CP9670 AutoScanner®

actron®

en User guide

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: 800-228-7667

Email: tech@actron.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.

Table of Contents

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
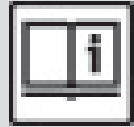
Read and understand the user guide before operating the tool.

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.

Flying particles can cause eye injury.

WARNING

Risk of burns.
- Batteries can produce a short-circuit current high enough to weld jewelry to metal.
  - Remove jewelry such as rings, bracelets and watches before working near batteries.

Short circuits can cause injury.

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.

WARNING

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.

3   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.actron.com/updates-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.
   To be able to use Scanning Suite the PC must meet the following minimum requirements:
   • Microsoft Windows 7, 8, and 10
   • Adobe Acrobat Reader
   • Screen Resolution of 800 x 600
     – If screen resolution is 800 x 600, in Display Properties, Settings Tab, set Font Size to Small Fonts.
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.actron.com/updates-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 manufacturers 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.
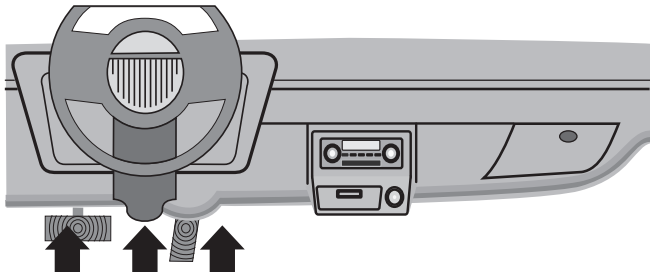
OBD II Data Link Connector (DLC) Pins
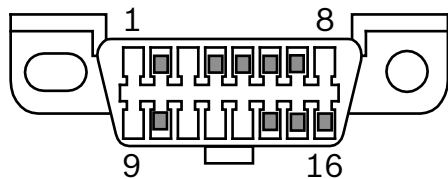
1. Manufacturer reserved
2. J1850 bus+
3. Manufacturer reserved
4. Chassis ground
5. Signal ground
6. CAN high, J-2284
7. K line, ISO 9141-2 & ISO/DIS 14230-4
8. Manufacturer reserved
9. Manufacturer reserved
10. J1850 Bus-
11. Manufacturer reserved
12. Manufacturer reserved
13. Manufacturer reserved
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.
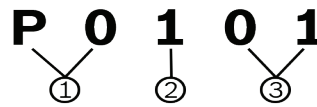
1. Bx = Body
   Cx = Chassis
   Px = Powertrain
   Ux = Network communication
   x - 0, 1, 2, or 3
2. Vehicle specific system
3. Specific fault designation

Example:

P0101 = Mass or volume air flow circuit range/performance problem

Powertrain Codes

Code	Type
P0xxx	Generic (SAE)
P1xxx	Manufacturer specific
P2xxx	Generic (SAE)
P30xx–P33xx	Manufacturer specific
P34xx–P39xx	Generic (SAE)

Chassis Codes

Code	Type
C0xxx	Generic (SAE)
C1xxx	Manufacturer specific
C2xxx	Manufacturer specific
C3xxx	Generic (SAE)

Body Codes

Code	Type
B0xxx	Generic (SAE)
B1xxx	Manufacturer specific
B2xxx	Manufacturer specific
B3xxx	Generic (SAE)

Network Communication Codes

Code	Type
U0xxx	Generic (SAE)
U1xxx	Manufacturer specific
U2xxx	Manufacturer specific
U3xxx	Generic (SAE)

4 Using the Scan Tool

4.1 The Scan Tool

1. LCD display (color, backlit, QVGA resolution)

2. ▲ 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\Er appears on the display to read codes.

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\Er appears on the display to erase codes.

4. ← BACK key returns to previous screen.

5. ↵ ENTER key selects item.
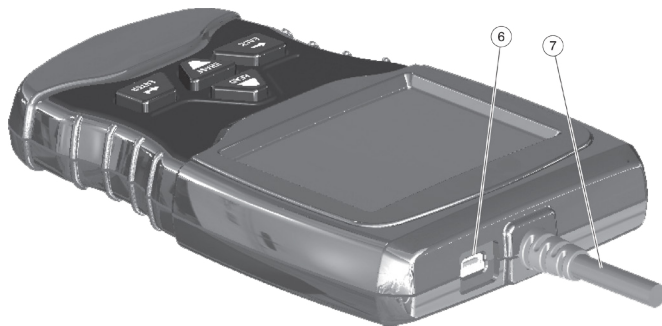
6. USB port provides USB connection for the computer.
7. DLC cable provides connection for vehicle interface.
8. Serial number plate (on back; not shown).

4.2 Specifications

Display	Color, backlit, QVGA resolution
Operating Temperature	0 to 50°C (32 to 122°F)
Storage Temperature	-20 to 70°C (-4 to 158°F)
External Power	7 to 16 Volts

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

Dimensions

Height	Width	Depth
5.6 inches	3.5 inches	0.9 inches
142 mm	89 mm	23 mm

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\Er 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 "6.2 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.
- Scan tool to be upgraded.
- Language to be changed.
- Long PID names to be turned ON or OFF.

From the **Diagnostic Menu**:
1. Select **System Setup**.

   - Use the ▼ (ERASE) key until **System Setup** is highlighted.

   - Press ENTER.

```
       Diagnostic Menu
 Diagnostic Monitor Tests
 On-Board Systems
 Charging System Monitor
 Vehicle Information
 Component Locator
 Acronyms
 Review Data
 Code Lookup
 System Setup
          ⬆ Rd\Er
```
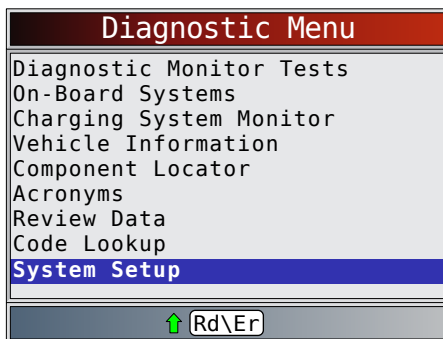
Changing Measurement Units

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

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

   - Use the READ ▲ and ▼ (ERASE) keys until **English/Metric** is highlighted.

   - Press ENTER.

```
        System Setup
 English/Metric
 Language Setup
 Long PID Names
 Tool Information
 Display Test
 Keypad Test
 Memory Test
 Program Mode
```
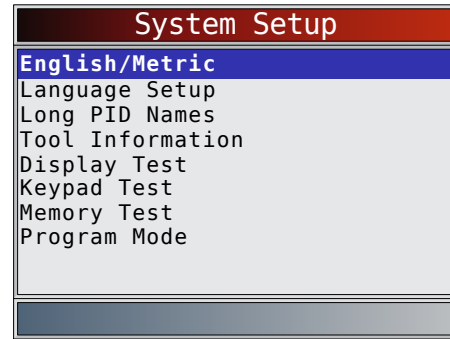
2. Select desired measurement unit.

   - Use the READ ▲ and ▼ (ERASE) keys until the desired unit is highlighted.

   - Press ENTER.

```
      Measurement Units
 English
 Metric
```
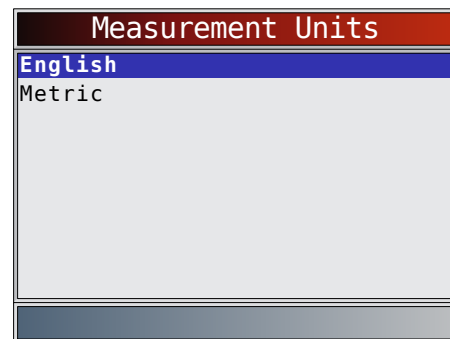
3. Save measurement setting.

   - Press ENTER.

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 READ ▲ and ▼ (ERASE) keys until **Language Setup** is highlighted.

   - Press ENTER.

```
        System Setup
 English/Metric
 Language Setup
 Long PID Names
 Tool Information
 Display Test
 Keypad Test
 Memory Test
 Program Mode
```
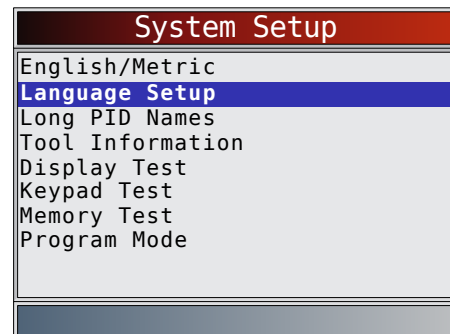
2. Select desired measurement unit.

    - Use the **READ** ▲ and ▼ **ERASE** keys until the desired language is highlighted.

    - ⏎ Press **ENTER**.

    ```
    ┌─────────────────────────────────┐
    │        Language Setup           │
    ├─────────────────────────────────┤
    │ English                         │
    │ Español                         │
    │ Francais                        │
    │                                 │
    │                                 │
    │                                 │
    │                                 │
    └─────────────────────────────────┘
    ```
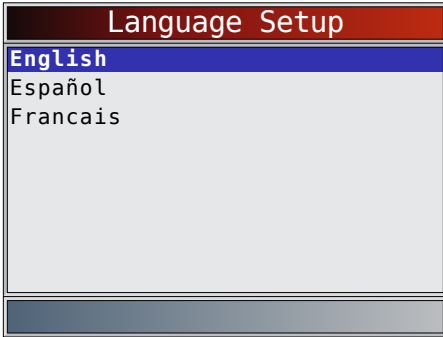
3. Save language setting.

    - ⏎ 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**.

    ```
    ┌─────────────────────────────────┐
    │         System Setup            │
    ├─────────────────────────────────┤
    │ English/Metric                  │
    │ Language Setup                  │
    │ Long PID Names                  │
    │ Tool Information                │
    │ Display Test                    │
    │ Keypad Test                     │
    │ Memory Test                     │
    │ Program Mode                    │
    └─────────────────────────────────┘
    ```
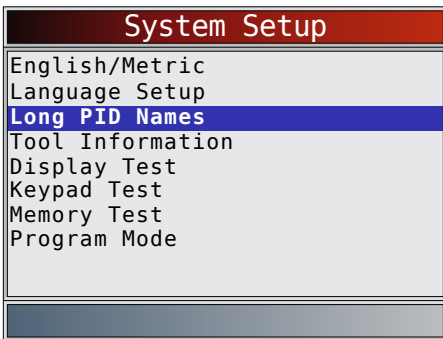
2. Select ON or OFF.

    - Use the **READ** ▲ and ▼ **ERASE** keys until the desired option is highlighted.

    - ⏎ Press **ENTER**.

```
┌─────────────────────────────────┐
│         Long PID Names          │
├─────────────────────────────────┤
│ ON                              │
│ OFF                             │
│                                 │
│                                 │
│                                 │
│                                 │
│                                 │
└─────────────────────────────────┘
```
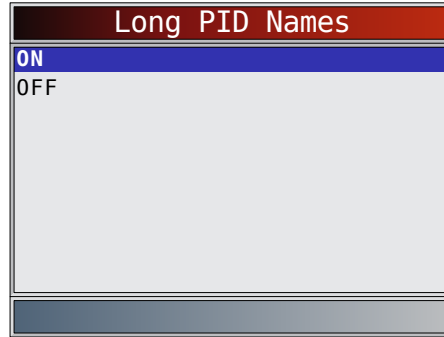
3. Save **Long PID Names** setting.

    - ⏎ 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**.

    ```
    ┌─────────────────────────────────┐
    │         System Setup            │
    ├─────────────────────────────────┤
    │ English/Metric                  │
    │ Language Setup                  │
    │ Long PID Names                  │
    │ Tool Information                │
    │ Display Test                    │
    │ Keypad Test                     │
    │ Memory Test                     │
    │ Program Mode                    │
    └─────────────────────────────────┘
    ```
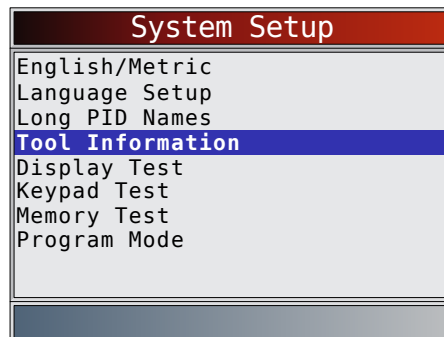
2. View information.
    - Serial Number (Serial No:)
    - Software ID (SW ID:)
    - Hardware Version (HW Ver:)
    - Boot Version (Boot Ver:)
    - Product ID (Prod ID:)
    - Board ID (Board ID:)
    - Burn Date (Burn Date:)
    - Burn Location (Burn Loc:)

```
┌─────────────────────────────────┐
│        Tool Information         │
├─────────────────────────────────┤
│ Serial No                  --   │
│ SW ID                    773B   │
│ HW Ver                     01   │
│ Boot Ver                   01   │
│ Prod ID                    23   │
│ Board ID                   35   │
│ Burn Date          --/--/--     │
│ Burn Loc                   --   │
└─────────────────────────────────┘
```
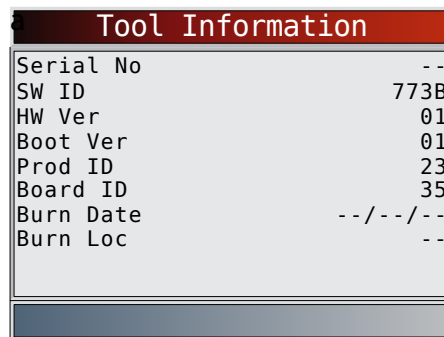
3. Record **Tool Information**.
   - Space is provided inside the front cover of this manual to write down the scan tool information.
4. Return to **System Setup** menu.

   - 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**. ↵

   ```
   ╔══════════════════════╗
   ║    System Setup      ║
   ╟──────────────────────╢
   ║ English/Metric       ║
   ║ Language Setup       ║
   ║ Long PID Names       ║
   ║ Tool Information     ║
   ║ Display Test         ║
   ║ Keypad Test          ║
   ║ Memory Test          ║
   ║ Program Mode         ║
   ╚══════════════════════╝
   ```
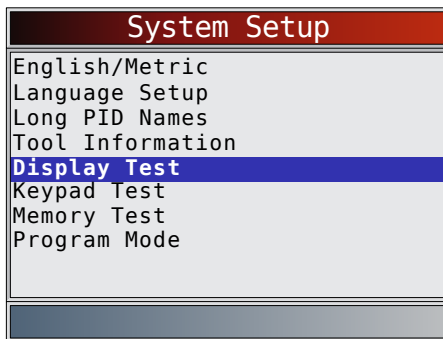
2. Start **Display Test**.
   - Press **ENTER**. ↵
3. Look for missing spots.
   - The first screen displayed says, "Check for missing spots in the display."

   ```
   ╔══════════════════════╗
   ║    Display Test      ║
   ╟──────────────────────╢
   ║          (i)         ║
   ║                      ║
   ║ Check for missing spots in ║
   ║     the display      ║
   ║                      ║
   ║  Press BACK⬅ to exit ║
   ╚══════════════════════╝
   ```

   - Solid red, green, and blue screens are displayed.
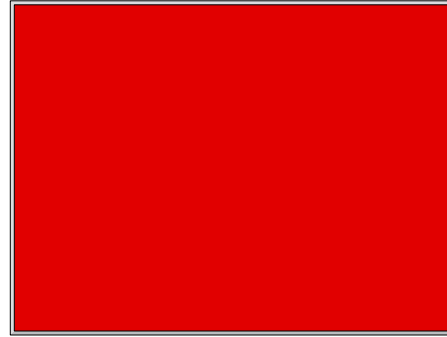
   - These four screens will continue in succession until **BACK** ⬅ is pressed.

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**. ↵

```
┌─────────────────────────────┐
│       System Setup          │
├─────────────────────────────┤
│ English/Metric              │
│ Language Setup              │
│ Long PID Names              │
│ Tool Information            │
│ Display Test                │
│ Keypad Test                 │
│ Memory Test                 │
│ Program Mode                │
│                             │
│                             │
└─────────────────────────────┘
```
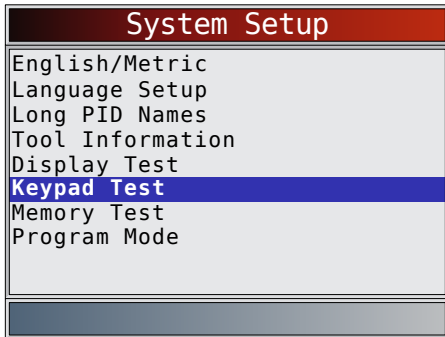
2. Press a key.
    *   The on-screen key will appear depressed, and the key name will appear bold.
    *   ← BACK will return the tool to the **System Setup** screen.
    *   If the **System Setup** menu does not return, the ← BACK key is not functioning correctly.

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.

```
┌─────────────────────────────┐
│       System Setup          │
├─────────────────────────────┤
│ English/Metric              │
│ Language Setup              │
│ Long PID Names              │
│ Tool Information            │
│ Display Test                │
│ Keypad Test                 │
│ Memory Test                 │
│ Program Mode                │
│                             │
│                             │
└─────────────────────────────┘
```
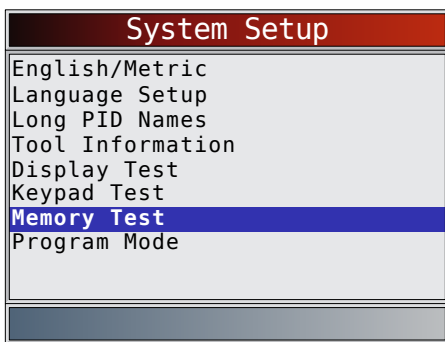
*   **Memory Test** may take several minutes to complete.
*   **Memory Test** results display:
    –   If no problems were detected, then "Passed" is displayed.
    –   If RAM fails, an error message is shown.
    –   If FLASH fails, a checksum is shown.

```
┌─────────────────────────────┐
│        Memory Test          │
├─────────────────────────────┤
│ INT RAM            Passed   │
│ INT FLASH            68ee   │
│                             │
│                             │
│                             │
│                             │
│     Press BACK← to exit     │
│                             │
└─────────────────────────────┘
```
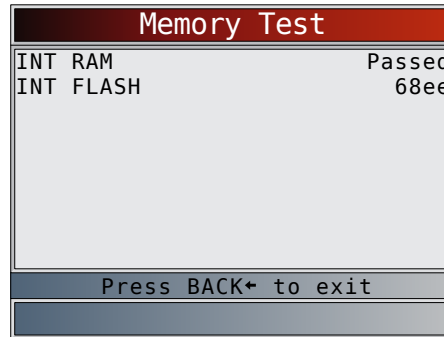
2. Return to **System Setup** menu.
    *   Press ← BACK.

Program Mode

The **Program Mode** is used for updating the scan tool. Instructions are provided with upgrades. Refer to "3.2 Download Scanning Suite" on page 8.

```
┌─────────────────────────────┐
│       System Setup          │
├─────────────────────────────┤
│ English/Metric              │
│ Language Setup              │
│ Long PID Names              │
│ Tool Information            │
│ Display Test                │
│ Keypad Test                 │
│ Memory Test                 │
│ Program Mode                │
│                             │
│                             │
└─────────────────────────────┘
```
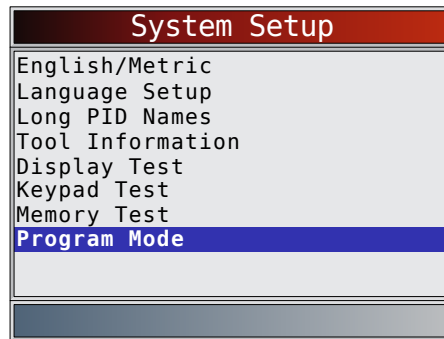
*   If the **Program Mode** is entered, ← BACK is not operational. The tool must be powered off to exit **Program Mode** and then restarted to continue.

```
┌─────────────────────────────┐
│                             │
│        PROGRAM MODE         │
│       See User Manual       │
│                             │
│                             │
│     Connect Tool to PC      │
│       with USB Cable        │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
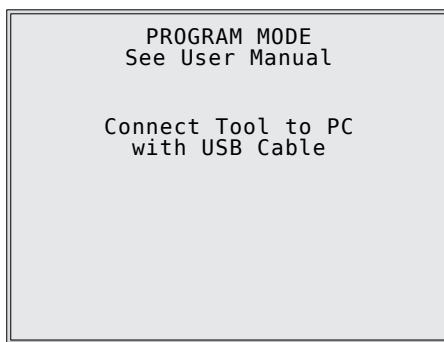
4.6   Vehicle-Specific Features

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 READ and ▼ (ERASE) keys until **Review Data** is highlighted.

- Press ENTER.

```
        Diagnostic Menu
  O2 Monitor Tests
  Diagnostic Monitor Tests
  On-Board Systems
  Charging System Monitor
  Vehicle Information
  Component Locator
  Acronyms
  Review Data
  Code Lookup
  ⬆ Rd\Er ⬇
```
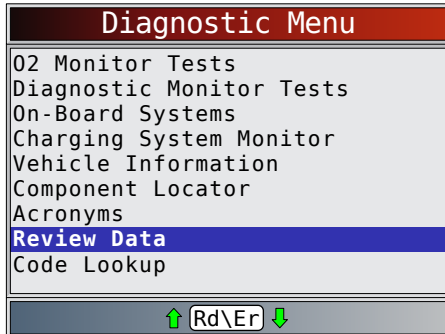
2. Follow prompts and instructions provided by scan tool and then select item whose data you wish to review.
   - The **Review Data** menu shows a checkmark next to the item(s) that has data.
   - If there is not a checkmark next to the item, then this item can't be selected until the appropriate function is run from the **Diagnostic Menu**.
   - See "Recording" on page 15 for detailed instructions on this function.

Recording

The **Recording** function is used to play back a recording. This function is very similar to **View Data**. The only difference is that **View Data** is real-time viewing of PIDs, while **Recording** is a viewing of previously recorded PIDs. From the **Review Data** menu:

1. Select **Recording**.

   - Use the READ and ▼ (ERASE) keys until **Recording** is highlighted.

   - Press ENTER.

```
        Review Data
  ✓I/M Monitors
  ✓DTCs (Codes)
  ✓State OBD Check
  ✓Recording
  ✓View Freeze Data
  ✓O2 Monitor Tests
  ✓Diagnostic Monitor Tests
  ✓Vehicle Information
  Rd\Er
```
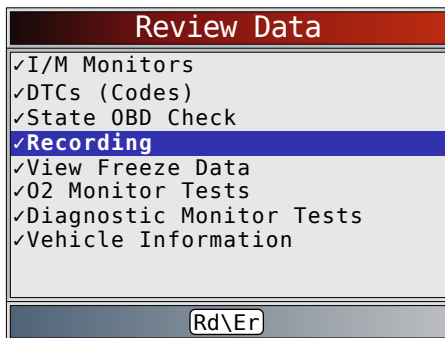
2. Select **Playback Recording**.

   - Use the READ and ▼ (ERASE) keys until **Playback Recording** is highlighted.

   - Press ENTER.

```
        Playback Options
  Playback Recording
  Long PID Names
  English/Metric
  Rd\Er
```
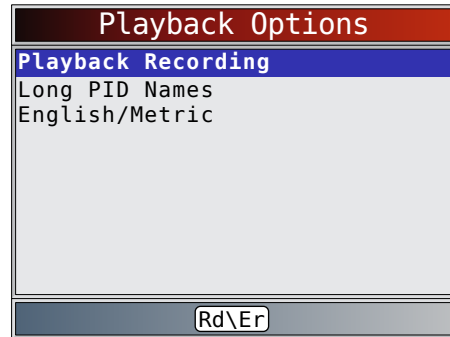
- The recording has frame number and timestamp (in seconds).
  - Negative frames and timestamps indicate data recorded before trigger event.
  - Positive frames and timestamps indicate data recorded after trigger event.
  - Use the READ and ▼ (ERASE) keys to view recorded PID data within each frame.
  - Use the 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.

```
  ABSLT TPS(%)              0.0
  CALC LOAD(%)              0.0
  COOLANT(°C)               -40
  ENG SPEED(RPM)              0
  EQ RATIO11              1.999
  FUEL SYS 1                N/A
  FUEL SYS 2                N/A
  IAT(°C)                   -40
  IGN ADV(°)                0.0

  Frame: -1        Time: -3.8
               ⬇
```
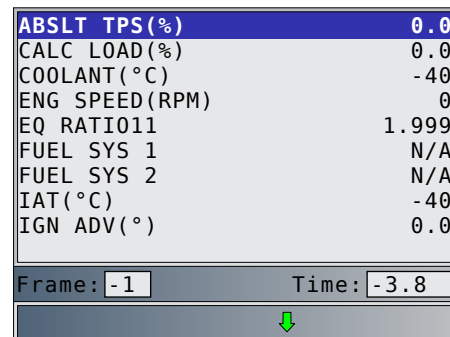
3. Return to **Review Data** menu.

   - Press BACK.

4.7   Code Lookup

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 **Code Lookup** function.
From the **Diagnostic** menu:

1. Select **Code Lookup**.

   - Use the READ and ▼ (ERASE) keys until **Code Lookup** is highlighted.

   - Press ENTER.

```
┌────────────────────────────────┐
│        Diagnostic Menu         │
├────────────────────────────────┤
│ Diagnostic Monitor Tests       │
│ On-Board Systems               │
│ Charging System Monitor        │
│ Vehicle Information            │
│ Component Locator              │
│ Acronyms                       │
│ Review Data                    │
│ Code Lookup                    │
│ System Setup                   │
├────────────────────────────────┤
│            ⬆ Rd\Er             │
└────────────────────────────────┘
```
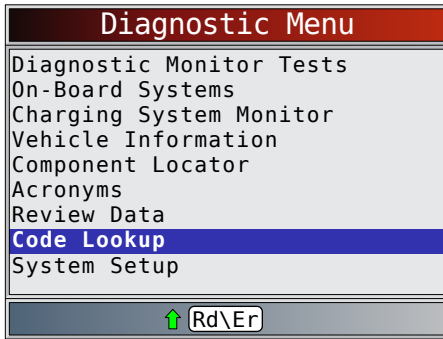
2. Select the appropriate module for the code.
   - The **Select Module** screen may not be shown for every vehicle. If not shown, the DTC will be looked up as OBDII/EOBD.

```
┌────────────────────────────────┐
│        Select Module           │
├────────────────────────────────┤
│ OBDII/EOBD                     │
│ Engine                         │
│ ABS                            │
│ All of the Above               │
│                                │
│                                │
│                                │
│                                │
└────────────────────────────────┘
```
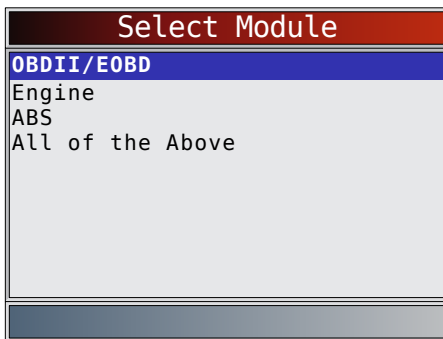
3. Enter code.
   - All characters must be entered.
   - Only one character can be changed at a time.
   - Use **ENTER** to advance to the next digit.
   - Use the **READ** and ▼ (ERASE) keys to change the selected digit.
   - Press **ENTER**.

```
┌────────────────────────────────┐
│        Code Lookup             │
├────────────────────────────────┤
│        ┌──────────┐            │
│        │ P2122    │            │
│        └──────────┘            │
│                                │
│     ▲▼ alters selected digit   │
│                                │
│     ↵ moves to next digit      │
│                                │
└────────────────────────────────┘
```
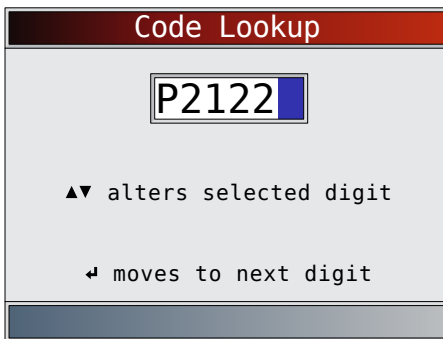
   - If the definition could not be found, the scan tool displays "No DTC Definition Found." See Service Manual.

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 **BACK** 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**.

```
┌─────────────────────────────────┐
│        Select Vehicle           │
├─────────────────────────────────┤
│ AutoID (>=2000)                 │
│ Manual (<=1999)                 │
│ Prev: 06 Lancer                 │
│                                 │
│                                 │
│                                 │
│ 2000-04 vehicles may support Aut│
│                                 │
└─────────────────────────────────┘
```
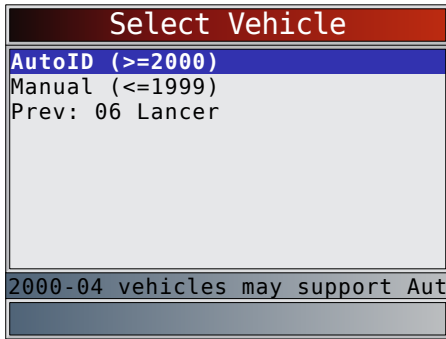
- A **Turn Key Off** screen will display.

```
┌─────────────────────────────────┐
│         Turn Key Off            │
├─────────────────────────────────┤
│              (i)                │
│                                 │
│   Please turn the key off for   │
│   10 seconds then turn the key  │
│              on.                │
│                                 │
│    Press ENTER ↵ to continue    │
│                                 │
└─────────────────────────────────┘
```
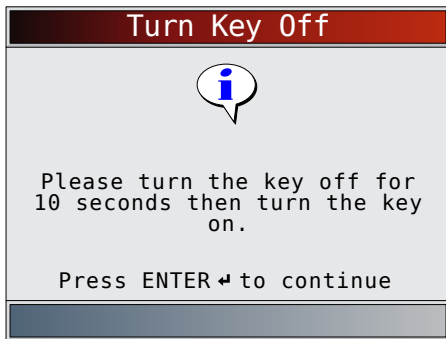
2. After 10 seconds, turn key ON.
   - If the vehicle is supported, the VIN number and essential vehicle data will display.

```
┌─────────────────────────────────┐
│        Select Vehicle           │
├─────────────────────────────────┤
│              (?)                │
│                                 │
│       Pre: 06 Lancer            │
│                                 │
│       Is this correct?          │
│                                 │
│    [No←]          [Yes↵]        │
│                                 │
└─────────────────────────────────┘
```
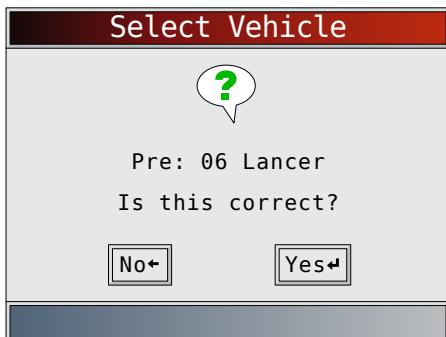
3. Use the **BACK** or **ENTER** key to select YES or NO.
   - If YES is selected, the Tool may display more selections to further select the vehicle because not every aspect of vehicle identification is contained in the VIN.
   - If NO is selected, the Tool proceeds to manual selection.

   - 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**.

```
┌─────────────────────────────────┐
│           Vehicle?              │
├─────────────────────────────────┤
│ OBDII/EOBD                      │
│ US                              │
│ Europe                          │
│ Asia                            │
│ Prev: 06 Lancer                 │
│                                 │
│                                 │
│                                 │
└─────────────────────────────────┘
```
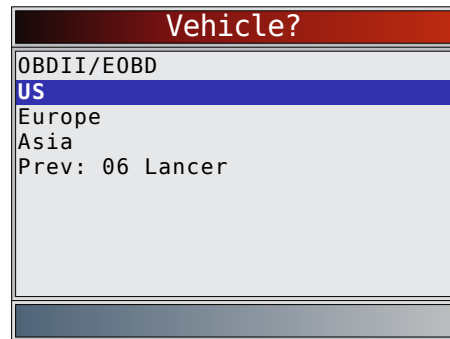
The OBDII/EOBD selection is provided for vehicles that are not listed, however, selection of the specific vehicle is recommended for maximum tool utility.

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**.

```
┌─────────────────────────────────┐
│         Turn Key Off            │
├─────────────────────────────────┤
│              (i)                │
│                                 │
│   Please turn the key off for   │
│   10 seconds then turn the key  │
│              on.                │
│                                 │
│    Press ENTER ↵ to continue    │
│                                 │
└─────────────────────────────────┘
```
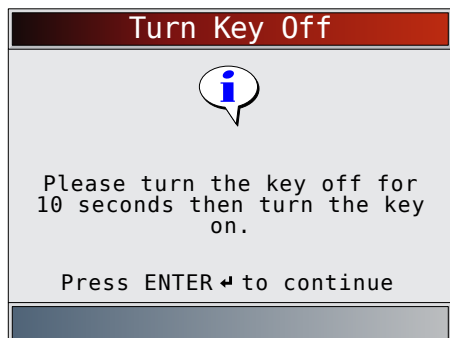
If vehicle power is not detected, a screen is shown to verify tool connection.

If a vehicle other than the previous vehicle is selected, 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.

If the previous vehicle is selected, all stored vehicle data will be retained until it is overwritten by the corresponding function selected from the **Diagnostic Menu**.

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**.

```
         Diagnostic Menu
 O2 Monitor Tests
 Diagnostic Monitor Tests
 On-Board Systems
 Charging System Monitor
 Vehicle Information
 Component Locator
 Acronyms
 Review Data
 Code Lookup

            ↑ Rd\Er ↓
```
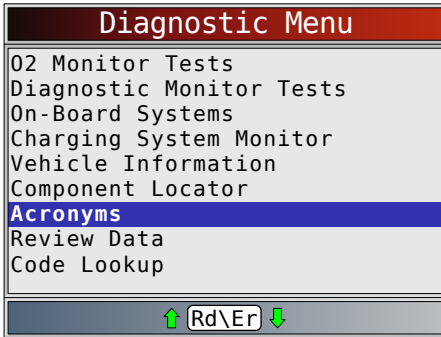
2. Select the alphabetical group range for the desired acronym.

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

- Press **ENTER**.

```
            Acronyms
 # - 24X C
 24X S - 5
 A - AF 1/1
 AF 1/2 - AI
 Al - B-
 BA - CA
 CA - CL
 Cl - c
 C - DIA

                    ↓
```
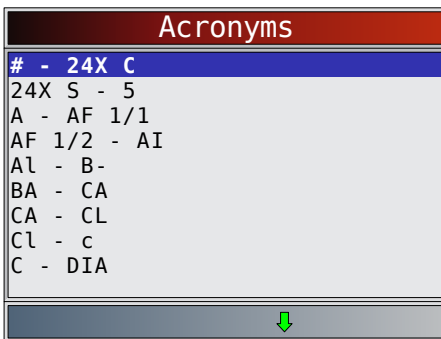
3. Select the acronym.

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

- Press **ENTER**.

```
            Acronyms
 # Of Emiss
 # Of Pwrt
 #CMP/CKP LOSS
 #TRP SNC MISF
 #TRPS SNC MISF
 % Alcohol
 % GRADE
 % Methanol
 % of Pdl

                    ↓
```

4. View selected acronym.

```
           # Of Emiss
 Number Of Emission Related DTC




```
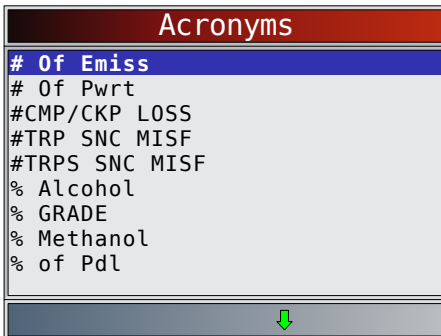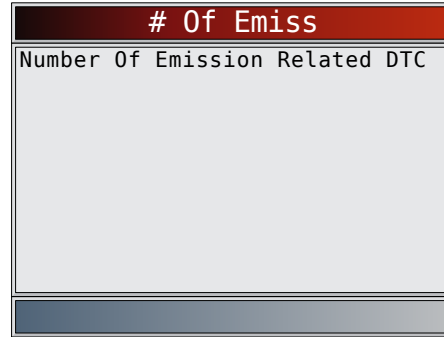
- Press **ENTER** to return to the **Diagnostic Menu**.

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**.

```
         Diagnostic Menu
 View Freeze Data
 Drive Cycle Monitor
 O2 Monitor Tests
 Diagnostic Monitor Tests
 On-Board Systems
 Charging System Monitor
 Vehicle Information
 Component Locator
 Acronyms

            ↑ Rd\Er ↓
```
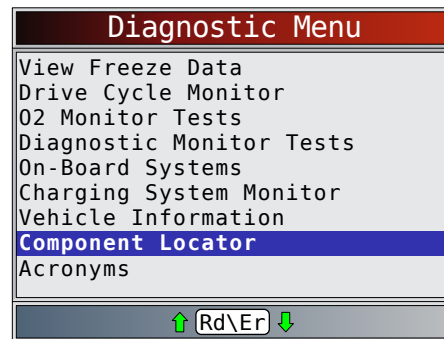
2. Select the alphabetical group range for the desired component.

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

- Press **ENTER**.

```
        Component Locator
 A - Fuel P
 Fuel T - O
 P - W



```
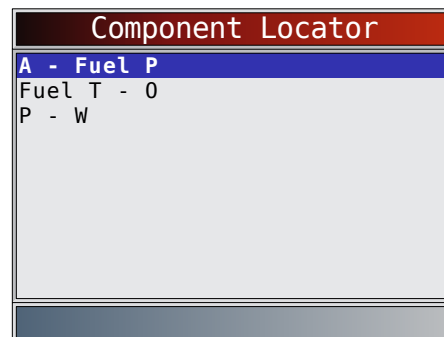
3. Select the component.

- Use the READ ▲ and ▼ ERASE keys until the desired component is highlighted.

- Press ENTER ↵.

```
Component Locator
A/T Control Solenoid Valve Asse
ABS Control Module
Accelerator Pedal Position Sens
Camshaft Position Sensor
Clutch Pedal Position Sensor (M
Crankshaft Position Sens
EGR Solenoid Valve
Engine Coolant Temperature Sens

A/T Control Solenoid Valve Assem
            ⬇
```
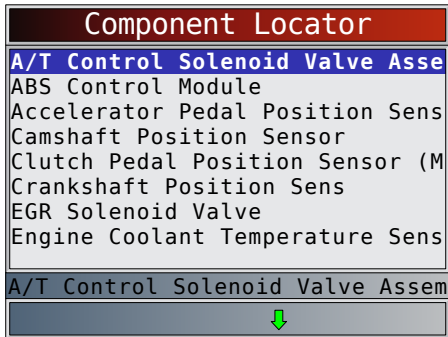
4. View selected component location.

```
Component Locator
A/T Control Solenoid Valve
Assembly
------------------------------
In the automatic transmission
```
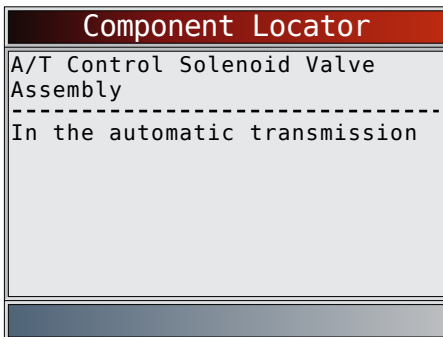
- Press ENTER ↵ to return to the **Diagnostic Menu**.

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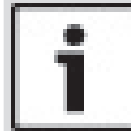
IMPORTANT
Review Data, Code Lookup, and **System Setup** are covered in Section 4 of this manual. These items are not covered in this section.

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 **ERASE** ▼ keys until **I/M Monitors** 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      ║
╟──────────────────────────╢
║          Rd\Er ⬇          ║
╚══════════════════════════╝
```
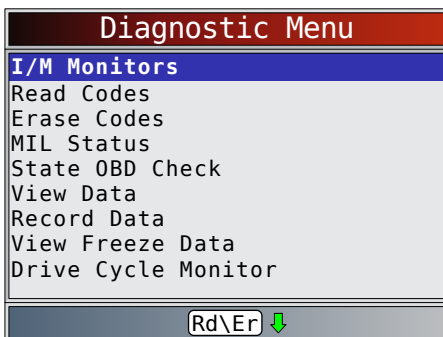
Two types of **I/M Monitors** test are:

- **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 **ERASE** ▼ keys (if required).

Depending on monitor test, one of these two screens will be present.

```
╔══════════════════════════╗
║    Since DTCs Cleared    ║
╠══════════════════════════╣
║ Misfire Monitor        ok║
║ Fuel System Mon        ok║
║ Comp Component         ok║
║ Catalyst Mon           ok║
║ Htd Catalyst          n/a║
║ Evap System Mon       inc║
║ Sec Air System        n/a║
║ A/C Refrig Mon        n/a║
║ Oxygen Sens Mon        ok║
║                          ║
╟──────────────────────────╢
║          Rd\Er ⬇          ║
╚══════════════════════════╝
```

```
╔══════════════════════════╗
║     This Drive Cycle     ║
╠══════════════════════════╣
║ Misfire Monitor        ok║
║ Fuel System Mon        ok║
║ Comp Component         ok║
║ Catalyst Mon          inc║
║ Htd Catalyst          n/a║
║ Evap System Mon       dis║
║ Sec Air System        n/a║
║ A/C Refrig Mon        n/a║
║ Oxygen Sens Mon       inc║
║                          ║
╟──────────────────────────╢
║          Rd\Er ⬇          ║
╚══════════════════════════╝
```
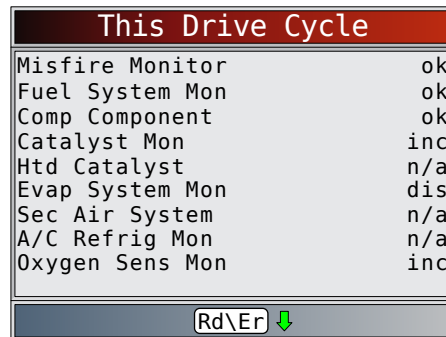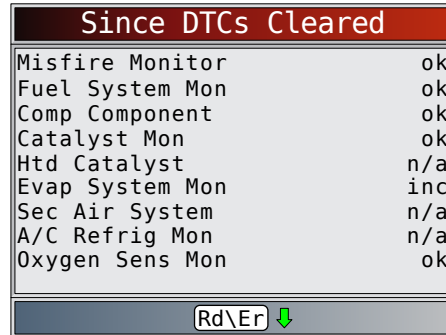
Abbreviations and names for OBDII monitors supported by the scan tool are shown below. They are required by the United States Environmental Protection Agency (EPA). Not all monitors are supported by all vehicles.

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

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 ▼ 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          │
│                              │
│        [Rd\Er] ⬇             │
└─────────────────────────────┘
```
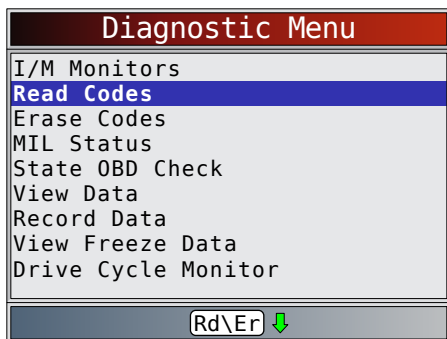
   - Alternately, press and hold the **READ** key for 2 seconds when **Rd\Er** appears on the display.

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

   - Use the **READ** and ▼ keys until the desired choice is highlighted.

   - Press **ENTER**.

```
┌─────────────────────────────┐
│      Select Module           │
├─────────────────────────────┤
│ OBDII/EOBD                   │
│ Engine                       │
│ ABS                          │
│ All of the Above             │
│                              │
│                              │
│                              │
└─────────────────────────────┘
```
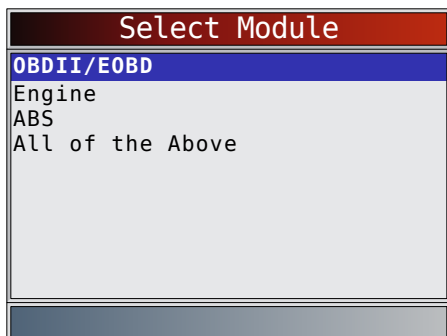
If no DTCs are present, a message stating "System Pass: No Faults Detected" is displayed. If **All of the Above** is selected from the **Select Module** menu, all of the codes will be displayed as if all menu items were selected individually.

3.   View and write down the DTCs.

   - Use the **READ** and ▼ keys until the desired choice is highlighted.

This screen indicates where the **Read Codes** information is located.

```
┌─────────────────────────────┐
│ DTC#                  X/Y    │
│                    Module    │
│                              │
│ DTC Description              │
│                              │
│                              │
│                              │
│ DTC Type                     │
│                              │
│        [Rd\Er] ⬇             │
└─────────────────────────────┘
```

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.

Module	Description
ECM	Engine or powertrain module
TCM	Transmission control module
TCCM	Transfer case control module
ABS	Anti-lock brake system module
HPCM	Hybrid powertrain control module
MOD $XX	Module address for the OBDII/EOBD module reporting the DTC

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.

DTC Type	Description
History	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.
Confirmed	Confirmed codes are reported when a component, sensor, or other part of the vehicle is indication a malfunction is present.
Current	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.
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 ▼ ERASE 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

Rd\Er ⬇
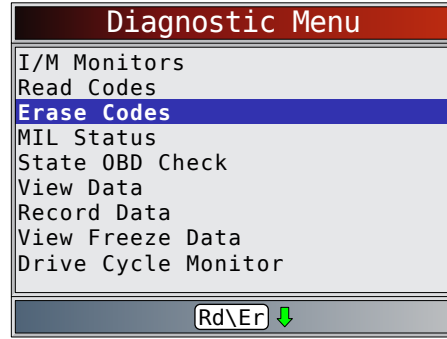
- Alternately, press and hold the ▼ ERASE key for 2 seconds when Rd\Er appears on the display.
- If diagnostic results and codes are not to be erased select **NO** and press ENTER.

Erase Codes

?

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

No◄   Yes↵

Rd\Er
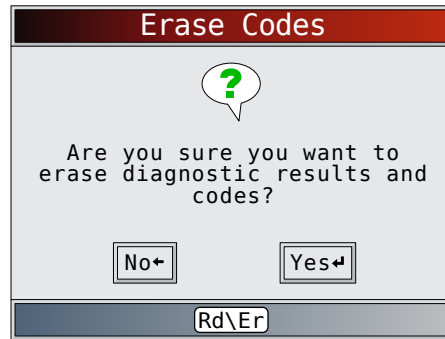
- Selecting **NO** displays a "Command canceled" message.

Erase Codes

i

Command canceled

Press ENTER↵ to continue

Rd\Er

2. Select **YES** to erase diagnostic results and codes.

- Press ENTER.
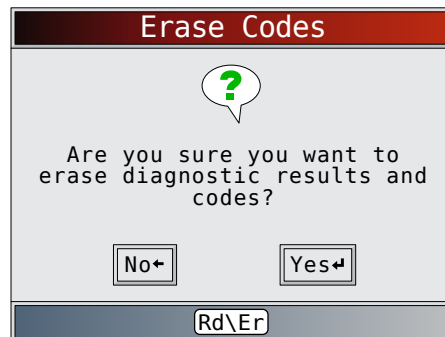
Erase Codes

?

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.

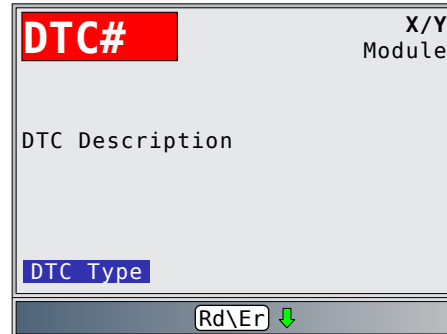- Use the READ and ▼ ^{ERASE} keys until the desired choice is highlighted.

- Press ENTER.

```
┌─────────────────────────────┐
│       Select Module         │
├─────────────────────────────┤
│ OBDII/EOBD                  │
│ Engine                      │
│ ABS                         │
│                             │
│                             │
│                             │
│                             │
└─────────────────────────────┘
```
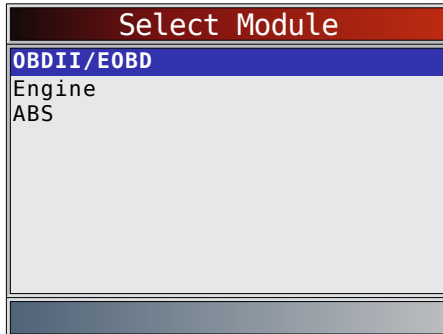
4. Observe "Command sent" message is displayed.

- Press ENTER.

```
┌─────────────────────────────┐
│        Erase Codes          │
├─────────────────────────────┤
│            i                │
│                             │
│       Command sent          │
│                             │
│    Codes remaining:36       │
│                             │
│   Press ENTER↵ to continue  │
│          [Rd\Er]            │
└─────────────────────────────┘
```
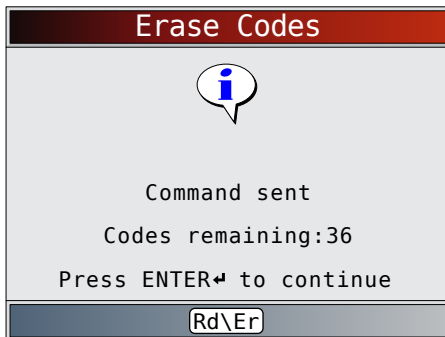
5. Return to **Diagnostic Menu**.

- Press BACK.

5.4 MIL Status

From **Diagnostic Menu**:

1. Select **MIL Status**.

- Use the READ and ▼ ^{ERASE} keys until **MIL Status** 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         │
│          [Rd\Er] ⬇          │
└─────────────────────────────┘
```

2. View **MIL Status**.

```
┌─────────────────────────────┐
│         MIL is ON           │
├─────────────────────────────┤
│            i                │
│                             │
│   MIL lamp should be ON if  │
│      engine is running      │
│                             │
│   Press ENTER↵ to continue  │
│          [Rd\Er]            │
└─────────────────────────────┘
```
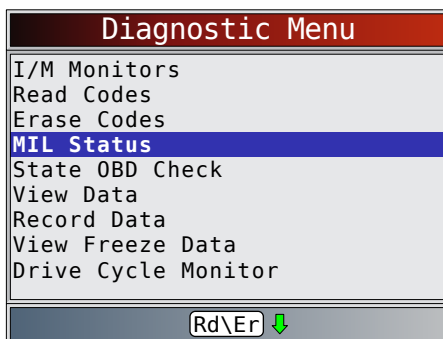
3. Return to **Diagnostic Menu**.

- Press ENTER.

5.5 State OBD Check

The **State OBD Check** function is used to display a basic status of the vehicles 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 READ and ▼ ^{ERASE} keys until **State OBD Check** 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         │
│          [Rd\Er] ⬇          │
└─────────────────────────────┘
```
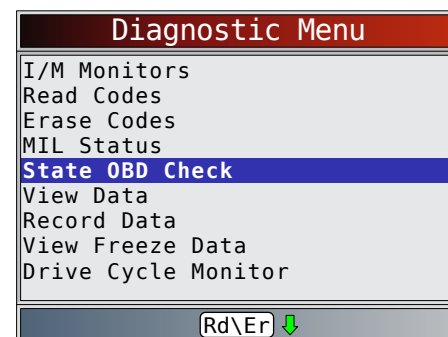
2. View **State OBD Check** display.

```
┌─────────────────────────────┐
│      State OBD Check        │
├─────────────────────────────┤
│ MIL Status            ON    │
│ Codes Found           18    │
│ Monitors OK            3    │
│ Monitors Inc           5    │
│ Monitors N/A           3    │
│                             │
│                             │
│          [Rd\Er]            │
└─────────────────────────────┘
```
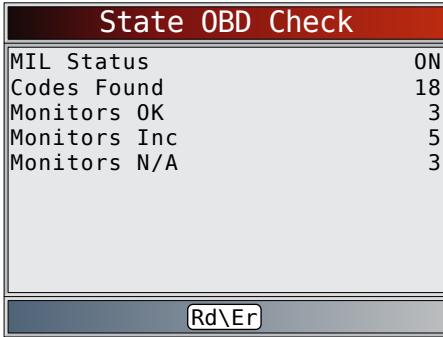
3.   Return to **Diagnostic Menu**.

•   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 **READ** and ▼ (**ERASE**) keys until **View Data** is highlighted.
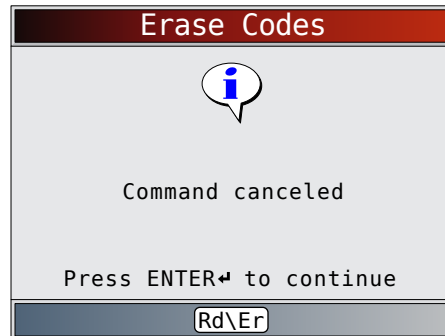
•   Press **ENTER**.

```
┌─────────────────────────────┐
│      Diagnostic Menu        │
├─────────────────────────────┤
│ I/M Monitors                │
│ Read Codes                  │
│ Erase Codes                 │
│ MIL Status                  │
│ State OBD Check             │
│ View Data                   │
│ Record Data                 │
│ View Freeze Data            │
│ Drive Cycle Monitor         │
│          [Rd\Er] ⬇          │
└─────────────────────────────┘
```
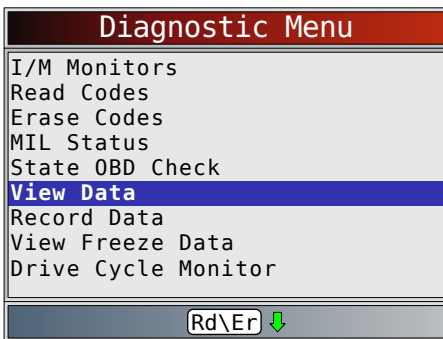
2.   Observe while the scan tool validates PID list.

```
┌─────────────────────────────┐
│      Validating PIDs        │
├─────────────────────────────┤
│                             │
│     Validating PID List     │
│                             │
│        PID   7/329          │
│                             │
│                             │
│        Please Wait          │
│ ⊗                        ⊗  │
└─────────────────────────────┘
```

•   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 **READ** and ▼ (**ERASE**) keys until **Entire Data List** is highlighted.

•   Press **ENTER**.

```
┌─────────────────────────────┐
│     Select Data to View     │
├─────────────────────────────┤
│ Entire Data List            │
│ Long PID Names              │
│ English/Metric              │
│                             │
│                             │
│                             │
│          [Rd\Er]            │
└─────────────────────────────┘
```
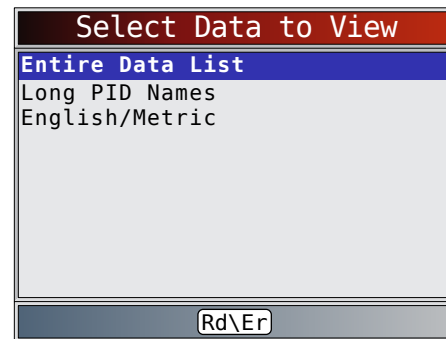
2.   View PIDs on scan tool.

•   Use the **READ** and ▼ (**ERASE**) keys.

```
┌─────────────────────────────────┐
│ ABSLT TPS(%)              0.0    │
│ CALC LOAD(%)              0.0    │
│ COOLANT(°C)               -40    │
│ ENG SPEED(RPM)              0    │
│ EQ RATIO11              1.999    │
│ FUEL SYS 1                N/A    │
│ FUEL SYS 2                N/A    │
│ IAT(°C)                   -40    │
│ IGN ADV(°)                0.0    │
│ LT FTRM1(%)               0.0    │
├─────────────────────────────────┤
│ Throttle Position               │
│              ⬚  ⬇              │
└─────────────────────────────────┘
```
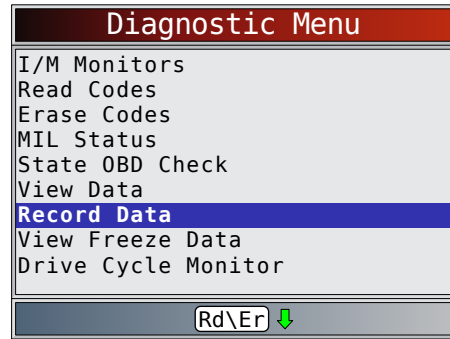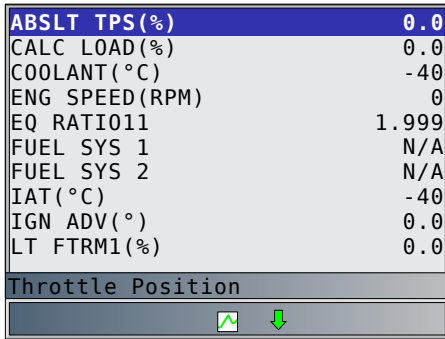
- See "Appendix A—PID Definitions" on page 34 for PID definitions.

- 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.
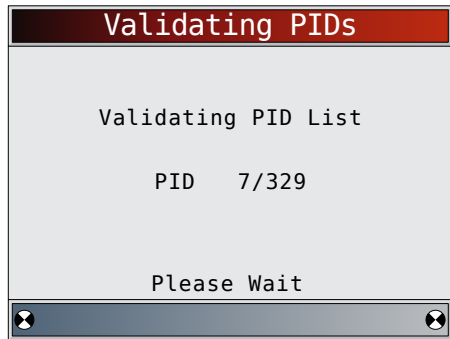
From **Diagnostic Menu**:

1. Select **Record Data**.

- Use the READ ▲ and ▼ ERASE keys until **Record Data** is highlighted.

- Press ENTER.

```
┌─────────────────────────────────┐
│        Diagnostic Menu          │
├─────────────────────────────────┤
│ I/M Monitors                    │
│ Read Codes                      │
│ Erase Codes                     │
│ MIL Status                      │
│ State OBD Check                 │
│ View Data                       │
│ Record Data                     │
│ View Freeze Data                │
│ Drive Cycle Monitor             │
├─────────────────────────────────┤
│          [Rd\Er] ⬇              │
└─────────────────────────────────┘
```

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            │
├─────────────────────────────────┤
│              ? ?                │
│                                 │
│    Previous recording in        │
│           memory.               │
│  Do you want to erase it and    │
│       make a new one?           │
│                                 │
│   [No←]            [Yes↵]       │
├─────────────────────────────────┤
└─────────────────────────────────┘
```
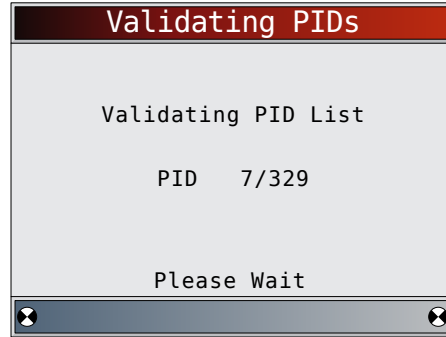
- Scan tool validates list of global PIDs from vehicle.

```
┌─────────────────────────────────┐
│        Validating PIDs          │
├─────────────────────────────────┤
│                                 │
│      Validating PID List        │
│                                 │
│        PID    7/329             │
│                                 │
│                                 │
│        Please Wait              │
└─────────────────────────────────┘
```

3. Press ENTER to begin recording.

```
┌─────────────────────────────────┐
│           Recording             │
├─────────────────────────────────┤
│              ⓘ                 │
│                                 │
│                                 │
│   Collecting pretrigger data    │
│                                 │
│    Press ENTER↵ to trigger      │
│           recording             │
└─────────────────────────────────┘
```

- Data continues to be saved until either:
  - Record memory is full.

– Operator presses **ENTER**. ⏎

```
Recording
     ( i )

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?

   [No⏎]      [Yes⏎]
```

- 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**. ⏎

```
Diagnostic Menu
I/M Monitors
Read Codes
Erase Codes
MIL Status
State OBD Check
View Data
Record Data
View Freeze Data
Drive Cycle Monitor
      [Rd\Er] ⬇
```
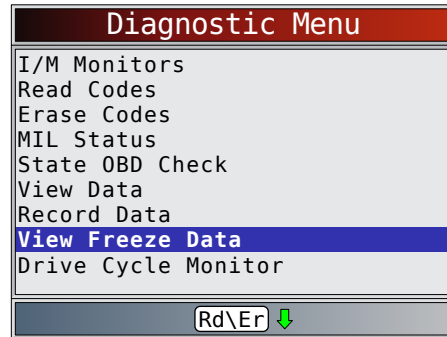
2. Select frame, if more than one frame is present.
   - Use the **READ** ▲ and **ERASE** ▼ keys until the desired frame is highlighted.
   - Press **ENTER**. ⏎

```
Select Data to View
P2122 (MOD $09)
Long PID Names
English/Metric




      [Rd\Er]
```
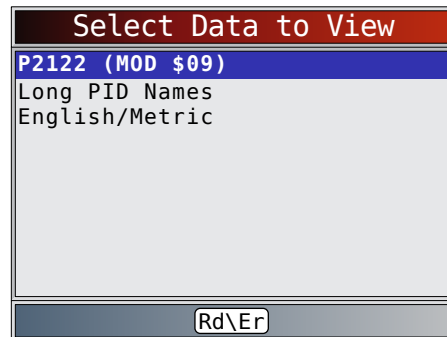
3. View PID on scan tool.

```
TROUB CODE              P2122
FUEL SYS 1                N/A
FUEL SYS 2                N/A
CALC LOAD(%)              0.0
COOLANT(°C)              -40
ST FTRM1(%)              0.0
LT FTRM1(%)              0.0
MAP(KPa)               177.0
ENG SPEED(RPM)             0
VEH SPEED(KPH)             0
Trouble Code that caused Freeze
            ⬇
```

- 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**.

▲ **ERASE** ▼
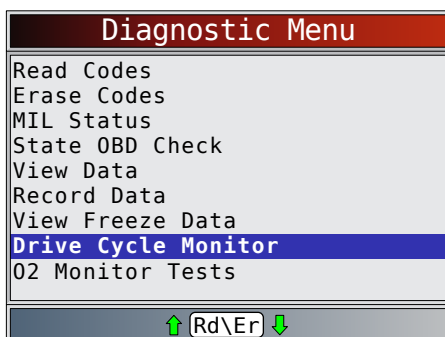• Use the **READ** and ▼ keys until **Drive Cycle Monitor** is highlighted.

↵
• Press **ENTER**.

```
╔══════════════════════════╗
║     Diagnostic Menu      ║
╠══════════════════════════╣
║ Read Codes               ║
║ Erase Codes              ║
║ MIL Status               ║
║ State OBD Check          ║
║ View Data                ║
║ Record Data              ║
║ View Freeze Data         ║
║ Drive Cycle Monitor      ║
║ O2 Monitor Tests         ║
╟──────────────────────────╢
║        ⬆ Rd\Er ⬇         ║
╚══════════════════════════╝
```

• Two types of drive cycle monitors are:

– **Since DTCs Cleared** shows status of the monitors since the Diagnostic Trouble Codes were last erased.

```
╔══════════════════════════╗
║   Since DTCs Cleared     ║
╠══════════════════════════╣
║ Misfire Monitor       ok ║
║ Fuel System Mon       ok ║
║ Comp Component        ok ║
║ Catalyst Mon          ok ║
║ Htd Catalyst         n/a ║
║ Evap System Mon      inc ║
║ Sec Air System       n/a ║
║ A/C Refrig Mon       n/a ║
║ Oxygen Sens Mon       ok ║
╟──────────────────────────╢
║        Rd\Er ⬇           ║
╚══════════════════════════╝
```
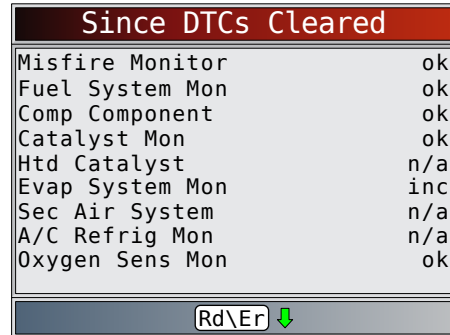
– **This Drive Cycle** shows status of monitors since start of current drive cycle. Refer to the vehicle service manual for more detailed information on emission-related monitors and their status.

```
╔══════════════════════════╗
║     This Drive Cycle     ║
╠══════════════════════════╣
║ Misfire Monitor       ok ║
║ Fuel System Mon       ok ║
║ Comp Component        ok ║
║ Catalyst Mon         inc ║
║ Htd Catalyst         n/a ║
║ Evap System Mon      dis ║
║ Sec Air System       n/a ║
║ A/C Refrig Mon       n/a ║
║ Oxygen Sens Mon      inc ║
╟──────────────────────────╢
║        Rd\Er ⬇           ║
╚══════════════════════════╝
```
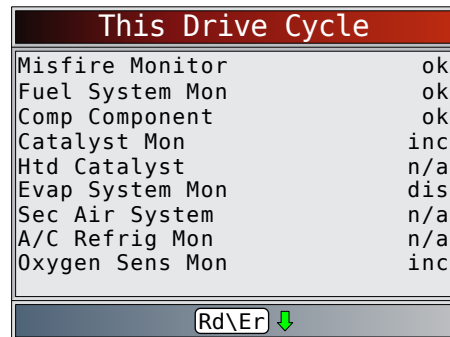
– Some vehicles do not support **Drive Cycle Monitor**. If vehicle supports both types of drive cycle monitors the **Drive Cycle Monitor** menu will display.

```
╔══════════════════════════╗
║   Drive Cycle Monitor    ║
╠══════════════════════════╣
║ Since DTCs Cleared       ║
║ This Drive Cycle         ║
║                          ║
║                          ║
║                          ║
║                          ║
╟──────────────────────────╢
║        Rd\Er             ║
╚══════════════════════════╝
```
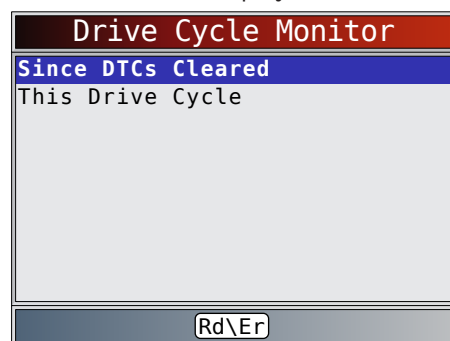
2. View summary of monitor status.

▲ **ERASE** ▼
• Use the **READ** and ▼ 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**. ⏎

```
Diagnostic Menu
Erase Codes
MIL Status
State OBD Check
View Data
Record Data
View Freeze Data
Drive Cycle Monitor
O2 Monitor Tests
Diagnostic Monitor Tests
          ⬆ Rd\Er ⬇
```
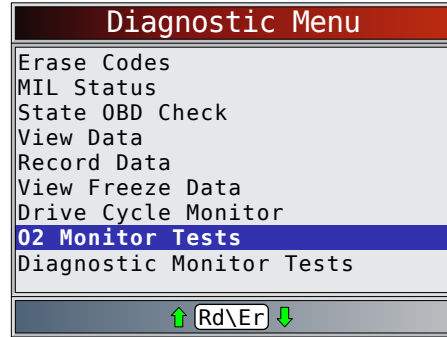
2.   Select O2 sensor.

*   Use the **READ** ▲ and ▼ **ERASE** keys until the desired O2 monitor is highlighted.

*   Press **ENTER**. ⏎

```
Select O2 Sensor
O2 Bank1 Sensor1
O2 Bank1 Sensor2




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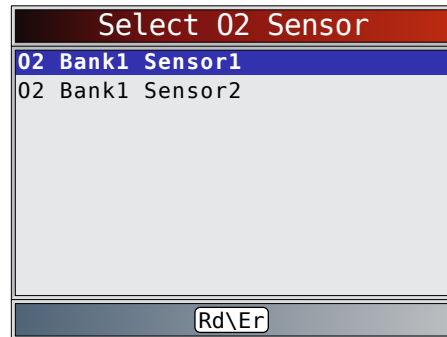
*   The O2 sensors located upstream (before catalyst) may perform differently than ones located downstream (after catalyst).
*   Test IDs are shown for unknown O2 sensor tests.

3.   View results of selection.

```
O2 Bank1 Sensor1
Test  $86
MOD                   $09
MAX                   128
MEAS                  128
MIN                   128

Test  $8D
MOD                   $09
MAX                   255
MEAS                  128
MIN                   128
          Rd\Er ⬇
```

*   Use the **READ** ▲ and ▼ **ERASE** keys.

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 **READ** and ▼ **ERASE** keys until **Diagnostic Monitor Test** is highlighted.
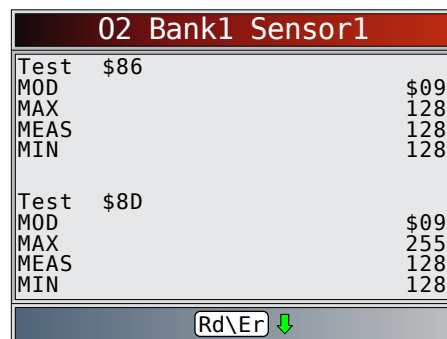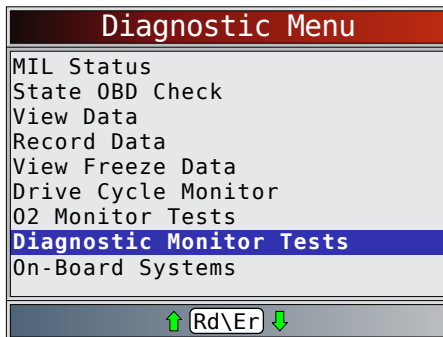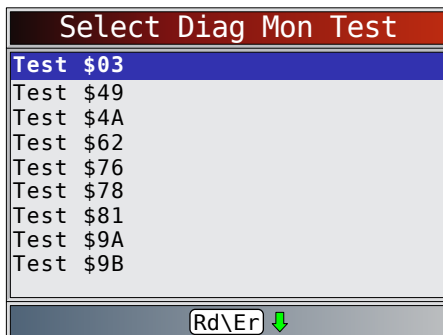   - Press **ENTER**.

```
          Diagnostic Menu
 MIL Status
 State OBD Check
 View Data
 Record Data
 View Freeze Data
 Drive Cycle Monitor
 O2 Monitor Tests
 Diagnostic Monitor Tests
 On-Board Systems
           ⬆ Rd\Er ⬇
```

   - Applicable diagnostic monitor tests are displayed.

2. Review test results displayed on scan tool.
   - Use the **READ** and ▼ **ERASE** keys until desired result is highlighted.
   - Press **ENTER**.
   - Non-CAN example:

```
        Select Diag Mon Test
 Test $03
 Test $49
 Test $4A
 Test $62
 Test $76
 Test $78
 Test $81
 Test $9A
 Test $9B
             Rd\Er ⬇
```

   - CAN example:

```
        Select Diag Mon Test
 O2 Sensor B1S1
 O2 Sensor B1S2
 Catalyst B1
 Purge Flow Mon
 HO2 Sen B1S2
 Misfire Data
 Misfire Cyl 1
 Misfire Cyl 2
 Misfire Cyl 3
             Rd\Er ⬇
```
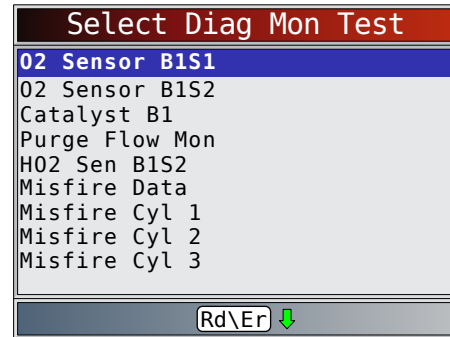
Or, refer to appropriate vehicle service manual for test IDs and definitions.

- 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)

```
             Test $03
 ID                       01
 MOD                     $09
 MAX                    ----
 MEAS                     00
 MIN                      00
 STS                      OK
             Rd\Er
```
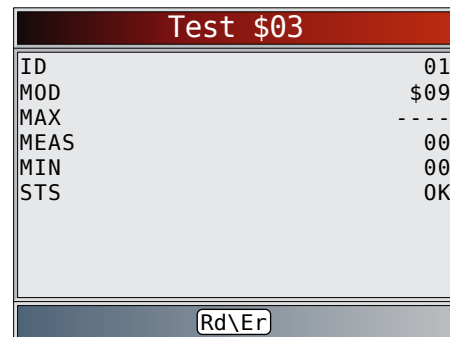
- On CAN vehicles scan tool displays:
  - Test performed. The test performed can be $## if test is not defined. Refer to vehicle service manual for details.
  - Measured values and units of measured (such as volts, amps, and seconds).
  - Status of monitor test data.
  - Module ID where the monitor test data came from.

```
           Purge Flow Mon
 Test                    $C9
 MOD                     $00
 MAX           32.767(KPa)
 MEAS           0.110(KPa)
 MIN            0.000(KPa)
 STS                      OK
             Rd\Er ⬇
```
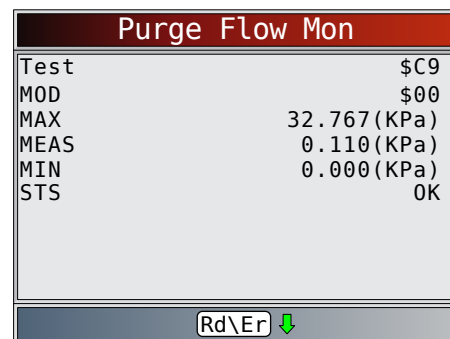
3. Return to **Select Test** menu.
   - Press **BACK**.

4. Return to **Diagnostic Menu**.

←
- Press BACK.

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**:

1. Select **On-Board Systems**.

   ERASE
   - Use the READ and ▼ keys until **On-Board Systems** is highlighted.

   ←
   - Press ENTER.

   ```
   Diagnostic Menu
   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
   ⬆ Rd\Er ⬇
   ```

   - A list of on-board systems and components available for testing are shown on the display.

2. Select test.

   ERASE
   - Use the READ and ▼ keys until desired test is highlighted.
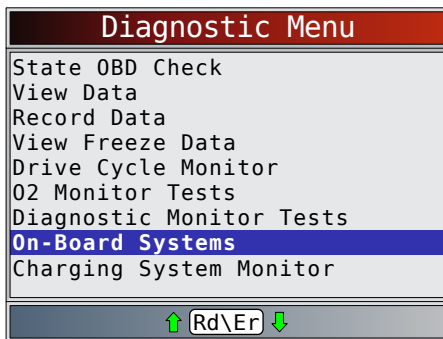
   ←
   - Press ENTER.

   ```
   On-Board Systems
   EVAP Systems Test




   Rd\Er
   ```
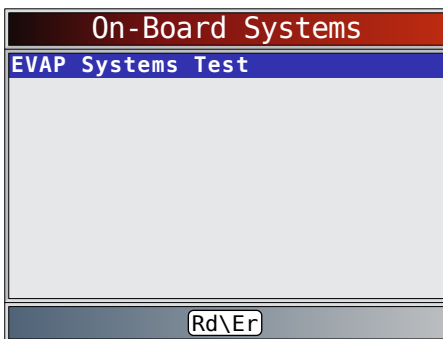
3. Return to **On-Board Systems** menu.

   ←
   - Press BACK.

4. Return to **Diagnostic Menu**.

←
- Press BACK.

5.13 Charging System Monitor

The Charging System Monitor function allows the ccan 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**

   ERASE
   - Use the READ and ▼ keys until **Charging System Monitor** is highlighted.

   ←
   - Press ENTER

   ```
   Diagnostic Menu
   View Data
   Record Data
   View Freeze Data
   Drive Cycle Monitor
   O2 Monitor Tests
   Diagnostic Monitor Tests
   On-Board Systems
   Charging System Monitor
   Vehicle Information
   ⬆ Rd\Er ⬇
   ```
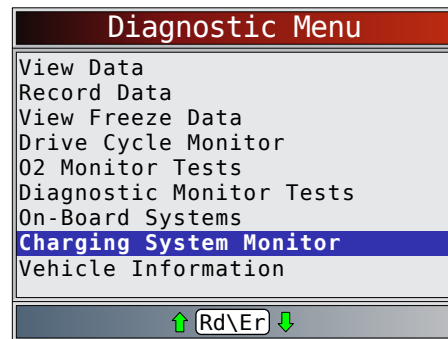
2. Turn the ignition key ON but do not start the engine.

   ←
   - Press ENTER.

   ```
   Charging System Monitor
   ⓘ

   Turn the key on.
   Do NOT start the engine.

   Press ENTER↵ to continue
   ```
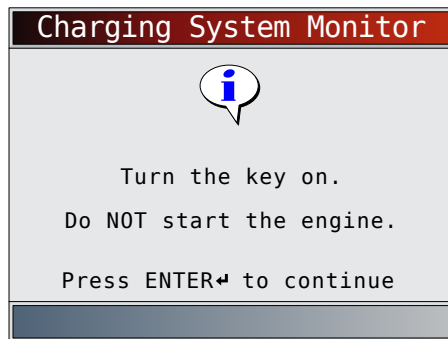
3. The DLC voltage is measured at KOEO.
   - The screen below shows a KOEO voltage of 11.4V.

   ```
   Charging System Monitor
   ⓘ

   DLC KOEO Voltage:
   11.4V
   Please start the engine.

   Press BACK← to exit.
   ```
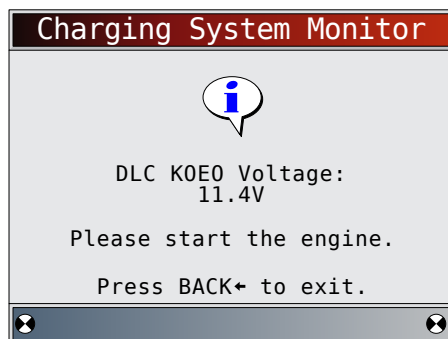
   - Start the engine, or press BACK to return to the Diagnostic Menu.
   - The scan tool will monitor the DLC voltage and progress to step 4 if starter cranking is detected.

4. When the cranking condition is detected, the scan tool will begin collecting DLC voltage readings.

- If the engine starts, press **ENTER**.

Charging System Monitor

ℹ

Collecting data

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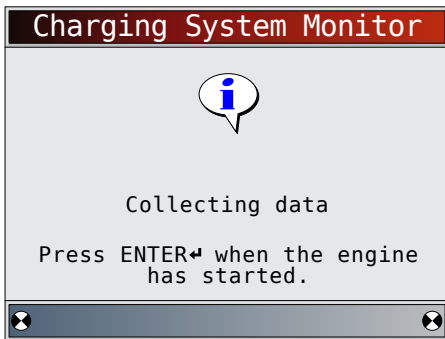
5. If an engine started condition is detected, the scan tool will collect Key On Engine running DLC voltages.

Charging System Monitor

ℹ

Determining DLC KOER voltage.

6. The test results are then displayed.

Test Results

DLC KOEO Voltage	11.4
DLC Cranking Voltage	7.9
DLC KOER Voltage	- - -

Test Results

DLC KOEO Voltage	11.7
DLC Cranking Voltage	8.0
DLC KOER Voltage	14.6
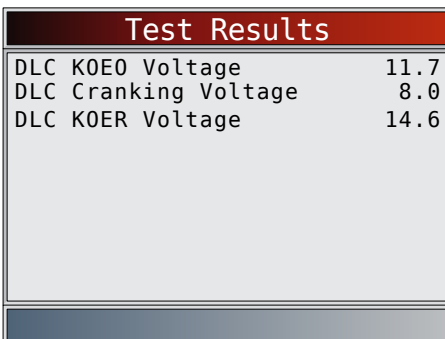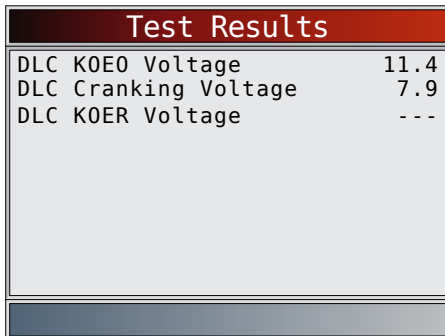
On the first "Test Results" screen example, the Scan Tool did not detect that the engine had started. Because of this, there is no KOER voltage reading.

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.

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.
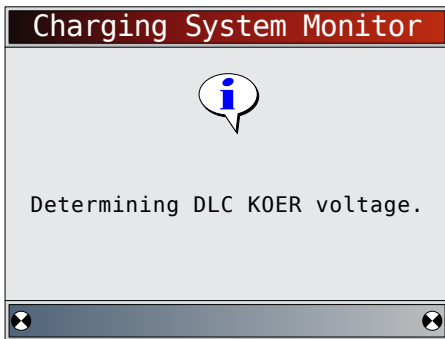
From **Diagnostic Menu**:

1. Select **Vehicle Information**.

- Use the **READ** and ▼ **ERASE** keys until **Vehicle Information** is highlighted.

- Press **ENTER**.

Diagnostic Menu

Record Data
View Freeze Data
Drive Cycle Monitor
O2 Monitor Tests
Diagnostic Monitor Tests
On-Board Systems
Charging System Monitor
Vehicle Information
Component Locator

⬆ Rd\Er ⬇
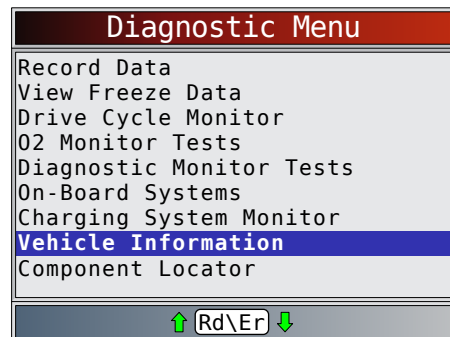
2. Select information to view from the menu.

- Use the **READ** ▲ and ▼ **ERASE** keys until desired selection is highlighted.

- Press **ENTER**. ↵

```
┌─────────────────────────────────┐
│      Vehicle Information         │
├─────────────────────────────────┤
│ VIN                             │
│ CVN                             │
│ CAL ID                          │
│ IPT                             │
│                                 │
│                                 │
│                                 │
│                                 │
├─────────────────────────────────┤
│            [Rd\Er]              │
└─────────────────────────────────┘
```

- If the selected menu item has data for more than one module, a menu listing all modules returning data for that menu item is shown.

3. View information supported by vehicle.

- Use the **READ** ▲ and ▼ **ERASE** keys (if required).

```
┌─────────────────────────────────┐
│        VIN (MOD $09)             │
├─────────────────────────────────┤
│ 1HGCM56866A018504               │
│                                 │
│                                 │
│                                 │
│                                 │
│                                 │
├─────────────────────────────────┤
│                                 │
└─────────────────────────────────┘
```

```
┌─────────────────────────────────┐
│        CVN (MOD $09)             │
├─────────────────────────────────┤
│ 00 5C 02 52                     │
│                                 │
│                                 │
│                                 │
│                                 │
│                                 │
├─────────────────────────────────┤
│                                 │
└─────────────────────────────────┘
```

```
┌─────────────────────────────────┐
│       CAL ID (MOD $09)           │
├─────────────────────────────────┤
│ 37805-RAD-A590                  │
│ --------------                  │
│                                 │
│                                 │
│                                 │
│                                 │
├─────────────────────────────────┤
│                                 │
└─────────────────────────────────┘
```
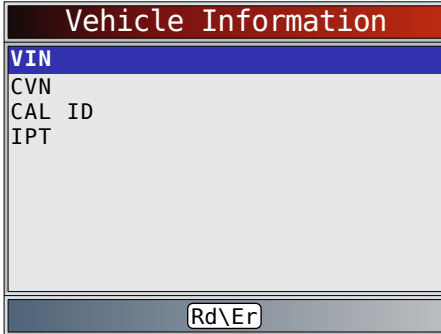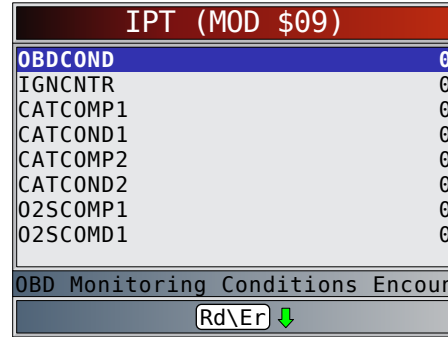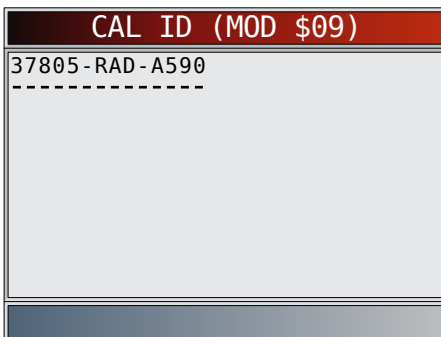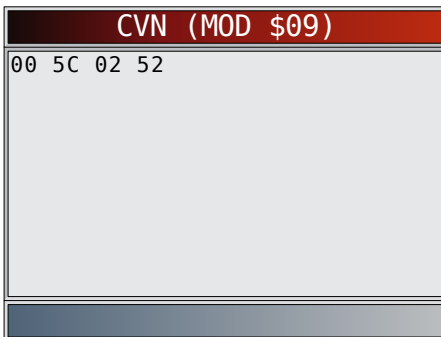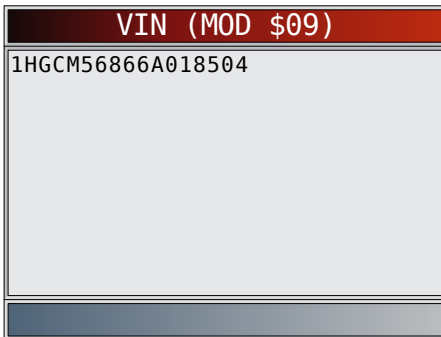
```
┌─────────────────────────────────┐
│        IPT (MOD $09)             │
├─────────────────────────────────┤
│ OBDCOND                       0 │
│ IGNCNTR                       0 │
│ CATCOMP1                      0 │
│ CATCOND1                      0 │
│ CATCOMP2                      0 │
│ CATCOND2                      0 │
│ O2SCOMP1                      0 │
│ O2SCOMD1                      0 │
├─────────────────────────────────┤
│ OBD Monitoring Conditions Encoun │
│          [Rd\Er] ⬇              │
└─────────────────────────────────┘
```

- 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.

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

- 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

> ⚠️ **WARNING**
> Review "Safety Messages" on page 5 before troubleshooting.

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.

- Press ENTER.

6.5 Tool Self-Tests

Tool Self-Tests check the display, keys, and internal memory.
- Refer to "4 Using the Scan Tool" on page 10 for the operation procedures for scan tool self-tests.

6.6 Technical Support

Toll-Free Number: 1-800-228-7667.

7   Appendix A—PID Definitions

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

PID	PID Description
ABS FRP	Absolute Fuel Rail Pressure
ABS LOAD	Absolute Load Value
ABS TPS B, C	Throttle Position B, C
ABSLT TPS	Absolute Throttle Position
ACC POS D	Accelerator Pedal D, E, F
ACC POS REL	Relative Accelerator Pedal Position
AECD1_TIME1, TIME 2	Total Run Time with El-AECD #1 Timer 1 Active, #2 Timer Active
AECD10_TIME1, TIME 2	Total Run Time with El-AECD #10 Timer 1 Active, #2 Timer Active
AECD11_TIME1, TIME 2	Total Run Time with El-AECD #11 Timer 1 active, #2 Timer Active
AECD12_TIME1, TIME 2	Total Run Time with El-AECD #12 Timer 1 active, #2 Timer Active
AECD13_TIME1, TIME 2	Total Run Time with El-AECD #13 Timer 1 active, #2 Timer Active
AECD14_TIME1, TIME 2	Total Run Time with El-AECD #14 Timer 1 active, #2 Timer Active
AECD15_TIME1, TIME 2	Total Run Time with El-AECD #15 Timer 1 active, #2 Timer Active
AECD16_TIME1, TIME 2	Total Run Time with El-AECD #16 Timer 1 active, #2 Timer Active
AECD17_TIME1, TIME 2	Total Run Time with El-AECD #17 Timer 1 active, #2 Timer Active
AECD18_TIME1, TIME 2	Total Run Time with El-AECD #18 Timer 1 active, #2 Timer Active
AECD19_TIME1, TIME 2	Total Run Time with El-AECD #19 Timer 1 active, #2 Timer Active
AECD2_TIME1, TIME 2	Total Run Time with El-AECD #2 Timer 1 Active, #2 Timer Active
AECD20_TIME1, TIME 2	Total Run Time with El-AECD #20 Timer 1 active, #2 Timer Active
AECD3_TIME1, TIME 2	Total Run Time with El-AECD #3 Timer 1 Active, #2 Timer Active
AECD4_TIME1, TIME 2	Total Run Time with El-AECD #4 Timer 1 Active, #2 Timer Active
AECD5_TIME1, TIME 2	Total Run Time with El-AECD #5 Timer 1 Active, #2 Timer Active
AECD6_TIME1, TIME 2	Total Run Time with El-AECD #6 Timer 1 Active, #2 Timer Active
AECD7_TIME1, TIME 2	Total Run Time with El-AECD #7 Timer 1 Active, #2 Timer Active
AECD8_TIME1, TIME 2	Total Run Time with El-AECD #8 Timer 1 Active, #2 Timer Active
AECD9_TIME1, TIME 2	Total Run Time with El-AECD #9 Timer 1 Active, #2 Timer Active
ALCOHOL	Alcohol Fuel Percent
BARO PRS	Barometric Pressure
BAT_PWR	Hybrid Battery Pack Remaining Life
BP_A_ACT, B_ACT	Boost Pressure Sensor A, Sensor B
BP_A_CMD, B_CMD	Commanded Boost Pressure A, Pressure B
BP_A_STAT, B_STAT	Boost Pressure A Control Status, B Control Status

PID	PID Description
CACT 11, 12	Charge Air Cooler Temperature Bank 1 Sensor 1 supported, Sensor 2 supported
CACT 21,22	Charge Air Cooler Temperature Bank 2 Sensor 1 supported, Sensor 2 supported
CALC LOAD	Calculated Engine Load
CAT TEMP11, TEMP12	Catalytic Converter Temp Bank1, Temp Bank 3
CAT TEMP21, TEMP22	Catalytic Converter Temp Bank2, Temp Bank 4
CLR DIST	Distance since erase
CLR TIME	Minutes Run since Erase
CLR TRPS	Warmups Since Erase
CMD EQ RAT	Commanded Equivalence Ratio
COOLANT	Engine Coolant Temp
DPF_REG_AVGD	Average Distance Between DPF Regen
DPF_REG_AVGT	Average Time Between DPF Regen
DPF_REG_STAT	Diesel Particulate Filter (DPF) Regen Status
DPF_REG_TYP	Diesel Particulate Filter (DPF) Regen Type
DPF_REGEN_PCT	Normalized Trigger for DPF Regen
DPF1_DP, DPF2_DP	Diesel Particulate Filter (DPF) Bank 1 Delta Pressure Bank 2 Delta Pressure
DPF1_INP, DPF2_INP	Diesel Particulate Filter (DPF) Bank 1 Inlet Pressure, Bank 2 Inlet Pressure
DPF1_INT, DPF2_INT	DPF Bank 1 Inlet Temperature Sensor, Bank 2 Inlet Temperature Sensor
DPF1_OUTP, DPF2_OUTP	Diesel Particulate Filter (DPF) Bank 1 Outlet Pressure, Bank 2 Outlet Pressure
DPF1_OUTT, DPF2_OUTT	DPF Bank 1 Outlet Temperature Sensor, Bank 2 Outlet Temperature Sensor
ECT 1, 2	Engine Coolant Temperature 1, Temperature 2
EGR CMD	Comanded EGR
EGR ERR	Exhaust Gas Recirculation Error
EGR_A_ACT, B_ACT	Actual EGR A Duty Cycle/Position, B Duty Cycle/Position
EGR_A_CMD, B_CMD	Commanded EGR A Duty Cycle/Position, B Duty Cycle/ Position
EGR_A_ERR, B_ERR	EGR A Error, B Error
EGRT 11, 21	Exhaust Gas Recirculation Temperature Bank 1 Sensor 1, Bank 2 Sensor 1
EGRT 12, 22	Exhaust Gas Recirculation Temperature Bank 1 Sensor 2, Bank 2 Sensor 2
EGT 11, 21	Exhaust Gas Temperature (EGT) Bank 1 Sensor 1, Bank 2 Sensor 1
EGT 12, 22	Exhaust Gas Temperature (EGT) Bank 1 Sensor 2, Bank 2 Sensor 2
EGT 13, 23	Exhaust Gas Temperature (EGT) Bank 1 Sensor 3, Bank 2 Sensor 3
EGT 14, 24	Exhaust Gas Temperature (EGT) Bank 1 Sensor 4, Bank 2 Sensor 4
EMIS_SUP	Emission requirements to which vehicle is designed
ENG RUN	Time Since Engine Start

PID	PID Description
ENG SPEED	Engine RPM
EOT	Engine Oil Temperature
EP_1, 2	Exhaust Pressure Sensor Bank 1, Bank 2
EQ RATIO	Equivalence Ratio
EVAP PURGE	Commanded EVAP Purge
EVAP VP	EVAP Vapor Pressure
EVAP VPA	Absolute EVAP Vapor Pressure
FRP_A, B	Fuel Rail Pressure A, B
FRP_A_CMD, B_CMD	Commanded Fuel Rail Pressure A, B
FRT_A, B	Fuel Rail Temperature A, B
FUEL LEVEL	Fuel Level Input
FUEL PRES	Fuel Rail Pressure
FUEL SYS 1, 2	Fuel System 1 Loop Status, System 2 Loop Status
FUEL TYPE	Fuel Type
FUEL_RATE	Engine Fuel Rate
FUEL_TIMING	Fueling Injection Timing
GPL_STAT	Glow Plug Lamp Status
IAF_A_CMD, B_CMD	Commanded Intake Air Flow A Control, B Control
IAF_A_REL, B_REL	Relative Intake Air Flow A Position, B Position
IAT	Intake Air Temp
IAT 11, 21	Intake Air Temperature Sensor Bank 1 Sensor 1, Bank 2 Sensor 1
IAT 12, 22	Intake Air Temperature Sensor Bank 1 Sensor 2, Bank 2 Sensor 2
IAT 13, 23	Intake Air Temperature Sensor Bank 1 Sensor 3, Bank 2 Sensor 3
ICP_A, B	Injection Control Pressure A, B
ICP_A_CMD, B_CMD	Commanded Injection Control Pressure A, B
IDLE_TIME	Total Idle Run Time
IGN ADV	Timing Advance
LAMBDA11, 21	02 Sensor Lambda Bank 1 Sensor 1, Bank 2 Sensor 1
LAMBDA12, 22	02 Sensor Lambda Bank 1 Sensor 2, Bank 2 Sensor 2
LT FTRM1	Long Term Fuel Trim 1 or 3
LT FTRM2	Long Term Fuel Trim 2 or 4
LT SEC FT1, 2, 3, 4	Long Term Secondary O2 Sensor Fuel Trim 1, 2, 3, 4
MAF, A, B	Mass Air Flow, A, B
MAP, A, B	Manifold Absolute Pressure, A, B
MIL DIST	MIL_DIST
MIL STATUS	Malfunction Indicator Lamp
MIL TIME	Minutes Run by MIL activated
MST	Manifold Surface Temperature
N/D_STAT	Auto Trans Neutral Drive Status
N/G_STAT	Manual Trans Neutral Gear Status
NNTE_Stat	NOx NTE control area status
NOX 11, 21	NOx Sensor Concentration Bank 1 Sensor 1, Bank 2 Sensor 1

PID	PID Description
NOX 12,22	NOx Sensor Concentration Bank 1 Sensor 2, Bank 2 Sensor 2
NOX LEVEL HI, HI1, HI2, HI3, HI4	SCR inducement system actual state 10K history HI1 (0-10000 km), 10K history HI2 (10000-20000 km), 10K history HI3 20000-30000 km), 10K history HI4 (30000-40000 km): NOx emission too high
NOX_ADS_DESUL	NOx Adsorber Desulfurization Status
NOX_ADS_REGEN	NOx Adsorber Regen Status
NWI_TIME	Total Run Time by the Engien whicle NOx warning mode is activated
O2S	O2 Voltage or Current indicates Bank/Sensor
O2S11_PCT, O2S21_PCT	02 Sensor Concentration Bank 1 Sensor 1, Bank 2 Sensor 1
O2S12_PCT, O2S22_PCT	02 Sensor Concentration Bank 1 Sensor 2, Bank 2 Sensor 2
OBD2 STAT	OBD Status
OUT TEMP	Ambient Air Temp
PM 11, PM 21	PM Sensor Mass Concentration Bank 1 Sensor 1, Bank 2 Sensor 1
PNTE_Stat	PM NTE control area status
PTO STATUS	PTO Status
PTO_STAT	Power Take Off (PTO) Status
PTO_TIME	Total Run Time With PTO Active
REAG_DEMD	Average Demanded Reagent Consumption
REAG_LVL	Reagent Tank Level
REAG_RATE	Average Reagent Consumption
REL FRP	Relative Fuel Rail Pressure
REL TPS	Relative Throttle Position
RUN_TIME	Total Engine Run Time
SCR REAG DEV, DEV1, DEV2, DEV3, DEV4	SCR inducement system actual state 10K history DEV1 (0 - 10000 km), 10K history DEV2 (10000 - 20000 km), 10K history DEV3 (20000 - 30000 km), 10K history DEV4 (30000 - 40000 km): deviation of reagent consumption
SCR REAG LOW, LOW1, LOW2, LOW3, LOW4	SCR inducement system actual state 10K history LOW1 (0 - 10000 km), 10K history LOW2 (10000 - 20000 km), 10K history LOW3 (20000 - 30000 km), 10K history LOW4 (30000 - 40000 km): reagent level too low
SCR REAG WRONG, WRONG1, WRONG2, WRONG3, WRONG4	SCR inducement system actual state 10K history WRONG1 (0 - 10000 km), 10K history WRONG2 (10000 - 20000 km), 10K history WRONG3 (20000 - 30000 km), 10K history WRONG4 (30000 - 40000 km): incorrect reagent
SCR SYS ACTIVE	SCR inducement system actual state: inducement system active
SCR_DIST_1D	Distance travelled in current 10K block (0 - 10000 km)

PID	PID Description
SCR_DIST_1N, 2N, 3N, 4N	Distance travelled while inducement system active in current 10K block 1N (0 - 10000 km), 20K block 2N (10 - 20000 km), 30K block 3N (20 - 30000 km), 40K block 4N (30 - 40000 km)
SECOND AIR	Secondary Air Status
ST FTRM	Fuel Trim Bank / Sensor
ST FTRM1, 3	Short Term Fuel Trim1 or 3
ST FTRM2, 4	Short Term Fuel Trim2 or 4
ST SEC FT1, 2, 3, 4	Short Term Secondary O2 Sensor Fuel Trim 1, 2, 3, 4
TAC_A_CMD, B_ CMD	Commanded Throttle Actuator A Control, B Control
TAC_A_REL, B_ REL	Relative Throttle A Position, B Position
TCA_CINP, TCB_ CINP	Turbocharger Compressor Inlet Pressure Sensor A, Pressure Sensor B
TCA_CINT, TCB_ CINT	Turbocharger A Compressor Inlet Temperature, Turbocharger B
TCA_COUTT, TCB_COUTT	Turbocharger A Compressor Outlet Temperature, Turbocharger B
TCA_RPM, TCB_ RPM	Turbocharger A RPM, B RPM
TCA_TOUTT, TCB_TOUTT	Turbocharger A Turbine Outlet Temperature, Turbocharger B
TCA_TINT, TCB_ TINT	Turbocharger A Turbine Inlet Temperature, Turbocharger B
THROT CMD	Commanded Throttle Actuator Control
TP G	Absolute Throttle Position G
TQ_ACT	Actual Engine - Percent Torque
TQ_DD	Driver's Demand Engine - Percent Torque
TQ_MAX1, MAX2, MAX3, MAX4, MAX5	Engine percent torque at idle point 1, 2, 3, 4, 5
TQ_REF	Engine Reference Torque
TROUB CODE	Code causing the Freeze Frame
VEH SPEED	Vehicle Speed
VGT_A_ACT	Variable geometry turbo A position
VGT_A_ACT, B_ ACT	Variable Geometry Turbo A Position, Turbo B
VGT_A_CMD	Commanded variable geometry turbo A position
VGT_A_CMD, B_ CMD	Commanded Variable Geometry Turbo A Position, Turbo B
VGT_A_STAT	Variable geometry turbo A control status
VGT_A_STAT, B_ STAT	Variable Geometry Turbo A Control Status, Turbo B
VGT_B_ACT	Variable geometry turbo B position
VGT_B_CMD	Commanded variable geometry turbo B position
VGT_B_STAT	Variable geometry turbo B control status
VPWR	Control Module Voltage
WG_A_ACT	Wastegate A position

PID	PID Description
WG_A_ACT, B_ ACT	Wastegate A Position, B Position
WG_A_CMD	Commanded wastegate A control
WG_A_CMD, B_ CMD	Commanded Wastegate A Control, B Control
WG_B_ACT	Wastegate B position
WG_B_CMD	Commanded wastegate B control

8 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 crake 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 x.

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 349ºC (660ºF). 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 maturing 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-energizs the A/C compressor at this time for acceleration purposes. The PCM uses a switch or the TPS to identify the WOT condition.

9   Limited Warranty

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