DIGITAL Can OBD2 Tool

OWNER'S MANUAL

The Easiest And Best Way To Troubleshoot 1996 and Newer OBD2 Vehicles!

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WHAT IS OBD?

The OBD2 Code Reader is designed to work on all OBD 2 compliant vehicles. All 1996 and newer vehicles (cars, light trucks and SUVs) sold in the United States are OBD 2 compliant.

One of the most exciting improvements in the automobile industry was the addition of on-board diagnostics (OBD) on vehicles, or in more basic terms, the computer that activates the vehicle's "CHECK ENGINE" light. OBD 1 was designed to monitor manufacturer-specific systems on vehicles built from 1981 to 1995. Then came the development of OBD 2, which is on all 1996 cars and light trucks sold in the U.S. Like its predecessor, OBD 2 was adopted as part of a government mandate to lower vehicle emissions. But what makes OBD 2 unique is its universal application for all late model cars and trucks - domestic and import. This sophisticated program in the vehicle's main computer system is designed to detect failures in a range of systems, and can be accessed through a universal OBD 2 port, which is usually found under the dashboard. For all OBD systems, if a problem is found, the computer turns on the "CHECK ENGINE" light to warn the driver, and sets a Diagnostic Trouble Code (DTC) to identify where the problem occurred. A special diagnostic tool, such as the OBD2 Code Reader, is required to retrieve these codes, which consumers and professionals use as a starting point for repairs.

To learn more about vehicle Computer Control Systems and OBD 2, see COMPUTER ENGINE CONTROLS on page 33.

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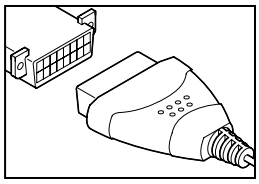
You Can Do It!

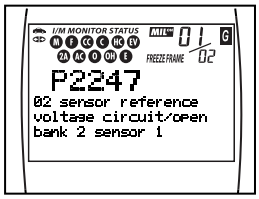
EASY TO USE - EASY TO VIEW - EASY TO DEFINE

Easy To Use . . . .



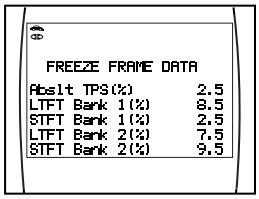
- Connect the Code Reader to the vehicle's test connector.
- Turn the ignition key "On."
- DO NOT start the engine.
- Code Reader turns "On" and links automatically.

Easy To View . . . .



- The Code Reader retrieves stored codes, Freeze Frame Data and I/M Readiness status.
- Codes, I/M Readiness status and Freeze Frame data are displayed on the Code Reader's LCD display. System status is indicated by LED indicators.

Easy To Define . . . .



- Read code definitions from the Code Reader's LCD display.
- View Freeze Frame data.

SAFETY FIRST!

To avoid personal injury, instrument damage and/or damage to your vehicle; do not use the OBD2 Code Reader before reading this manual.

This manual describes common test procedures used by experienced service technicians. Many test procedures require precautions to avoid accidents that can result in personal injury, and/or damage to your vehicle or test equipment. Always read your vehicle's service manual and follow its safety precautions before and during any test or service procedure. **ALWAYS** observe the following general safety precautions:

When an engine is running, it produces carbon monoxide, a toxic and poisonous gas. To prevent serious injury or death from carbon monoxide poisoning, operate the vehicle **ONLY** in a **well-ventilated** area.

To protect your eyes from propelled objects as well as hot or caustic liquids, **always** wear **approved** safety eye protection.

When an engine is running, many parts (such as the coolant fan, pulleys, fan belt etc.) turn at high speed. To avoid serious injury, always be aware of moving parts. Keep a safe distance from these parts as well as other potentially moving objects.

Engine parts become very hot when the engine is running. To prevent severe burns, avoid contact with hot engine parts.

Before starting an engine for testing or trouble-shooting, make sure the parking brake is engaged. Put the transmission in **park** (for automatic transmission) or **neutral** (for manual transmission). Block the drive wheels with suitable blocks.

Connecting or disconnecting test equipment when the ignition is **ON** can damage test equipment and the vehicle's electronic components. Turn the ignition **OFF** before connecting the Code Reader to or disconnecting the Code Reader from the vehicle's Data Link Connector (DLC).

Safety Precautions

SAFETY FIRST!

To prevent damage to the on-board computer when taking vehicle electrical measurements, always use a digital multimeter with at least 10 megOhms of impedance.

Fuel and battery vapors are highly flammable. To prevent an explosion, keep all sparks, heated items and open flames away from the battery and fuel / fuel vapors. DO NOT SMOKE NEAR THE VEHICLE DURING TESTING.

Don't wear loose clothing or jewelry when working on an engine. Loose clothing can become caught in the fan, pulleys, belts, etc. Jewelry is highly conductive, and can cause a severe burn if it makes contact between a power source and ground.

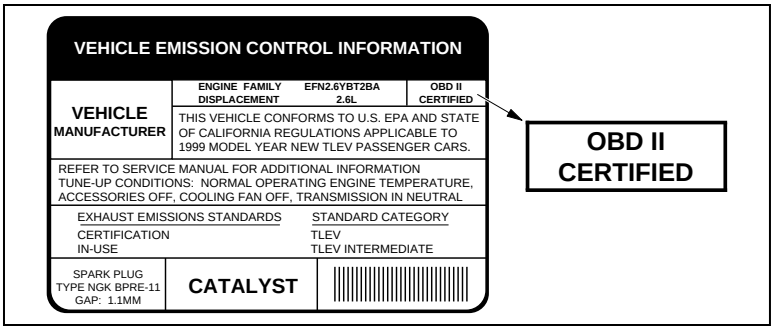
VEHICLES COVERED

The OBD2 Code Reader is designed to work on all OBD 2 compliant vehicles. All 1996 and newer vehicles (cars and light trucks) sold in the United States are OBD 2 compliant.

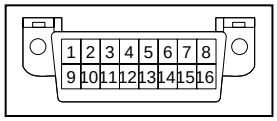
Federal law requires that all 1996 and newer cars and light trucks sold in the United States must be OBD 2 compliant; this includes all Domestic, Asian and European vehicles.

Some 1994 and 1995 vehicles are OBD 2 compliant. To find out if a 1994 or 1995 vehicle is OBD 2 compliant, check the following:

1. **The Vehicle Emissions Control Information (VECI) Label.** This label is located under the hood or by the radiator of most vehicles. If the vehicle is OBD 2 compliant, the label will state "**OBD II Certified**."



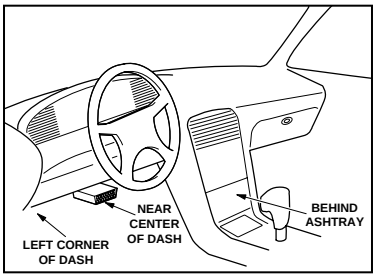
2. Government Regulations require that all OBD 2 compliant vehicles **must** have a "common" sixteen-pin **Data Link Connector (DLC)**.



Some 1994 and 1995 vehicles have 16-pin connectors but are not OBD 2 compliant. Only those vehicles with a Vehicle Emissions Control Label stating "OBD II Certified" are OBD 2 compliant.

Data Link Connector (DLC) Location

The 16-pin DLC is usually located under the instrument panel (dash), within 12 inches (300 mm) of center of the panel, on the driver's side of most vehicles. It should be easily accessible and visible from a kneeling position outside the vehicle with the door open.



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On some Asian and European vehicles the DLC is located behind the "ashtray" (the ashtray must be removed to access it) or on the far left corner of the dash. If the DLC cannot be located, consult the vehicle's service manual for the location.

BATTERY REPLACEMENT

Replace batteries when the battery symbol is visible on display and/or the 3 LEDS are all lit and no other data is visible on screen.

1. Locate the battery cover on the back of the Code Reader.
2. Slide the battery cover off (use your fingers).
3. Replace batteries with two AA-size batteries (for longer life, use Alkaline-type batteries).
4. Reinstall the battery cover on the back of the Code Reader.

ADJUSTMENTS/SETTINGS AND DTC LIBRARY

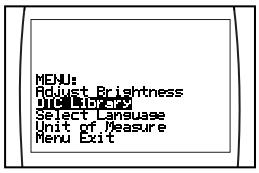
The OBD2 Code Reader lets you make several adjustments and settings to configure the Code Reader to your particular needs. The following functions, adjustments and settings can be performed when the OBD2 Code Reader is in "MENU Mode":

- **Adjust Brightness:** Adjusts the brightness of the LCD display screen.
- **DTC Library:** Lets you search the library of OBD2 DTC definitions.
- **Select Language:** Sets the display language for the Code Reader to English, French or Spanish.
- **Unit of Measure:** Sets the Unit of Measure for the Tool's display to USA or metric.

Adjustments and settings can be made only when the Code Reader is NOT connected to a vehicle.

To enter the MENU Mode:

1. With the Code Reader "off", press and hold the **SCROLL** button, then press and release the **POWER/LINK** button.
   - The adjustments and setting **MENU** displays.



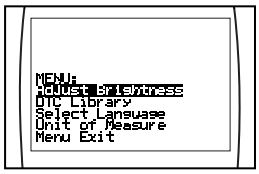
2. Release the **SCROLL** button.

*DO NOT release the **SCROLL** button until the adjustments and settings **MENU** is visible on the display.*

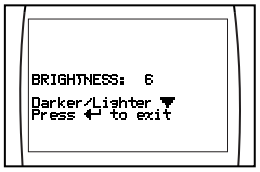
3. Make adjustments and settings as described in the following paragraphs.

Adjusting Display Brightness

1. Use the **SCROLL** button, as necessary, to highlight **Adjust Brightness** in the **MENU**, then press the **ENTER/FF** button.



*When the last option in the **MENU** is reached, pressing the **SCROLL** button again will return to the first menu option.*



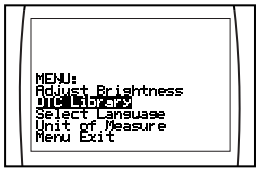
- The Adjust Brightness screen displays.
- The **Brightness** field shows the current brightness setting, from 0 to 43.

2. Press the **SCROLL** button to increase the brightness of the LCD display (make the display lighter). When the display reaches the *brightest* setting, pressing the **SCROLL** button again will return the display to its *darkest* setting.

3. When the desired brightness is obtained, press the **ENTER/FF** button to save your changes and return to the **MENU**.

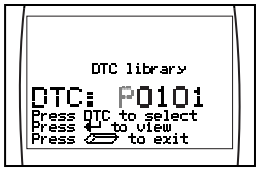
Searching for a DTC Definition Using the DTC Library

1. Use the **SCROLL** button, as necessary, to highlight **DTC Library** in the **MENU**, then press the **ENTER/FF** button.



- The Enter DTC screen displays. The screen shows the code “P0000”, with the “P” highlighted.

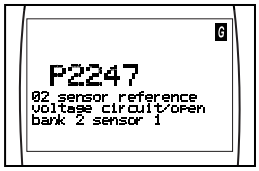
2. Use the **SCROLL** button, as necessary, to scroll to the desired DTC type (P=Powertrain, U=Network, B=Body, C=Chassis), then press the **DTC SCROLL** button.



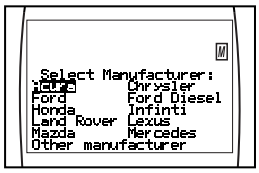
- The next character will highlight.

3. Select the remaining characters in the DTC in the same way, pressing the **DTC SCROLL** button to confirm each character. When you have selected all the DTC characters, press the **ENTER/FF** button to view the DTC definition.

- If you entered a “Generic” DTC (DTCs that start with “P0”, “P2” and some “P3”):
  - The selected DTC and DTC definition (if available), show on the Code Reader’s LCD display.



- If you entered a “Manufacturer-Specific” DTC (DTCs that start with “P1” and some “P3”):
  - The “Select Manufacturer” screen displays.
  - Use the **SCROLL** button, as necessary, to highlight the appropriate manufacturer, then press the **ENTER/FF** button to display the correct DTC for your vehicle.

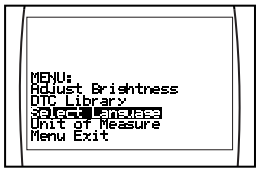


If a definition for the DTC you entered is not available, an advisory message shows on the Code Reader’s LCD display.

4. If you wish to view definitions for additional DTCs, press the **ENTER/FF** button to return to the Enter DTC screen, and repeat steps 2 and 3.
5. When all desired DTCs have been viewed, press the **ERASE** button to exit the DTC Library.

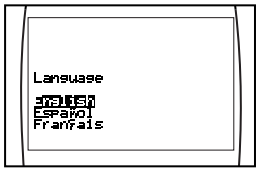
Selecting the Display Language

1. Use the **SCROLL** button, as necessary, to highlight **Select Language** in the **MENU**, then press the **ENTER/FF** button.



*When the last option in the **MENU** is reached, pressing the **SCROLL** button again will return to the first menu option.*

- The Select Language screen displays.
- The currently selected display **Language** is highlighted.



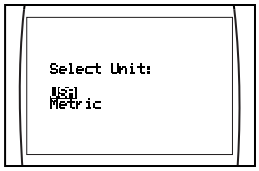
2. Press the **SCROLL** button, as necessary, to highlight the desired display language. Pressing the **SCROLL** button repeatedly will toggle between the available selections.

3. When the desired display language is highlighted, press the **ENTER/FF** button to save your changes and return to the **MENU**.

Setting the Unit of Measure

1. Use the **UP** and **DOWN** buttons, as necessary, to highlight **Unit of Measure** in the **MENU**, then press the **ENTER/FF** button.

2. Press the **UP** or **DOWN** button, as necessary, to highlight the desired **Unit of Measure**.



3. When the desired **Unit of Measure** value is selected, press the **ENTER/FF** button to save your changes.

Exiting the MENU Mode

1. Use the **SCROLL** button, as necessary, to highlight **Menu Exit** in the **MENU**, then press the **ENTER/FF** button.

- The LCD display returns to the DTC screen.

CONTROLS AND INDICATORS

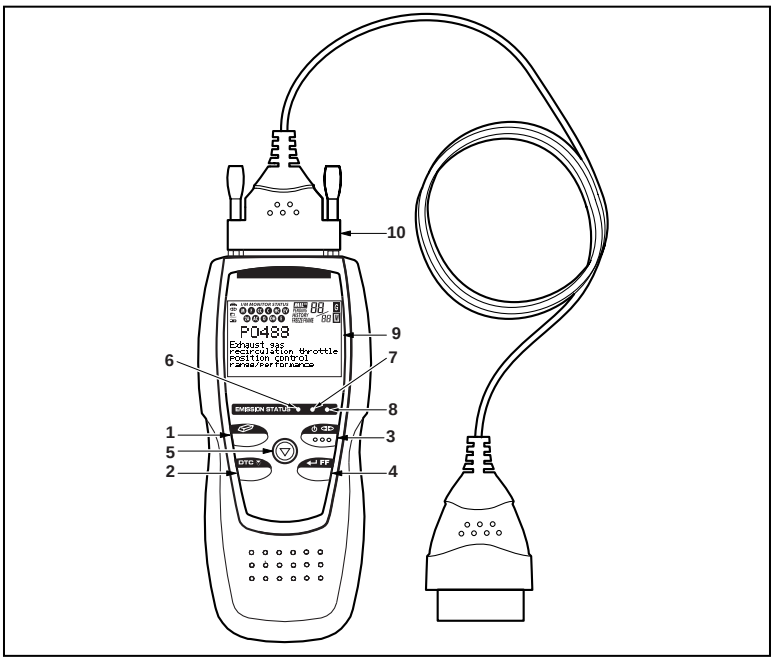


Figure 1. Controls and Indicators

See Figure 1 for the locations of items 1 through 10, below.

1. ERASE button - Erases Diagnostic Trouble Codes (DTCs) and “Freeze Frame” data from your vehicle’s computer, and resets Monitor status.

2. DTC SCROLL button - Displays the DTC View screen and/or scrolls the LCD display to view DTCs when more than one DTC is present.

3. POWER/LINK button - When the Code Reader IS NOT connected to a vehicle, turns the Code Reader “**On**” and “**Off**”. When the Code Reader is connected to a vehicle, re-links the Code Reader to the vehicle’s PCM if the Code Reader is taken out of link.

To turn the Code Reader "On", you must press and hold the ***POWER/LINK*** *button for approximately 3 seconds.*

4. ENTER/FF button - When in MENU mode, confirms the selected option or value. When retrieving DTCs, displays Freeze Frame data for the highest priority code.

5. SCROLL button - When in MENU mode, scrolls DOWN through the menu and submenu selection options. When retrieving and viewing DTCs, scrolls down through the current display screen to display any additional data. When the end of the screen is reached, pressing the button again returns to the top of the screen.

6. GREEN LED - Indicates that all engine systems are running normally (all Monitors on the vehicle are active and performing their diagnostic testing, and no DTCs are present).

7. YELLOW LED - Indicates there is a possible problem. A “Pending” DTC is present and/or some of the vehicle’s emission monitors have not run their diagnostic testing.

8. RED LED - Indicates there is a problem in one or more of the vehicle’s systems. The red LED is also used to show that DTC(s) are present. DTCs are shown on the Code Reader’s LCD display. In this case, the Multifunction Indicator (“Check Engine”) lamp on the vehicle’s instrument panel will light steady on.

9. LCD Display - Displays settings Menu and submenus, test results, Code Reader functions and Monitor status information. See **DISPLAY FUNCTIONS**, on next page, for more details.

10. CABLE - Connects the Code Reader to the vehicle’s Data Link Connector (DLC).

DISPLAY FUNCTIONS

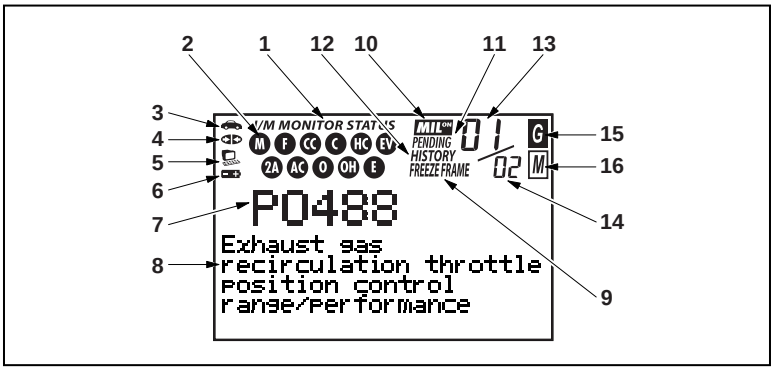


Figure 2. Display Functions

See Figure 2 for the locations of items 1 through 16, below.

1. **I/M MONITOR STATUS field** - Identifies the I/M Monitor status area.
2. **Monitor icons** - Indicate which Monitors are supported by the vehicle under test, and whether or not the associated Monitor has run its diagnostic testing (Monitor status). When a Monitor icon is solid, it indicates that the associated Monitor has completed its diagnostic testing. When a Monitor icon is flashing, it indicates that the vehicle supports the associated Monitor, but the Monitor has not yet run its diagnostic testing.
3. **Vehicle icon** - Indicates whether or not the Code Reader is being properly powered through the vehicle's Data Link Connector (DLC). A visible icon indicates that the Code Reader is being powered through the vehicle's DLC connector.
4. **Link icon** - Indicates whether or not the Code Reader is communicating (linked) with the vehicle's on-board computer. When visible, the Code Reader is communicating with the computer. If the Link icon is not visible, the Code Reader is not communicating with the computer.
5. **Computer icon** - When this icon is visible it indicates that the Code Reader is linked to a personal computer. An optional "Tek Link Kit" is available that makes it possible to upload retrieved data to a personal computer.
6. **Code Reader Internal Battery icon** - When visible, indicates the Code Reader batteries are "low" and should be replaced. If the batteries are not replaced when the battery symbol is "on", all 3 LEDs will flash for 10 seconds each time the unit is turned "on" as a last resort indicator to warn you that the batteries need replacement.

7. **DTC Display Area** - Displays the Diagnostic Trouble Code (DTC) number. Each fault is assigned a code number that is specific to that fault.
8. **Test Data Display Area** - Displays DTC definitions and other pertinent test information messages.
9. **FREEZE FRAME icon** - Indicates that there is Freeze Frame data from “Priority Code” (Code #1) stored in the vehicle’s computer memory.
10. **MIL icon** - Indicates the status of the Malfunction Indicator Lamp (MIL). The MIL icon is visible only when a DTC has commanded the MIL on the vehicle’s dashboard to light.
11. **PENDING icon** - Indicates the currently displayed DTC is a “Pending” code.
12. **HISTORY icon** - Indicates the currently displayed DTC is a “History” code.
13. **Code Number Sequence** - The Code Reader assigns a sequence number to each DTC that is present in the computer’s memory, starting with “01.” This number indicates which code is currently displayed. Code number “01” is always the highest priority code, and the one for which “Freeze Frame” data has been stored.

    If “01” is a “Pending” code, there may or may not be “Freeze Frame” data stored in memory.
14. **Code Enumerator** - Indicates the total number of codes retrieved from the vehicle’s computer.
15. **G Generic DTC icon** - When visible, indicates that the currently displayed DTC is a “generic” or universal code.
16. **M Manufacturer Specific DTC icon** - When visible, indicates that the currently displayed DTC is a Manufacturer Specific Code.

PRELIMINARY VEHICLE DIAGNOSIS WORKSHEET

The purpose of this form is to help you gather preliminary information on your vehicle before you retrieve codes. By having a complete account of your vehicle's current problem(s), you will be able to systematically pinpoint the problem(s) by comparing your answers to the fault codes you retrieve. You can also provide this information to your mechanic to assist in diagnosis and help avoid costly and unnecessary repairs. It is important for you to complete this form to help you and/or your mechanic have a clear understanding of your vehicle's problems. An electronic version of this Preliminary Vehicle Diagnosis Worksheet is available online at www.canOBD2.com. You can complete the form online and print a copy to take to your mechanic.

NAME:

DATE:

VIN*:

YEAR:

MAKE:

MODEL:

ENGINE SIZE:

VEHICLE MILEAGE:

*VIN: Vehicle Identification Number, found at the base of the windshield on a metallic plate, or at the driver door latch area (consult your vehicle owner's manual for location).

TRANSMISSION:

- ❑ Automatic
- ❑ Manual

Please check all applicable items in each category.

DESCRIBE THE PROBLEM:

WHEN DID YOU FIRST NOTICE THE PROBLEM:

- ❑ Just Started
- ❑ Started Last Week
- ❑ Started Last Month
- ❑ Other:

LIST ANY REPAIRS DONE IN THE PAST SIX MONTHS:

PROBLEMS STARTING

- ❑ No symptoms
- ❑ Will not crank
- ❑ Cranks, but will not start
- ❑ Starts, but takes a long time

ENGINE QUITS OR STALLS

- ❑ No symptoms
- ❑ Right after starting
- ❑ When shifting into gear
- ❑ During steady-speed driving
- ❑ Right after vehicle comes to a stop
- ❑ While idling
- ❑ During acceleration
- ❑ When parking

IDLING CONDITIONS

- ❑ No symptoms
- ❑ Is too slow at all times
- ❑ Is too fast
- ❑ Is sometimes too fast or too slow
- ❑ Is rough or uneven
- ❑ Fluctuates up and down

RUNNING CONDITIONS

- ❑ No symptoms
- ❑ Runs rough
- ❑ Lacks power
- ❑ Bucks and jerks
- ❑ Poor fuel economy
- ❑ Hesitates or stumbles on accelerations
- ❑ Backfires
- ❑ Misfires or cuts out
- ❑ Engine knocks, pings or rattles
- ❑ Surges
- ❑ Dieseling or run-on

AUTOMATIC TRANSMISSION PROBLEMS (if applicable)

- ❑ No symptoms
- ❑ Shifts too early or too late
- ❑ Changes gear incorrectly
- ❑ Vehicle does not move when in gear
- ❑ Jerks or bucks

PROBLEM OCCURS

- ❑ Morning
- ❑ Afternoon
- ❑ Anytime

ENGINE TEMPERATURE WHEN PROBLEM OCCURS

- ❑ Cold
- ❑ Warm
- ❑ Hot

DRIVING CONDITIONS WHEN PROBLEM OCCURS

- ❑ Short - less than 2 miles
- ❑ 2 - 10 miles
- ❑ Long - more than 10 miles
- ❑ Stop and go
- ❑ While turning
- ❑ While braking
- ❑ At gear engagement
- ❑ With A/C operating
- ❑ With headlights on
- ❑ During acceleration
- ❑ Mostly driving downhill
- ❑ Mostly driving uphill
- ❑ Mostly driving level
- ❑ Mostly driving curvy roads
- ❑ Mostly driving rough roads

DRIVING HABITS

- ❑ Mostly city driving
- ❑ Highway
- ❑ Park vehicle inside
- ❑ Park vehicle outside
- ❑ Drive less than 10 miles per day
- ❑ Drive 10 to 50 miles per day
- ❑ Drive more than 50 miles per day

GASOLINE USED

- ❑ 87 Octane
- ❑ 89 Octane
- ❑ 91 Octane
- ❑ More than 91 Octane

WEATHER CONDITIONS WHEN PROBLEM OCCURS

- ❑ 32 - 55° F (0 - 13° C)
- ❑ Below freezing (32° F / 0° C)
- ❑ Above 55° F (13° C)

CHECK ENGINE LIGHT / DASH WARNING LIGHT

- ❑ Sometimes ON
- ❑ Always ON
- ❑ Never ON

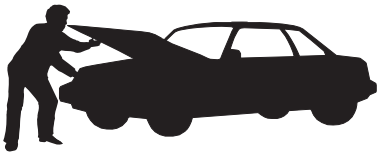
PECULIAR SMELLS

- ❑ "Hot"
- ❑ Sulfur ("rotten egg")
- ❑ Burning rubber
- ❑ Gasoline
- ❑ Burning oil
- ❑ Electrical

STRANGE NOISES

- ❑ Rattle
- ❑ Knock
- ❑ Squeak
- ❑ Other

BEFORE YOU BEGIN



The OBD2 Code Reader aids in monitoring electronic- and emissions-related faults in your vehicle and retrieving fault codes related to malfunctions in these systems. Mechanical problems such as low oil level or damaged hoses, wiring or electrical connectors can cause poor engine performance and may also cause a fault code to set. Fix any known mechanical problems before performing any test. See your vehicle's service manual or a mechanic for more information.

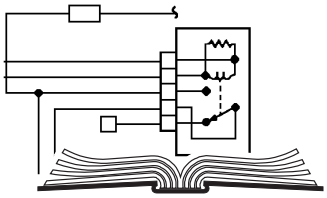
Check the following areas **before** starting any test:

- Check the engine oil, power steering fluid, transmission fluid (if applicable), engine coolant and other fluids for proper levels. Top off low fluid levels if needed.
- Make sure the air filter is clean and in good condition. Make sure all air filter ducts are properly connected. Check the air filter ducts for holes, rips or cracks.
- Make sure all engine belts are in good condition. Check for cracked, torn, brittle, loose or missing belts.
- Make sure mechanical linkages to engine sensors (throttle, gearshift position, transmission, etc.) are secure and properly connected. See your vehicle's service manual for locations.
- Check all rubber hoses (radiator) and steel hoses (vacuum/fuel) for leaks, cracks, blockage or other damage. Make sure all hoses are routed and connected properly.
- Make sure all spark plugs are clean and in good condition. Check for damaged, loose, disconnected or missing spark plug wires.
- Make sure the battery terminals are clean and tight. Check for corrosion or broken connections. Check for proper battery and charging system voltages.
- Check all electrical wiring and harnesses for proper connection. Make sure wire insulation is in good condition, and there are no bare wires.
- Make sure the engine is mechanically sound. If needed, perform a compression check, engine vacuum check, timing check (if applicable), etc.

VEHICLE SERVICE MANUALS

Always refer to the manufacturer's service manual for your vehicle before performing any test or repair procedures. Contact your local car dealership, auto parts store or bookstore for availability of these manuals. The following companies publish valuable repair manuals:

- **Haynes Publications**
  861 Lawrence Drive
  Newbury Park, California 91320
  Phone: 800-442-9637
- **Mitchell International**
  14145 Danielson Street
  Poway, California 92064
  Phone: 888-724-6742
- **Motor Publications**
  5600 Crooks Road, Suite 200
  Troy, Michigan 48098
  Phone: 800-426-6867



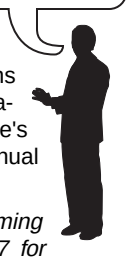
FACTORY SOURCES

Ford, GM, Chrysler, Honda, Isuzu, Hyundai and Subaru Service Manuals

- **Helm Inc.**
  14310 Hamilton Avenue
  Highland Park, Michigan 48203
  Phone: 800-782-4356

CODE RETRIEVAL PROCEDURE

Retrieving and using Diagnostic Trouble Codes (DTCs) for troubleshooting vehicle operation is only one part of an overall diagnostic strategy.

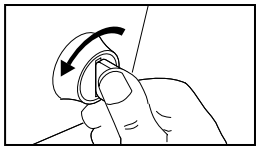


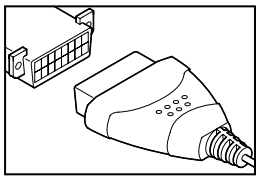
Never replace a part based only on the DTC definition. Each DTC has a set of testing procedures, instructions and flow charts that must be followed to confirm the location of the problem. This information is found in the vehicle's service manual. Always refer to the vehicle's service manual for detailed testing instructions.

*Check your vehicle thoroughly before performing any test. See **Before You Begin** on page 17 for details.*

***ALWAYS** observe safety precautions whenever working on a vehicle. See **Safety Precautions** on page 3 for more information.*

1. Turn the ignition off.
2. Locate the vehicle's 16-pin Data Link Connector (DLC). See page 5 for connector location.





Some DLCs have a plastic cover that must be removed before connecting the Code Reader cable connector.

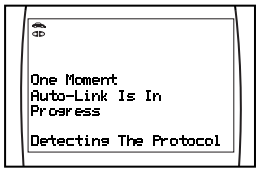
*If the Code Reader is ON, turn it OFF by pressing the **POWER/LINK** button BEFORE connecting the Code Reader to the DLC.*

3. Connect the Code Reader cable connector to the vehicle's DLC. The cable connector is keyed and will only fit one way.
   - If you have problems connecting the cable connector to the DLC, rotate the connector 180° and try again.
   - If you still have problems, check the DLC on the vehicle and on the Code Reader. Refer to your vehicle's service manual to properly check the vehicle's DLC.
4. When the Code Reader's cable connector is properly connected to the vehicle's DLC, the unit automatically turns ON, and LINKS to the vehicle's on-board computer.

- If the unit does not power on automatically when connected to the vehicle's DLC connector, it usually indicates there is no power present at the vehicle's DLC connector. Check your fuse panel and replace any burned-out fuses.
- If replacing the fuse(s) does not correct the problem, consult your vehicle's repair manual to identify the proper computer (PCM) fuse/ circuit, and perform any necessary repairs before proceeding.

5. Turn the ignition on. **DO NOT** start the engine.

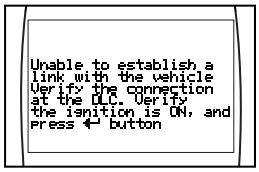
- The Code Reader will automatically start a check of the vehicle's computer to determine which type of communication protocol it is using. When the Code Reader identifies the computer's communication protocol, a communication link is established. The protocol type used by the vehicle's computer is shown on the LCD display.



A PROTOCOL is a set of rules and procedures for regulating data transmission between computers, and between testing equipment and computers. As of this writing, five different types of protocols (ISO 9141, Keyword 2000, J1850 PWM, J1850 VPW and CAN) are in use by vehicle manufacturers. The Code Reader automatically identifies the protocol type and establishes a communication link with the vehicle's computer.

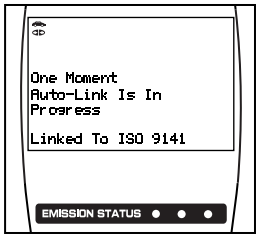
6. After approximately 10~60 seconds, the Code Reader will **retrieve** and **display** any Diagnostic Trouble Code and Monitor Status retrieved from the vehicle's computer memory.

- If the Code Reader fails to link to the vehicle's computer a "Linking Failed" message shows on the Code Reader's LCD display.

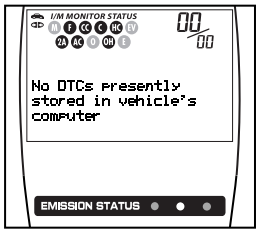


  - Verify the connection at the DLC and verify the ignition is ON.
  - Turn the ignition OFF, wait 5 seconds, then turn back ON to reset the computer.
  - Ensure your vehicle is OBD2 compliant. See **Vehicles Covered** on page 5 for vehicle compliance verification information.

- The Code Reader will automatically re-link to the vehicle's computer every 30 seconds to refresh the data being retrieved. When data is being refreshed, the message "One moment Auto – link in progress" is shown on the LCD display. This action repeats as long as the Code Reader is communicating with the vehicle's computer.



- The Code Reader will display a code only if codes are present in the vehicle's computer memory. If no codes are present, a "No DTC's are presently stored in the vehicle's computer" is displayed.

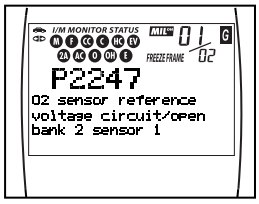


- The Code Reader is capable of retrieving and storing up to 32 codes in memory, for immediate or later viewing.

7. To read the display:

*Refer to **Display Functions** on page 12 for a description of LCD display elements.*

- A visible icon indicates that the Code Reader is being powered through the vehicle's DLC connector.
- A visible icon indicates that the Code Reader is linked to (communicating with) the vehicle's computer.
- The I/M Monitor Status icons indicate the type and number of Monitors the vehicle supports, and provides indications of the current status of the vehicle's Monitors. A **solid** Monitor icon indicates the associated Monitor **has run** and completed its testing. A **blinking** Monitor icon indicates the associated Monitor **has not run** and completed its testing.
- The upper right hand corner of the display shows the number of the code currently being displayed, the total number of codes retrieved, the type of code (**G** = Generic; **M** = Manufacturer Specific), and whether or not the displayed code commanded the MIL on. If the code being displayed is a PENDING code, the PENDING icon is shown.



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*Freeze Frame data is always associated with the "Priority Code" (identified as Code #1 in the Code Reader's display). If the **FREEZE FRAME** icon is lit when the "Priority Code" (Code #1) is displayed on the Code Reader's screen, it indicates that there is Freeze Frame data associated with this code, and the vehicle's computer has saved it in its memory.*

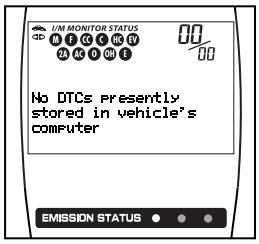
- The Diagnostic Trouble Code (DTC) and related code definition are shown in the lower section of the LCD display.

In the case of long code definitions, a small arrow is shown in the upper/lower right-hand corner of the code display area to indicate the presence of additional information. Use the **SCROLL** *button, as necessary, to view the additional information. When the end of the screen is reached, pressing the button again returns to the top of the screen.*

8. Read and interpret Diagnostic Trouble Codes/system condition using the LCD display and the green, yellow and red LEDs.

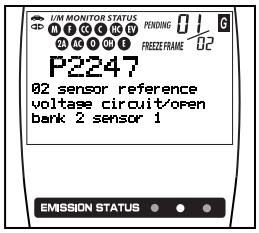
The green, yellow and red LEDs are used (with the LCD display) as visual aids to make it easier to determine engine system conditions.

- **Green LED** – Indicates that all engine systems are "OK" and operating normally. All monitors supported by the vehicle have run and performed their diagnostic testing, and no trouble codes are present. A zero will show on the Code Reader's LCD display, and all Monitor icons will be solid.

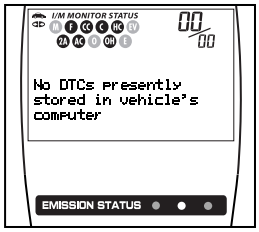


- **Yellow LED** – Indicates one of the following conditions:

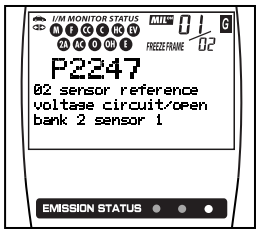
A. A PENDING CODE IS PRESENT – If the yellow LED is illuminated, it may indicate a Pending code is present. Check the Code Reader's LCD display for confirmation. A Pending code is confirmed by the presence of a numeric code and the word PENDING on the Code Reader's LCD display.



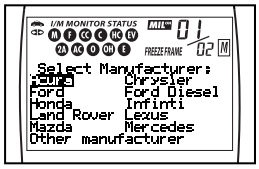
B. MONITOR NOT RUN STATUS – If the Code Reader's LCD display shows a zero (indicating there are no DTC's present in the vehicle's computer memory), but the yellow LED is illuminated, it may be an indication that some of the Monitors supported by the vehicle have not yet run and completed their diagnostic testing. Check the Code Reader's LCD display for confirmation. All Monitor icons that are **blinking** have not yet run and completed their diagnostic testing; all Monitor icons that are **solid** have run and completed their diagnostic testing.



- **Red LED** – Indicates there is a problem with one or more of the vehicle's systems. The red LED is also used to indicate that DTC(s) are present (displayed on the Code Reader's screen). In this case, the Multifunction Indicator (Check Engine) lamp on the vehicle's instrument panel will be illuminated.



- DTC's that start with "P0", "P2" and some "P3" are considered Generic (Universal). All Generic DTC definitions are the same on all OBD2 equipped vehicles. The Code Reader automatically displays the code definitions for Generic DTC's.
- DTC's that start with "P1" and some "P3" are Manufacturer Specific codes and their code definitions vary with each vehicle manufacturer. When a Manufacturer Specific DTC is retrieved, the LCD display shows a list of vehicle manufacturers. Use the **SCROLL** button, as necessary, to highlight the appropriate manufacturer, then press the **ENTER/FF** button to display the correct code definition for your vehicle.



When the last manufacturer in the list is reached, pressing the **SCROLL** button *again will return to the first manufacturer in the list.*

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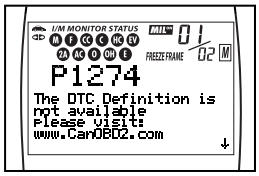
If the manufacturer for your vehicle is not listed, use the **SCROLL** button*, as necessary, to select* ***Other manufacturer*** *and press the* ***ENTER/FF*** *button for additional DTC information.*

If the Manufacturer Specific definition for the currently displayed code is not available, an advisory message shows on the Code Reader's LCD display.

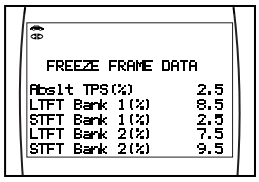


9. If more than one code was retrieved press the **DTC SCROLL** button, as necessary, to display additional codes one at a time.

- Whenever the Scroll function is used to view additional codes, the Code Reader's communication link with the vehicle's computer disconnects. To re-establish communication, press the **LINK** button again.

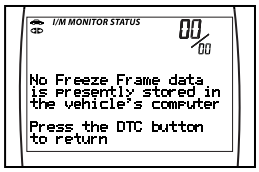
10. Freeze Frame Data (if available) can be viewed at any time (except MENU mode) by pressing the **ENTER/FF** button.

- In OBD2 systems, when an emissions-related engine malfunction occurs that causes a DTC to set, a record or snapshot of engine conditions at the time that the malfunction occurred is also saved in the vehicle's computer memory. The record saved is called Freeze Frame data. Saved engine conditions include, but are not limited to: engine speed, open or closed loop operation, fuel system commands, coolant temperature, calculated load value, fuel pressure, vehicle speed, air flow rate, and intake manifold pressure.



*If more than one malfunction is present that causes more than one DTC to be set, only the code with the highest priority will contain Freeze Frame data. The code designated "**01**" on the Code Reader display is referred to as the PRIORITY code, and Freeze Frame data always refers to this code. The priority code is also the one that has commanded the MIL on.*

If Freeze Frame data is not available for the code shown on the LCD display when the **ENTER/FF** button *is pressed, an advisory message shows on the LCD display. Press the* ***DTC SCROLL*** *button to return to the previous code display.*



11. Determine engine system(s) condition by viewing the Code Reader's LCD display for any retrieved Diagnostic Trouble Codes and code definitions, and interpreting the green, yellow and red LEDs.

- If DTC's were retrieved and you are going to perform the repairs yourself, proceed by consulting the Vehicle's Service Repair Manual for testing instructions, testing procedures, and flow charts related to retrieved code(s).
- If you plan to take the vehicle to a professional to have it serviced, complete the **Preliminary Vehicle Diagnosis Worksheet** on page 14 and take it together with the retrieved codes, freeze frame data and LED information to aid in the troubleshooting procedure.
- To prolong battery life, the Code Reader automatically shuts "Off" approximately three minutes after it is disconnected from the vehicle. The DTCs retrieved and Monitor Status will remain in the Code Reader's memory, and may be viewed at any time by turning the unit "On". If the Code Reader is re-linked to a vehicle to retrieve codes/data, any prior codes/data in its memory are automatically cleared.

The Diagnostic information retrieved can be transferred to a personal computer (PC) with the use of an optional Tek-Link program. See documentation that comes with program for instructions.

ERASING DIAGNOSTIC TROUBLE CODES (DTCs)

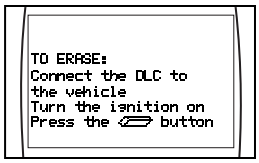
When the Code Reader's ERASE function is used to erase DTCs from the vehicle's on-board computer, "Freeze Frame" data and manufacturer-specific enhanced data are also erased.

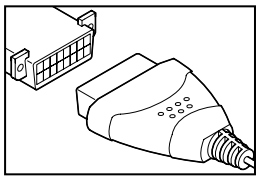
If you plan to take the vehicle to a Service Center for repair, **DO NOT** erase the codes from the vehicle's computer. If the codes are erased, valuable information that might help the technician troubleshoot the problem will also be erased.

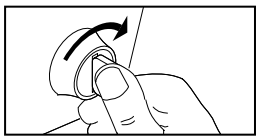
Erase DTCs from the computer's memory as follows:

When DTCs are erased from the vehicle's computer memory, the I/M Readiness Monitor Status program resets the status of all Monitors to a not run "flashing" condition. To set all of the Monitors to a DONE status, an OBD 2 Drive Cycle must be performed. Refer to your vehicle's service manual for information on how to perform an OBD 2 Drive Cycle for the vehicle under test.

The Code Reader must be connected to the vehicle's DLC to erase the codes from the computer's memory. If you press the ***ERASE*** *button when the Code Reader is not connected to the vehicle's DLC, the erase instruction screen displays.*

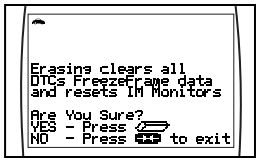






1. If not connected already, connect the Code Reader to the vehicle's DLC, and turn the ignition "On." (If the Code Reader is already connected and linked to the vehicle's computer, proceed directly to step 3. If not, continue to step 2.)

2. Perform the Code Retrieval procedure as described on page 19. Wait until the codes are displayed on the Code Readers LCD and then proceed to step 3.



3. Press and release the **ERASE** button. A confirmation message shows on the LCD display.
   - If you are sure you want to proceed press the **ERASE** button again to erase DTCs from the vehicle's computer.
   - If you do not want to continue with the erase process, press the **POWER/LINK** button to exit the erase mode.
4. If you chose to erase DTCs, a progress screen displays while the erase function is in progress.
   - When the erase process has completed, the Code Reader automatically re-links to the vehicle, and displays any new information retrieved. Some of the Monitor icons will be flashing to indicate that the Monitors have been re-set.

Erasing DTCs does not fix the problem(s) that caused the code(s) to be set. If proper repairs to correct the problem that caused the code(s) to be set are not made, the code(s) will appear again (and the check engine light will illuminate) as soon as the vehicle is driven long enough for its Monitors to complete their testing.

I/M READINESS TESTING

I/M is an Inspection and Maintenance program legislated by the Government to meet federal clean-air standards.

The program requires that a vehicle be taken periodically to an Emissions Station for an "Emissions Test" or "Smog Check," where the emissions-related components and systems are inspected and tested for proper operation. Emissions Tests are generally performed once a year, or once every two years.

On OBD 2 systems, the I/M program is enhanced by requiring vehicles to meet stricter test standards. One of the tests instituted by the Federal Government is called I/M 240. On I/M 240, the vehicle under test is driven under different speeds and load conditions on a dynamometer for 240 seconds, while the vehicle's emissions are measured.

Emissions tests vary depending on the geographic or regional area in which the vehicle is registered. If the vehicle is registered in a highly urbanized area, the I/M 240 is probably the type of test required. If the vehicle is registered in a rural area, the stricter “dynamometer type” test may not be required.

I/M Readiness Monitors

I/M Readiness shows whether the various emissions-related systems on the vehicle are operating properly and are ready for Inspection and Maintenance testing.

State and Federal Governments enacted Regulations, Procedures and Emission Standards to ensure that all emissions-related components and systems are **continuously** or **periodically** monitored, tested and diagnosed whenever the vehicle is in operation. It also requires vehicle manufacturers to automatically detect and report any problems or faults that may increase the vehicle's emissions to an unacceptable level.

The vehicle's emissions control system consists of several components or sub-systems (Oxygen Sensor, Catalytic Converter, EGR, Fuel System, etc.) that aid in reducing vehicle emissions.

To have an efficient Vehicle Emission Control System, all the emissions-related components and systems must work correctly whenever the vehicle is in operation.

To comply with State and Federal Government regulations, vehicle manufacturers designed a series of special computer programs called "Monitors" that are programmed into the vehicle's computer. Each of these Monitors is specifically designed to run tests and diagnostics on a specific emissions-related component or system (Oxygen Sensor, Catalytic Converter, EGR Valve, Fuel System, etc.) to ensure their proper operation. Currently, there are a maximum of eleven Monitors available for use.

To learn more about Emissions Inspection and Maintenance (I/M) Readiness Monitors, see OBD 2 MONITORS on page 42.

Each Monitor has a specific function to test and diagnose only its designated emissions-related component or system. The names of the Monitors (Oxygen Sensor Monitor, Catalyst Monitor, EGR Monitor, Misfire Monitor, etc.) describe which component or system each Monitor is designed to test and diagnose.

Emissions Inspection and Maintenance (I/M) Readiness

Monitor Status Information

I/M Readiness Monitor Status shows which of the vehicle's Monitors have run and completed their diagnosis and testing, and which ones have not yet run and completed testing and diagnosis of their designated sections of the vehicle's emissions system.

- If a Monitor was able to meet all the conditions required to enable it to perform the self-diagnosis and testing of its assigned engine system, it means the monitor "HAS RUN."
- If a Monitor has not yet met all the conditions required for it to perform the self-diagnosis and testing of its assigned engine system; it means the Monitor "HAS NOT RUN."

The Monitor Run/Not Run status does not show whether or not a problem exists in a system. Monitor status only indicates whether a particular Monitor has or has not run and performed the self-diagnosis and testing of its associated system.

Performing I/M Readiness Quick Check

When a vehicle first comes from the factory, all Monitors indicate a "HAVE RUN" status. This indicates that all Monitors have run and completed their diagnostic testing. The "HAVE RUN" status remains in the computer's memory, unless the Diagnostic Trouble Codes are erased or the vehicle's computer memory is cleared.

The Code Reader allows you to retrieve Monitor/System Status Information to help you determine if the vehicle is ready for an Emissions Test (Smog Check). In addition to retrieving Diagnostic Trouble Codes, the Code Reader also retrieves Monitor Run/Not Run status. This information is very important since different areas of the state/country have different emissions laws and regulations concerning Monitor Run/Not Run status.

Before an Emissions Test (Smog Check) can be performed, your vehicle must meet certain rules, requirements and procedures legislated by the Federal and state (country) governments where you live.

1. In most areas, one of the requirements that must be met before a vehicle is allowed to be Emissions Tested (Smog Checked) is that the vehicle does not have any Diagnostic Trouble Codes present (with the exception of PENDING Diagnostic Trouble Codes).
2. In addition to the requirement that no Diagnostic Trouble Codes be present, some areas also require that all the Monitors that a particular vehicle supports indicate a "Has Run" status condition before an Emissions Check may be performed.
3. Other areas may only require that some (but not all) Monitors indicate a "Has Run" status before an Emissions Test (Smog Check) may be performed.

Monitors with a "Has Run" status indicate that all the required conditions they needed to perform diagnosis and testing of their assigned engine area (system) have been met, and all diagnostic testing has completed successfully.

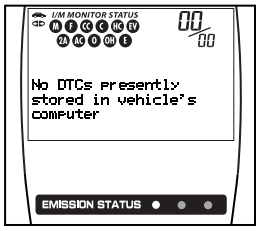
Monitors with a "Has Not Run" status have not yet met the conditions they need to perform diagnosis and testing of their assigned engine area (system), and have not been able to perform diagnostic testing on that system.

The green, yellow and red LEDs provide a quick way to help you determine if a vehicle is ready for an Emissions Test (Smog Check). Follow the instructions below to perform the Quick Check.

Perform the **Code Retrieval Procedure** as described on page 19, then interpret the LED indications as follows:

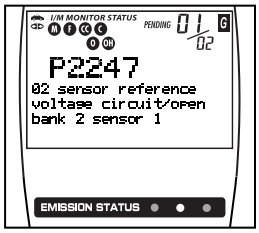
Interpreting I/M Readiness Test Results

1. **GREEN LED** - Indicates that all engine systems are "OK" and operating normally (all Monitors supported by the vehicle have run and performed their self-diagnostic testing). The vehicle is ready for an Emissions Test (Smog Check), and there is a good possibility that it can be certified.

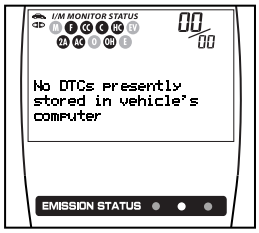


2. **YELLOW LED** - Determine from the Code Retrieval Procedure (page 19) which of the two possible conditions is causing the yellow LED to light.

   - If a "PENDING" Diagnostic Trouble Code is causing the yellow LED to light, it is possible that the vehicle will be allowed to be tested for emissions and certified. Currently, most areas (states / countries) will allow an Emissions Test (Smog Check) to be performed if the only code in the vehicle's computer is a "PENDING" Diagnostic Trouble Code.

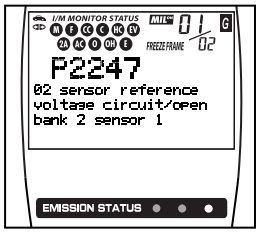


   - If the illumination of the Yellow LED is being caused by monitors that "have not run" their diagnostic testing, then the issue of the vehicle being ready for an Emissions Test (Smog Check) depends on the emissions regulations and laws of your local area.



     - Some areas require that all Monitors indicate a "Has Run" status before they allow an Emissions Test (Smog Check) to be performed. Other areas only require that some, but not all, Monitors have run their self-diagnostic testing before an Emissions Test (Smog Check) may be performed.

       From the code retrieval procedure, determine the status of each Monitor (a solid Monitor icon shows Monitor "Has Run" status, a flashing Monitor icon indicates "Has Not Run" status). Take this information to an emissions professional to determine (based on your test results) if your vehicle is ready for an Emissions Test (Smog Check).



3. **RED LED** - Indicates there is a problem with one or more of the vehicle's systems. A vehicle displaying a red LED is definitely not ready for an Emissions Test (Smog Check). The red LED is also an indication that there are Diagnostic Trouble Code(s) present (displayed on the Code Reader's screen). The Multifunction Indicator (Check Engine) Lamp on the vehicle's instrument panel will light steady. The problem that is causing the red LED to light must be repaired before an Emissions Test (Smog Check) can be performed. It is also suggested that the vehicle be inspected/repaired before driving the vehicle further.

   If the Red LED was obtained, there is a definite problem present in the system(s). In these cases, you have the following options.

   - Repair the vehicle yourself. If you are going to perform the repairs yourself, proceed by reading the vehicle service manual and following all its procedures and recommendations.
   - Take the vehicle to a professional to have it serviced. The problem(s) causing the red LED to light must be repaired before the vehicle is ready for an Emissions Test (Smog Check).

Using the I/M Readiness Monitor Status to Confirm a Repair

The I/M Readiness Monitor Status function can be used (after repair of a fault has been performed) to confirm that the repair has been performed correctly, and/or to check for Monitor Run Status. Use the following procedure to determine I/M Readiness Monitor Status:

1. Using retrieved Diagnostic Trouble Codes (DTCs) and code definitions as a guide, and following manufacturer's repair procedures, repair the fault or faults as instructed.
2. After the fault or faults have been repaired, connect the Code Reader to the vehicle's DLC and erase the code or codes from the vehicle's computer memory.
   - See page 25 for procedures to erase DTCs from the vehicle's on-board computer.
   - Write the codes down on a piece of paper for reference before erasing.
3. After the erase procedure is performed, most of the Monitor icons on the Code Reader’s LCD display will be flashing. Leave the Code Reader connected to the vehicle, and perform a Trip Drive Cycle for each "flashing" Monitor:

Misfire, Fuel and Comprehensive Component Monitors run continuously and their icons will always be on solid, even after the erase function is performed.

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- Each DTC is associated with a specific Monitor. Consult the vehicle's service manual to identify the Monitor (or Monitors) associated with the faults that were repaired. Follow the manufacturer's procedures to perform a Trip Drive Cycle for the appropriate Monitors.
- While observing the Monitor icons on the Code Reader's LCD display, perform a Trip Drive Cycle for the appropriate Monitor or Monitors.

If the vehicle needs to be driven in order to perform a Trip Drive Cycle, ALWAYS have a second person help you. One person should drive the vehicle while the other person observes the Monitor icons on the Code Reader for Monitor RUN status. Trying to drive and observe the Code Reader at the same time is dangerous, and could cause a serious traffic accident.

4. When a Monitor's Trip Drive Cycle is performed properly, the Monitor icon on the Code Reader's LCD display changes from "flashing" to "solid," indicating that the Monitor has run and finished its diagnostic testing.

- If, after the Monitor has run, the MIL on the vehicle's dash is not lit, and no stored or pending codes associated with that particular Monitor are present in the vehicle's computer, the repair was successful.
- If, after the Monitor has run, the MIL on the vehicle's dash lights and/or a DTC associated with that Monitor is present in the vehicle's computer, the repair was unsuccessful. Refer to the vehicle's service manual and recheck repair procedures.

COMPUTER ENGINE CONTROLS

The Introduction of Electronic Engine Controls

Electronic Computer Control Systems make it possible for vehicle manufacturers to comply with the tougher emissions and fuel efficiency standards mandated by State and Federal Governments.

As a result of increased air pollution (smog) in large cities, such as Los Angeles, the California Air Resources Board (**CARB**) and the Environmental Protection Agency (**EPA**) set new regulations and air pollution standards to deal with the problem. To further complicate matters, the energy crisis of the early 1970s caused a sharp increase in fuel prices over a short period. As a result, vehicle manufacturers were not only required to comply with the new emissions standards, they also had to make their vehicles more fuel-efficient. Most vehicles were required to meet a miles-per-gallon (MPG) standard set by the U.S. Federal Government.

Precise fuel delivery and spark timing are needed to reduce vehicle emissions. Mechanical engine controls in use at the time (such as ignition points, mechanical spark advance and the carburetor) responded too slowly to driving conditions to properly control fuel delivery and spark timing. This made it difficult for vehicle manufacturers to meet the new standards.

A new Engine Control System had to be designed and integrated with the engine controls to meet the stricter standards. The new system had to:

- Respond instantly to supply the proper mixture of air and fuel for any driving condition (idle, cruising, low-speed driving, high-speed driving, etc.).
- Calculate instantly the best time to “ignite” the air/fuel mixture for maximum engine efficiency.
- Perform both these tasks without affecting vehicle performance or fuel economy.

Vehicle Computer Control Systems can perform millions of calculations each second. This makes them an ideal substitute for the slower mechanical engine controls. By switching from mechanical to electronic engine controls, vehicle manufacturers are able to control fuel delivery and spark timing more precisely. Some newer Computer Control Systems also provide control over other vehicle functions, such as transmission, brakes, charging, body, and suspension systems.

The Basic Engine Computer Control System

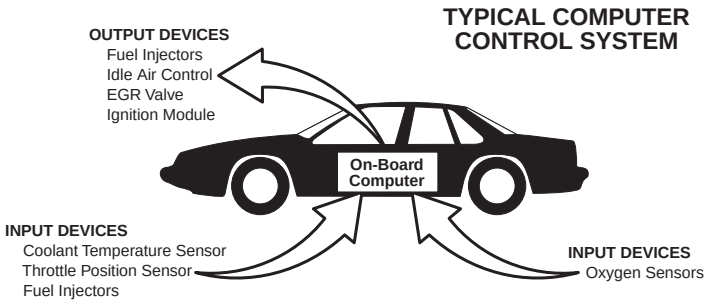
The Computer Control System consists of an on-board computer and several related control devices (sensors, switches, and actuators).

The on-board computer is the heart of the Computer Control System. The computer contains several programs with preset reference values for air/fuel ratio, spark or ignition timing, injector pulse width, engine speed, etc. Separate values are provided for various driving conditions, such as idle, low speed driving, high-speed driving, low load, or high load. The preset reference values represent the ideal air/fuel mixture, spark timing, transmission gear selection, etc., for any driving condition. These values are programmed by the vehicle manufacturer, and are specific to each vehicle model.

Most on-board computers are located inside the vehicle behind the dashboard, under the passenger's or driver's seat, or behind the right kick panel. However, some manufacturers may still position it in the engine compartment.

Vehicle sensors, switches, and actuators are located throughout the engine, and are connected by electrical wiring to the on-board computer. These devices include oxygen sensors, coolant temperature sensors, throttle position sensors, fuel injectors, etc. Sensors and switches are **input devices**. They provide signals representing current engine operating conditions to the computer. Actuators are **output devices**. They perform actions in response to commands received from the computer.

The on-board computer receives information inputs from sensors and switches located throughout the engine. These devices monitor critical engine conditions such as coolant temperature, engine speed, engine load, throttle position, air/fuel ratio etc.



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The computer compares the values received from these sensors with its preset reference values, and makes corrective actions as needed so that the sensor values always match the preset reference values for the current driving condition. The computer makes adjustments by commanding other devices such as the fuel injectors, idle air control, EGR valve or Ignition Module to perform these actions.

Vehicle operating conditions are constantly changing. The computer continuously makes adjustments or corrections (especially to the air/fuel mixture and spark timing) to keep all the engine systems operating within the preset reference values.

On-Board Diagnostics - First Generation (OBD 1)

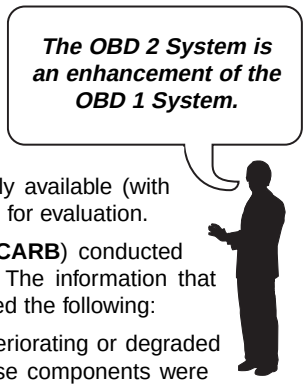
With the exception of some 1994 and 1995 vehicles, most vehicles from 1982 to 1995 are equipped with some type of first generation On-Board Diagnostics.

Beginning in 1988, California's Air Resources Board (**CARB**), and later the Environmental Protection Agency (**EPA**) required vehicle manufacturers to include a self-diagnostic program in their on-board computers. The program would be capable of identifying emissions-related faults in a system. The first generation of Onboard Diagnostics came to be known as **OBD 1**.

OBD 1 is a set of self-testing and diagnostic instructions programmed into the vehicle's on-board computer. The programs are specifically designed to detect failures in the sensors, actuators, switches and wiring of the various vehicle emissions-related systems. If the computer detects a failure in any of these components or systems, it lights an indicator on the dashboard to alert the driver. The indicator lights **only** when an emissions-related problem is detected.

The computer also assigns a numeric code for each specific problem that it detects, and stores these codes in its memory for later retrieval. These codes can be retrieved from the computer's memory with the use of a "Code Reader" or a "Scan Tool."

On-Board Diagnostics - Second Generation (OBD 2)



In addition to performing all the functions of the OBD 1 System, the OBD 2 System has been enhanced with new Diagnostic Programs. These programs closely monitor the functions of various emissions-related components and systems (as well as other systems) and make this information readily available (with the proper equipment) to the technician for evaluation.

The California Air Resources Board (**CARB**) conducted studies on OBD 1 equipped vehicles. The information that was gathered from these studies showed the following:

- A large number of vehicles had deteriorating or degraded emissions-related components. These components were causing an increase in emissions.
- Because OBD 1 systems only detect failed components, the degraded components were not setting codes.
- Some emissions problems related to degraded components only occur when the vehicle is being driven under a load. The emission checks being conducted at the time were not performed under simulated driving conditions. As a result, a significant number of vehicles with degraded components were passing Emissions Tests.
- Codes, code definitions, diagnostic connectors, communication protocols and emissions terminology were different for each manufacturer. This caused confusion for the technicians working on different make and model vehicles.

To address the problems made evident by this study, CARB and the EPA passed new laws and standardization requirements. These laws required that vehicle manufacturers to equip their new vehicles with devices capable of meeting all of the new emissions standards and regulations. It was also decided that an enhanced on-board diagnostic system, capable of addressing all of these problems, was needed. This new system is known as "**On-Board Diagnostics Generation Two (OBD 2)**." The primary objective of the OBD 2 system is to comply with the latest regulations and emissions standards established by CARB and the EPA.

The Main Objectives of the OBD 2 System are:

- To detect degraded and/or failed emissions-related components or systems that could cause tailpipe emissions to exceed by 1.5 times the Federal Test Procedure (FTP) standard.
- To expand emissions-related system monitoring. This includes a set of computer run diagnostics called Monitors. Monitors perform diagnostics and testing to verify that all emissions-related components and/or systems are operating correctly and within the manufacturer's specifications.

- To use a standardized Diagnostic Link Connector (DLC) in all vehicles. (Before OBD 2, DLCs were of different shapes and sizes.)
- To standardize the code numbers, code definitions and language used to describe faults. (Before OBD 2, each vehicle manufacturer used their own code numbers, code definitions and language to describe the same faults.)
- To expand the operation of the Malfunction Indicator Lamp (MIL).
- To standardize communication procedures and protocols between the diagnostic equipment (Scan Tools, Code Readers, etc.) and the vehicle's on-board computer.

OBD 2 Terminology

The following terms and their definitions are related to OBD 2 systems. Read and reference this list as needed to aid in the understanding of OBD 2 systems.

- **Powertrain Control Module (PCM)** - The PCM is the OBD 2 accepted term for the vehicle's "on-board computer." In addition to controlling the engine management and emissions systems, the PCM also participates in controlling the powertrain (transmission) operation. Most PCMs also have the ability to communicate with other computers on the vehicle (ABS, ride control, body, etc.).
- **Monitor** - Monitors are "diagnostic routines" programmed into the PCM. The PCM utilizes these programs to run diagnostic tests, and to monitor operation of the vehicle's emissions-related components or systems to ensure they are operating correctly and within the vehicle's manufacturer specifications. Currently, up to eleven Monitors are used in OBD 2 systems. Additional Monitors will be added as the OBD 2 system is further developed.

  Not all vehicles support all eleven Monitors.

- **Enabling Criteria** - Each Monitor is designed to test and monitor the operation of a specific part of the vehicle's emissions system (EGR system, oxygen sensor, catalytic converter, etc.). A specific set of "conditions" or "driving procedures" must be met before the computer can command a Monitor to run tests on its related system. These "conditions" are known as "**Enabling Criteria**." The requirements and procedures vary for each Monitor. Some Monitors only require the ignition key to be turned "**On**" for them to run and complete their diagnostic testing. Others may require a set of complex procedures, such as, starting the vehicle when cold, bringing it to operating temperature, and driving the vehicle under specific conditions before the Monitor can run and complete its diagnostic testing.

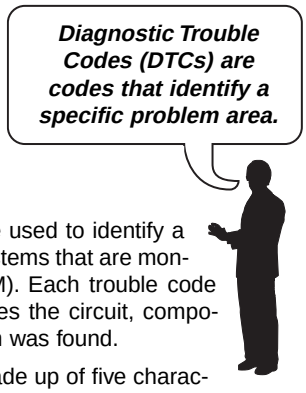
- **Monitor Has/Has Not Run** - The terms “Monitor has run” or “Monitor has not run” are used throughout this manual. “**Monitor has run**,” means the PCM **has** commanded a particular Monitor to perform the required diagnostic testing on a system to ensure the system is operating correctly (within factory specifications). The term “**Monitor has not run**” means the PCM **has not** yet commanded a particular Monitor to perform diagnostic testing on its associated part of the emissions system.
- **Trip** - A Trip for a particular Monitor requires that the vehicle is being driven in such a way that all the required “Enabling Criteria” for the Monitor to run and complete its diagnostic testing are met. The “Trip Drive Cycle” for a particular Monitor begins when the ignition key is turned “**On**.” It is successfully completed when all the “Enabling Criteria” for the Monitor to run and complete its diagnostic testing are met by the time the ignition key is turned “**Off**.” Since each of the eleven monitors is designed to run diagnostics and testing on a different part of the engine or emissions system, the “Trip Drive Cycle” needed for each individual Monitor to run and complete varies.
- **OBD 2 Drive Cycle** - An OBD 2 Drive Cycle is an extended set of driving procedures that takes into consideration the various types of driving conditions encountered in real life. These conditions may include starting the vehicle when it is cold, driving the vehicle at a steady speed (cruising), accelerating, etc. An OBD 2 Drive Cycle begins when the ignition key is turned “On” (when cold) and ends when the vehicle has been driven in such a way as to have all the “Enabling Criteria” met for **all** its applicable Monitors. Only those trips that provide the Enabling Criteria for **all** Monitors applicable to the vehicle to run and complete their individual diagnostic tests qualify as an OBD 2 Drive Cycle. OBD 2 Drive Cycle requirements vary from one model of vehicle to another. Vehicle manufacturers set these procedures. Consult your vehicle’s service manual for OBD 2 Drive Cycle procedures.

*Do not confuse a “Trip” Drive Cycle with an OBD 2 Drive Cycle. A “Trip” Drive Cycle provides the “Enabling Criteria” for **one** specific Monitor to run and complete its diagnostic testing. An OBD 2 Drive Cycle must meet the “Enabling Criteria” for **all** Monitors on a particular vehicle to run and complete their diagnostic testing.*

- **Warm-up Cycle** - Vehicle operation after an engine off period where engine temperature rises at least 40°F (22°C) from its temperature before starting, **and** reaches at least 160°F (70°C). The PCM uses warm-up cycles as a counter to automatically erase a specific code and related data from its memory. When no faults related to the original problem are detected within a specified number of warm-up cycles, the code is erased automatically.

DIAGNOSTIC TROUBLE CODES (DTCs)

Diagnostic Trouble Codes (DTCs) are meant to guide you to the proper service procedure in the vehicle's service manual. **DO NOT** replace parts based only on DTCs without first consulting the vehicle's service manual for proper testing procedures for that particular system, circuit or component.



DTCs are alphanumeric codes that are used to identify a problem that is present in any of the systems that are monitored by the on-board computer (PCM). Each trouble code has an assigned message that identifies the circuit, component or system area where the problem was found.

OBD 2 diagnostic trouble codes are made up of five characters:

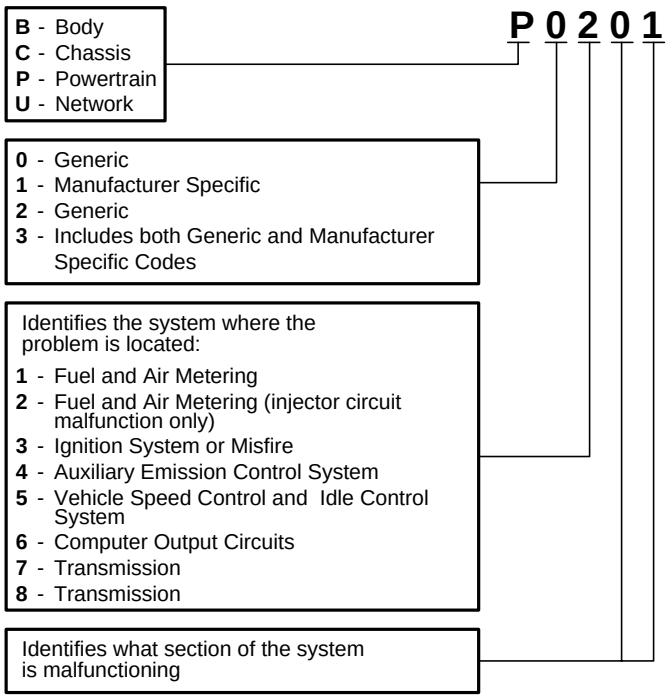
- The 1st character is a **letter**. It identifies the "main system" where the fault occurred (Body, Chassis, Powertrain, or Network).
- The 2nd character is a **numeric digit**. It identifies the "type" of code (Generic or Manufacturer-Specific).

Generic DTCs *are codes that are used by all vehicle manufacturers. The standards for generic DTCs, as well as their definitions, are set by the Society of Automotive Engineers (SAE).*

Manufacturer-Specific DTCs *are codes that are controlled by the vehicle manufacturers. The Federal Government does not require vehicle manufacturers to go beyond the standardized generic DTCs in order to comply with the new OBD2 emissions standards. However, manufacturers are free to expand beyond the standardized codes to make their systems easier to diagnose.*

- The 3rd character is a **numeric digit**. It identifies the specific system or sub-system where the problem is located.
- The 4th and 5th characters are **numeric digits**. They identify the section of the system that is malfunctioning.

OBD 2 DTC EXAMPLE
P0201 - Injector Circuit Malfunction, Cylinder 1



DTCs and MIL Status

When the vehicle's on-board computer detects a failure in an emissions-related component or system, the computer's internal diagnostic program assigns a diagnostic trouble code (DTC) that points to the system (and sub-system) where the fault was found. The diagnostic program saves the code in the computer's memory. It records a "Freeze Frame" of conditions present when the fault was found, and lights the Malfunction Indicator Lamp (MIL). Some faults require detection for two trips in a row before the MIL is turned on.

The "Malfunction Indicator Lamp" (MIL) is the accepted term used to describe the lamp on the dashboard that lights to warn the driver that an emissions-related fault has been found. Some manufacturers may still call this lamp a "Check Engine" or "Service Engine Soon" light.

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There are two types of DTCs used for emissions-related faults: Type “A” and Type “B.” Type “A” codes are “One-Trip” codes; Type “B” DTCs are usually Two-Trip DTCs.

When a **Type “A”** DTC is found on the First Trip, the following events take place:

- The computer commands the MIL “On” when the failure is first found.
- If the failure causes a severe misfire that may cause damage to the catalytic converter, the MIL “flashes” **once per second**. The MIL continues to flash as long as the condition exists. If the condition that caused the MIL to flash is no longer present, the MIL will light “steady” On.
- A DTC is saved in the computer’s memory for later retrieval.
- A “Freeze Frame” of the conditions present in the engine or emissions system when the MIL was ordered “On” is saved in the computer’s memory for later retrieval. This information shows fuel system status (closed loop or open loop), engine load, coolant temperature, fuel trim value, MAP vacuum, engine RPM and DTC priority.

When a **Type “B”** DTC is found on the First Trip, the following events take place:

- The computer sets a Pending DTC, but the MIL is not ordered “On.” “Freeze Frame” data may or may not be saved at this time depending on manufacturer. The Pending DTC is saved in the computer’s memory for later retrieval.
- If the failure **is found** on the second consecutive trip, the MIL is ordered “On.” “Freeze Frame” data is saved in the computer’s memory.
- If the failure **is not found** on the second Trip, the Pending DTC is erased from the computer’s memory.

The MIL will stay lit for both Type “A” and Type “B” codes until one of the following conditions occurs:

- If the conditions that caused the MIL to light are no longer present for the next three trips in a row, the computer automatically turns the MIL “Off” if no other emissions-related faults are present. However, the DTCs remain in the computer’s memory as a history code for 40 warm-up cycles (80 warm-up cycles for fuel and misfire faults). The DTCs are automatically erased if the fault that caused them to be set is not detected again during that period.
- Misfire and fuel system faults require three trips with “similar conditions” before the MIL is turned “Off.” These are trips where the engine load, RPM and temperature are similar to the conditions present when the fault was first found.

After the MIL has been turned off, DTCs, Freeze Frame data, and manufacturer-specific enhanced data stay in the computer's memory. Most of the enhanced data can only be retrieved with special equipment such as a Scan Tool.

- Erasing the DTCs from the computer's memory can also turn off the MIL. See **ERASING DIAGNOSTIC TROUBLE CODES (DTCs)** on page 25, before erasing codes from the computer's memory. If a Code Reader or Scan Tool is used to erase the codes, Freeze Frame data as well as other manufacturer-specific enhanced data will also be erased.

OBD 2 MONITORS

To ensure the correct operation of the various emissions-related components and systems, a diagnostic program was developed and installed in the vehicle's on-board computer. The program has several procedures and diagnostic strategies. Each procedure or diagnostic strategy is made to monitor the operation of, and run diagnostic tests on, a specific emissions-related component or system. These tests ensure the system is running correctly and is within the manufacturer's specifications. On OBD 2 systems, these procedures and diagnostic strategies are called "Monitors."

Currently, a maximum of eleven Monitors are used in OBD 2 systems. Additional monitors may be added as a result of Government regulations as the OBD 2 system grows and matures. Not all vehicles support all eleven Monitors.

Monitor operation is either "**Continuous**" or "**Non-Continuous**," depending on the specific monitor.

Continuous Monitors

Three of these Monitors are designed to constantly monitor their associated components and/or systems for proper operation. Continuous Monitors run constantly when the engine is running. The Continuous Monitors are:

- CC Comprehensive Component Monitor (CCM)
- M Misfire Monitor
- F Fuel System Monitor

Non-Continuous Monitors

The other eight Monitors are "non-continuous" Monitors. "Non-continuous" Monitors perform and complete their testing once per trip. The "non-continuous" Monitors are:

- O Oxygen Sensor Monitor
- OH Oxygen Sensor Heater Monitor
- C Catalyst Monitor
- HC Heated Catalyst Monitor
- E EGR System Monitor
- EV EVAP System Monitor
- 2A Secondary Air System Monitor
- AC Air Conditioning (A/C) Monitor

The following provides a brief explanation of the function of each Monitor:

CC **Comprehensive Component Monitor (CCM)** - This Monitor continuously checks all inputs and outputs from sensors, actuators, switches and other devices that provide a signal to the computer. The Monitor checks for shorts, opens, out of range value, functionality and "rationality."

Rationality: Each input signal is compared against all other inputs and against information in the computer's memory to see if it makes sense under the current operating conditions. Example: The signal from the throttle position sensor indicates the vehicle is in a wide-open throttle condition, but the vehicle is really at idle, and the idle condition is confirmed by the signals from all other sensors. Based on the input data, the computer determines that the signal from the throttle position sensor is not rational (does not make sense when compared to the other inputs). In this case, the signal would fail the rationality test.

The CCM may be either a "One-Trip" or a "Two-Trip" Monitor, depending on the component.

F **Fuel System Monitor** - This Monitor uses a Fuel System Correction program, called Fuel Trim, inside the on-board computer. Fuel Trim is a set of positive and negative values that represent adding or subtracting fuel from the engine. This program is used to correct for a lean (too much air/not enough fuel) or rich (too much fuel/not enough air) air-fuel mixture. The program is designed to add or subtract fuel, as needed, up to a certain percent. If the correction needed is too large and exceeds the time and percent allowed by the program, a fault is indicated by the computer.

The Fuel System Monitor may be a "One-Trip" or "Two-Trip" Monitor, depending on the severity of the problem.

Misfire Monitor - This Monitor continuously checks for engine misfires. A misfire occurs when the air-fuel mixture in the cylinder does not ignite. The misfire Monitor uses changes in crankshaft speed to sense an engine misfire. When a cylinder misfires, it no longer contributes to the speed of the engine, and engine speed decreases each time the affected cylinder(s) misfire. The misfire Monitor is designed to sense engine speed fluctuations and determine from which cylinder(s) the misfire is coming, as well as how bad the misfire is. There are three types of engine misfires, Types 1, 2, and 3.

- Type 1 and Type 3 misfires are two-trip monitor faults. If a fault is sensed on the first trip, the computer temporarily saves the fault in its memory as a Pending Code. The MIL is not commanded on at this time. If the fault is found again on the second trip, under similar conditions of engine speed, load and temperature, the computer commands the MIL “On,” and the code is saved in its long term memory.
- Type 2 misfires are the most severe type of misfire. When a Type 2 misfire is sensed on the first trip, the computer commands the MIL to light when the misfire is sensed. If the computer determines that a Type 2 misfire is severe , and may cause catalytic converter damage, it commands the MIL to “flash” once per second as soon as the misfire is sensed. When the misfire is no longer present, the MIL reverts to steady “On” condition.

Catalyst Monitor - The catalytic converter is a device that is installed downstream of the exhaust manifold. It helps to oxidize (burn) the unburned fuel (hydrocarbons) and partially burned fuel (carbon monoxide) left over from the combustion process. To accomplish this, heat and catalyst materials inside the converter react with the exhaust gases to burn the remaining fuel. Some materials inside the catalytic converter also have the ability to store oxygen, and release it as needed to oxidize hydrocarbons and carbon monoxide. In the process, it reduces vehicle emissions by converting the polluting gases into carbon dioxide and water.

The computer checks the efficiency of the catalytic converter by monitoring the oxygen sensors used by the system. One sensor is located before (upstream of) the converter; the other is located after (downstream of) the converter. If the catalytic converter loses its ability to store oxygen, the downstream sensor signal voltage becomes almost the same as the upstream sensor signal. In this case, the monitor fails the test.

The Catalyst Monitor is a “Two-Trip” Monitor. If a fault is found on the first trip, the computer temporarily saves the fault in its memory as a Pending Code. The computer does not command the MIL on at this time. If the fault is sensed again on the second trip, the computer commands the MIL “On” and saves the code in its long-term memory.

HC **Heated Catalyst Monitor** - Operation of the “heated” catalytic converter is similar to the catalytic converter. The main difference is that a heater is added to bring the catalytic converter to its operating temperature more quickly. This helps reduce emissions by reducing the converter’s down time when the engine is cold. The Heated Catalyst Monitor performs the same diagnostic tests as the catalyst Monitor, and also tests the catalytic converter’s heater for proper operation. This Monitor is also a “Two-Trip” Monitor.

E **Exhaust Gas Recirculation (EGR) Monitor** - The Exhaust Gas Recirculation (EGR) system helps reduce the formation of Oxides of Nitrogen during combustion. Temperatures above 2500°F cause nitrogen and oxygen to combine and form Oxides of Nitrogen in the combustion chamber. To reduce the formation of Oxides of Nitrogen, combustion temperatures must be kept below 2500°F. The EGR system recirculates small amounts of exhaust gas back into the intake manifold, where it is mixed with the incoming air/fuel mixture. This reduces combustion temperatures by up to 500°F. The computer determines when, for how long, and how much exhaust gas is recirculated back to the intake manifold. The EGR Monitor performs EGR system function tests at preset times during vehicle operation.

The EGR Monitor is a “Two-Trip” Monitor. If a fault is found on the first trip, the computer temporarily saves the fault in its memory as a Pending Code. The computer does not command the MIL on at this time. If the fault is sensed again on the second trip, the computer commands the MIL “On,” and saves the code in its long-term memory.

EV **Evaporative System (EVAP) Monitor** - OBD 2 vehicles are equipped with a fuel Evaporative system (EVAP) that helps prevent fuel vapors from evaporating into the air. The EVAP system carries fumes from the fuel tank to the engine where they are burned during combustion. The EVAP system may consist of a charcoal canister, fuel tank cap, purge solenoid, vent solenoid, flow monitor, leak detector and connecting tubes, lines and hoses.

Fumes are carried from the fuel tank to the charcoal canister by hoses or tubes. The fumes are stored in the charcoal canister. The computer controls the flow of fuel vapors from the charcoal canister to the engine via a purge solenoid. The computer energizes or de-energizes the purge solenoid (depending on solenoid design). The purge solenoid opens a valve to allow engine vacuum to draw the fuel vapors from the canister into the engine where the vapors are burned. The EVAP Monitor checks for proper fuel vapor flow to the engine, and pressurizes the system to test for leaks. The computer runs this Monitor once per trip.

The EVAP Monitor is a “Two-Trip” Monitor. If a fault is found on the first trip, the computer temporarily saves the fault in its memory as a Pending Code. The computer does not command the MIL on at this time. If the fault is sensed again on the second trip, the PCM commands the MIL “On,” and saves the code in its long-term memory.

Air Conditioning (A/C) Monitor - The A/C Monitor senses leaks in air conditioning systems that utilize R-12 refrigerant. Vehicle manufacturers have been given two options:

1. Use R-12 refrigerant in their A/C systems, and integrate an A/C Monitor in the OBD 2 systems of these vehicles to detect for refrigerant leaks; or
2. Use R-134 refrigerant instead of R12. The A/C Monitor is not required on these vehicles.

To date, all vehicle manufacturers have opted to use R-134 in their A/C systems. As a result, this Monitor has not yet been implemented.

Oxygen Sensor Heater Monitor - The Oxygen Sensor Heater Monitor tests the operation of the oxygen sensor's heater. There are two modes of operation on a computer-controlled vehicle: "open-loop" and "closed-loop." The vehicle operates in open-loop when the engine is cold, before it reaches normal operating temperature. The vehicle also goes to open-loop mode at other times, such as heavy load and full throttle conditions. When the vehicle is running in open-loop, the oxygen sensor signal is ignored by the computer for air/fuel mixture corrections. Engine efficiency during open-loop operation is very low, and results in the production of more vehicle emissions.

Closed-loop operation is the best condition for both vehicle emissions and vehicle operation. When the vehicle is operating in closed-loop, the computer uses the oxygen sensor signal for air/fuel mixture corrections.

In order for the computer to enter closed-loop operation, the oxygen sensor must reach a temperature of at least 600°F. The oxygen sensor heater helps the oxygen sensor reach and maintain its minimum operating temperature (600°F) more quickly, to bring the vehicle into closed-loop operation as soon as possible.

The Oxygen Sensor Heater Monitor is a "Two-Trip" Monitor. If a fault is found on the first trip, the computer temporarily saves the fault in its memory as a Pending Code. The computer does not command the MIL on at this time. If the fault is sensed again on the second trip, the computer commands the MIL "On," and saves the code in its long-term memory.

Oxygen Sensor Monitor - The Oxygen Sensor monitors how much oxygen is in the vehicle's exhaust. It generates a varying voltage of up to one volt, based on how much oxygen is in the exhaust gas, and sends the signal to the computer. The computer uses this signal to make corrections to the air/fuel mixture. If the exhaust gas has a large amount of oxygen (a lean air/fuel mixture), the oxygen sensor generates a "low" voltage signal. If the exhaust gas has very little oxygen (a rich mixture condition), the oxygen sensor generates a "high" voltage signal. A 450mV signal indicates the most efficient, and least polluting, air/fuel ratio of 14.7 parts of air to one part of fuel.

The oxygen sensor must reach a temperature of at least 600-650°F, and the engine must reach normal operating temperature, for the computer to enter into closed-loop operation. The oxygen sensor only functions when the computer is in closed-loop. A properly operating oxygen sensor reacts quickly to any change in oxygen content in the exhaust stream. A faulty oxygen sensor reacts slowly, or its voltage signal is weak or missing.

The oxygen sensor is a “Two-Trip” monitor. If a fault is found on the first trip, the computer temporarily saves the fault in its memory as a Pending Code. The computer does not command the MIL on at this time. If the fault is sensed again on the second trip, the computer commands the MIL “On,” and saves the code in its long-term memory.

2A **Secondary Air System Monitor** - When a cold engine is first started, it runs in open-loop mode. During open-loop operation, the engine usually runs rich. A vehicle running rich wastes fuel and creates increased emissions, such as carbon monoxide and some hydrocarbons. A Secondary Air System injects air into the exhaust stream to aid catalytic converter operation:

1. It supplies the catalytic converter with the oxygen it needs to oxidize the carbon monoxide and hydrocarbons left over from the combustion process during engine warm-up.
2. The extra oxygen injected into the exhaust stream also helps the catalytic converter reach operating temperature more quickly during warm-up periods. The catalytic converter must heat to operating temperature to work properly.

The Secondary Air System Monitor checks for component integrity and system operation, and tests for faults in the system. The computer runs this Monitor once per trip.

The Secondary Air System Monitor is a “Two-Trip” monitor. If a fault is found on the first trip, the computer temporarily saves this fault in its memory as a Pending Code. The computer does not command the MIL on at this time. If the fault is sensed again on the second trip, the computer commands the MIL “On,” and saves the code in its long-term memory.

OBD 2 Reference Table

The table below lists current OBD 2 Monitors, and indicates the following for each Monitor:

A. Monitor Type (how often does the Monitor run; Continuous or Once per trip)

B. Number of trips needed, with a fault present, to set a pending DTC

C. Number of consecutive trips needed, with a fault present, to command the MIL “On” and store a DTC

D. Number of trips needed, with no faults present, to erase a Pending DTC

E. Number and type of trips or drive cycles needed, with no faults present, to turn off the MIL

F. Number of warm-up periods needed to erase the DTC from the computer’s memory after the MIL is turned off

Name of Monitor	A	B	C	D	E	F
Comprehensive Component Monitor	Continuous	1	2	1	3	40
Misfire Monitor (Type 1 and 3)	Continuous	1	2	1	3 - similar conditions	80
Misfire Monitor (Type 2)	Continuous		1		3 - similar conditions	80
Fuel System Monitor	Continuous	1	1 or 2	1	3 - similar conditions	80
Catalytic Converter Monitor	Once per trip	1	2	1	3 trips	40
Oxygen Sensor Monitor	Once per trip	1	2	1	3 trips	40
Oxygen Sensor Heater Monitor	Once per trip	1	2	1	3 trips	40
Exhaust Gas Recirculation (EGR) Monitor	Once per trip	1	2	1	3 trips	40
Evaporative Emissions Controls Monitor	Once per trip	1	2	1	3 trips	40
Secondary Air System (AIR) Monitor	Once per trip	1	2	1	3 trips	40

GLOSSARY OF TERMS AND ABBREVIATIONS

CARB – California Air Resources Board

CCM – Continuous Component Monitor

Computer Control System – An electronic control system, consisting of an on-board computer and related sensors, switches and actuators, used to ensure peak performance and fuel efficiency while reducing pollutants in the vehicle's emissions.

DIY – Do-It-Yourself

DLC – Data Link Connector

Drive Cycle – An extended set of driving procedures that takes into consideration the various types of driving conditions encountered in real life.

Driving Condition – A specific environmental or operation condition under which a vehicle is operated; such as starting the vehicle when cold, driving at steady speed (cruising), accelerating, etc.

DTC(s) – Diagnostic Trouble Code(s)

EGR – Exhaust Gas Recirculation

EPA – Environmental Protection Agency

EVAP – Evaporative Emissions System

Fault Code – See DTCs

Freeze Frame – A digital representation of engine and/or emissions system conditions present when a fault code was recorded.

FTP – Fuel Tank Pressure

Generic Code – A DTC that applies to all OBD 2 compliant vehicles.

I/M Readiness – An indication of whether or not a vehicle's emissions-related system are operating properly and are ready for Inspection and Maintenance testing.

I/M Test / Emissions Test / Smog Check – A functional test of a vehicle to determine if tailpipe emissions are within Federal/State/Local requirements.

LCD – Liquid Crystal Display

LED – Light Emitting Diode

LTFT – Long Term Fuel Trim, is a program in the vehicle's computer designed to add or subtract fuel from the vehicle to compensate for operating conditions that vary from the ideal A/F ratio (long term).

Manufacturer Specific Code – A DTC that applies only to OBD 2 compliant vehicles made by a specific manufacturer.

MIL – Malfunction Indicator Lamp (also referred to as "Check Engine" light

OBD 1 – On-Board Diagnostics Version 1 (also referred to as “OBD I”)

OBD 2 – On-Board Diagnostics Version 2 (also referred to as “OBD II”)

On-Board Computer – The central processing unit in the vehicle’s computer control system.

PCM – Powertrain Control Module

Pending Code – A code recorded on the “first trip” for a “two-trip” code. If the fault that caused the code to be set is not detected on the second trip, the code is automatically erased.

STFT – Short Term Fuel Trim, is a program in the vehicle’s computer designed to add or subtract fuel from the vehicle to compensate for operating conditions that vary from the ideal A/F ratio. The vehicle uses this program to make minor fuel adjustments (fine tune) on a short-term basis.

Trip Drive Cycle – Vehicle operation that provides the necessary driving condition to enable a vehicle Monitor to run and complete its diagnostic testing.

VECI – Vehicle Emission Control Information Decal

LIMITED ONE YEAR WARRANTY

The Manufacturer warrants to the original purchaser that this unit is free of defects in materials and workmanship under normal use and maintenance for a period of one (1) year from the date of original purchase.

If the unit fails within the one (1) year period, it will be repaired or replaced, at the Manufacturer's option, at no charge, when returned prepaid to the Service Center with Proof of Purchase. The sales receipt may be used for this purpose. Installation labor is not covered under this warranty. All replacement parts, whether new or remanufactured, assume as their warranty period only the remaining time of this warranty.

This warranty does not apply to damage caused by improper use, accident, abuse, improper voltage, service, fire, flood, lightning, or other acts of God, or if the product was altered or repaired by anyone other than the Manufacturer's Service Center.

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SERVICE PROCEDURES

If you have any questions, require technical support or information on UPDATES and OPTIONAL ACCESSORIES, please contact your local store, distributor or the Service Center.

USA & Canada:

(800) 544-4124 (6:00 AM-6:00 PM, Monday-Friday PST)

All others: (714) 241-6802 (6:00 AM-6:00 PM, Monday-Friday PST)

FAX: (714) 432-7511 (24 hr.)

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TECHNICAL ASSISTANCE
1 800 544 4124

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Innova Electronics Corp.
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