, -125% offset

Byte: 3 Intended Retarder Percent Torque - N/A

Byte: 4 Coolant Load Increase
- Bits: 8-5 Not Defined
- Bits: 3,4 Retarder Requesting Brake Light–N/A
- Bits: 1,2 Engine Coolant Load Increase–N/A

Byte: 5 Source address of controlling device for retarder control (SPN 1480)

Byte: 6 Drivers Demand Retarder–Percent Torque–N/A

Byte: 7 Retarder Selection, non-engine–N/A

Byte: 8 Actual Maximum Available Retarder–Percent Torque–N/A

All information subject to change without notice. (Rev. 3/05)
Software Identification – SOFT

Transmission Rate: On Request
Data Length: 30 bytes
Data Page: 0
PDU format: 254
PDU specific: 218
Default priority: 6
PGN: 65,242 (0x00FEDA)

Byte 1: Number of Software Identification Fields - 7
Byte 2: 1st digit of Cal Major Version - ASCII
Byte 3: 2nd digit of Cal Major Version - ASCII
Byte 4: 3rd digit of Cal Major Version - ASCII
Byte 5: * - Delimiter
Byte 6: 1st digit of Cal Minor Version - ASCII
Byte 7: 2nd digit of Cal Minor Version - ASCII
Byte 8: 3rd digit of Cal Minor Version - ASCII
Byte 9: * - Delimiter
Byte 10: 1st Digit of Cal Edit Version - ASCII
Byte 11: 2nd Digit of Cal Edit Version - ASCII
Byte 12: 3rd Digit of Cal Edit Version - ASCII
Byte 13: * - Delimiter
Byte 14: 1st Digit of Edit Build Version - ASCII
Byte 15: 2nd Digit of Edit Build Version - ASCII
Byte 16: 3rd Digit of Edit Build Version - ASCII
Byte 17: * - Delimiter
Byte 18: Software Release Type - ASCII
   X - Experimental
   T - Pre-production
   R - Production
Byte 19: * - Delimiter
Byte 20: DDEC Hardware Version - ASCII
   3 – DDEC III, 4 – DDEC IV, 5 – DDEC V
Byte 21: * - Delimiter
Bytes 22-29: ECM Serial Number - ASCII
Byte 30: * - Delimiter
Component Identification – CI

Transmission Rate : On Request
Data Length: 37 bytes
Data Page: 0
PDU format: 254
PDU specific: 235
Default priority: 6
PGN: 65,259 (0x00FEEB)
Bytes: 1-5 DTDSC - ASCII
Byte: 6 * - Delimiter
Byte: 7-14 Engine Model Number - ASCII
Byte: 15 * - Delimiter
Byte: 16-25 Engine Serial Number - ASCII
Byte: 26 * - Delimiter
Byte: 27-36 Unit Number (VIN) - ASCII
Byte: 37 * - Delimiter
Retarder Configuration – RC

Transmission Rate: 5 sec or upon receipt of a destination specific request
Data Length: 19 bytes
Data Page: 0
PDU format: 254
PDU specific: 225
Default priority: 6
PGN: 65,249 (0x00FEE1)

Byte: 1 Type And Location
Bits: 8-5 Retarder Location (SPN 902)
   0000: Primary Engine Retarder For Compression Brakes
   0001: Primary Engine Retarder For Exhaust Brakes

Bits: 4-1 Retarder Type (SPN 901)
   0011: Compression Release (Engine Retarder)
   0100: Exhaust

Byte: 2 Retarder Control Method (SPN 557)
255 - when not configured
   0 - DVB
   1 - Konstantdrossel
   2 - Low/High Compression
   3 - Low/Med/High Compression

Bytes: 3, 4 Retarder Speed At Idle, Point 1 - N/A
Byte: 5 Percent Torque At Idle, Point 1 - N/A
Bytes: 6, 7 Maximum Retarder Speed, Point 2 - N/A
Byte: 8 Percent Torque At Maximum Speed, Point 2 - N/A
Bytes: 9, 10 Retarder Speed At Point 3 - N/A
Byte: 11 Percent Torque At Point 3 - N/A
Bytes: 12, 13 Retarder Speed At Point 4 - N/A
Byte: 14 Percent Torque At Point 4 - N/A
Bytes: 15,16 Retarder Speed At Peak Torque, Point 5 - N/A
Bytes: 17,18 Reference Retarder Torque - N/A
Bytes: 19 Percent Torque At Peak Torque, Point 5 - N/A

Engine Configuration – EC

Transmission Rate: 5 sec, on change of torque/speed points of more than 10% since last transmission, or upon receipt of a destination specific request.
Data Length: 34 bytes
Data Page: 0
PDU format: 254
PDU specific: 227
Default priority: 6
PGN: 65.251 (0x00FEE3)
Bytes: 1,2  Engine Speed At Idle, Point 1 (SPN 188)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 3  Percent Torque At Idle, Point 1 (SPN 539)
Resolution: 1% / Bit, -125% offset
Bytes: 4, 5  Engine Speed At Point 2 (SPN 528)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 6  Percent Torque At Point 2 (SPN 540)
Resolution: 1% / Bit, -125% offset
Bytes: 7,8  Engine Speed At Point 3 (SPN 529)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 9  Percent Torque At Point 3 (SPN 541)
Resolution: 1% / Bit, -125% offset
Bytes: 10, 11  Engine Speed At Point 4 (SPN 530)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 12  Percent Torque At Point 4 (SPN 542)
Resolution: 1% / Bit, -125% offset
Bytes: 13, 14  Engine Speed At Point 5 (SPN 531)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 15  Percent Torque At Point 5 (SPN 543)
Resolution: 1% / Bit, -125% offset
Bytes: 16, 17  Engine Speed At High Idle, Point 6 (SPN 532)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Bytes: 18, 19  (KP) Of Endspeed Governor - N/A
Bytes: 20, 21  Reference Engine Torque (SPN 544)
Resolution: 1 Nm / Bit, 0 Nm offset
Byte: 22, 23  Maximum Momentary Engine Override Speed, Point 7 (SPN 533)
Resolution: 0.125 rpm / Bit, 0 rpm offset
Byte: 24  Maximum Momentary Engine Override Time Limit (SPN 534)
Resolution: 0.1 s / Bit, 0 s offset
Byte: 25  Requested Speed Control Range Lower Limit - 300 RPM (SPN 535)
Resolution: 10 rpm / Bit, 0 rpm offset
Byte: 26  Requested Speed Control Range Upper Limit (SPN 536)
Resolution: 10 rpm / Bit, 0 rpm offset
Byte: 27  Requested Torque Control Range Lower Limit (SPN 537)
Resolution: 1% / Bit, -125% offset
Byte: 28  Requested Torque Control Range Upper Limit (SPN 538)
Resolution: 1% / Bit, -125% offset

All information subject to change without notice. (Rev. 3/05)

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Extended Range Requested Speed Control Range Upper Limit

Bytes: 29–30
(SPN 1712)
Note: Rel 36.0 or later
Resolution: 0.125 rpm/bit, 0 rpm offset

Bytes: 31–32
Engine Moment of Inertia (SPN1794)
Resolution: 0.004 kgm²/bit, 0 kgm² offset
Note: Rel 36.0 or later

Bytes: 33–34
Default Engine Torque Limit – N/A

### Adaptive Cruise Control – ACC1

Reception rate : 100 ms
Data length: 8 bytes
Data Page: 0
PDU format: 254
PDU specific: 111
PGN: 65135 (0x00FE6F)

Byte : 1 Speed of Forward Vehicle - N/A
Byte : 2 Distance to Forward Vehicle - N/A
Byte : 3 Adaptive Cruise Control Set Speed - N/A
Byte : 4 ACC Status 1
  Bits: 8,7 Not Defined
  Bits: 6-4 Adaptive Cruise Control Set Distance Mode - N/A
  Bits: 3-1 Adaptive Cruise Control State
    110: Error
    111: Not Available

Byte : 5 Road Curvature - N/A
Byte : 6 Not Defined
Byte : 7 Bits: 8,7 Not Defined
  Bits: 5,6 ACC Distance Alert Signal–N/A
  Bits: 3,4 ACC System Shutoff Warning–N/A
  Bits: 1,2 ACC Target Detected–N/A
Byte : 8 Not Defined

Note: This message is received only from an ACC device. It is not transmitted by the ECM.
## Torque Speed Control — TSC1

Reception Rate : 10 ms  
Data Length: 8 bytes  
Data Page: 0  
PDU format: 0  
PDU specific: Destination Address  
Default priority: 3  
PGN: 0 (0x000000)  

<table>
<thead>
<tr>
<th>Byte : 1</th>
<th>Control Bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bits: 8,7</td>
<td>Not Defined</td>
</tr>
<tr>
<td>Bits: 6,5</td>
<td>Override Control Mode Priority (SPN 897)</td>
</tr>
<tr>
<td>00:</td>
<td>Highest</td>
</tr>
<tr>
<td>01:</td>
<td>High</td>
</tr>
<tr>
<td>10:</td>
<td>Medium</td>
</tr>
<tr>
<td>11:</td>
<td>Low</td>
</tr>
</tbody>
</table>

| Bits: 4,3 | Requested Speed Control Conditions - N/A |
| Bits: 2,1 | Override Control Modes (SPN 695) |
| 00:       | Override Disabled |
| 01:       | Speed Control    |
| 10:       | Torque Control   |
| 11:       | Speed/Torque Limit |

| Byte: 2,3 | Requested Speed / Speed Limit (SPN 898) |
| Resolution: | 0.125 rpm / Bit, 0 rpm offset |

| Byte: 4  | Requested Torque / Torque Limit (SPN 518) |
| Resolution: | 1% / Bit, -125% offset |
| 0-125% for engine torque requests |
| -125-0% for retarder torque requests |

Bytes: 5-8 Not Defined
## Electronic Transmission Controller #1 – ETC1

<table>
<thead>
<tr>
<th>Reception Rate</th>
<th>10 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Length:</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Data Page:</td>
<td>0</td>
</tr>
<tr>
<td>PDU format:</td>
<td>240</td>
</tr>
<tr>
<td>PDU specific:</td>
<td>2</td>
</tr>
<tr>
<td>Default priority:</td>
<td>3</td>
</tr>
<tr>
<td>PGN:</td>
<td>61,442 (0x00F002)</td>
</tr>
</tbody>
</table>

**Byte 1: Status_ETC1**

- **Bits: 8,7** - Not Defined
- **Bits: 6,5** - Shift in Progress (SPN 574)
  - 00: shift is not in process
  - 01: shift in process
  - 11: N/A
- **Bits: 4,3** - Torque Converter Lockup Engaged (SPN 573)
  - 00: Torque Converter Lockup Disengaged
  - 01: Torque Converter Lockup Engaged
  - Note: Rel 38.0 or later
- **Bits: 2,1** - Driveline Engaged
  - 00: Driveline Disengaged
  - 01: Driveline Engaged
  - 11: N/A

**Byte 2: Output Shaft Speed (SPN 191)**

- Resolution: 0.125 rpm / Bit, 0 rpm offset

**Byte 4: Percent Clutch Slip - N/A**

**Byte 5: Command_ETC1**

- **Bits: 8-5** - Not Defined
- **Bits: 4-3** - Progressive Shift Disabled (SPN 607)
  - 00: Progressive Shift Is Not Disabled
  - 01: Progressive Shift Is Disabled
  - 11: N/A
- **Bits: 2,1** - Momentary Engine Overspeed Enable (SPN 606)
  - 00: Momentary Engine Overspeed Is Disabled
  - 01: Momentary Engine Overspeed Is Enabled
  - 11: N/A

**Bytes 6,7: Input Shaft Speed - N/A**

**Byte 8: Source Address of Controlling Device for Transmission**

Control–N/A
6.4.3 SAE J1939/21 DATA LINK LAYER

The Data Link Layer Parameter Group number (PGN) response definitions are described in the following sections.

**Acknowledge / Negative Acknowledge – ACK/NACK**

Transmission Rate: As Needed

Data Length: 8 bytes

Data Page: 0

PDU format: 232

PDU specific: Destination Address

Default priority: 6

PGN: 59, 392 (0x00E800)

Byte: 1 Control Byte

0: Positive Acknowledgment (ACK)

1: Negative Acknowledgment (NACK)

2: Access Denied (PGN supported but access denied)

Byte: 2 Group Function Value (if applicable) - N/A

Bytes: 3-5 Not Defined

Bytes: 6 Least Significant Byte of PGN of Requested Information

Byte: 7 Middle Byte of PGN of Requested Information

Byte: 8 Most Significant Byte of PGN of Requested Information
Requests

Transmission Rate: As Needed
Data Length: 3 bytes
Data Page: 0
PDU format: 234
PDU specific: Destination Address
Default priority: 6
PGN: 59,904 (0x00EA00)

Byte: 1 Least Significant Byte of PGN
Byte: 2 Byte 2 of PGN
Byte: 3 Most Significant Byte of PGN

NOTE:
It is recommended that requests occur no more than 2 or 3 times per second.

NOTE:
For any unsupported PGN that are destination specific DDEC will transmit a NACK. DDEC will not transmit a NACK to a global request.

Transport Protocol Broadcast Announce (TP.CM_BAM)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 236
PDU Specific: 255
Default Priority: 7

Byte: 1 Control Byte — set to 32 for CM_BAM
Byte: 2, 3 Total Message Size, number of bytes
Byte: 4 Total number of packets
Byte: 5 Not Defined
Byte: 6–8 PGN of packeted message
Transport Protocol Data (TP.DT)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 235
PDU Specific: 255
Default Priority: 7

Byte: 1 Sequence Number
Byte 2–8 Packetized Data (7 bytes)

NOTE:
The last packet of a multi-packet parameter group may require less than eight data bytes. The extra bytes will be filled with 255.

NOTE:
The data packets are spaced between 50 and 200 ms.

Transport Protocol Request to Send (TP.CM_RTS)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 236
PDU Specific: Destination Address
Default Priority: 7

Byte: 1 Control Byte
16 — Designation Specific Request_To_Send (RTS)
Bytes: 2, 3 Total Message Size, number of bytes
Byte: 4 Total Number of Packets, zero not allowed
Byte: 5 Not Defined
Bytes: 6–8 Parameter group Number (PGN)

NOTE:
The ECM does not support incoming multi-placket messages and will ignore TP.CM_RTS messages.
Transport Protocol Connection Abort (TP.ConnAbort)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 236
PDU Specific: Destination Address
Default Priority: 7

Byte: 1  Control Byte
       255 — Connection Abort
Byte: 2–5  Not Defined
Bytes: 6–8  Parameter Group Number (PGN)

NOTE:
This message is sent if any of the time outs occurs or an invalid packet request occurs.

Transport Protocol End of Message (TP.EndofMsgACK)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 236
PDU Specific: Destination Address
Default Priority: 7

Byte: 1  Control Byte
       19—End_of_Message Acknowledge
Bytes: 2, 3  Total Message Size, number of bytes
Byte: 4  Total Number of Packets, zero not allowed
Byte 5:  Not Defined
Bytes: 6–8  Parameter Group Number (PGN)
Transport Protocol Clear to Send (TP.CM_CTS)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 236
PDU Specific: Destination Address
Default Priority: 7

Byte: 1 Control Byte
17 — Destination Specific Clear_to_Send (CTS)
Byte: 2 Number of packets that can be sent
Byte: 3 Next packet number to be sent
Bytes: 4-5 Not Defined
Bytes: 6-8 Parameter Group Number (PGN)

Transport Protocol Data (TP.DT)

Transmission Rate: As Required
Data Length: 8 bytes
Data Page: 0
PDU Format: 235
PDU Specific: Destination Address
Default Priority: 7

Byte: 1 Sequence Number
Bytes: 2–8 Packetized Data (7 Bytes)

NOTE:
The last packet of a multi-packet parameter group may require less than eighty data bytes. The extra bytes will be filled with 255.

The data packets will be spaced no more than 200 ms.
6.4.4 SAE J1939/73 DIAGNOSTIC LAYER

The Diagnostic Layer Parameter Group Number (PGN) response definitions are described in the following sections:

**Active Diagnostic Trouble Codes – DM1**

- **Note:** Rel 32.0 or later
- **Transmission**
  - Whenever a DTC becomes an active fault and at a normal update rate of one second or longer, and then becomes inactive, a DM1 message will be transmitted to reflect this state change. If a different DTC changes state within one second update period, a new DM1 message is transmitted to reflect this new DTC.

- **Data Length:** Variable
- **Data Page:** 0
- **PDU Format:** 254
- **PDU Specific:** 202
- **Default Priority:** 6
- **PGN:** 65226 (0x00FECA)

**Byte 1**
- **Bits:** 8–7 Malfunction Indicator lamp Status–N/A
- **Bits:** 6–5 Red Stop Lamp Status (SPN 623)
  - 00 – Lamp Off
  - 01 – Lamp On

**Byte 2**
- **Bits:** 8–1 Reserved for SAE assignment Lamp Status (set to 0xFF)

**Byte 3**
- **Bits:** 8–1 SPN, 8 least significant bits of SPN

**Byte 4**
- **Bits:** 8–1 SPN, 8 second byte of SPN

**Byte 5**
- **Bits:** 8–6 SPN, 3 most significant bits
- **Bits:** 5–1 FMI

**Byte 6**
- **Bit:** 8 SPN Conversion Method (SPN 1706)
- **Bits:** 7–1 Occurrence Count (SPN 1216)

**Byte 7**
- **Bits:** 8–1 Not Defined (Set to 0xFF)

**Byte 8**
- **Bits:** 8–1 Not Defined (Set to 0xFF)
Previously Active Diagnostic Trouble Codes – DM2

Note: Rel 32.0 or later

Transmission Rate:

Data Length: Variable

Data Page: 0

PDU Format: 254

PDU Specific: 203

Default Priority: 6

PGN: 65227 (0x00FECB)

Byte: 1
Bits: 8–7 Malfunction Indicator lamp Status–N/A

Bits: 6–5 Red Stop Lamp Status (SPN 623)

00 – Lamp Off
01 – Lamp On

Bits: 4–3 Amber Warning Lamp Status (SPN 624)

00 – Lamp Off
01 – Lamp On

Bits: 2–1 Protect lamp Status–N/A

Byte: 2
Bits: 8–1 Reserved for SAE assignment Lamp Status (set to 0xFF)

Byte: 3
Bits: 8–1 SPN, 8 least significant bits of SPN

Byte: 4
Bits: 8–1 SPN, 8 second byte of SPN

Byte: 5
Bits: 8–6 SPN, 3 most significant bits

Bits: 5–1 FMI

Byte: 6
Bit: 8 SPN Conversion Method (SPN 1706)
Bits: 7–1 Occurrence Count (SPN 1216)

Byte: 7
Bits: 8–1 Not Defined (Set to 0xFF)

Byte: 8
Bits: 8–1 Not Defined (Set to 0xFF)
**Diagnostic Data Clear/Reset of Previously Active DTCs – DM3**

- **Note:** Rel 33.0 or later
- **Transmission Rate:** On Request using PGN 59904
- **Data Length:** 0
- **Data Page:** 0
- **PDU Format:** 254
- **PDU Specific:** 204
- **Default Priority:** 6
- **PGN:** 65228 (00FECC)

All of the non-permanent diagnostic information pertaining to previously active (inactive) visible diagnostic trouble codes will be erased when this PG is requested. The diagnostic data associated with active trouble codes will not be affected.

**Diagnostic Data Clear/Reset of Active DTCs – DM11**

- **Note:** Rel 33.0 or later
- **Transmission Rate:** On Request using PGN 59904
- **Data Length:** 0
- **Data Page:** 0
- **PDU Format:** 254
- **PDU Specific:** 211
- **Default Priority:** 6
- **PGN:** 65235 (0x00FED3)

All of the non-permanent diagnostic information pertaining to active visible diagnostic trouble codes will be erased when this PG is requested. The diagnostic data associated with previously active (inactive) trouble codes will not be affected.

**Stop Start Broadcast – DM13**

- **Transmission Rate:** As Needed
- **Data Length:** 8 bytes
- **Data Page:** 0
- **PDU format:** 223
- **PDU specific:** Destination Address
- **Default priority:** 3
<table>
<thead>
<tr>
<th>PGN: 57,008 (0x00DF00)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Byte : 1</strong> SAE Primary Links</td>
</tr>
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<tr>
<td><strong>Byte: 2</strong> Other Networks #1</td>
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<tr>
<td><strong>Byte: 3</strong> Other Networks #2</td>
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<tr>
<td><strong>Byte: 4</strong> Control Flags</td>
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</tr>
<tr>
<td><strong>Bytes: 5-8</strong> Not Defined</td>
</tr>
</tbody>
</table>

* Only the broadcast data for the J1587 data link will be shutdown. The ECM will still respond to requests for data.

† Only the broadcast data for the J1922 data link will be shutdown. The ECM will still respond to commands from other devices.

‡ Only the broadcast data for the J1939 data link will be shutdown. The ECM will still respond to requests for data.