Serial No: __________________________
SW ID: ____________________________
HW Ver: ____________________________
Boot Ver: ____________________________
Prod ID: ____________________________
Board ID: ____________________________
Burn Date: __________________________

Record the above information about your tool. The information is available at Main Menu --> System Setup --> Tool Information. Provide this information when contacting technical support.

If you have questions or concerns contact Technical Support:

Phone: 1-800-533-6127

Email: tech@otctools.com

The information, specifications, and illustrations in this guide are based on the latest information available. Bosch reserves the right to make changes at any time without notice.
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1 Safety Precautions

For your safety, read this manual thoroughly before operating your scan tool. Always refer to and follow safety messages and test procedures provided by the manufacturer of the vehicle or equipment being tested. The safety messages presented below and throughout this user’s manual are reminders to the operator to exercise extreme care when using this test instrument.

1.1 Read All Instructions

Read and understand the user guide before operating the tool.

Read, understand, and follow all safety messages and instructions in this manual and on the test equipment. Safety messages in this section of the manual contain a signal word with a three-part message and, in some instances, an icon.

1.2 Safety Messages

Safety messages are provided to help prevent personal injury and equipment damage. All safety messages are introduced by a signal word. The signal word indicates the level of the hazard in a situation. The types of safety messages are:

- **DANGER**
  Indicates a possible hazardous situation which, if not avoided, will result in death or serious injury to operator or bystanders.

- **WARNING**
  Indicates a possible hazardous situation which, if not avoided, could result in death or serious injury to operator or bystanders.

- **CAUTION**
  Indicates a possible hazardous situation which, if not avoided, may result in moderate or minor injury to operator or bystanders.

- **IMPORTANT**
  Indicates a condition which, if not avoided, may result in damage to test equipment or vehicle.

2 Important Safety Warnings and Instructions

**WARNING**

Risk of electric shock.
- Do not exceed voltage limits between inputs indicated in the Specifications.
- Use extreme caution when working with circuits that have voltage greater than 60 volts DC or 24 volts AC.

Electric shock can cause injury.

**WARNING**

Risk of poisoning.
- Safety goggles and protective clothing must be worn by the operator and any bystanders.
  - Even if everyday glasses have impact resistant lenses, they are NOT safety glasses, and may not provide adequate protection.
- Do not use this scan tool in environments where explosive vapors may collect. These areas include:
  - below-ground pits.
  - confined areas.
  - areas that are less than 18 inches above floor.
- Use this scan tool in locations with mechanical ventilation providing at least 4 air changes per hour.
- Flammable fuel and vapors can ignite.
- Do not smoke, strike a match, or cause a spark in the vicinity of the battery.
- Battery gases can ignite.
- Avoid making an accidental connection between the battery terminals. Do not place uninsulated metal tools on the battery.
- When removing battery cables, remove the ground cable first.
- Avoid sparks when connecting or disconnecting power leads to the battery.
- Make sure ignition is off, headlights and other accessories are off and vehicle doors are closed before disconnecting the battery cables.
  - This also helps prevent damage to on-board computer systems.
- Always disconnect the battery ground connections before servicing electrical system components.

Explosion can cause injury.
WARNING
Risk of poisoning.
• Use this scan tool in locations with mechanical ventilation providing at least 4 air changes per hour. Engine exhaust contains odorless gas which can be lethal.
• Route the exhaust outside while testing with the engine running. Poisoning can result in death or serious injury.

WARNING
Battery acid is a highly corrosive sulfuric acid.
• Safety goggles and protective gloves must be worn by the operator and any bystanders.
  – Even if your everyday glasses have impact resistant lenses, they are NOT safety glasses, and may not provide adequate protection.
• Make sure someone can hear you or is close enough to provide aid when working near a battery.
• Have plenty of fresh water and soap nearby.
  – If battery acid contacts skin, clothing, or eyes, flush exposed area with soap and water for 10 minutes. Seek medical help.
• Do not touch eyes while working near battery. Battery acid can burn eyes and skin.

WARNING
Risk of fire.
• Safety goggles and protective clothing must be worn by the operator and any bystanders.
  – Even if your everyday glasses have impact resistant lenses, they are NOT safety glasses, and may not provide adequate protection.
• Do not position your head directly in front of or over the throttle body.
• Do not pour gasoline down the throttle body when cranking or running the engine, when working with fuel delivery systems or any open fuel line.
  – Engine backfire can occur when the air cleaner is out of position.
• Do not use fuel injector cleaning solvents when performing diagnostic testing.
• Keep cigarettes, sparks, open flame and other sources of ignition away from vehicle.
• Keep a dry chemical (Class B) fire extinguisher rated for gasoline, chemical and electrical fires in work area. Fire can cause death or serious injury.

WARNING
Risk of flying particles.
• Safety goggles and protective gloves must be worn by the operator and any bystanders while using electrical equipment.
  – Electrical equipment or rotating engine parts can cause flying particles.
  – Even if your everyday glasses have impact resistant lenses, they are NOT safety glasses, and may not provide adequate protection.

WARNING
Battery acid is a highly corrosive sulfuric acid.
• Safety goggles and protective gloves must be worn by the operator and any bystanders.
  – Even if your everyday glasses have impact resistant lenses, they are NOT safety glasses, and may not provide adequate protection.
• Make sure someone can hear you or is close enough to provide aid when working near a battery.
• Have plenty of fresh water and soap nearby.
  – If battery acid contacts skin, clothing, or eyes, flush exposed area with soap and water for 10 minutes. Seek medical help.
• Do not touch eyes while working near battery. Battery acid can burn eyes and skin.

WARNING
Risk of burns.
• Do not remove radiator cap unless engine is cold.
  – Pressurized engine coolant may be hot.
• Do not touch hot exhaust systems, manifolds, engines, radiators, sample probe.
• Wear insulated gloves when handling hot engine components.
• Tester leads can become hot after extended testing in close proximity to manifolds. Hot components can cause injury.

WARNING
Risk of expelling fuel, oil vapors, hot steam, hot toxic exhaust gases, acid, refrigerant and other debris.
• Safety goggles and protective clothing must be worn by the operator and any bystanders.
  – Even if your everyday glasses have impact resistant lenses, they are NOT safety glasses, and may not provide adequate protection.
• Engine systems can malfunction, expelling fuel, oil vapors, hot steam, hot toxic exhaust gases, acid, refrigerant and other debris.

Fuel, oil vapors, hot steam, hot toxic exhaust gases, acid, refrigerant and other debris can cause serious injury.
### WARNING

**Engine compartment contains electrical connections and hot or moving parts.**
- Keep yourself, test leads, clothing and other objects clear of electrical connections and hot or moving engine parts.
- Do not wear watches, rings, or loose fitting clothing when working in an engine compartment.
- Do not place tools or test equipment on fenders or other places in engine compartment.
- Barriers are recommended to help identify danger zones in test area.
- Prevent personnel from walking through test area.

Contacting electrical connections and hot or moving parts can cause injury.

### CAUTION

**Risk of injury.**
- The scan tool should be operated by qualified personnel only.
- Use the scan tool only as described in the user’s manual.
- Use only manufacturer’s recommended attachments.
- Do not operate the scan tool with damaged cables.
- Do not operate the scan tool if it has been dropped or damaged, until examined by a qualified service representative.

Operation of the scan tool by anyone other than qualified personnel may result in injury.

### WARNING

**Risk of unexpected vehicle movement.**
- Block drive wheels before performing a test with engine running.
- Unless instructed otherwise:
  - set parking brake
  - put gear selector in neutral for manual transmissions
  - put gear selector in park for automatic transmissions
  - disconnect release mechanism on the automatic parking brake release for testing and reconnect when testing is completed.
- Do not leave a running engine unattended. A moving vehicle can cause injury.

### CAUTION

**Risk of equipment or circuit damage.**
- Unless specifically directed by manufacturer, make sure ignition is off before connecting or disconnecting connectors or any vehicle electrical terminals.
- Do not create a short between battery terminals with a jumper wire or tools. Improper equipment use can cause equipment or circuit damage.

### CAUTION

**Misdiagnosis may lead to incorrect or improper repair and/or adjustment.**
- Do not rely on erratic, questionable, or obviously erroneous test information or results.
  - If test information or results are erratic, questionable, or obviously erroneous, make sure all connections and data entry information are correct and test procedures were performed correctly.
  - If test information or results are still suspicious, do not use them for diagnosis.

Improper repair and/or adjustment may cause vehicle or equipment damage or unsafe operation.

### DANGER

Some vehicles are equipped with air bags.
- Follow service manual warnings when working around air bag components or wiring.
  - If service manual instructions are not followed, an air bag may deploy unexpectedly, resulting in injury.
  - Note an air bag can still deploy several minutes after ignition key is off (or even if vehicle battery is disconnected) because of a special energy reserve module.

An air bag opening can cause injury.
# Getting Started

## 3.1 Introduction

The scan tool was developed by experts in the automotive service industry to help diagnose vehicles and assist in troubleshooting procedures.

The scan tool monitors vehicle events and retrieves codes from the vehicle's control modules to help pinpoint problem areas.

All information, illustrations and specifications contained in this manual are based on the latest information available from industry sources at the time of publication. No warranty (expressed or implied) can be made for its accuracy or completeness, nor is any responsibility assumed by the manufacturer or anyone connected with it for loss or damages suffered through reliance on any information contained in this manual or misuse of accompanying product. The manufacturer reserves the right to make changes at any time to this manual or accompanying product without obligation to notify any person or organization of such changes.

## 3.2 Download Scanning Suite

1. Go to www.otctools.com/service-and-support/updates-and-downloads to download the Scanning Suite PC application. Scanning Suite is NOT required to operate the scan tool.
2. Install the downloaded Scanning Suite application before connecting the scan tool to the PC.
3. Use Scanning Suite to determine if any updates are available for your tool by clicking Check for Update button.
4. Check for updates to Use Scanning Suite by clicking on the Check For Scanning Suite Update button. This should be done before checking for Tool Updates.

You can also configure the Scanning Suite Frequency (SS Frequency) to automatically check every xx minutes. The default frequency is 7 days. Refer to instructions provided on www.otctools.com/service-and-support/updates-and-downloads for how to install Scanning Suite and Tool updates.

## 3.3 OBDII

On-board diagnostics version II (OBDII) is a system that the Society of Automotive Engineers (SAE) developed to standardize automotive electronic diagnosis.

Beginning in 1996, most new vehicles sold in the United States were fully OBDII compliant.

Technicians can now use the same tool to test any OBDII compliant vehicle without special adapters. SAE established guidelines that provide:

- A universal OBDII data link connector, called the DLC, with dedicated pin assignments.
- A standard location for the DLC, visible under the dash on driver's side.
- A standard list of diagnostic trouble codes (DTCs) used by all manufacturers.
- A standard list of parameter identification (PID) data used by all manufacturers.
- Ability for vehicle systems to record operating conditions when a fault occurs.
- Expanded diagnostic capabilities that records a code whenever a condition occurs that affects vehicle emissions.
- Ability to clear stored codes from the vehicle's memory with a scan tool.

## 3.4 SAE Publications

SAE has published hundreds of pages of text defining a standard communication protocol that establishes hardware, software, and circuit parameters of OBDII systems. Unfortunately, vehicle manufacturers have different interpretations of this standard communications protocol. As a result, the generic OBDII communications scheme varies, depending on the vehicle. SAE publishes recommendations, not laws, but the Environmental Protection Agency (EPA) and California Air Resources Board (CARB) made many of SAE's recommendations legal requirements that vehicle manufacturers were required to phase in over a three-year period. Beginning in 1994, vehicles with a new engine management computer (about 10% of each manufacturer's fleet) were supposed to comply with OBDII standards. For 1995, OBDII systems were to appear on about 40% of the new vehicles sold in the United States. Some of the 1994-1995 OBDII systems were not fully compliant, so the Government granted waivers to give manufacturers time to fine-tune their systems. Beginning in 1996, most of the new vehicles sold in the United States were fully OBDII compliant.

## 3.5 OBDII Data Link Connector (DLC)

The OBDII data link connector (DLC) allows the scan tool to communicate with the vehicle's computer(s). Beginning in 1996, vehicles sold in the United States use the J1962 (OBDII) DLC, a term taken from a physical and electrical specification number assigned by the SAE (J1962). The DLC should be located under the dashboard on the driver's side of the vehicle. If the DLC is not located under the dashboard as stated, a decal describing its location should be attached to the dashboard in the area the DLC should have been located. For more information on OBDII connectors, go to http://www.obdclearinghouse.com/oemdb.
OBD II Data Link Connector (DLC) Pins

1. Manufacturer reserved
2. J1850 bus+
3. Manufacturer reserved
4. Chassis ground
5. Signal ground
6. CAN high, J-2284
7. K line, ISO 9141-2 & ISO/DIS 14230-4
8. Manufacturer reserved
9. Manufacturer reserved
10. J1850 Bus-
11. Manufacturer reserved
12. Manufacturer reserved
13. Manufacturer reserved
14. CAN low, J-2284
15. L line, ISO 9141-2 & ISO/DIS 14230-4
16. Battery power

3.6 OBDII Diagnostic Trouble Codes (DTCs)

J2012 and ISO 15031-6 are standards for all DTCs, established by the SAE, International Organization for Standardization (ISO) and other governing bodies.

- Codes and definitions assigned by these specifications are known as Generic OBDII codes.
- OBDII requires compliance to these standards for all cars, light trucks, APVs, MPVs, and SUVs sold in the United States.
- Codes not reserved by the SAE are reserved for the manufacturer and referred to as Manufacturer Specific Codes.

DTCs are used to help determine the cause of a problem or problems with a vehicle.

- DTCs consist of a five-digit alphanumeric code.
- The DTC format and general code types are shown below.

### Powertrain Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0xxx</td>
<td>Generic (SAE)</td>
</tr>
<tr>
<td>P1xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>P2xxx</td>
<td>Generic (SAE)</td>
</tr>
<tr>
<td>P30xx–P33xx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>P34xx–P39xx</td>
<td>Generic (SAE)</td>
</tr>
</tbody>
</table>

### Chassis Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0xxx</td>
<td>Generic (SAE)</td>
</tr>
<tr>
<td>C1xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>C2xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>C3xxx</td>
<td>Generic (SAE)</td>
</tr>
</tbody>
</table>

### Body Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>B0xxx</td>
<td>Generic (SAE)</td>
</tr>
<tr>
<td>B1xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>B2xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>B3xxx</td>
<td>Generic (SAE)</td>
</tr>
</tbody>
</table>

### Network Communication Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>U0xxx</td>
<td>Generic (SAE)</td>
</tr>
<tr>
<td>U1xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>U2xxx</td>
<td>Manufacturer specific</td>
</tr>
<tr>
<td>U3xxx</td>
<td>Generic (SAE)</td>
</tr>
</tbody>
</table>
4 Using the Scan Tool

4.1 The Scan Tool

1. DLC cable provides connection for vehicle interface.
2. LCD display (color, backlit, QVGA resolution).
3. ERASE key performs the Erase Codes function and scrolls forward through the screens. Press this key when a down arrow (↓) appears on the display to scroll forward, or press and hold for 2 seconds when RD ERASE appears on the display to erase codes.
4. ENTER key selects item.
5. BACK key returns to previous screen.
6. READ key performs the Read Codes function and scrolls back through the screens. Press this key when an up arrow (↑) appears on the display to scroll backwards, or press and hold for 2 seconds when RD ERASE appears on the display to read codes.
7. USB port provides USB connection for the computer (on top; not shown).
8. Serial number plate (on back; not shown).

4.2 Specifications

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Color, backlit, QVGA resolution</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0 to 50°C (32 to 122°F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-20 to 70°C (-4 to 158°F)</td>
</tr>
<tr>
<td>External Power</td>
<td>7 to 16 Volts</td>
</tr>
</tbody>
</table>

A minimum of 8.0 V is required for most control modules to operate properly in a vehicle.

<table>
<thead>
<tr>
<th>Dimensions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>5.6 inches</td>
</tr>
<tr>
<td>Width</td>
<td>3.5 inches</td>
</tr>
<tr>
<td>Depth</td>
<td>0.9 inches</td>
</tr>
<tr>
<td></td>
<td>142 mm</td>
</tr>
<tr>
<td></td>
<td>89 mm</td>
</tr>
<tr>
<td></td>
<td>23 mm</td>
</tr>
</tbody>
</table>

4.3 Display

The display has a large viewing area for displaying messages, instructions, and diagnostic information. The back-lit liquid crystal display (LCD) is a QVGA pixel display. Characters used to help operate the scan tool are:

- ↓ Indicates additional information is available by scrolling down.
- ↑ Indicates additional information is available by scrolling up.
- Rd Erase Indicates the READ and ERASE hot keys are active.
- ✔ Indicates data is available for items on the Review Data Menu.
- ▶ Indicates graphical viewing of data items is available in View Data.

Keypad

The keypad is used to move through the different menus of the scan tool. The scan tool’s software is designed for ease in operating and navigating through menus.

**CAUTION**

Do not use solvents such as alcohol to clean keypad or display. Use a mild nonabrasive detergent and a soft, cotton cloth.

**CAUTION**

Do not soak keypad as water might find its way inside the scan tool.
4.4 Power

Vehicle Power
When the scan tool is connected to the vehicle's DLC, the tool is powered by the vehicle and will automatically turn on once connected.

USB Power
When the tool is connected to a PC via the USB cable (not provided), the tool will automatically power up. Refer to “Scan Tool Does Not Power Up” on page 33 if there are problems.

4.5 System Setup

System Setup allows:
• Measurement units to be changed.
• Scan tool information to be viewed.
• Display to be checked.
• Operation of the keypad to be checked.
• Memory of the tool to be checked.
• Language to be changed.
• Long PID names to be turned ON or OFF.

From the Diagnostic Menu:
1. Select System Setup.

2. Select desired measurement unit.
   • Use the keys until ENGLISH/METRIC is highlighted.
   • Press ENTER.

3. Save measurement setting.
   • Press ENTER.

Changing Measurement Units

English is the default measurement unit. Measurement units can be changed in View and Record Data.

From System Setup screen:
1. Select English/Metric.

Language Setup

Language Setup selection allows the user to change the language used by the Tool. English is the default language.

From System Setup screen:
1. Select Language Setup.

   • Use the keys until Language Setup is highlighted.
   • Press ENTER.
2. Select desired measurement unit.
   • Use the READ and ERASE keys until the desired language is highlighted.
   • Press ENTER.

3. Save language setting.
   • Press ENTER.

NOTE: When Spanish or French translation is not known, English will be shown.

**Long PID Names**

**Long PID Names** allows the user to enable/disable the tool scrolling the complete PID name on the bottom line of the display while viewing Live Data or viewing Freeze Data.

From **System Setup** screen:

1. Select Long PID Names.
   • Use the READ and ERASE keys until Long PID Names is highlighted.
   • Press ENTER.

2. Select ON or OFF.
   • Use the READ and ERASE keys until the desired option is highlighted.
   • Press ENTER.

3. Save Long PID Names setting.
   • Press ENTER.

**Tool Information**

**Tool Information** allows the user to view specific tool information that may be needed when contacting customer service.

From **System Setup** screen:

1. Select Tool Information.
   • Use the READ and ERASE keys until Tool Information is highlighted.
   • Press ENTER.

2. View information.
   • Serial Number (Serial No:)
   • Software ID (SW ID:)
   • Hardware Version (HW Ver:)
   • Boot Version (Boot Ver:)
   • Product ID (Prod ID:)
   • Board ID (Board ID:)
   • Burn Date (Burn Date:)
   • Burn Location (Burn Loc:)

<table>
<thead>
<tr>
<th>Tool Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial No</td>
</tr>
<tr>
<td>SW ID</td>
</tr>
<tr>
<td>HW Ver</td>
</tr>
<tr>
<td>Boot Ver</td>
</tr>
<tr>
<td>Prod ID</td>
</tr>
<tr>
<td>Board ID</td>
</tr>
<tr>
<td>Burn Date</td>
</tr>
<tr>
<td>Burn Loc</td>
</tr>
</tbody>
</table>
3. Record **Tool Information**.
   - Space is provided inside the front cover of this manual to write down the scan tool information.

4. Return to **System Setup** menu.
   - Press **BACK** or press **ENTER**.

**Display Test**
The **Display Test** is used to check the display. The test fills every pixel of the display with a solid color.

From **System Setup** screen:
1. Select **Display Test**.
   - Use the **READ** and **ERASE** keys until **Display Test** is highlighted.
   - Press **ENTER**.

2. Start **Display Test**.
   - Press **ENTER**.

3. Look for missing spots.
   - The first screen displayed says, "Check for missing spots in the display."
   - Solid red, green, and blue screens are displayed.

4. Press **BACK** to exit the test and return to the **System Setup** menu.

**Keypad Test**
The **Keypad Test** is used to verify that the keys are working correctly.

From **System Setup** screen:
1. Select **Keypad Test**.
   - Use the **READ** and **ERASE** keys until **Keypad Test** is highlighted.
   - Press **ENTER**.
2. Press a key.
   • The on-screen key will appear depressed, and the key name will appear bold.
     • BACK will return the tool to the System Setup screen.
     • If the System Setup menu does not return, the BACK key is not functioning correctly.

Memory Test
The Memory Test will test RAM and flash ROM. Run the Memory Test if the tool has trouble:
• Playing back recorded data.
• Displaying trouble code definitions.
From System Setup screen:
1. Select Memory Test.
   • Use the Read and Erase keys until Memory Test is highlighted.
   • Press ENTER.

• Memory Test may take several minutes to complete.
• Memory Test results display:
  – If no problems were detected, then “Passed” is displayed.
  – If RAM fails, an error message is shown.
  – If FLASH fails, a checksum is shown.

Program Mode
The Program Mode is used for updating the scan tool. Instructions are provided with upgrades. Refer to “Download Scanning Suite” on page 8.

4.6 Vehicle-Specific Features

Review Data
The Review Data function allows the user to view the information from the previous vehicle tested. The scan tool can be powered from vehicle or PC using USB to use the Review Data function.
Review Data is a mixture of all previous vehicles scanned. If the origin of the data is questionable, perform all functions for the currently selected vehicle.
1. Select Review Data.
• Use the \texttt{READ} and \texttt{ERASE} keys until \texttt{Review Data} is highlighted.
  \begin{itemize}
  \item Press \texttt{ENTER}.
  \end{itemize}

2. Follow prompts and instructions provided by scan tool and then select item whose data you wish to review.
• The \texttt{Review Data} menu shows a checkmark next to the item(s) that has data.
• If there is not a checkmark next to the item, then this item can’t be selected until the appropriate function is run from the \texttt{Diagnostic Menu}.
• See “Recording” on page 15 for detailed instructions on this function.

\textbf{Recording}

The \texttt{Recording} function is used to play back a recording. This function is very similar to \texttt{View Data}. The only difference is that \texttt{View Data} is real-time viewing of PIDs, while \texttt{Recording} is a viewing of previously recorded PIDs.

From the \texttt{Review Data} menu:
1. Select \texttt{Recording}.
  \begin{itemize}
  \item Use the \texttt{READ} and \texttt{ERASE} keys until \texttt{Recording} is highlighted.
  \item Press \texttt{ENTER}.
  \end{itemize}

2. Select \texttt{Playback Recording}.
  \begin{itemize}
  \item Use the \texttt{READ} and \texttt{ERASE} keys until \texttt{Playback Recording} is highlighted.
  \item Press \texttt{ENTER}.
  \end{itemize}

• The recording has frame number and timestamp (in seconds).
  \begin{itemize}
  \item Negative frames and timestamps indicate data recorded before trigger event.
  \item Positive frames and timestamps indicate data recorded after trigger event.
  \end{itemize}
• Use the \texttt{READ} and \texttt{ERASE} keys to view recorded PID data within each frame.
• Use the \texttt{ENTER} key to scroll back and forth through frames.
• See “Appendix A—PID Definitions” on page 34.
• Different vehicles communicate at different speeds and support a different number of PIDs.
Therefore, the maximum number of frames that can be recorded varies.

3. Return to \texttt{Review Data} menu.
  \begin{itemize}
  \item Press \texttt{BACK}.
  \end{itemize}

\textbf{4.7 Code Lookup}

\textbf{Code Lookup} is used to look up definitions of DTCs stored in the scan tool. The scan tool can be powered from vehicle or from a PC using USB to use the \texttt{Code Lookup} function.

From the \texttt{Diagnostic} menu:
1. Select \texttt{Code Lookup}.
  \begin{itemize}
  \item Use the \texttt{READ} and \texttt{ERASE} keys until \texttt{Code Lookup} is highlighted.
  \item Press \texttt{ENTER}.
  \end{itemize}
2. Select the appropriate module for the code.
   • The Select Module screen may not be shown for every vehicle. If not shown, the DTC will be looked up as OBDII/EOBD.

3. Enter code.
   • All characters must be entered.
   • Only one character can be changed at a time.
   • Use ENTER to advance to the next digit.
   • Use the READ and ERASE keys to change the selected digit.
   • Press ENTER.

4. To look up another DTC, press BACK.

5. Press BACK again to return to the Diagnostic Menu.

4.8 Locating Data Link Connector
   • The OBDII data link connector (DLC) is usually located under the driver’s side dash.
   • Refer to vehicle user manual for DLC location.
   • For more information, go to http://www.obdclearinghouse.com/oemdb.

4.9 Connect the Tool
1. Locate the OBDII data link connector (DLC) under the steering column. If the connector is not there, a label should be there indicating the whereabouts of the connector.
2. If necessary, remove the cover from the vehicle connector.
3. Turn the ignition switch to the ON position. Do not start the engine.
4. Plug the OBDII connector attached to the tool into the DLC.
5. The tool will attempt to identify the vehicle. If successful, the vehicle identified will be displayed. If vehicle couldn’t be identified, menus will be shown for you to select the vehicle manually. The tool can support one previous vehicle in the garage. If you already have a previous vehicle in your garage, the tool will automatically overwrite the previous vehicle with the currently selected one. All previous scanned data in Review Data will be a combination of all previous vehicles. Run all functions again to ensure that all data was scanned from the current vehicle.
6. Review Quick Test results.
7. Go to Diagnostic Menu by pressing ENTER.

4.10 Vehicle Selection
If the scan tool failed to identify the vehicle, or if was pressed from the Diagnostic Menu, the Vehicle Selection screen will appear.
1. Use the READ and ERASE keys to select AutoID™, Manual or Prev.: 
   • If the vehicle is a model year 2000 or newer, select AutoID.
   • If the vehicle is 1999 or older, or if the vehicle is 2000 to 2004 but does not support AutoID™, select Manual and go to Step 3.
   • If the previously tested vehicle listed after Prev: is desired, select Prev:. If this is the first time the tool has been used, the space after Prev: will be blank.
   • Press ENTER.
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Select Vehicle


2000-04 vehicles may support AutoID

A Turn Key Off screen will display.

Turn Key Off

Please turn the key off for 10 seconds then turn the key on.

Press ENTER to continue

2. After 10 seconds, turn key ON.
   - If the vehicle is supported, the VIN number and essential vehicle data will display.

Select Vehicle

| OBDII/EOBD | US | Europe | Asia | Prev: 06 Lancer |

The OBDII/EOBD selection is provided for vehicles that are not listed, however, selection of the specific vehicle is recommended for maximum tool utility.

If vehicle power is not detected, a screen is shown to verify tool connection.

If vehicle power is not detected, a screen is shown to verify tool connection.

The previously selected vehicle will appear as the Prev: menu selection after Asia.

- To select a vehicle other than the previous vehicle, choose between OBDII/EOBD, US, Europe, or Asia, and continue making selections until the vehicle selection is complete.

The following screen only displays when power comes from vehicle.

- Turn vehicle key OFF for 10 seconds.
- Turn vehicle key back to the ON position.

Press ENTER.

3. Use the BACK OR ENTER key to select YES or NO.
   - If YES is selected, the Tool may display more selections to further select the vehicle because not every aspect of vehicle identification is contained in the VIN.
   - If NO is selected, the Tool proceeds to manual selection.

Press ENTER.

4. If Manual was selected in Step 1, use the READ and ERASE keys to select:
   - OBDII/EOBD
   - US
   - Europe
   - Asia
   - Prev:

Press ENTER.

4.11 Acronyms

The Acronyms function allows the user to view acronyms and abbreviations used by the scan tool.

From the Diagnostic Menu.
1. Select Acronyms.

- Use the READ and ERASE keys until Acronyms is
highlighted.

• Press ENTER.

2. Select the alphabetical group range for the desired acronym.

• Use the READ and ERASE keys until the desired group range is highlighted.

• Press ENTER.

3. Select the acronym.

• Use the READ and ERASE keys until the desired acronym is highlighted.

• Press ENTER.

4. View selected acronym.

### # Of Emiss

Number of Emission Related DTC

• Press ENTER to return to the Diagnostic Menu.

#### 4.12 Component Locator

**Component Locator** provides a vehicle-specific location of components found on the selected vehicle. **Component Locator** can be selected from the Diagnostic Menu. Because **Component Locator** provides vehicle-specific component locations, a previous vehicle must be stored in the scan tool.

From the Diagnostic Menu.

1. Select **Component Locator**.

• Use the READ and ERASE keys until **Component Locator** is highlighted.

• Press ENTER.

2. Select the alphabetical group range for the desired component.

• Use the READ and ERASE keys until the desired group range is highlighted.

• Press ENTER.
3. Select the component.
   • Use the READ and ERASE keys until the desired component is highlighted.
   • Press ENTER.

4. View selected component location.
   • Press ENTER to return to the Diagnostic Menu.

5 Diagnostic Menu
The first time the scan tool links to the vehicle, the communication protocol is automatically detected, and is used until the scan tool is turned off or another vehicle is diagnosed.
If an error message displays, make sure the DLC cable is attached and the ignition key is on. Cycle ignition key to OFF for 10 seconds, then ON. This may be required to reset computer. If required, select YES to try again. If problem still exists, refer to “Error Messages” in Troubleshooting.
The scan tool keeps all data received from the last vehicle selected until any of the following occurs:
• A new vehicle is selected.
• Scan tool is flash programmed to update software.
On initial link to vehicle, scan tool checks the status of I/M Monitors no matter which function is selected.

IMPORTANT
Review Data, Code Lookup, and System Setup are covered in Section 4 of this manual. These items are not covered in this section.

The Diagnostic Menu is broken down into the following selections:
• I/M Monitors
• Read Codes
• Erase Codes
• MIL Status
• State OBD Check
• View Data
• Record Data
• View Freeze Data
• Drive Cycle Monitor
• O2 Monitor Tests
• Diagnostic Monitor Tests
• On-Board Systems
• Charging System Monitor
• Vehicle Information
• Component Locator
• Acronyms
• Review Data
  – I/M Monitors
  – DTCs (Codes)
  – State OBD Check
  – Recording
  – View Freeze Data
  – O2 Monitor Tests
  – Diag Monitor Tests
  – Vehicle Information
• Code Lookup
• System Setup
  – English/Metric
  – Language Setup
  – Long PID Names
  – Tool Information
  – Display Test
  – Keypad Test
  – Memory Test
  – Program Mode
5.1 I/M Monitors (Emissions)
The I/M Monitors (Inspection / Maintenance) function is used to view a snapshot of the operations for the emission system on OBDII vehicles. I/M Monitors is a very useful function. To guarantee no faults exist make sure all monitors are ok or n/a and no DTC’s exist. Refer to the vehicles service manual for the drive cycle operation. During normal driving conditions, the vehicle computer scans the emission system. After a specific amount of drive time (each monitor has specific driving conditions and time required), the computer monitors decide if the vehicles emission system is working correctly or not as well as detecting out of range values. When the monitor status is:

- ok - vehicle was driven enough to complete the monitor.
- inc (Incomplete) - vehicle was not driven enough to complete the monitor.
- n/a (not applicable) - vehicle does not support that monitor.

Depending on vehicle, disconnecting or a discharged battery may erase DTCs and clear monitor status. Monitors may be reset by:

- Erasing codes
- Vehicle control modules losing power

The I/M Monitors function can be run key on engine running (KOER) or key on engine off (KOEO). Extreme weather and/or road conditions can prevent a monitor from running. Also, some monitors may require a cold start to complete.

From the Diagnostic Menu.
1. Select I/M Monitors.
   - Use the READ and DOWN keys until I/M Monitors is highlighted.
   - Press ENTER.

   Two types of I/M Monitors test are:

   - Since DTCs Cleared - shows status of the monitors since the DTCs were last erased.
   - This Drive Cycle - shows status of monitors since the start of the current drive cycle. Refer to the vehicle service manual for more detailed information on emission-related monitors and their status.

   Some vehicles do not support This Drive Cycle. If vehicle supports both types of monitors the I/M Monitors Menu displays.

2. View summary of monitor status.
   - Use the READ and DOWN keys (if required). Depending on monitor test, one of these two screens will be present.

   - Since DTCs Cleared

   - This Drive Cycle

   Abbreviations and names for OBDII monitors supported by the scan tool are shown below. They are required by the United States Environmental Protection Agency (EPA). Not all monitors are supported by all vehicles.

<table>
<thead>
<tr>
<th>Monitors</th>
<th>Expanded Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misfire Monitor</td>
<td>Misfire monitor</td>
</tr>
<tr>
<td>Fuel System Mon</td>
<td>Fuel System Monitor</td>
</tr>
<tr>
<td>Comp Component</td>
<td>Comprehensive components monitor</td>
</tr>
<tr>
<td>Catalyst Mon</td>
<td>Catalyst monitor</td>
</tr>
<tr>
<td>Htd Catalyst</td>
<td>Heated catalyst monitor</td>
</tr>
<tr>
<td>Evap System Mon</td>
<td>Evaporative system monitor</td>
</tr>
<tr>
<td>Sec Air System</td>
<td>Secondary air system monitor</td>
</tr>
<tr>
<td>A/C Refrig Mon</td>
<td>Air conditioning refrigerant monitor</td>
</tr>
<tr>
<td>Oxygen Sens Mon</td>
<td>Oxygen sensor monitor</td>
</tr>
<tr>
<td>Oxygen Sens Htr</td>
<td>Oxygen sensor heater monitor</td>
</tr>
<tr>
<td>EGR/VVT Sys Mon</td>
<td>Exhaust gas recirculation or variable valve timing monitor</td>
</tr>
<tr>
<td>NMHC Cat Mon</td>
<td>Non-methane hydrocarbon catalyst monitor</td>
</tr>
<tr>
<td>NOX Treat Mon</td>
<td>Nitrogen oxide treatment monitor</td>
</tr>
<tr>
<td>Boost Pres Mon</td>
<td>Boost pressure monitor</td>
</tr>
<tr>
<td>Exhst Gas Sensr</td>
<td>Exhaust gas sensor</td>
</tr>
<tr>
<td>PM Filter Mon</td>
<td>Particulate matter filter monitor</td>
</tr>
</tbody>
</table>

3. Return to Diagnostic Menu.
   - Press BACK.
5.2 Read Codes

The Read Codes function allows the scan tool to read the DTCs from the vehicle’s control modules. DTCs are used to help determine the cause of a problem or problems with a vehicle. These codes cause the control module to illuminate the malfunction indicator lamp (MIL) when emission-related or driveability fault occurs. When referring to the engine control module, MIL is also known as service engine soon or check engine lamp. Read Codes can be done with the key on engine off (KOEO) or with the key on engine running (KOER).

From the Diagnostic Menu.

1. Select Read Codes.
   - Use the read and erase keys until Read Codes is highlighted.
   - Press enter.

   Diagnostic Menu
   - I/M Monitors
   - Read Codes
   - Erase Codes
   - MIL Status
   - State OBD Check
   - View Data
   - Record Data
   - View Freeze Data
   - Drive Cycle Monitor

   • Alternately, press and hold the read key for 2 seconds when Rd\Er appears on the display.

2. If more than one module is supported, a menu is displayed.
   - Use the read and erase keys until the desired choice is highlighted.
   - Press enter.

   Select Module
   - OBDII/EOBD
   - Engine
   - ABS
   - All of the Above

If no DTCs are present, a message stating “System Pass: No Faults Detected” is displayed. If All of the Above is selected from the Select Module menu, all of the codes will be displayed as if all menu items were selected individually.

3. View and write down the DTCs.

   DTC# - Number of the trouble code found in vehicle service information.
   X of Y - Indication that code x of y is being viewed, where x is the code being viewed of the total y.
   Module - The name of the module (e.g. ABS) or address of the module (e.g. Mod $28) or both are shown (ABS $28) in this field. The table below describes modules supported.

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECM</td>
<td>Engine or powertrain module</td>
</tr>
<tr>
<td>TCM</td>
<td>Transmission control module</td>
</tr>
<tr>
<td>TCCM</td>
<td>Transfer case control module</td>
</tr>
<tr>
<td>ABS</td>
<td>Anti-lock brake system module</td>
</tr>
<tr>
<td>HPCM</td>
<td>Hybrid powertrain control module</td>
</tr>
<tr>
<td>MOD $XX</td>
<td>Module address for the OBDII/EOBD module reporting the DTC</td>
</tr>
<tr>
<td>SRS</td>
<td>Supplemental restraint system module</td>
</tr>
</tbody>
</table>

DTC Description - This area is reserved for the text describing the trouble code listed in the DTC number field.

DTC Type - This area is reserved for providing additional information about the DTC. Multiple DTC types may be possible for a given DTC number. Not all vehicles support DTC types. This table describes possible DTC types.

<table>
<thead>
<tr>
<th>DTC Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Intermittent codes placed in the vehicle’s memory when the trouble originally occurred, and will remain there even if the trouble has been corrected. If no trouble after 50 engine warm-up cycles, the DTC will be erased.</td>
</tr>
<tr>
<td>Confirmed</td>
<td>Confirmed codes are reported when a component, sensor, or other part of the vehicle is indication a malfunction is present.</td>
</tr>
<tr>
<td>Current</td>
<td>Codes transmitted through the PCMs data stream when a trouble condition is active and cannot be erased. The problem must be repaired to remove the DTC.</td>
</tr>
</tbody>
</table>
Intermittent
Indicates the current code has been set at least once but possibly not enough to cause a history code to be stored.

MIL
Indicates that this DTC has turned on the MIL light.

Pending
Pending codes are also referred to as continuous monitor or maturing codes. An intermittent fault causes the control module to store a code in memory. If the fault does not occur within a certain number of warm-up cycles (depending on vehicle), the code clears from memory. If fault occurs a specific number of times, the code matures into a DTC and the MIL illuminates or blinks. This function can be used with KOEO or KOER.

Non-MIL
DTC that is not emission-related and did not turn on the MIL light.

MIL Code
This DTC type also has a number with it indicating that this is the code number turning on the MIL. Vehicle service manuals may refer to this number instead of the one listed in the DTC number field.

Permanent
Permanent codes are a special type of confirmed code. Permanent codes began being reported by vehicles around 2010, and therefore not supported by every vehicle. While Confirmed Codes can be erased by the Tool, Permanent Codes cannot. Permanent Codes are erased by the vehicle when the vehicle has determined the fault is no longer present.

Active
DTC that was present at the time of scan tool request.

Stored
DTC that was not present at the time of scan tool request.

4. Return to Diagnostic Menu.
   • Press BACK.

5.3 Erase Codes
The Erase Codes function deletes DTCs and resets I/M Monitor data from vehicle's control module(s). Perform this function key on engine off (KOEO). Do not start the engine.
The Erase Codes function may also erase View Freeze Data, O2 Monitor Tests, and Diagnostic Monitor Test results depending on vehicle.
The Erase Codes function sets monitors to inc.
Perform Erase Codes function only after systems have been checked completely and DTCs have been written down.
After servicing the vehicle, erase stored DTCs and verify no codes have returned. If a DTC returns, problem has not been fixed or other faults are present.
Depending on which monitor sets a code the vehicle may need to be driven and the monitor ran before concluding that the fault is repaired.
From Diagnostic Menu:
1. Select Erase Codes.
   • Use the READ and keys until Erase Codes is highlighted.

   Press ENTER.

Diagnostic Menu
I/M Monitors
Read Codes
Erase Codes
MIL Status
State OBD Check
View Data
Record Data
View Freeze Data
Drive Cycle Monitor

   Alternately, press and hold the key for 2 seconds when appears on the display.
   • If diagnostic results and codes are not to be erased select NO and press ENTER.

Erase Codes
Are you sure you want to erase diagnostic results and codes?

No
Yes

Rd\Er

   Selecting NO displays a “Command canceled” message.

Erase Codes
Command canceled

Press ENTER to continue

Rd\Er

2. Select YES to erase diagnostic results and codes.
   • Press ENTER.

Erase Codes
Are you sure you want to erase diagnostic results and codes?

No
Yes

Rd\Er

3. If more than one module is supported, a menu is
displayed.

- Use the \[\text{READ}\] and \[\text{ERASE}\] keys until the desired choice is highlighted.

- Press ENTER.

4. Observe “Command sent” message is displayed.

- Press ENTER.

5. Return to Diagnostic Menu.

- Press BACK.

5.4 MIL Status

From Diagnostic Menu:

1. Select MIL Status.

- Use the \[\text{READ}\] and \[\text{ERASE}\] keys until MIL Status is highlighted.

- Press ENTER.

5.5 State OBD Check

The State OBD Check function is used to display a basic status of the vehicle’s OBD system.

- Malfunction indicator lamp (MIL) status
- Codes found
- I/M monitors

Erase Codes deletes DTCs and resets I/M monitors from vehicle’s computer module(s).

The State OBD Check function has the following areas:

- MIL Status ON or OFF
- Number of Codes Found
- Number of Monitors OK
- Number of Monitors Inc
- Number of Monitors N/A

State OBD Check should be done with the key on engine running (KOER) due to showing MIL status.

The number of codes found are OBDII/EOBD confirmed codes and permanent codes. Pending codes are not included.

The number of monitors that are either ok, inc, or na are only Since DTCs Cleared and not This Drive Cycle.

Refer to Read Codes and I/M Monitors for more detailed information about the results.

From Diagnostic Menu:

1. Select State OBD Check.

- Use the \[\text{READ}\] and \[\text{ERASE}\] keys until State OBD Check is highlighted.

- Press ENTER.
3. Return to Diagnostic Menu.
   • Press BACK.

5.6 View Data
The View Data function allows real time viewing of the vehicle's computer module's parameter identification (PID) data. As the computer monitors the vehicle, information is simultaneously transmitted to scan tool.

View Data allows the following items to be viewed on the scan tool:
• Sensor data
• Operation of switches
• Operation of solenoids
• Operation of relays

Apart from Read Codes, View Data is the most useful diagnostic function for isolating the cause of a vehicle operation problem.

From Diagnostic Menu:
1. Select View Data.
   • Use the keys until View Data is highlighted.
   • Press ENTER.

2. Observe while the scan tool validates PID list.

   • PID MAP validation is the tool asking the vehicle which PIDs are supported. See “Appendix A—PID Definitions” on page 34 for a complete list of PIDs supported by the tool.
   • Multiple PIDs may be sent if vehicle is equipped with more than one computer module (for example a powertrain control module [PCM] and a transmission control module [TCM]). The scan tool identifies them by their identification names (ID) assigned by manufacturer (i.e. $10 or $1A).
   • If one or more control module stops responding, the scan tool displays a message.
     – If continuing, dashes will replace data in right-hand column.
     – If NO is selected, the scan tool attempts to re-establish communication with that module.

From Select Data to View menu:
1. Select Entire Data List.
   • Use the keys until Entire Data List is highlighted.
   • Press ENTER.
• See “Appendix A—PID Definitions” on page 34 for PID definitions.

• If the ▶ icon displays while a PID is selected press ENTER to view graph.

• Press ENTER to pause the graph. Press ENTER again to continue graphing.

3. Return to PID screen.

• Press BACK.

4. Return to Select Data to View menu.

• Press BACK.

5. Return to Diagnostic Menu.

• Press BACK.

### 5.7 Record Data

The Record Data function records PIDs while vehicle is parked or being driven. The Record Data function is mainly used for diagnosing intermittent driveability problems that cannot be isolated by any other method. The recording time varies. A recording consists of frames of data before the trigger and several frames after the trigger.

**CAUTION**

Two people must be in vehicle when driving. One to drive and the other to operate the scan tool.

From Diagnostic Menu:

1. Select Record Data.

• Use the READ and ERASE keys until Record Data is highlighted.

• Press ENTER.

2. Follow all instructions on display.
   • The scan tool can maintain only one recording. Make sure to thoroughly review old recording before erasing.
   • If a recording currently exists in memory, a message prompting to erase data is displayed.

   ![Record Data Menu](image)

• Scan tool validates list of global PIDs from vehicle.

3. Press ENTER to begin recording.

   ![Recording Data](image)

• Data continues to be saved until either:
  - Record memory is full.
Operator presses **ENTER**.

- **Recording**
  
  Collecting data for frame #2
  Press **ENTER** to end recording

  • Scan tool recording times vary. A recording consists of frames of data before trigger and several frames after trigger.

4. After recording, scan tool displays a prompt to Playback Data.

- **Record Data**

  Playback data?

  • Select **NO** to return to Diagnostic Menu.
  • Select **YES** to display recorded data.
  • Refer to “Recording” on page 15 for instructions on how to play back data.

5.8 **View Freeze Data**

When an emission-related fault occurs, certain vehicle conditions are recorded by the on-board computer. This information is referred to as freeze frame data. **View Freeze Data** is a snapshot of the operating conditions at the time of an emission-related fault. **View Freeze Data** can be overwritten by faults with a higher priority. If codes were erased, **View Freeze Data** may not be stored in vehicle memory depending on vehicle.

From **Diagnostic Menu**:

1. Select **View Freeze Data**.
   - Use the **READ** and **ERASE** keys until **View Freeze Data** is highlighted.
   - Press **ENTER**.

2. Select frame, if more than one frame is present.
   - Use the **READ** and **ERASE** keys until the desired frame is highlighted.
   - Press **ENTER**.

3. View PID on scan tool.

<table>
<thead>
<tr>
<th>TROUBLE CODE</th>
<th>P2122</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUEL SYS 1</td>
<td>N/A</td>
</tr>
<tr>
<td>FUEL SYS 2</td>
<td>N/A</td>
</tr>
<tr>
<td>CALC LOAD(%)</td>
<td>0.0</td>
</tr>
<tr>
<td>COOLANT(°C)</td>
<td>-40</td>
</tr>
<tr>
<td>ST FTRM1(%)</td>
<td>0.0</td>
</tr>
<tr>
<td>LT FTRM1(%)</td>
<td>0.0</td>
</tr>
<tr>
<td>MAP(KPa)</td>
<td>177.0</td>
</tr>
<tr>
<td>ENG SPEED(RPM)</td>
<td>0</td>
</tr>
<tr>
<td>VEH SPEED(KPH)</td>
<td>0</td>
</tr>
</tbody>
</table>

  • Use the **READ** and **ERASE** keys.
  • See “Appendix A—PID Definitions” on page 34 for PID definitions.
  • If Long PID Names is turned on, the expanded text for the PID will scroll on the bottom line of the display. See “Long PID Names” on page 12.

4. Select another frame to view (if available).
   - Press **ENTER**.
5. Return to **Diagnostic Menu**.
   - Press **BACK**.

### 5.9 Drive Cycle Monitor

The **Drive Cycle Monitor** function is very similar to I/M Monitors though the **Drive Cycle Monitor** is used to view real-time operations of the emissions system on OBDII vehicles. **Drive Cycle Monitor** continuously updates as the vehicle reports operations of the emission system.

**CAUTION**

Two people must be in vehicle when driving. One to drive and the other to operate the scan tool.

- Refer to the vehicle service manual for the drive cycle operation.

**Drive Cycle Monitor** can be used if you want to drive the vehicle until all of the monitors are OK.

During normal driving conditions, the vehicle computer scans the emission system. After a specific amount of drive time (each monitor has specific driving conditions and time requirements), the computer monitors will decide if the vehicle emissions system is working correctly or not as well as detecting out a range of values. When the monitor status is:

- **“ok”** - vehicle has been driven enough for function.
- **“inc”** (incomplete) - vehicle was not driven enough to complete all of the monitors.
- **“n/a”** (not applicable) - vehicle does not support that monitor.

Reset monitors by:

- Erasing codes.
- Vehicle computer module losing power (on some vehicles).

From **Diagnostic Menu**:

1. Select **Drive Cycle Monitor**.
   - Use the **READ** and **ERASE** keys until **Drive Cycle Monitor** is highlighted.
   - Press **ENTER**.

<table>
<thead>
<tr>
<th>Since DTCs Cleared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misfire Monitor</td>
</tr>
<tr>
<td>Fuel System Mon</td>
</tr>
<tr>
<td>Comp Component</td>
</tr>
<tr>
<td>Catalyst Mon</td>
</tr>
<tr>
<td>Htd Catalyst</td>
</tr>
<tr>
<td>Evap System Mon</td>
</tr>
<tr>
<td>Sec Air System</td>
</tr>
<tr>
<td>A/C Refrig Mon</td>
</tr>
<tr>
<td>Oxygen Sens Mon</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>This Drive Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misfire Monitor</td>
</tr>
<tr>
<td>Fuel System Mon</td>
</tr>
<tr>
<td>Comp Component</td>
</tr>
<tr>
<td>Catalyst Mon</td>
</tr>
<tr>
<td>Htd Catalyst</td>
</tr>
<tr>
<td>Evap System Mon</td>
</tr>
<tr>
<td>Sec Air System</td>
</tr>
<tr>
<td>A/C Refrig Mon</td>
</tr>
<tr>
<td>Oxygen Sens Mon</td>
</tr>
</tbody>
</table>

- Some vehicles do not support **Drive Cycle Monitor**. If vehicle supports both types of drive cycle monitors the **Drive Cycle Monitor** menu will display.

<table>
<thead>
<tr>
<th>Drive Cycle Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since DTCs Cleared</td>
</tr>
<tr>
<td>This Drive Cycle</td>
</tr>
</tbody>
</table>

2. View summary of monitor status.
   - Use the **READ** and **ERASE** keys (if required).

3. Depending on the drive cycle monitors, either the **This Drive Cycle** or the **Since DTCs Cleared** screen will display.
   - The scan tool display is continuously updated. Monitors that are “ok” will disappear and only the “inc” monitors will remain displayed. Monitors designated “n/a” are not displayed.
   - When all Monitors are “OK” a screen stating “All supported monitors are OK” will display.
4. Return to **Diagnostic Menu**.
   - Press **BACK**.

**5.10 O2 Monitor Tests**

OBDII regulations require applicable vehicles monitor and test oxygen (O2) sensors to determine problems related to fuel and emissions. The O2 Monitor Tests allows retrieval of completed O2 sensors monitor test results.

- The **O2 Monitor Tests** is not an on-demand test. O2 sensors are not tested when selected via the menu. O2 sensors are tested when engine operating conditions are within specified limits.
- If the vehicle communicates using a controller area network (CAN), **O2 Monitor Tests** are not supported by vehicle. A message is displayed. See “Diagnostic Monitor Tests” in this section to see O2 monitor data.
- O2 sensors are located before (upstream) and after (downstream) catalyst(s). Sensors are named (xy) for their position to both cylinder banks and catalysts.
  - The O2 sensor for cylinder bank 1 has prefix 1y while O2 sensor for cylinder bank 2 has prefix 2y.
  - The O2 sensor upstream of catalyst (closest to engine) has suffix x1 while O2 sensor downstream of catalyst has suffix x2. If vehicle contains more catalysts, O2 sensor downstream of second catalyst has suffix x3 and O2 sensor downstream of next catalyst has suffix x4.
  - For example, O2S21 is upstream O2 sensor for cylinder bank 2.

The following O2 Sensor Tests are available:

- Rich-to-lean sensor threshold voltage
- Lean-to-rich sensor threshold voltage
- Low sensor voltage for switch time
- High sensor voltage for switch time
- Rich-to-lean sensor switch time
- Lean-to-rich sensor switch time
- Minimum sensor voltage test cycle
- Maximum sensor voltage test cycle
- Time between sensor transitions
- Sensor period
- Manufacturer specific tests

From **Diagnostic Menu**:

1. Select **O2 Monitor Tests**.
   - Use the **READ** and **ERASE** keys until **O2 Monitor Tests** is highlighted.
   - Press **ENTER**.

2. Select O2 sensor.
   - Use the **READ** and **ERASE** keys until the desired O2 monitor is highlighted.
   - Press **ENTER**.

- The O2 sensors located upstream (before catalyst) may perform differently than ones located downstream (after catalyst).
- Test IDs are shown for unknown O2 sensor tests.

3. View results of selection.

4. Return to **O2 Sensor Tests** menu.
   - Press **BACK**.

5. Return to **Diagnostic Menu**.
   - Press **BACK**.
5.11 Diagnostic Monitor Tests

The Diagnostic Monitor Test function is useful after servicing or after erasing a vehicle’s memory. Test results do not necessarily indicate a faulty component or system.

- Non-CAN vehicles **Diagnostic Monitor Test** receives test results for emission-related powertrain components and systems that are not continuously monitored.
- CAN vehicles **Diagnostic Monitor Test** receives test results for emission-related powertrain components and systems that are and are not continuously monitored.
- Vehicle manufacturer is responsible for assigning test and component IDs.

From **Diagnostic Menu**:
1. Select **Diagnostic Monitor Test**.
   - Use the \( \uparrow \) and \( \downarrow \) keys until **Diagnostic Monitor Test** is highlighted.
   - Press ENTER.
   - Applicable diagnostic monitor tests are displayed.
2. Review test results displayed on scan tool.
   - Use the \( \uparrow \) and \( \downarrow \) keys until desired result is highlighted.
   - Press ENTER.
   - Non-CAN example:
     - CAN example:

3. Return to **Select Test** menu.
   - Press BACK.
4. Return to **Diagnostic Menu**.

Or, refer to appropriate vehicle service manual for test IDs and definitions.

- On Non-CAN vehicles the scan tool displays:
  - Test data (test ID)
  - Maximum value (MAX)
  - Test measurements (MEAS)
  - Minimum value (MIN)
  - Status (STS)
  - Measurements and Specification values are hexadecimal numbers (i.e., $1A, $FE, $11.)
  - Module (MOD)

- On CAN vehicles scan tool displays:
  - Test performed. The test performed can be $## if test is not defined. Refer to vehicle service manual for details.
  - Measured values and units of measured (such as volts, amps, and seconds).
  - Status of monitor test data.
  - Module ID where the monitor test data came from.
5.12 On-Board Systems

The On-Board Systems test allows the scan tool to control operation of vehicle components, tests or systems.

- Some manufacturers do not allow tools to control vehicle systems. A vehicle not supporting an on-board system is identified by a message that is displayed when selected.
- Refer to the vehicle service manual for on-board systems instructions.
- The manufacturer is responsible for determining the criteria to automatically stop test. Refer to appropriate vehicle service manual.

From Diagnostic Menu:
   - Use the \ and \ keys until On-Board Systems is highlighted.
   - Press \.

2. Select test.
   - Use the \ and \ keys until desired test is highlighted.
   - Press \.

3. Return to On-Board Systems menu.
   - Press \.

4. Return to Diagnostic Menu.

5.13 Charging System Monitor

The Charging System Monitor function allows the scan tool to provide voltage measurements at the DLC to give an indication of battery, starter, and alternator performance.

From the Diagnostic Menu:
1. Select Charging System Monitor
   - Use the \ and \ keys until Charging System Monitor is highlighted.
   - Press \.

2. Turn the ignition key ON but do not start the engine.
   - Press \.

3. The DLC voltage is measured at KOEO.
   - The screen below shows a KOEO voltage of 11.4V.
   - Start the engine, or press BACK to return to the Diagnostic Menu.
   - The scan tool will monitor the DLC voltage and progress to step 4 if starter cranking is detected.
4. When the cranking condition is detected, the scan tool will begin collecting DLC voltage readings.

   • If the engine starts, press ENTER.

   

5. If an engine started condition is detected, the scan tool will collect Key On Engine running DLC voltages.

6. The test results are then displayed.

   

7. After reviewing the test results, press ENTER or BACK to return to the Diagnostic Menu.

5.14 Vehicle Information

The Vehicle Information function allows the scan tool to request the vehicle’s VIN number, calibration ID(s) which identifies software version in vehicle control module(s), calibration verification numbers (CVN(s)) and in-use performance tracking.

   • Vehicle Information function applies to model year 2000 and newer OBDII compliant vehicles.
   • The scan tool cannot verify if data is correct for scanned vehicles.
   • CVNs are calculated values required by OBDII regulations.
   • The CVN calculation may take several minutes.
   • CVNs are reported to determine if emission-related calibrations have been changed. Multiple CVNs may be reported for a control module.
   • In-use performance tracking, tracks performance of key I/M Monitors.

From Diagnostic Menu:

1. Select Vehicle Information.

   • Use the ↑↓ and ←→ keys until Vehicle Information is highlighted.

   • Press ENTER.

2. Select information to view from the menu.

On the first “Test Results” screen example, the Scan Tool did not detect that the engine had started. Because of this, there is no KOER voltage reading.

The second “Test Results” screen example did detect that the engine had started, and a KOER reading is displayed.

The second “Test Results” screen example shows that the KOEO voltage before an engine start was attempted was 11.7V. Once the starter began cranking the engine, a cranking voltage of 8V was measured. After the engine started, a KOER voltage reading of 14.6V was measured.

   • If the KOEO voltage is very low, this could be an indication of a bad battery, or one that needs to be charged.
   • If the cranking voltage is a lot lower than the KOEO voltage, than this is an indication of a worn starter.
   • If the KOER voltage is not higher than the KOEO voltage, than this indicates a bad or weak alternator.
3. View information supported by vehicle.
   - Use the READ and ERASE keys (if required).

   • In the above examples, Module $09$ returned data. Scroll down to view information. CVNs are shown as hexadecimal numbers.
   • Abbreviations and names for in-use performance tracking data supported by the tool are shown below. Not all data is supported by all vehicles.

<table>
<thead>
<tr>
<th>Abbreviated Name</th>
<th>Expanded Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Use Perf Tracking</td>
<td>In-Use Performance Tracking</td>
</tr>
<tr>
<td>OBDCOND</td>
<td>OBD Monitoring Conditions Encountered Counts</td>
</tr>
<tr>
<td>IGNCNTR</td>
<td>Ignition Counter</td>
</tr>
<tr>
<td>CATCOMPX</td>
<td>Catalyst Monitor Completion Counts Bank x</td>
</tr>
<tr>
<td>CATCONDX</td>
<td>Catalyst Monitor Conditions Encountered Counts Bank x</td>
</tr>
<tr>
<td>O2SCOMPX</td>
<td>O2 Sensor Monitor Completion Counts Bank x</td>
</tr>
<tr>
<td>O2SCONDX</td>
<td>O2 Sensor Conditions Encountered Counts Bank x</td>
</tr>
<tr>
<td>EGRCOMP</td>
<td>EGR Monitor Completion Condition Counts</td>
</tr>
<tr>
<td>EGRCOND</td>
<td>EGR Monitor Conditions Encountered Counts</td>
</tr>
<tr>
<td>AIRCOMP</td>
<td>AIR Monitor Completion Condition Counts (Secondary Air)</td>
</tr>
<tr>
<td>AIRCOND</td>
<td>AIR Monitor Conditions Encountered Counts (Secondary Air)</td>
</tr>
<tr>
<td>EVAPCOMP</td>
<td>EVAP Monitor Completion Condition Counts</td>
</tr>
<tr>
<td>EVAPCOND</td>
<td>EVAP Monitor Conditions Encountered Counts</td>
</tr>
</tbody>
</table>

   • If message INVALID displays on screen, the data returned from the vehicle is incorrect, or is not formatted in accordance with OBDII specifications.

4. Return to Vehicle Information menu.
   - Press BACK.

5. Return to Diagnostic Menu.
   - Press BACK.
6 Troubleshooting

6.1 Error Messages
Check the following if an error message displays:
• Verify ignition key is in the ON and not in the ACCESSORIES position.
• Make sure the DLC Cable is attached to vehicle’s data link connector (DLC) and scan tool.
• Look at DLC and check for cracked or recessed pins, or for any substance that could prevent a good electrical connection.
• Test for continuity between the DLC wiring and the computer. In an extreme case, there may be a broken wire.
• Check for bent or broken pins.
• With the engine off, check for blown fuses in the vehicle fuse box.
• Make sure the vehicle’s control module has a good ground. If the computer case is grounded, then clean the connection and apply a conductive (dielectric) grease to the mating surfaces.
• With the key on engine off (KOEO), verify vehicle battery voltage is at least 8.0V.
• Verify the control module is not defective.

6.2 Scan Tool Does Not Power Up

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review “Safety Messages” on page 5 before troubleshooting.</td>
</tr>
</tbody>
</table>

If scan tool will not power up, communicate with vehicle control module, pass scan tool self-tests, or functions incorrectly in any other way, do the following:
• Clean the DLC pins.
• Disconnect and reconnect DLC making sure it is connected correctly.
• Check vehicle battery to make sure at least 8.0 volts is present.
• Contact customer service.
• With the engine off, check for blown fuses in the vehicle fuse box.

6.3 Vehicle Communication Fault
The vehicle’s control module(s) enters into an unrecoverable state.
1. Turn vehicle key to off position.
   • Wait 10 seconds.
   • Press ENTER.

6.4 Operating Error or Erroneous Data
An Operating Error or Erroneous Data occurs if vehicle’s computer(s) stop(s) communicating with the scan tool.
1. Make selection.
   • Use the READ and ERASE keys.

6.5 Tool Self-Tests
Tool Self-Tests check the display, keys, and internal memory.
• Refer to “Using the Scan Tool” on page 10 for the operation procedures for scan tool self-tests.

6.6 Technical Support
Toll-Free Number: 1-800-533-6127.
7 Appendix A—PID Definitions

Although there are in excess of 300 PIDs, the tool only displays the PIDs the vehicle supports.

<table>
<thead>
<tr>
<th>PID</th>
<th>PID Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS FRP</td>
<td>Absolute Fuel Rail Pressure</td>
</tr>
<tr>
<td>ABS LOAD</td>
<td>Absolute Load Value</td>
</tr>
<tr>
<td>ABS TPS, C</td>
<td>Throttle Position B, C</td>
</tr>
<tr>
<td>ABS TPS</td>
<td>Absolute Throttle Position</td>
</tr>
<tr>
<td>ACC POS D</td>
<td>Accelerator Pedal D, E, F</td>
</tr>
<tr>
<td>ACC POS REL</td>
<td>Relative Accelerator Pedal Position</td>
</tr>
<tr>
<td>AEDC1_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #1 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC10_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #10 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC11_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #11 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC12_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #12 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC13_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #13 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC14_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #14 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC15_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #15 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC16_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #16 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC17_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #17 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC18_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #18 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC19_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #19 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC20_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #20 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC3_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #3 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC4_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #4 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC5_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #5 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC6_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #6 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC7_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #7 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC8_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #8 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>AEDC9_TIME1, TIME 2</td>
<td>Total Run Time with E1-AECD #9 Timer 1 Active, #2 Timer Active</td>
</tr>
<tr>
<td>ALCOHOL</td>
<td>Alcohol Fuel Percent</td>
</tr>
<tr>
<td>BARO PRS</td>
<td>Barometric Pressure</td>
</tr>
<tr>
<td>BAT_PWR</td>
<td>Hybrid Battery Pack Remaining Life</td>
</tr>
<tr>
<td>BP_A_ACT, B_ACT</td>
<td>Boost Pressure Sensor A, Sensor B</td>
</tr>
<tr>
<td>BP_A_CMD, B_CMD</td>
<td>Commanded Boost Pressure A, Pressure B</td>
</tr>
<tr>
<td>BP_A_STAT, B_STAT</td>
<td>Boost Pressure A Control Status, B Control Status</td>
</tr>
<tr>
<td>CACT 11, 12</td>
<td>Charge Air Cooler Temperature Bank 1 Sensor 1 supported, Sensor 2 supported</td>
</tr>
<tr>
<td>CACT 21,22</td>
<td>Charge Air Cooler Temperature Bank 1 Sensor 1 supported, Sensor 2 supported</td>
</tr>
<tr>
<td>CALC LOAD</td>
<td>Calculated Engine Load</td>
</tr>
<tr>
<td>CAT TEMP11, TEMP12</td>
<td>Catalytic Converter Temp Bank1, Temp Bank 3</td>
</tr>
<tr>
<td>CAT TEMP21, TEMP22</td>
<td>Catalytic Converter Temp Bank2, Temp Bank 4</td>
</tr>
<tr>
<td>CLR DIST</td>
<td>Distance since erase</td>
</tr>
<tr>
<td>CLR TIME</td>
<td>Minutes Run since Erase</td>
</tr>
<tr>
<td>CLR TRPS</td>
<td>Warmups Since Erase</td>
</tr>
<tr>
<td>CMD EQ RAT</td>
<td>Commanded Equivalence Ratio</td>
</tr>
<tr>
<td>COOLANT</td>
<td>Engine Coolant Temp</td>
</tr>
<tr>
<td>DPF_REG_AVGD</td>
<td>Average Distance Between DPF Regen</td>
</tr>
<tr>
<td>DPF_REG_AVGT</td>
<td>Average Time Between DPF Regen</td>
</tr>
<tr>
<td>DPF_REG_STAT</td>
<td>Diesel Particulate Filter (DPF) Regen Status</td>
</tr>
<tr>
<td>DPF_REG_TYP</td>
<td>Diesel Particulate Filter (DPF) Regen Type</td>
</tr>
<tr>
<td>DPF_REGEN_PCT</td>
<td>Normalized Trigger for DPF Regen</td>
</tr>
<tr>
<td>DPF1_DP, DPF2_DP</td>
<td>Diesel Particulate Filter (DPF) Bank 1 Delta Pressure Bank 2 Delta Pressure</td>
</tr>
<tr>
<td>DPF1_INP, DPF2_INP</td>
<td>Diesel Particulate Filter (DPF) Bank 1 Inlet Pressure, Bank 2 Inlet Pressure</td>
</tr>
<tr>
<td>DPF1_INT, DPF2_INT</td>
<td>DPF Bank 1 Inlet Temperature Sensor, Bank 2 Inlet Temperature Sensor</td>
</tr>
<tr>
<td>DPF1_OUTP, DPF2_OUTP</td>
<td>Diesel Particulate Filter (DPF) Bank 1 Outlet Pressure, Bank 2 Outlet Pressure</td>
</tr>
<tr>
<td>ECT 1, 2</td>
<td>Engine Coolant Temperature 1, Temperature 2</td>
</tr>
<tr>
<td>EGR CMD</td>
<td>Comanded EGR</td>
</tr>
<tr>
<td>EGR ERR</td>
<td>Exhaust Gas Recirculation Error</td>
</tr>
<tr>
<td>EGR_A_ACT, B_ACT</td>
<td>Actual EGR A Duty Cycle/Position, B Duty Cycle/Position</td>
</tr>
<tr>
<td>EGR_A_CMD, B_CMD</td>
<td>Commanded EGR A Duty Cycle/Position, B Duty Cycle/Position</td>
</tr>
<tr>
<td>EGR_A_ERR, B_ERR</td>
<td>EGR A Error, B Error</td>
</tr>
<tr>
<td>EGRT 11, 2</td>
<td>Exhaust Gas Recirculation Temperature Bank 1 Sensor 1, Bank 2 Sensor 1</td>
</tr>
<tr>
<td>EGRT 12, 2</td>
<td>Exhaust Gas Recirculation Temperature Bank 1 Sensor 2, Bank 2 Sensor 2</td>
</tr>
<tr>
<td>EGT 11, 21</td>
<td>Exhaust Gas Temperature (EGT) Bank 1 Sensor 1, Bank 2 Sensor 1</td>
</tr>
<tr>
<td>EGT 12, 22</td>
<td>Exhaust Gas Temperature (EGT) Bank 1 Sensor 2, Bank 2 Sensor 2</td>
</tr>
<tr>
<td>EGT 13, 23</td>
<td>Exhaust Gas Temperature (EGT) Bank 1 Sensor 3, Bank 2 Sensor 3</td>
</tr>
<tr>
<td>EGT 14, 24</td>
<td>Exhaust Gas Temperature (EGT) Bank 1 Sensor 4, Bank 2 Sensor 4</td>
</tr>
<tr>
<td>EMIS_SUP</td>
<td>Emission requirements to which vehicle is designed</td>
</tr>
<tr>
<td>ENG RUN</td>
<td>Time Since Engine Start</td>
</tr>
<tr>
<td>PID</td>
<td>PID Description</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ENG SPEED</td>
<td>Engine RPM</td>
</tr>
<tr>
<td>EOT</td>
<td>Engine Oil Temperature</td>
</tr>
<tr>
<td>EP_1, 2</td>
<td>Exhaust Pressure Sensor Bank 1, Bank 2</td>
</tr>
<tr>
<td>EQ RATIO</td>
<td>Equivalence Ratio</td>
</tr>
<tr>
<td>EVAP PURGE</td>
<td>Commanded EVAP Purge</td>
</tr>
<tr>
<td>EVAP VP</td>
<td>EVAP Vapor Pressure</td>
</tr>
<tr>
<td>EVAP VPA</td>
<td>Absolute EVAP Vapor Pressure</td>
</tr>
<tr>
<td>FRP_A, B</td>
<td>Fuel Rail Pressure A, B</td>
</tr>
<tr>
<td>FRP_A_CMD, B_CMD</td>
<td>Commanded Fuel Rail Pressure A, B</td>
</tr>
<tr>
<td>FRT_A, B</td>
<td>Fuel Rail Temperature A, B</td>
</tr>
<tr>
<td>FUEL LEVEL</td>
<td>Fuel Level Input</td>
</tr>
<tr>
<td>FUEL PRES</td>
<td>Fuel Rail Pressure</td>
</tr>
<tr>
<td>FUEL SYS 1, 2</td>
<td>Fuel System 1 Loop Status, System 2 Loop Status</td>
</tr>
<tr>
<td>FUEL TYPE</td>
<td>Fuel Type</td>
</tr>
<tr>
<td>FUEL_RATE</td>
<td>Engine Fuel Rate</td>
</tr>
<tr>
<td>FUEL_TIMING</td>
<td>Fueling Injection Timing</td>
</tr>
<tr>
<td>GPL_STAT</td>
<td>Glow Plug Lamp Status</td>
</tr>
<tr>
<td>IAF_A_CMD, B_CMD</td>
<td>Commanded Intake Air Flow A Control, B Control</td>
</tr>
<tr>
<td>IAF_A_REL, B_REL</td>
<td>Relative Intake Air Flow A Position, B Position</td>
</tr>
<tr>
<td>IAT</td>
<td>Intake Air Temp</td>
</tr>
<tr>
<td>IAT 11, 21</td>
<td>Intake Air Temperature Sensor Bank 1 Sensor 1, Bank 2 Sensor 1</td>
</tr>
<tr>
<td>IAT 12, 22</td>
<td>Intake Air Temperature Sensor Bank 1 Sensor 2, Bank 2 Sensor 2</td>
</tr>
<tr>
<td>IAT 13, 23</td>
<td>Intake Air Temperature Sensor Bank 1 Sensor 3, Bank 2 Sensor 3</td>
</tr>
<tr>
<td>ICP_A_CMD, B_CMD</td>
<td>Injection Control Pressure A, B</td>
</tr>
<tr>
<td>IDLE_TIME</td>
<td>Total Idle Run Time</td>
</tr>
<tr>
<td>IGN ADV</td>
<td>Timing Advance</td>
</tr>
<tr>
<td>LAMBDA11, 21</td>
<td>02 Sensor Lambda Bank 1 Sensor 1, Bank 2 Sensor 1</td>
</tr>
<tr>
<td>LAMBDA12, 22</td>
<td>02 Sensor Lambda Bank 1 Sensor 2, Bank 2 Sensor 2</td>
</tr>
<tr>
<td>LT FTRM1</td>
<td>Long Term Fuel Trim 1 or 3</td>
</tr>
<tr>
<td>LT FTRM2</td>
<td>Long Term Fuel Trim 2 or 4</td>
</tr>
<tr>
<td>LT SEC FT1, 2, 3, 4</td>
<td>Long Term Secondary O2 Sensor Fuel Trim 1, 2, 3, 4</td>
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### Appendix B—Glossary

**A/C:**
Air conditioner

**A/D:**
Analog to digital

**A/F:**
Air/Fuel ratio. The proportion of air and fuel delivered to the cylinder for combustion. For example, an A/F ratio of 14:1 denotes 14 times as much air as fuel in the mixture. Ideally the A/F ratio is 14.7:1.

**ABS:**
Anti-lock brake system

**A/C clutch relay:**
The PCM uses this relay to energize the A/C clutch, turning the A/C compressor on or off.

**A/C pressure sensor:**
Measures air conditioning refrigerant pressure and sends a voltage signal to the PCM.

**A/C pressure switch:**
A mechanical switch connected to the A/C refrigerant line. The switch is activated (sending a signal to the PCM) when the A/C refrigerant pressure becomes too low or high.

**Actuator:**
Actuators such as relays, solenoids, and motors allow the PCM to control the operation of vehicle systems. Air Injection Reaction (AIR) System:
An emission control system operated by the PCM. During cold starts, an air pump injects outside air into the exhaust manifold to help burn hot exhaust gases. This reduces pollution and speeds warm-up of oxygen sensors and catalytic converters. After the engine is warm, the air will either be dumped back to the atmosphere (or into the air cleaner assembly) or sent to the catalytic converter.

**APP:**
Acceleration pedal position (sensor)

**ASR:**
Acceleration slip regulation

**Bank x:**
The standard way of referring to the bank of cylinders containing cylinder #x. In-line engines have only one bank of cylinders. Most commonly used to identify the location of oxygen sensors. See O2S, Sensor x, Sensor y.

**BARO:**
Barometric pressure sensor. See MAP sensor.

**BBV:**
Brake boost vacuum (sensor)
BCM:
Body control module

Boost control solenoid:
A solenoid that is energized by the PCM, in order to control turbo/supercharger boost pressure.

Brake switch signal:
An input signal to the PCM indicating that the brake pedal is being pressed. This signal is typically used to disengage cruise control systems and torque converter clutch (TCC) solenoids. See also TCC.

CAM:
Camshaft position sensor. Sends a frequency signal to the PCM to synchronize fuel injector and spark plug firing.

Catalytic converter:
Designed to reduce exhaust emissions.

CAN:
Controller area network

CARB:
California air resources board. Governing body for emissions control in California.

CKP REF:
Crankshaft position reference.

CKP:
Crankshaft position. See CPS.

CKT:
Circuit

Closed loop (CL):
A feedback system that uses the O2 Sensor(s) to monitor the results of combustion. Based on the signal(s) from the O2 sensor(s), the PCM modifies the air/fuel mixture to maintain optimum performance with lowest emissions. In closed loop mode, the PCM can fine tune control of a system to achieve an exact result.

CMP:
Camshaft position sensor

CO:
Carbon monoxide; odorless gas produced by incomplete combustion.

Code scanner:
A device that interfaces with and communicates information via a data link.

Continuous memory codes:
See pending codes.

CPS:
Crankshaft position sensor. Sends a frequency signal to the PCM. It is used to reference fuel injector operation and synchronize spark plug firing on distributorless ignition systems (DIS).

CTS:
Coolant temperature sensor. A resistance sensor that sends a voltage signal to the PCM indicating the temperature of the coolant. This signal tells the PCM whether the engine is cold or warm.

CVRTD:
Continuous variable real time damping

D/R:
Drive/reverse

Data Link Connector (DLC):
Connector providing access and/or control of the vehicle information, operating conditions, and diagnostic information. Vehicles with OBD II use a 16-pin connector located in the passenger compartment.

Data stream:
The actual data communications sent from the vehicle's PCM to the data connector.

DEPS:
Digital engine position sensor.

Detonation:
See knock.

DI/DIS:
Direct Ignition/Distributorless Ignition System. A system that produces the ignition spark without the use of a distributor.

DPFE:
Differential pressure feedback-exhaust gas recirculation sensor

DTC:
Diagnostic trouble code. An alphanumeric identifier for a fault condition identified by the on board diagnostic system.

Duty Cycle:
A term applied to signals that switch between on and off. Duty cycle is the percentage of time the signal is on. For example, if the signal is on only one fourth of the time, then the duty cycle is 25%. The PCM uses duty cycle type signals to maintain precise control of an actuator.

EBCM:
Electronic brake control module

EBTCM:
Electronic brake/traction control module

ECM:
Engine control module or electronic control module

ECT:
Engine coolant temperature sensor. See CTS.

EEPROM:
Electrically erasable programmable read only memory

EFE:
Early fuel evaporation

EFI:
Electronic fuel injection. Any system where a computer controls fuel delivery to the engine by using fuel injectors.

EGR:
Exhaust gas recirculation. The PCM uses the EGR system to recirculate exhaust gases back into the intake manifold to reduce emissions. EGR is used only during warm engine cruise conditions.

EOP:
Engine oil pressure (switch)

EOT:
Engine oil temperature (sensor)

EPA:
Environmental protection agency
ESC:
Electronic spark control. An ignition system function that warns the PCM when knock is detected. The PCM then retards spark timing to eliminate the knocking condition.

EST:
Electronic spark timing. An ignition system that allows the PCM to control spark advance timing. The PCM determines optimum spark timing from sensor information — engine speed, throttle position, coolant temperature, engine load, vehicle speed, Park/Neutral switch position, and knock sensor condition.

EVAP:
Evaporative emissions system
FC:
Fan control
Freeze frame:
A block of memory containing DTCs of the vehicle operating conditions for a specific time.
FTP:
Federal test procedure. Strict test of vehicle’s emissions.
Ground (GND):
An electrical conductor used as a common return for an electric circuit(s) and with a relative zero potential (voltage).
Hall effect sensor:
Any of a type of sensor utilizing a permanent magnet and a transistorized Hall Effect switch. Hall Effect type sensors may be used to measure speed and position of the crankshaft or camshaft — for spark timing and fuel injector control.
HO2S:
Heated oxygen sensor. See O2S.
HVAC:
Heating, ventilation, & air conditioning (system)
I/M:
Inspection and maintenance. An emission control program.
IAC:
Idle air control. A device mounted on the throttle body which adjusts the amount of air bypassing a closed throttle so that the PCM can control idle speed.
IAT:
Intake air temperature (sensor)
ICM:
Ignition control module.
IMRC:
Intake manifold runner control
IPC:
Instrument panel cluster
ISC:
Idle speed control. A small electric motor mounted on the throttle body and controlled by the PCM. The PCM can control idle speed by commanding the ISC to adjust its position.
ISO:
International Organization of Standardization also know as International Standards Organization.
KAM:
Keep alive memory
Knock sensor (KS):
Used to detect engine detonation or knock. The sensor contains a piezoelectric element and is threaded into the engine block. Special construction makes the element sensitive only to engine vibrations associated with detonation.
Knock:
Uncontrolled ignition of the air/fuel mixture in the cylinder. Also referred to as detonation or ping. Knock indicates extreme cylinder pressures or “hotspots” that are causing the air/fuel mixture to detonate prematurely.
KOEO:
Key ON engine OFF. Turn the ignition key to on, but don’t start the engine.
KOER:
Key ON engine running. Start the vehicle.
LCD:
Liquid crystal display
LTFT:
Long term fuel trim
M/T:
Manual transmission or manual transaxle.
MAF:
Mass air flow (sensor). Measures the amount and density of air entering the engine and sends a frequency or voltage signal to the PCM. The PCM uses this signal in its fuel delivery calculations.
MAP:
Manifold absolute pressure (sensor). Measures intake manifold vacuum or pressure and sends a frequency or voltage signal (depending on sensor type) to the PCM. This gives the PCM information on engine load for control of fuel delivery, spark advance, and EGR flow.
MAT:
Manifold air temperature (sensor). A resistance sensor in the intake manifold that sends a voltage signal to the PCM indicating the temperature of the incoming air. The PCM uses this signal for fuel delivery calculations.
MIL:
Malfunction indicator lamp. The MIL is most commonly known as the check engine or service engine soon light. A required on-board indicator to alert the driver of an emission-related malfunction.
Misfire:
Caused by the air fuel ratio being incorrect.
Monitor:
A test performed by the on-board computer to verify proper operation of emission-related systems or components.
MPFI or MFI:
Multi-port fuel injection. MPFI is a fuel injection system using one (or more) injector(s) for each cylinder. The
injectors are mounted in the intake manifold, and fired in groups rather than individually.

NOx:
Oxides of nitrogen. The system EGR and Camshafts injects exhaust gases into the intake manifold to reduce these gases at the tailpipe.

O2S:
Oxygen sensor. Generates a voltage of 0.6 to 1.1 volts when the exhaust gas is rich (low oxygen content). The voltage changes to 0.4 volts or less when the exhaust gas is lean (high oxygen content). This sensor only operates after it reaches a temperature of approximately 349°C (660°F). O2 sensors are usually found both upstream and downstream of the catalytic converter. The PCM uses these sensors to fine tune the air-fuel ratio and to monitor the efficiency of the catalytic converter. See Bank 1, Bank 2, Sensor 1, Sensor 2.

OBDII:
On-board diagnostics, second generation. OBD II is a U.S. Government-mandated standard requiring all cars and light trucks to have a common data connector, connector location, communication protocol, DTCs and code definitions. OBD II first appeared on vehicles in late 1994, and is required to be present on all cars sold in the US after January 1, 1996.

ODM:
Output device monitor

Open loop (OL):
A control system mode that does not monitor the output to verify if the desired results were achieved. A fuel delivery system usually operates in open loop mode during cold engine warm-up because the oxygen sensors are not yet ready to send a signal. Without the oxygen sensor signal, the computer cannot check the actual results of combustion.

PCM:
Powertrain control module. The brains of the engine and transmission control systems housed in a metal box with a number of sensors and actuators connected via a wiring harness. Its job is to control fuel delivery, idle speed, spark advance timing, and emission systems. The PCM receives information from sensors, then energizes various actuators to control the engine. The PCM is also known as the ECM (engine control module).

Pending codes:
Also referred to as continuous memory codes and matur ing diagnostic trouble codes. Pending codes may be set by emission related powertrain components and systems. If the fault does not occur after a certain number of drive cycles, the code is erased from memory.

PID:
Parameter identification. Identifies an address in memory which contains vehicle operating information.

PNP:
Park/neutral position. A switch that tells the PCM when the gear shift lever is in the park or neutral position.

When in park or neutral, the PCM operates the engine in an idle mode.

PROM:
Programmable read-only memory. The PROM contains programming information the PCM needs to operate a specific vehicle model/engine combination.

PSPS:
Power steering pressure switch

Purge solenoid:
Controls the flow of fuel vapors from the carbon canister to the intake manifold. The canister collects vapors evaporating from the fuel tank, preventing them from escaping to the atmosphere and causing pollution. During warm engine cruise conditions, the PCM energizes the Purge Solenoid so the trapped vapors are drawn into the engine and burned.

PWM:
Pulse width modulated

PZM:
Platform zone module

QDM:
Quad driver module

RAM:
Random access memory

Relay:
An electromechanical device in which connections in one circuit are switched.

Reluctance sensor:
A type of sensor typically used to measure crankshaft or camshaft speed and/or position, driveshaft speed, and wheel speed.

ROM:
Read-only memory. Permanent programming information stored inside the PCM, containing the information the PCM needs to operate a specific vehicle model/engine combination.

RPM:
Revolutions per minute

SAE:
Society of Automotive Engineers

Scan tool:
A device that interfaces with and communicates information on a data link.

SDM:
Sensing and diagnostic module

Sensor x:
A standard term used to identify the location of oxygen sensors. Sensor 1 is located upstream of the catalytic converter. See O2S, Bank 1, Bank 2.

Sensor:
Any device that reports information to the PCM. The job of the sensor is to convert a parameter such as engine temperature into an electrical signal that the PCM can understand.

SFI or SEFI:
Sequential fuel injection or sequential electronic fuel injection. A fuel injection system that uses one or more
injectors for each cylinder. The injectors are mounted in the intake manifold and are fired individually.

**Solenoid:**
A device consisting of an electrical coil which when energized, produces a magnetic field in a plunger, which is pulled to a central position. A solenoid may be used as an actuator in a valve or switch.

**STFT:**
Short term fuel trim

**STS:**
Service throttle soon

**TAC:**
Throttle actuator control

**TBI:**
Throttle body injection. A fuel injection system having one or more injectors mounted in a centrally located throttle body, as opposed to positioning the injectors close to an intake valve port. TBI is also called Central Fuel Injection (CFI) in some vehicles.

**TCC:**
Torque converter clutch

**TCM:**
Transmission control module

**TCS:**
Traction control system for PCM and brakes

**TDC:**
Top dead center. When a piston is at its uppermost position in the cylinder.

**TFP:**
Transmission fluid pressure

**TFT:**
Transmission fluid temperature (sensor)

**Throttle body:**
A device which performs the same function as a carburetor in a fuel injection system. On a throttle body injection (TBI) system, the throttle body is both the air door and the location of the fuel injectors. On port fuel injection systems (PFI, MPFI, SFI, etc.), the throttle body is simply an air door. Fuel is not added until the injectors at each intake port are activated. In each case, the throttle body is attached to the accelerator pedal.

**TPS:**
Throttle position sensor. Potentiometer-type sensor connected to the throttle shaft. Its voltage signal output increases as the throttle is opened. The PCM uses this signal to control many systems such as idle speed, spark advance, fuel delivery, etc.

**Traction assist:**
Assist in traction with brakes only.

**Trip:**
Vehicle operation for a period of time so the systems can be monitored.

**TTS:**
Transmission temperature sensor. A resistance sensor mounted in the transmission housing in contact with the transmission fluid. It sends a voltage signal to the PCM indicating the temperature of the transmission.

**VECI:**
Vehicle emission control information. A decal located in the engine compartment containing information about the emission control systems found on the vehicle. The VECI is the authoritative source for determining whether a vehicle is OBDII compliant.

**VIN:**
Vehicle identification number. This is the factory-assigned vehicle serial number. This number is stamped on a number of locations throughout the vehicle, but the most prominent location is on top of the dashboard on the driver’s side, visible from outside the car. The VIN includes information about the car, including where it was built, body and engine codes, options, and a sequential build number.

**VSS:**
Vehicle speed sensor. Sends a frequency signal to the PCM. The frequency increases as the vehicle moves faster to give the PCM vehicle speed information used to determine shift points, engine load, and cruise control functions.

**VTD:**
Vehicle theft deterrent

**Warm-up cycle:**
Warm-up cycle is when the engine coolant temperature rises at least 40 degrees above that at engine start up.

**WOT:**
Wide-open throttle. The vehicle operating condition brought about when the throttle is completely (or nearly) open. The PCM typically delivers extra fuel to the engine and de-energizes the A/C compressor at this time for acceleration purposes. The PCM uses a switch or the TPS to identify the WOT condition.
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