MICROSCAN® III

User Manual

EAZ0067L50A Rev. A

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User Manual

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IMPORTANT:
Before operating or maintaining this unit, please read this manual carefully paying extra attention to the safety warnings and precautions.

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www.diagnostics.snapon.com/microscan (North America)

www1.snapon.com/diagnostics/uk (United Kingdom)

snapontools.com.au.com (Australia and New Zealand)

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Safety Information

For your own safety and the safety of others, and to prevent damage to the equipment and vehicles upon which it is used, it is important that these Safety Messages be read and understood by all persons operating, or coming into contact with, the equipment.

This product is intended for use by properly trained and skilled professional automotive technicians. The safety messages presented throughout this manual are reminders to the operator to exercise extreme care when using this test instrument.

There are many variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. Because of the vast number of test applications and variations in the products that can be tested with this instrument, we cannot possibly anticipate or provide advice or safety messages to cover every situation. It is the automotive technician's responsibility to be knowledgeable of the system being tested. It is essential to use proper service methods and test procedures. It is important to perform tests in an appropriate and acceptable manner that does not endanger your safety, the safety of others in the work area, the equipment being used, or the vehicle being tested.

It is assumed that the operator has a thorough understanding of vehicle systems before using this product. Understanding of these system principles and operating theories is necessary for competent, safe and accurate use of this instrument.

Before using the equipment, always refer to and follow the safety messages and applicable test procedures provided by the manufacturer of the vehicle or equipment being tested. Use the equipment only as described in this manual.

Read, understand and follow all safety messages and instructions in this manual, the accompanying safety manual, and on the test equipment.

Safety Message Conventions

Safety messages are provided to help prevent personal injury and equipment damage. All safety messages are introduced by a signal word indicating the hazard level.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury to the operator or to bystanders.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to the operator or to bystanders.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury to the operator or to bystanders.

Safety messages contain three different type styles.

- Normal type states the hazard.
- Bold type states how to avoid the hazard.
- Italic type states the possible consequences of not avoiding the hazard.

An icon, when present, gives a graphical description of the potential hazard.

Example:

⚠ WARNING

Risk of unexpected vehicle movement.
- **Block drive wheels before performing a test with engine running.**
A moving vehicle can cause injury.

Important Safety Instructions

For a complete list of safety messages, refer to the accompanying safety manual.

SAVE THESE INSTRUCTIONS

Contents

Chapter 1   Using This Manual

This manual contains tool usage instructions.

Some of the illustrations shown in this manual may contain accessories and optional equipment that are not included on your system. Contact your sales representative for availability of accessories and optional equipment.

1.1   Conventions

The following conventions are used.

1.1.1 Bold Text

Bold is used in procedures to highlight selectable items such as buttons and menu options.

Example:

- Press the **Y** button.

1.1.2 Symbols

Different types of arrows are used. The "greater than" arrow (>) indicates an abbreviated set of selection instructions.

Example:

- Select **Utilities > Tool Setup > Date**.

The example statement abbreviates the following procedure:

1. Navigate to the **Utilities** screen.
2. Select the **Tool Setup** submenu.
3. Select the **Date** option from the submenu.
4. Select to confirm the selection.

1.1.3 Terminology

The term "select" means navigating to the listed item, then tapping a button or selectable menu item on the touch screen to activate the item.

1.1.4 Notes and Important Messages

The following messages are used.

Notes

A NOTE provides helpful information such as additional explanations, tips, and comments.

Example:

NOTE:
For additional information refer to...

Important

IMPORTANT indicates a situation which, if not avoided, may result in damage to the test equipment or vehicle.

Example:

IMPORTANT:
The Test ID Table below is for CAN Protocol only.

1.1.5 Hyperlinks

Hyperlinks, or links, that take you to other related articles, procedures, and illustrations are available in electronic documents. Blue colored text indicates a selectable hyperlink.

Example:

IMPORTANT:
Read all applicable Safety Information before using this tool!

1.1.6 Procedures

An arrow icon indicates a procedure.

Example:

To clear diagnostic trouble codes (DTCs):
1. Select **Global OBD2/EOBD** from the main menu.
2. Select **Clear Codes** from the sub-menu.
3. Select **Continue** from the confirmation screen.
    A "Cleared" message displays.
4. Select **Return** to go back to the Global OBD menu.

Introduction

Your new scan tool provides On-board Diagnostic (OBD) trouble codes and datastream information for electronic vehicle control systems. The scanner also graphs live data parameters, records vehicle data, clears diagnostic trouble codes (DTCs) from the electronic control module (ECM), and resets the vehicle malfunction indicator lamp (MIL).

2.1   Functional Description
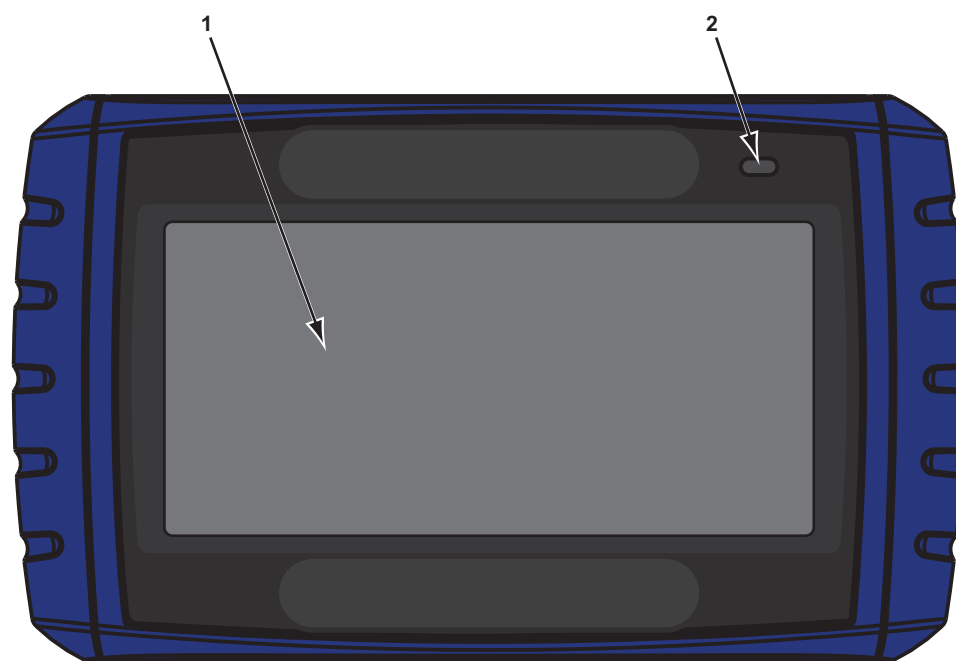
1— Liquid Crystal Display (LCD) Touch Screen
2— Power Light emitting Diode (LED)

Figure 2-1 *Front view*
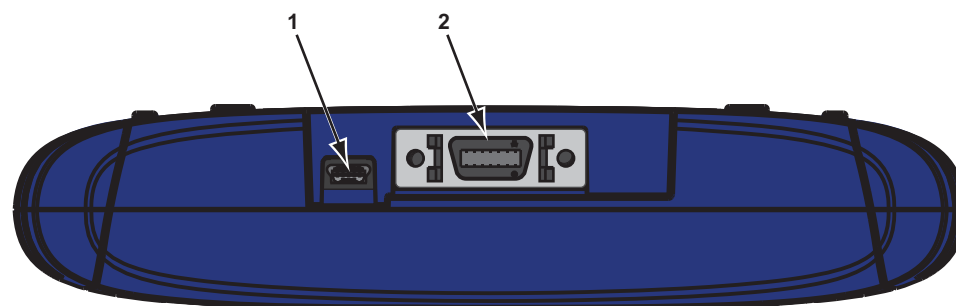
1— USB Port
2— Data Cable Connector

Figure 2-2 *Top view*

3

2.2   Technical Specifications

Display:

Transreflective monochrome LCD with touch panel

240 x 128 pixel screen

Dimensions:

Width:

   5.83 inch

   148 mm

Height:

   3.39 inch

   86 mm

Depth:

   1.25 inch

   31.7 mm

Weight:

   9.6 ounce

   272 g

Operating Temperature Range:

14 to 140°F

–10 to 40°C

Storage Temperature Range:

–4 to 149°F

–20 to 65°C

Data Buffer:

64 data frames (values per parameter)

Communication Protocols:

Your MICROSCAN supports the following OBD-II/EOBD communications protocols:

- SAE J1850 (VPW and PWM)
- SAE J1939 HD OBD (optional)
- ISO 9141-2
- ISO 14230-2 (KWP 2000)
- ISO 15765-4 (CAN)

In addition, the vehicle communications software allows you to access "enhanced" diagnostic information for specific vehicle manufacturers.

2.3   Connections

The scan tool uses two connections; a USB port and a data cable port (Figure 2-2 on page 3).

2.3.1 USB Port

The USB port is for connecting to a personal computer (PC) and is used for updating the internal software, and for transferring saved files. The scan tool receives power through the USB port when it is connected to a PC.

2.3.2 Data Cable Connector

The data cable connector is used to connect the scan tool to a vehicle data link connector (DLC) for testing. The scan tool automatically powers up when it is connected to a vehicle.

2.4   Power Supply

The scan tool can be operated by two power sources:

- Vehicle Power on page 5
- USB Power on page 6

2.4.1 Vehicle Power

Vehicle power is required for the scan tool to properly communicate with the vehicle during testing. The Data Cable provides power to the unit through the vehicle data link connector (DLC). The scan tool turns on automatically whenever it is connected to a DLC with power.

Two auxiliary power cables are available as optional equipment for the scan tool. These cables are used for testing non-OBD-II/EOBD vehicles without battery power on the diagnostic connector. Optional adapters are also needed to connect to these vehicles. Refer to Auxiliary Power Cables (Optional) on page 7 for information on connecting to a vehicle with these cables.
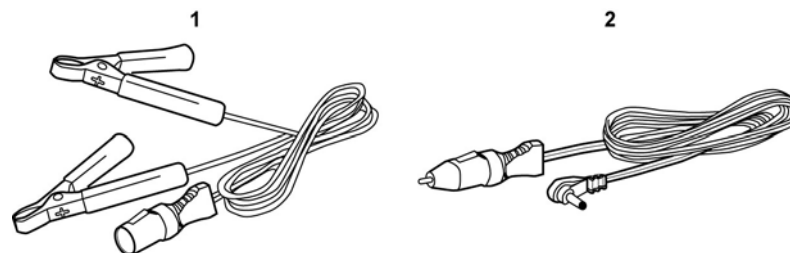
1— **Battery Power Cable**
2— **Lighter Power Cable**

Figure 2-3 *Auxiliary power cables*

2.4.2 USB Power

The scan tool can be powered by a personal computer (PC) when connected to the PC with a standard USB cable. The scan tool automatically powers up when it is connected to a USB port.

2.5   Data Cable

A Data Cable is included with your scan tool. The data cable plugs directly into the 16-pin data link connector (DLC) on all OBD-II/EOBD vehicles.

2.6   Disconnecting the Scan Tool from the Vehicle

Always make sure the scan tool is no longer communicating with the vehicle electronic control module (ECM) before disconnecting the data cable. Opening the data cable connection while the scan tool is actively communicating with the ECM may cause irreversible damage to the ECM on some models. Refer to Stopping Vehicle Communication on page 45 for information on how to properly end a diagnostic session.

Similarly, if the scan tool is disconnected while in the process of saving a movie or image file, or performing any other data writing operation, the file or data may be lost or otherwise corrupted. A "saving" icon displays on the title bar while the scan tool is writing data to a file and a "save success" message momentarily displays when the process is complete. Make sure a movie is completely saved before disconnecting power to the scan tool.

Getting Started

3.1   Supplying Power

There are two ways to supply power to this scanner:

- Connect to vehicle power
- Connect to a personal computer (PC) with a USB cable

3.2   Connecting to Vehicle Power

The scanner Data Cable plugs directly into on OBD-II/EOBD data link connector (DLC).

▶ **To connect to vehicle power:**

1. Attach the Data Cable connector to the data port on the scan tool.
2. Connect the 16-pin connector of the Data Cable to the DLC of the test vehicle.
3. Switch the vehicle ignition on.
4. The scan tool automatically powers on and the Main menu appears.

ℹ **NOTE:**
This scan tool can communicate with many non-OBD-II/EOBD vehicles, however, a data cable adapter and other optional equipment may be needed to connect to the vehicle and to power the tool. Contact your sales representative for details.

3.2.1 Auxiliary Power Cables (Optional)

Two auxiliary power cables for testing vehicles without battery power on the diagnostic connector are available as an option. Data cable adapters, which work with the auxiliary power cables, are also available for testing non-OBD-II/EOBD compliant vehicles.
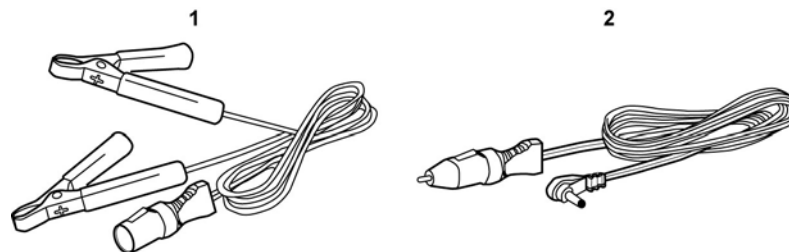
1— **Battery Power Cable**
2— **Lighter Power Cable**

Figure 3-1 *Auxiliary power cables*

▶ **To use the auxiliary power cables on OBD-I vehicles:**

1. Connect the required test adapter to the data cable.
2. Plug the small end of the Lighter Power Cable into the port on the test adapter.
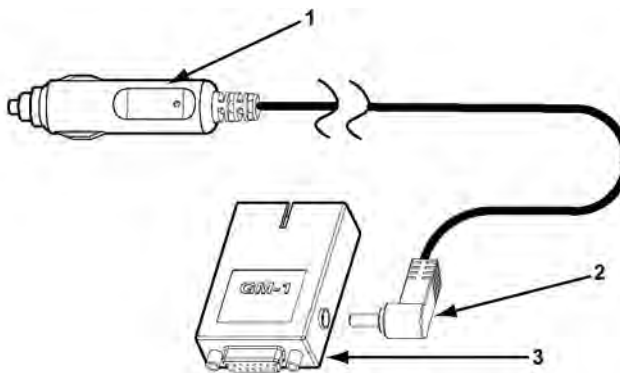3. Plug the large end of the Lighter Power Cable into the socket of the Battery Power Cable.
4. Connect the clamps of the Battery Power Cable to the vehicle battery. Be sure to observe correct polarity when connecting to the vehicle battery.

1— Lighter Power Cable, large end

2— Lighter Power Cable, small end

3— Vehicle test adapter

Figure 3-2 *Auxiliary power cable connections*

3.3 Powering On the Unit

The scan tool powers up whenever it is connected to vehicle power. After power is applied, the scan tool Main menu displays.
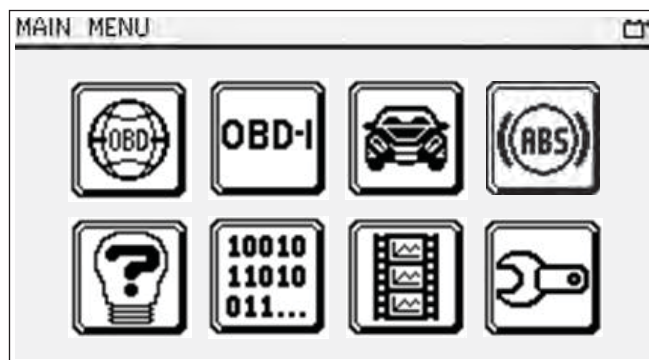

Figure 3-3 *Sample Main menu*

The Main menu is your gateway to scan tool operations, see Main Menu on page 31for details.

3.4   Selecting a Language

You are asked to select a language the first time your new scan tool is powered on. Languages are presented as buttons with an international country code icon, as shown in the table below:

Table 3-1 *Language selection buttons*

Icon	Description
	Español, Spanish
	Français, French
	United States of America, English

Tap the desired language and the scan tool loads that database, and then opens the Main menu. All subsequent screens appear in the designated language. The selected language remains active until language is chose from the menu. You can change the language setting at any time using the following procedure.

   To change the language setting:

1.   Select **Tools** from the main menu.
2.   Select **Settings** from the Tools menu.
3.   Select **Languages** from the Settings menu.
4.   Select a language from the list and press **Return** to exit.

The language remains as selected after powering down.

On-Board Diagnostics (OBD) Basics

Your new MICROSCAN conforms to Global OBD (OBD-II in North America and EOBD in Europe) standards, and is designed for testing compliant vehicles. This chapter describes Global OBD.

4.1 OBD-II/EOBD Advantages

The advantage of OBD-II and EOBD is the simple "Plug and Play" function:

- Unlike using a manufacturer specific scan tool or vehicle communication software, one does not have to select the vehicle make, year or model.
- The communication protocol can be automatically detected by the scan tool software.
- Depending on the ECM and amount of parameters selected, data update rates may vary. By using functions as Custom Data List and Manual Select PID in Service $01, sometimes data update rates may be higher than with manufacturer specific software. This can be helpful in finding intermittent signal glitches.

Data and monitors that are not described in the OBD/EOBD standards are filtered out, although they are selectable.

4.2 Communication Protocols

A communication protocol is a standardized way of data communication between an ECM and a scan tool.

For OBD-II and EOBD compliant vehicles, the following communication protocols are permitted:

- SAE J1850 PWM (pulse width modulation) and VPW (variable pulse width)
- SAE J1939 HD (heavy duty) OBD
- ISO 9141-2 (K-LINE)
- ISO 14230-2 (keyword protocol 2000)
- ISO 15765-4 (CAN)

The scanner attempts to automatically determine the communication protocol by the vehicle. If the scan tool is unable to determine the protocol in use, it must be selected from the menu.

4.2.1 What is CAN?

Many late-model vehicles have Controller Area Network (CAN) systems, which means the vehicle control units are linked together in a network and can interchange data. Although some manufacturers have used CAN for some years to communicate between electronic control modules (ECMs), it was not always directly connected to the diagnostic connector. In approximately 2001/2002 for Europe and 2003 for North America, the manufacturers started to connect the CAN communication lines to the diagnostic connector.

4.3   Diagnostic Services Introduction

The OBD program is divided into several sub programs, called Services:

- is used to display current data
- is used to access powertrain freeze frame data
- is used to display emission related DTCs
- is used to clear or reset emission-related diagnostic data
- is used to display oxygen sensor monitoring test results
- is used to display specific monitored systems test results
- is used to display emission related DTCs detected during current or last completed drive cycle
- is used to access on-board activation tests
- is used to access vehicle information and performance tracking
- is used to display emission related DTCs with permanent status

4.3.1 Readiness Monitor Test Status

OBD-II/EOBD stipulates the monitoring (continuous or non-continuous) of the functions of the following emission control related subsystems):

Table 4-1 *Continuous or Non-continuous monitors*

Readiness Monitor	Remark
Misfire monitoring	Continuous
Fuel system monitoring	Continuous
Comprehensive component monitoring	Continuous
Catalyst monitoring	†
Heated catalyst monitoring	†
Evaporative system monitoring	†
Secondary air system monitoring	†
A/C system refrigerant monitoring	†
Oxygen sensor monitoring	†
Oxygen sensor heater monitoring	†
EGR system monitoring	†
† Will only be monitored if the correct conditions are met.	

NOTE:
Not all data is applicable or supported by all vehicles.

Each vehicle manufacturer has unique monitor test criteria. The Readiness Test Status indicates whether a particular diagnostic monitor or function passed its specific test criteria and was found to be within specification.

Monitors should run and set the Readiness Test Status during normal vehicle operation. The OBD-II Drive Cycle (Figure 4-1) can be used to drive the vehicle in a prescribed manner.
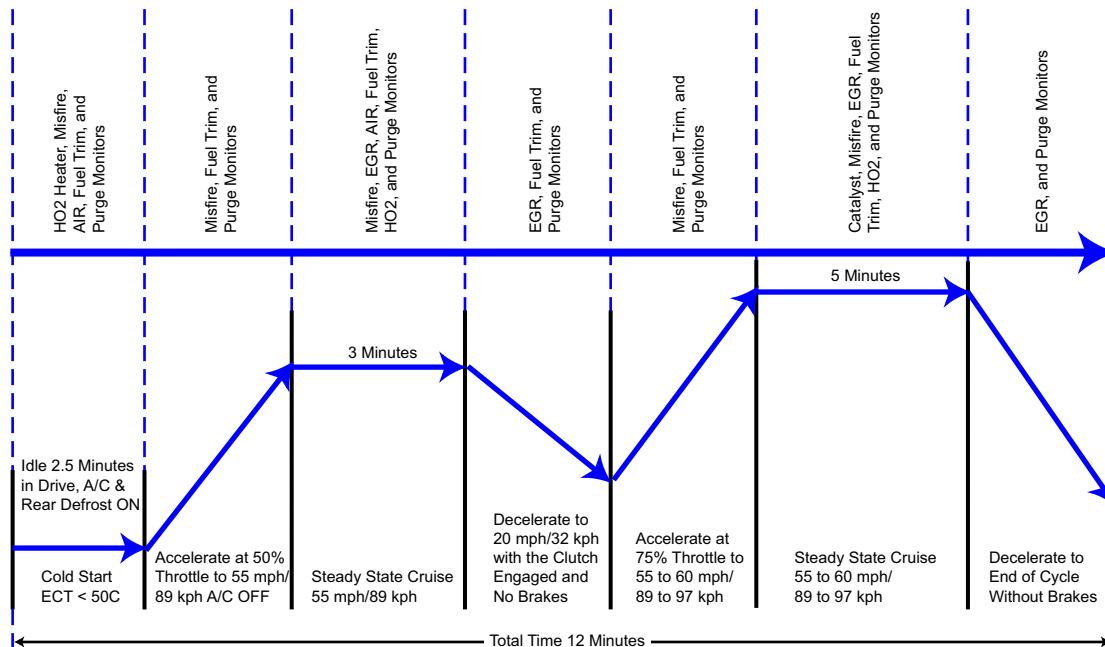
Figure 4-1 *Typical OBD-II Drive Cycle*

As this is a generic drive cycle, it may have limited results on some vehicles. If available, use the drive cycle information as supplied by the vehicle manufacturer.

System malfunctions that occur later and record a DTC (Diagnostic Trouble Code) will not change the Readiness Test Status. When the failure is repaired and the DTC is erased, all Readiness Test Status will be reset to a 'Not Completed' status.

Repair validation

Use the following procedure to validate a repair.

▶ **To validate the repair:**
1. Perform a drive cycle (generic or vehicle specific).
2. Check Service $03 (refer to Emission-related DTCs on page 14) and Service $07 (refer to Emission-related DTCs detected during Current or Last Completed Drive Cycle (Pending Codes) on page 22).

If no DTCs are reported (that relate to the initial failure), it can be assumed that the fault has been repaired correctly.

4.3.2 MIL Status

Emission related malfunctions set failure specific DTC(s). The MIL (malfunction Indicator lamp) may light up as soon as the first emission related DTC has been stored and confirmed (stored a second time). Depending on the type of malfunction, it may take multiple drive cycles before the MIL turns on.

The MIL is located in the instrument panel. The MIL may display a symbol of an engine and should light up as soon as the ignition is switched on. Three different states are possible when the engine is running:

1. OFF: no emission limits exceeded.
2. ON: at least one OBD-II/EOBD emission limit exceeded.
3. Blinking: possibility of damage to the catalytic converter.
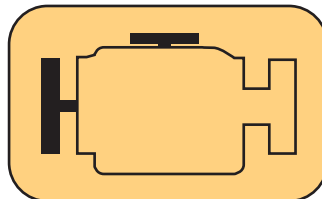
Figure 4-2 *Example of Malfunction Indicator Lamp*

NOTE:
The MIL may also be called the "Check Engine" lamp.

The ECM transmits the status of the Malfunction Indicator including the identification of the ECM that commanded the MIL to turn on.

NOTE:
The MIL status indicates "off" during the ignition key on, engine off instrument panel bulb check unless the MIL has been commanded "on" for a detected malfunction.

4.4   Diagnostic Service Definitions

4.4.1 Service $01:

Display Current Data

The ECMs transmit the data value stored by the system. The data is commonly called PID (Parameter IDentification). All of the sensors parameters show the actual readings. Not default or substitute values used by the system, because of a fault with that sensor.

Depending on the ECM and amount of parameters selected, data update rates may vary. Use Custom Data List to select the parameters to be displayed in Service $01. The fewer data parameters were selected, the faster the update rate.

4.4.2 Service $02:

Powertrain Freeze Frame Data

Engine conditions are stored by the ECM at the time a Monitor detects an emission-related fault. A "Freeze Frame" is such a group of captured information.

Using Freeze Frame for Diagnostic Purposes

Freeze Frame is useful for determining the exact conditions the vehicle was operating under when the DTC was set.

> **NOTE:**
> Freeze Frame is captured and stored when the DTC is set, not when the problem began.

For example, misfire is evaluated every 1000 rpm. A misfire DTC may be stored 60 to 90 seconds after the misfire initially occurred, at substantially different speed and load conditions.

The Technician can duplicate these conditions to verify the complaint or the repair. In some cases the on-board tests for a specific DTC may report no problem found. But when the conditions match the Freeze Frame conditions, that same DTC would set with the MIL on.

> **NOTE:**
> Freeze Frame data is erased whenever codes are cleared.

Does a stored DTC change?

It can be overwritten by higher priority Emission DTCs. Misfire and Fuel System DTCs have the highest priority. A lower rated DTC may be overwritten by a higher priority DTC.

Only data parameters supported by the ECM are included in the Freeze Frame data list.

4.4.3 Service $03:

Emission-related DTCs

The purpose of this service is to enable the scan tool to obtain stored DTCs from the power train ECMs that are emission-related.

The OBD-I ECM primarily identifies a faulty signal or a faulty sensor using three steps:

- Signal or component shorted to ground
- Signal or component shorted to battery positive
- No signal or component (open circuit)

For each of these tests, a specific trouble code is set.

With OBD-II/EOBD, expanded diagnostics now includes "rationality" testing. One input signal is compared against other input signals to determine if the reading is reasonable, given the current operating conditions.

All OBD-II/EOBD/JOBD codes use a five character format that identifies the control system and the type of failure detected. Generic codes are the same for all manufacturers, while enhanced codes are unique to a specific manufacturer.
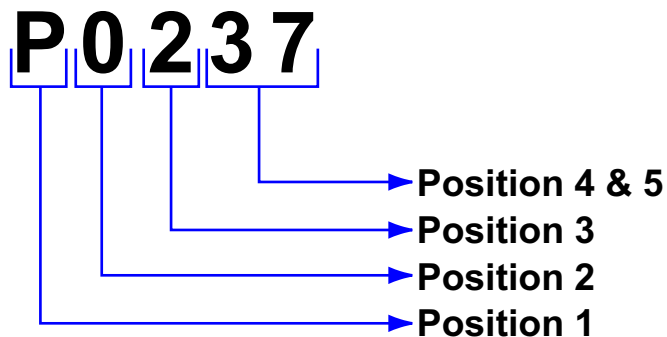
Figure 4-3 *Example: DTC "P0237"*

The table that follows explains how to define a DTC. Definitions listed for Position 3 in the table are only valid for DTCs starting with "P". For other codes (C, B, U) there are other definitions. Please refer to ruling OBD standards for more information.

Table 4-2 *Diagnostic Trouble Code description*

Position	Description
1	P = Power train
	C = Chassis
	B = Body
	U = Network
2	0 = Standardized emission-related trouble code
	1 = Manufacturer-specific trouble code
	2 = Standardized or Manufacturer-specific trouble code
	3 = Standardized or Manufacturer-specific trouble code
3	0 = Overall system
	1 = Secondary air system/Mixture preparation
	2 = Fuel system
	3 = Ignition system/Misfires
	4 = Additional exhaust gas monitoring
	5 = Cruise control/Idle speed control
	6 = Input/Output signals, Control units
	7 = Gearbox/Transmission
	8 = Transmission
	9 = Transmission
	A = Hybrid Propulsion
	B = Reserved
4 & 5	Serial numbering of individual components or systems

Code Ranking

OBD-II/EOBD Codes have a priority according to their emission severity, with higher priority codes overwriting lower priority codes. The priority of the code determines the illumination of the MIL and the code erase procedure. Vehicle manufacturers have implemented this ranking differently.

4.4.4 Service $04:

Clear/Reset Emission-related Diagnostic Data

NOTE:
It is recommended to perform the Clear Code/Reset function with the engine off and the ignition switched on.

The purpose of this service is to clear codes and turn off the MIL. It is recommended to print the DTCs before erasing them, for comparison after repairs are made.

Clearing the code memory erases all diagnostic information stated in "Reset Information" below:

Table 4-3 *Reset Information*

Service	Items to reset
$01	Status of system monitoring tests
	Number of diagnostic trouble codes
	Distance travelled while MIL is activated
	Number of warm-ups since DTCs cleared
	Distance travelled since DTCs cleared
	Time run by the engine while MIL is activated
	Time since diagnostic trouble codes cleared
$02	Diagnostic trouble code for freeze frame data
	Freeze frame data
$03	Confirmed diagnostic trouble codes
$05	Oxygen sensor test data
$06	Specific on-board monitoring test results
$07	Pending diagnostic trouble codes

The following may occur as well:

- It may also erase engine management adaptive memory (some vehicle manufacturers only) when codes are cleared. Depending on the vehicle, adaptive memory may not correct itself without extensive driving.
- Other manufacturer specific actions for clearing and setting may also occur in response to this request message.
- Normally the MIL automatically turns off after a successful repair, if emissions are normal. Refer to Repair validation on page 12.

IMPORTANT:
For safety and/or technical design reasons, some ECMs may not respond to this service under all conditions.

NOTE:
In most cases, once a MIL is deactivated, the original code remains in memory until forty to eighty warm-up cycles are completed without the fault reappearing.

4.4.5 Service $05:

Oxygen Sensor Monitoring Test Results

The purpose of this service is to allow access to the on-board oxygen sensor monitoring test results (if implemented).

NOTE:
Service $05 is not supported on CAN vehicles, and oxygen sensor test results are incorporated into Service $06. Manufacturers are allowed to use Service $06 as an alternative to Service $05 for non-CAN vehicles.

Different manufacturers may use many methods to calculate test results for this service. The scan tool converts test values and displays them in the standard units of measurement.

The ECM transmits the latest test results available from the system. Test results are retained by the ECM, even over multiple ignition OFF cycles, until replaced by the results of a more recent test. Test results are requested by Test ID. (See Test ID Table).

Test results can be reported either as a constant or as a calculated value, depending on the Test ID. Calculated values are reported with minimum and maximum limits.

NOTE:
Depending on the manufacturer, calculated values may be rounded off, which means that a test may fail despite the values reading within min. and max limits.

The scan tool checks if the readiness status of oxygen sensors is completed. If the test is not completed, the scan tool displays a warning.
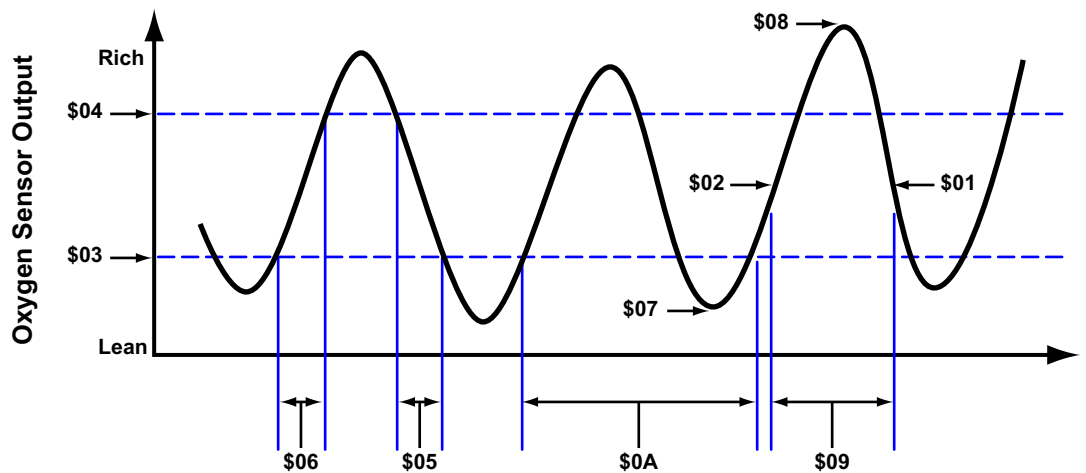
Numbers Refer to Test ID

Figure 4-4 *Test ID Values Example*

NOTE:
Refer to Table 4-4 for an explanation of the individual Test ID numbers.

Table 4-4 *O2 Monitor Test ID Table*

Test ID No.	Description
$01	Rich to Lean sensor threshold voltage (constant)
$02	Lean to Rich sensor threshold voltage (constant)
$03	Low sensor voltage for switch time calculation (constant)
$04	High sensor voltage for switch time calculation (constant)
$05	Rich to Lean sensor switch time (calculated)
$06	Lean to Rich sensor switch time (calculated)
$07	Minimum sensor voltage for test cycle (calculated)
$08	Maximum sensor voltage for test cycle (calculated)
$09	Time between sensor transitions (calculated)
$0A	Sensor Period (calculated)
$0B	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated) Calculation: 0.1 * (current counts) + 0.9 * (previous average) Initial value for (previous average) = 0
$0C	Misfire counts for last/current driving cycles (calculated)

NOTE:

Not all test values are applied on or supported by all vehicles. Only supported Test IDs appear in the selection list.

Cylinder Bank & O2S Locations, Examples
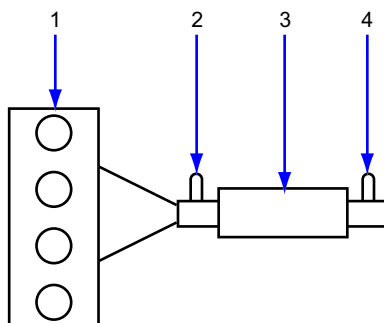
1— **Engine, exhaust bank**

2— **Sensor 1**

3— **Catalyst**

4— **Sensor 2, (heated)**

Figure 4-5 *L4 Cylinder Engine with 1 exhaust bank and 1 Catalyst*
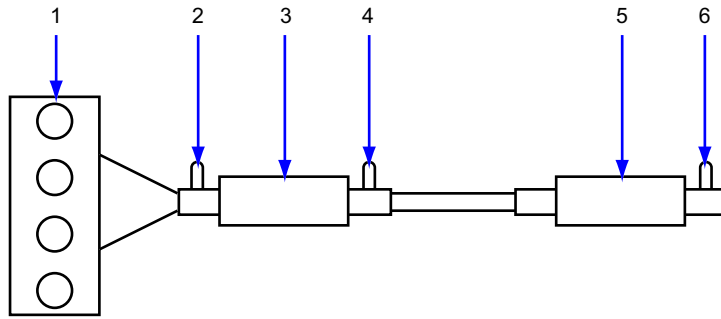
1— **Engine, exhaust bank**

2— **Sensor 1**

3— **Catalyst**

4— **Sensor 2, (heated), Bank 1**

5— **Catalyst**

6— **Sensor 3 (heated), Bank 1**

Figure 4-6 *L4 Cylinder Engine with 1 exhaust bank and 2 Catalysts*
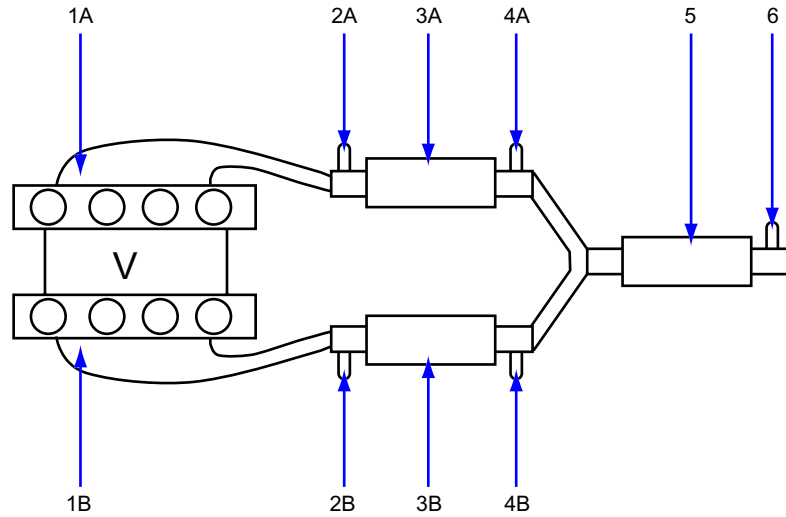
1— **Exhaust Bank X**

2— **Sensor 1, Bank X**

3— **Catalyst**

4— **Sensor 2, (heated), Bank X**

5— **Catalyst**

6— **Sensor 3 (heated), Bank X**

Figure 4-7 *V8 Cylinder Engine with 2 exhaust banks and 3 Catalysts*
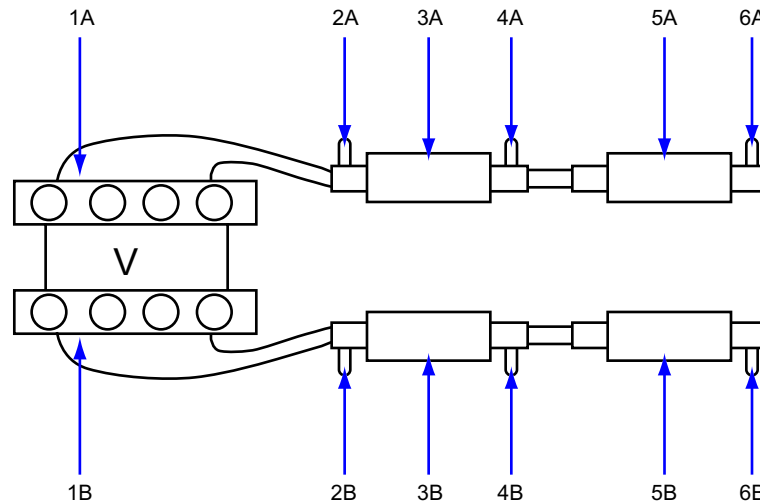
1— Exhaust Bank X
2— Sensor 1, Bank X
3— Catalyst
4— Sensor 2, (heated), Bank X
5— Catalyst
6— Sensor 3 (heated), Bank X

Figure 4-8 *V8 Cylinder Engine with 2 exhaust banks and 4 Catalysts*

4.4.6 Service $06:

Specific Monitored Systems Test Results

The purpose of this service is to allow access to the test results for on-board diagnostic monitoring tests of specific components or systems that are continuously monitored (CAN only) and non-continously monitored.

The misfire monitor is an example of a continuously monitored system, and the catalyst system would be an example of a non-continously monitored system.

CAN Protocol

For CAN the Test ID Table from Service $05 is used. The request message for test values includes an OBDMID (On-Board Diagnostic Monitor IDentification) that indicates the information requested. Unit information is given with the values. Test values (results) are always reported with the minimum and maximum test limits.

IMPORTANT:
The Test ID Table that follows is for CAN Protocol only.

Table 4-5 *Test ID Table for CAN Protocol*

Test ID No.	Description
$01	Rich to Lean sensor threshold voltage, (Constant)
$02	Lean to Rich sensor threshold voltage, (Constant)
$03	Low sensor voltage for switch time calculation, (Constant)
$04	High sensor voltage for switch time calculation, (Constant)
$05	Rich to Lean sensor switch time, (Calculated)
$06	Lean to Rich sensor switch time, (Calculated)
$07	Minimum sensor voltage for test cycle, (Calculated)
$08	Maximum sensor voltage for test cycle, (Calculated)
$09	Time between sensor transitions, (Calculated)
$0A	Sensor Period, (Calculated)
$0B	EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated) Calculation: 0.1 * (current counts) + 0.9 * (previous average) Initial value for (previous average) = 0
$0C	Misfire counts for last/current driving cycles (calculated)

If an OBDMID has not been completed at least once since Service $04 or battery disconnect, then the following properties of the parameter are set to zero by the ECM:

- Test Value (Results)
- Minimum Test Limit
- Maximum Test Limit

Non CAN Protocol

The vehicle manufacturer is responsible for assigning Test IDs and Component IDs for tests of different systems and components. The latest test results are to be retained, even over multiple ignition OFF cycles, until replaced by more recent test results. Test results are requested by Test ID. Test results are reported only for supported combinations of test limit type and component ID and are reported as positive (unassigned) values. Service $06 test values and limits are raw values that not scaled.

To date, only some manufacturers have provided conversion factors for technicians to use this data. See the example below for a US Ford version of Service $06 Catalytic Converter test results.

Table 4-6 *Service $06 Catalytic Converter test results*

Test ID	Comp ID	Test	Value	Min.	Max
$10	$11	Cat monitor Switch ratio Bank1	45	0	48
$10	$21	Cat monitor Switch ratio Bank2	42	0	48

Ford conversion factor: multiply the value by 0.0156 to get a value from 0 to 1.0.

Table 4-7 *Calculated values*

Item	Factor	Result
Bank 1	45 * 0.0156	0.702
Bank 2	42 * 0.0156	0.655
Threshold	48 * 0.0156	0.749

This catalyst is about to fail. Normal readings for a good catalyst should be approximately 0 to 0.1 (switch ratio).

Service $06 Notes

Consider the following when performing this service:

- If in Service $01 (Readiness Test Status) one of the tests is not completed, a warning message displays indicating that the values may be invalid or not available.
- Not all test values are applicable or supported by all vehicles. Only supported Test IDs appear on the selection list. To be able to select none supported Test IDs, the last item of the selection list is Manual Selection of Test ID.
- This service can be used as an alternative to Service $05 to report oxygen sensor test results The values are not converted and are displayed in standard units.

4.4.7 Service $07:

Emission-related DTCs detected during Current or Last Completed Drive Cycle (Pending Codes)

The purpose of this service is to enable the scan tool to obtain "pending" or maturing diagnostic trouble codes. These are codes for emission-related components or systems that are tested or continuously monitored during normal driving conditions that were detected during the current or last completed driving cycle.

Test results for these components or systems are reported in the same format as the DTCs in Service $03; refer to Emission-related DTCs on page 14.

The intended use of this service is to assist the service technician after a vehicle repair and after clearing diagnostic information, by reporting test results after a single driving cycle.

- If a test failed during the driving cycle, the DTC associated with that test will be reported. If the pending fault does not occur again within 40 to 80 warm-up cycles, the fault is automatically cleared from memory.
- Test results reported by this service do not necessarily indicate a faulty component or system. If test results indicate a failure again after additional driving, then a DTC sets with Service $03, which indicates a faulty component or system. The MIL is illuminated.

This service can always be used to request the results of the latest test, independent of the setting of a DTC.

4.4.8 Service $08:

On-board Activation Tests

This service controls the operation of vehicle components, tests or systems, if the test vehicle supports the tests. These tests are also known as "On-Board Activation Tests".

4.4.9 Service $09:

There are two types of Service $09; Vehicle Information and In-use Performance Tracking.

Vehicle Information

The purpose of this service is to enable the scan tool to request vehicle specific vehicle information such as:

- Vehicle Identification Number (VIN)
- Calibration IDs
- Calibration Verification Numbers (CVN, displayed as hexadecimal value)
- Engine Serial Number (ESN)
- Exhaust Regulation or Type Approval Number (EROTAN)

Some of this information may be required by regulations and some may be desirable to be reported in a standard format, if supported by the vehicle manufacturer.

In-use Performance Tracking

This data is used to support possible regulatory requirements for "In-use Performance Tracking". Manufacturers are required to implement software programs that track in-use performance for each of the following components or systems:

- Catalyst Bank 1
- Catalyst Bank 2
- Primary Oxygen Sensor Bank 1
- Primary Oxygen Sensor Bank 2
- Evaporative Leak Detection System
- EGR System
- Secondary Air System

The completion value tracks the number of times that all conditions necessary for a specific monitor to detect a malfunction have been encountered. The condition value indicates the number of times that the vehicle has been operated in the specified conditions.

OBD Monitoring Conditions—displays the number of times that the vehicle has been operated in the specified OBD monitoring conditions.

Engine Starts—displays the count of the number of times that the engine has been started.

Catalyst Monitor Completion Bank X—displays the number of times that all conditions necessary to detect a Catalyst System Bank 1 or 2 malfunction have been encountered.

Catalyst Monitor Conditions Bank X—displays the number of times that the vehicle has been operated in the specified Catalyst monitoring conditions.

O2 Sensor Monitor Completion Bank X—displays the number of time that all conditions necessary to detect an Oxygen Sensor Bank 1 or 2 malfunction have been encountered.

O2 Sensor Monitor Conditions Bank X—displays the number of times that the vehicle has been operated in the specified Oxygen Sensor monitoring conditions.

EGR Monitor Completion—displays the number of time that all conditions necessary to detect an EGR system malfunction have been encountered.

EGR Monitor Conditions—displays the number of times that the vehicle has been operated in the specified EGR system monitoring conditions.

Secondary Air Monitor Completion—displays the number of time that all conditions necessary to detect a Secondary Air system malfunction have been encountered.

Secondary Air Monitor Conditions—displays the number of times that the vehicle has been operated in the specified Secondary Air system monitoring conditions.

EVAP Monitor Completion—displays the number of time that all conditions necessary to detect an EVAP system leak malfunction have been encountered.

EVAP Monitor Conditions—displays the number of times that the vehicle has been operated in the specified EVAP system leak malfunction monitoring conditions.

4.4.10 Service $0A:

Emission Related DTC with Permanent Status

This option displays a record of any "permanent" codes on late-model vehicles if the vehicle supports Service $0A. A permanent status DTC is one that was severe enough to illuminate the MIL at some point, but the MIL may not be on at the present time.

Whether the MIL was switched off by clearing codes or because the setting conditions did not repeat after a specified number of drive cycles, a record of the DTC is retained by the ECM. Permanent status codes automatically clear after repairs have been made and the related system monitor runs successfully.

Navigation

The following sections describe screen layout, how to navigate the interface, and how to make selections using screen menus and buttons. The various types of screen messages are also explained in this section.

5.1 Screen Layout

A typical scan tool data display screen includes three elements:

Figure 5-1 *Sample screen*
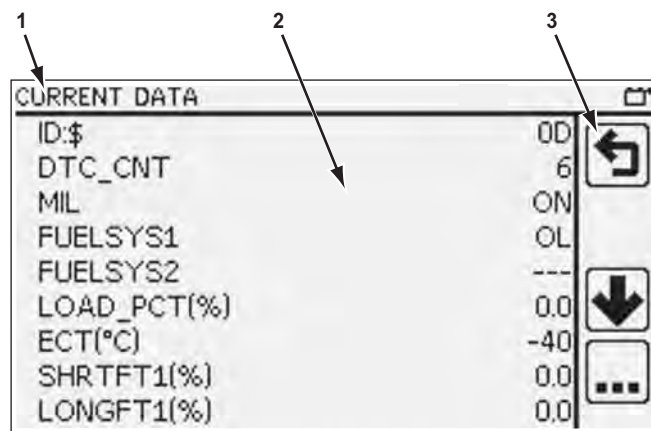
1— **Title bar**, which shows the type of test being performed and the power source
2— **Main body**, which shows test data
3— **Toolbar**, which contains controls for the touch screen

5.1.1 Title Bar

There are no selectable items in the title bar that appears at the top of the display screen. The title bar simply lets you know the test mode the scan tool is presently operating in and how power is being provided to the tool. An icon indicates the power source as shown in the table below.

Table 5-1 *Title bar icon definitions*

Name	Icon	Description
Vehicle		Indicates the scan tool is being powered by the vehicle through the data link connector (DLC).
USB		Indicates the scan tool is being powered by a computer through the USB port.

Additional information, such as elapsed time or pause and cursor position, may appear on the title bar under certain circumstances. A "saving" icon appears on the title bar while the scan tool is

writing to the internal flash drive (saving a movie). Disconnecting the data cable while saving a movie disrupts power to the scan tool and the saved file may be lost.
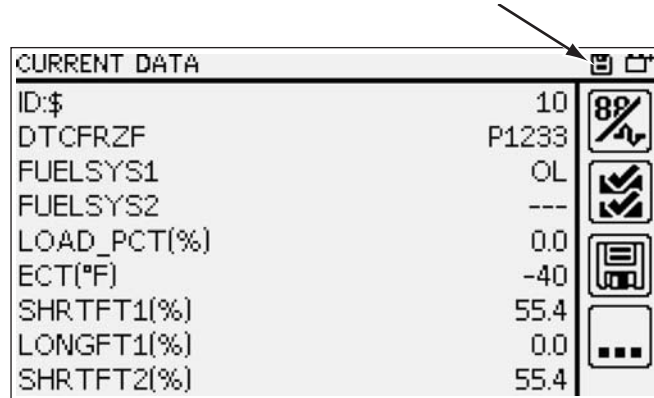

Figure 5-2 *Sample title bar save icon*

5.1.2 Main Body

One of three basic types of screen displays for most scan tool procedures:

- Trouble code screens
- Menu screens
- Data screens

Each type is explained below.

Trouble Code Screens

A trouble code screen displays a list of the diagnostic trouble codes (DTCs) stored in the electronic control module (ECM) of the test vehicle. An "establishing link" message momentarily displays on the screen while the scan tool gathers code information. A "No Codes" message displays if there are no DTCs stored in the ECM. If there are stored codes, a code report similar to the example shown in Figure 5-3 displays.
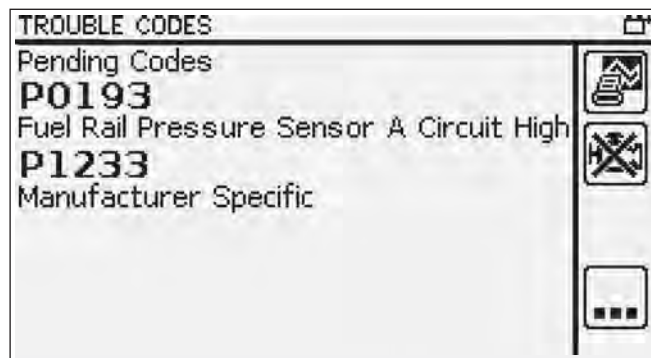

Figure 5-3 *Sample code report*

A sub-title, which can read Confirmed Codes, Pending Codes, or Permanent Codes, appears at the top of the report. The sub-title changes as you scroll through the list if there are more than one

type of code in memory. Codes are listed up to four per screen in ascending order with a truncated description of the code on the line immediately below the DTC. Touching a code opens a pop-up window with the complete code description. A return button on the pop-up closes the window and returns you to the code list. The arrow buttons appear on the toolbar if there are more than four codes in memory. Scroll up and down with the arrow buttons to view the entire code list.

Menu Screens

Menu screens present a list of options from which you can select. Selecting a menu option can open a test, perform a function, open a sub-menu of additional choices, or simply confirm or cancel a prior selection. A variety of different menu screens are used. All menu screens require you to make a selection in order to continue, or to cancel and return to the previous screen.
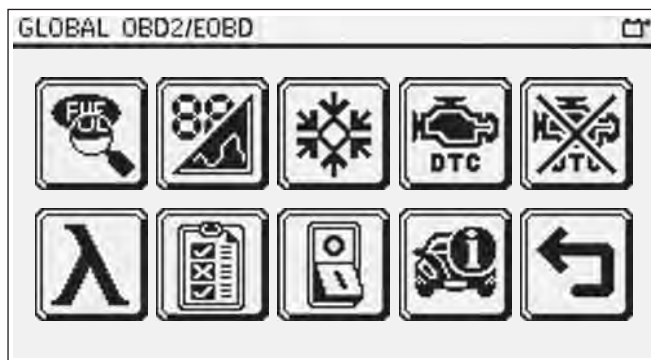

Figure 5-4 *Sample Global OCBD2/EOBD Main menu*

Data Screens

Data screens display serial datastream parameter values, which represent input and output information that the ECM is receiving and transmitting to the various actuators, sensors, and switches in the electronic control system.
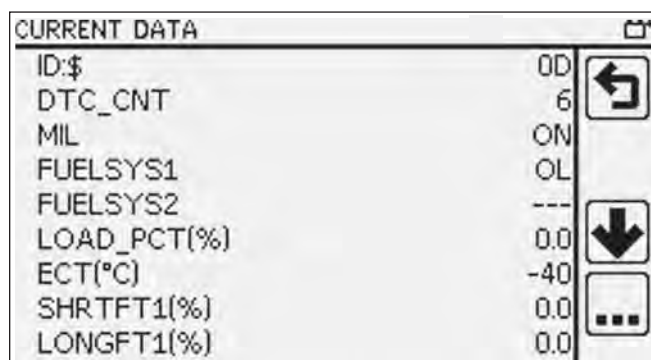

Figure 5-5 *Sample data screen*

Vehicle datastream information can be displayed in two formats; list view and graph view. Use the List/Graph button on the toolbar to switch between viewing modes. In list view mode the data presentation can also be switched between landscape (horizontal) and portrait (vertical) formats.

5.1.3 Toolbar

The Toolbar contains up to four selectable buttons arranged in a vertical column along the right-hand edge of the touch panel. A More button displays when more than four option are available, selecting More opens the next group of available buttons. Toolbar buttons are used to control scan tool operations. What buttons display varies based on the function being performed with the scan tool. The table that follows gives a brief description of button functions.

Table 5-2 *Toolbar icon definitions (part 1 of 2)*

Name	Graphic	Description
Up		Scrolls the data toward the bottom of the screen if there is additional information above what is visible.
Down		Scrolls the data toward the top of the screen if there is additional information below what is visible.
Return		Returns to the previous screen.
More		Opens the next set of toolbar buttons.
Settings		Opens a menu for configuring the scan tool display, this is the same as the Settings selection from the main menu.
Save Screen		Saves a bitmap image of the last screen viewed before the button was pressed.
Save Report		Saves one complete ECM serial data transmission.
Screen Mode		Switches screen configuration between portrait and landscape.
Save Movie		Saves a copy of the data recorded in the data buffer.
Lock/Unlock		Locks or unlocks the parameter highlighted on the previous screen to either prevent or allow it to scroll.
List/Graph		Switches the data between a list, or text, view and a graph view.

Table 5-2 *Toolbar icon definitions (part 2 of 2)*

Name	Graphic	Description
Min/Max		Calibrates the minimum and maximum data values displayed on a data graph.
Pause/Play		Suspends data collection when viewing live data to allow closer examination, and restarts data collection when viewing paused data.
Clear ECM Memory		Erases all data, stored codes, pending codes, and freeze frame information, from the vehicle ECM.
Custom Data List		Allows you to select which data parameters display on the data list.
Delete All		Erases all the files in the active folder.
Save Settings		Stores the adjustable information on the screen in tool memory.
Exit		Close the open window without making any changes.
Plus		Adds an increment to an adjustable value shown on the screen.
Minus		Subtracts an increment to an adjustable value shown on the screen.

5.2   Screen Messages

There are four types of on-screen messages:

- Loading and connecting
- Confirmations
- Warnings
- Errors

5.2.1 Loading and Connecting Messages

Loading and connecting messages display when the scan tool is performing an internal operation, such as loading a database, initiating a test, or establishing communications with the vehicle. The message automatically clears once the internal operation is complete.

5.2.2 Confirmation Messages

Confirmation messages inform you when you are about to perform an action that cannot be reversed or when an action that requires your confirmation to continue has been initiated.

When a response is not required, the message displays briefly before disappearing.

5.2.3 Warning Messages

Warning messages inform you when completing the selected action may result in an irreversible change or loss of data.

5.2.4 Error Messages

Error messages inform you when a system or procedural error has occurred. Examples of possible errors include a disconnected cable, a poor connection, or some other mechanical failure that prevents the tool from communicating with the vehicle.

Chapter 6 — **Operations**

This chapter details the operations available from the Main Menu and the USB Power Menu.

6.1 Main Menu

This section details the tests and procedures available from the Main menu, it includes:
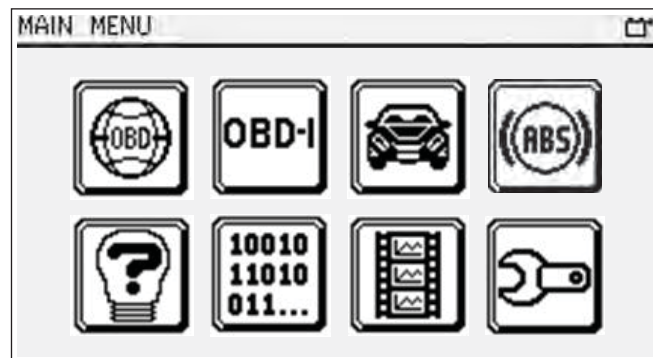
Figure 6-1 *Sample Main menu*

6.1.1 Global OBD-2/EOBD

Selecting Global OBD-2/EOBD opens a service menu that lists the tests available on the vehicle. Menu choices include:

- Readiness Monitors
- Current Data
- Freeze Frame Data
- Codes
- Clear Codes
- O2 Monitors
- Continuous and Non-Continuous Monitored Systems
- Control of On-board Systems
- Vehicle Information

Readiness Monitors

Designated OBD Mode $00, this selection opens a menu of available tests on monitored systems. Selecting Readiness Status from the main menu opens a submenu with the following options:

- Complete since DTC Cleared
- Enable Status this Cycle
- Complete this Cycle

Select a menu option to open the monitor report.

Figure 6-2 *Sample readiness status report*

Complete since DTC Cleared

This option compiles a report of monitor activity since the last time codes were cleared from ECM memory. The report, which typically spans multiple pages, lists all of the system monitors with either a completed or not completed value. Scroll to view the complete results.

Enable Status this Cycle

This option compiles a report on whether or not monitors were enabled, or allowed to run, during the current, or most recent, drive cycle. Specific operating conditions must be met before the ECM allows a monitor to run. Each monitor has a unique set of criteria that enables it to run. The report lists all of the system monitors with either an enabled or disabled value to show their status.

Complete this Cycle

This option compiles a report of monitor activity during the current, or most recent, drive cycle. The report, which typically spans multiple pages, lists all of the system monitors with a value that can read completed, disabled, or not supported. Scroll to view the complete results.

Current Data

Designated OBD Mode $01, this selection displays the current emission related data from the selected electronic control module (ECM) of the vehicle. Displayed data includes analog inputs and outputs, digital inputs and outputs, and system status information broadcast on the vehicle data stream. Each signal becomes a parameter, or a single line of data in the list.

Figure 6-3 *Sample current data display in list view*

NOTE:
Parameters display in the order in which they are transmitted by the ECM, and are also grouped by ECM when there are multiple ECMs responding with the same parameter. Therefore, where things appear in a list can vary considerably depending upon make, model, and year.

Data can be displayed in either list view or graph view. The List/Graph button on the toolbar switches the display between the two modes. The Mode button on the toolbar switches the screen between portrait and landscape views.

Tapping on a parameter description opens a new window with the complete name and display options for that parameter. Menu screens vary slightly between list and graph modes, but operation is the same.

Figure 6-4 *Sample parameter menu*

The Lock/Unlock button either prevents and releases a line of data from scrolling. Up to three parameters can be locked in place to allow side-by-side comparison while in the list view. When a parameter is locked, it moves to the top of the data list, when it is released it returns to its original position in the data list.

The Parameter Trigger button, which is optional and only available for some applications, allows you to configure the scan tool to automatically capture a data movie when the value of the triggering parameter crosses a preset threshold value.

An additional button in graph mode selects whether one or three parameters graphs display at a time. The minimum and maximum values are shown below the parameter name when viewing a single graph.

The Return button closes the parameter menu so the data list is visible again.

List View

List view screens include a parameter description and a parameter value. When applicable, the units of the value, such as V for volts, ms for milliseconds, and % for percent, are shown in parenthesis after the parameter description. A lock icon appears to the left of the description if the parameter has been locked to prevent it from scrolling. An arrow pointing up appears to the left of the description if the parameter is set to trigger a data recording. Up and down arrows appear on the toolbar when additional parameters are above and below those shown on the current screen.

The screen presentation can be changed from the standard landscape (horizontal) view to a portrait (vertical) view when in list mode. This allows you to see more parameters simultaneously on a single screen making it easier to compare readings and evaluate responses. Use the Screen Mode button on the toolbar to switch between landscape and portrait views. The toolbar moves to the bottom of the screen in portrait mode, functions and operation remain the same.
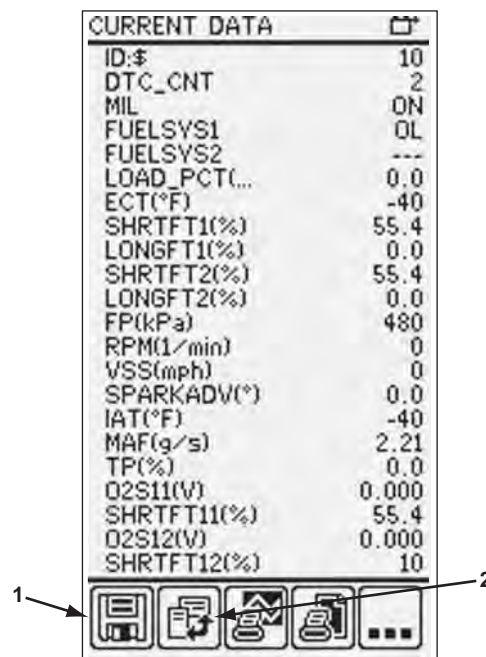
1— **Toolbar**
2— **Screen Mode button**

Figure 6-5 *Sample portrait screen view*

Graph View

Graph view screens include a parameter description and a data graph of parameter value activity. The data value, the lock icon, and the scroll arrows are similar as for list view.

Due to the height of the data graphs, only three parameters are displayed at a time and only one parameter can be locked. A parameter moves to the top of the data list when it is locked. If more than one parameter was locked when graph view is selected, the top parameter in the list remains locked and the other locked parameters return to their original positions in the data list.
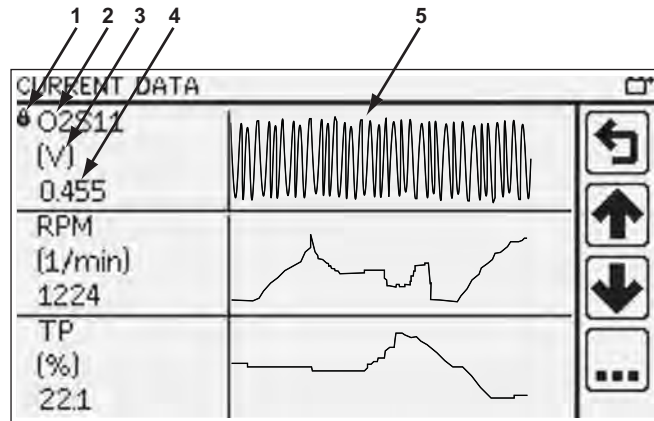
1— **Lock icon**

2— **Parameter description**

3— **Parameter value unit**

4— **Current data value**

5— **Parameter data graph**

Figure 6-6 *Sample graph view screen*

The scan tool constructs the graphs from left to right across the screen and generates a point on the graph for each data stream transmission from the ECM. How quickly the graph area of the screen is filled depends upon the transmission speed of the ECM and the number of parameters that have to be collected, so expect graphing speed differences between makes and models. Using the custom data list feature to minimize the number of parameters that display dramatically increases the data collection speed. Once the graph fills the screen older points at the left edge are hidden as new points on the right edge are added. The value of the current sample point displays below the parameter name alongside the graph.

A special cursor function that allows you to scroll across the data graphs is available when data collection is paused in graph view. An icon and frame counter, which shows the relative position of the cursor displays in the title bar when data is paused. The cursor appears as a vertical line on the graphs. Touch within the graph area to move the cursor.
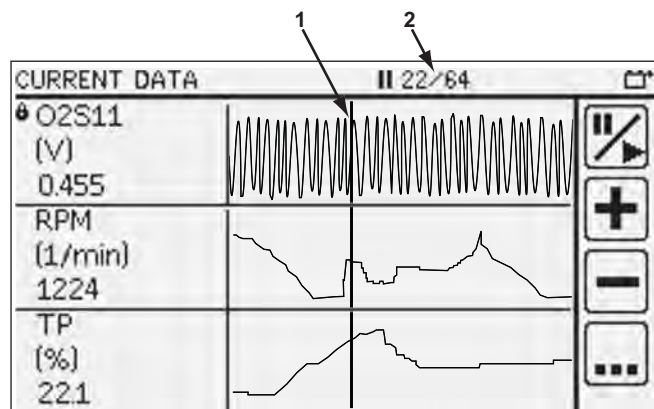
1— **Cursor**

2— **Frame counter**

Figure 6-7 *Sample graph with cursor*

Custom Data List

The **Custom Data List** button is available on the toolbar in both list and graph view modes. It is used to determine which parameters display. Minimizing the number of parameters on the data list allows you to focus on any suspicious or symptom-specific data. A smaller data list also increases the screen update rate. You can add or remove parameters from the list by selecting the button.

NOTE:
Limiting the number of parameters that displays to those that apply to a particular situation results in a faster data refresh rate, and reduces the amount of memory used for saved files.

To create a custom data list:

1. Tap the **Custom Data List** button on the toolbar.

   The data selection screen displays and two new buttons appear on the toolbar. Check marks to the left of the parameter description indicates which parameters are selected for display. Two new toolbar buttons allow you to simultaneously deselect and select the entire data list:

Button	Description
	Deselect All, use to hide all of the parameters in the list. You must select at least one parameter before returning to the live data screen.
	Select All, use to display all of the parameters in the list.

NOTE:
You may have to tap the **More** button to get to the **Deselect All** and **Select All** buttons.

2. Create a custom data list by touching the parameters to include. A parameter that displays has a check mark alongside the name, a parameter that does not display does not. Select which parameters to display:

3. Select the **Return** button to display the updated data list.

Freeze Frame Data

Designated OBD Mode $02, this selection displays freeze fame data for any stored emission related diagnostic trouble codes (DTC). Freeze frame data includes a "snapshot" of critical parameter values at the time the DTC set.

Figure 6-8 *Sample freeze frame data*

The scan tool uses the same screen layout for freeze frame data as for current data. Only one set of freeze frame data is retained in by the ECM. In most cases it is the last DTC that occurred. Certain DTCs, those that have a greater impact on vehicle emissions, have a higher priority. In these cases, the highest priority DTC is the one for which the freeze frame records are retained.

Codes

Designated OBD Mode $03, $07, and $0A this selection displays any stored emission related DTCs reported by the various ECMs. A code list can include three types of codes:
- Confirmed Codes (mode $03)
- Pending Codes (mode $07)
- Permanent Codes (mode $0A)
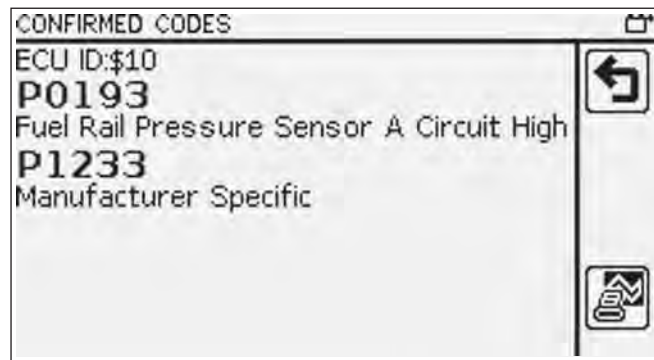
Figure 6-9 *Sample codes list*

Generic codes are identified by a zero (0) as the second character of the code. These generic codes are defined by OBD-II/EOBD/JOBD standards and the are the same for all manufactures. Any other character in the second position of the code indicates the code is defined by the vehicle manufacturer. Manufacturer-specific codes vary, refer to vehicle service manual for information.

Clear Codes

Designated OBD Mode $04, this selection is used to erase all emission related diagnostic data from the memory of the selected ECM. Selecting eliminates all DTC records, freeze frame data, and test results. A confirmation message displays when Clear Codes is selected, follow the on screen instructions to continue.
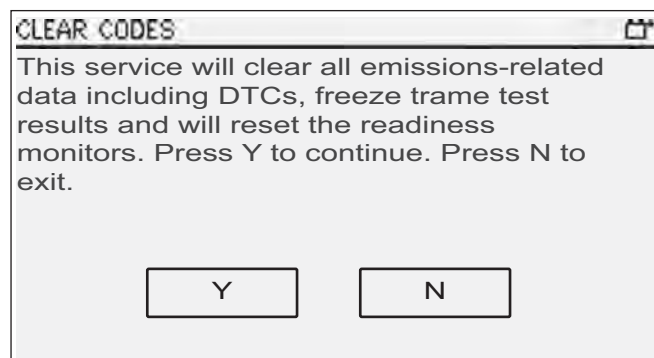
Figure 6-10 *Sample clear codes confirmation message*

▶ **To clear codes:**

1. Select **Clear Codes** from the Global OBD menu.
2. Select from the confirmation screen:
   - **Y**—erases ECM memory
   - **N**—returns to the Global OBD menu
3. When the "Cleared" message displays, select **Return** to the Global OBD menu.

O2 Monitors

Designated OBD Mode $05, this selection opens a sub-menu of tests available for the oxygen sensor (O2S) monitoring system. Tests display on the screen with an identification (ID) number and an abbreviated description. Complete test names are shown in the table below.

Table 6-1 *O2 Monitor descriptions*

Test ID	Abbreviated Description	Complete Description
$01	R/L Sensor Threshold Volt	Rich to lean sensor threshold voltage
$02	L/R Sensor Threshold Volt	Lean to rich sensor threshold voltage
$03	Low Sensor Volt Switch Time	Low sensor voltage switch time
$04	Hi Sensor Volt Switch Time	High sensor voltage switch time
$05	R/L Sensor Switch Time	Rich to lean sensor switch time
$06	L/R Sensor Switch Time	Lean to rich sensor switch time
$07	Test Cycle Min Sensor Volt	Test cycle minimum sensor voltage
$08	Test Cycle Max Sensor Volt	Test cycle maximum sensor voltage
$09	Time Between Sensor Trans	Time between sensor transitions

Making a selection displays all of the pertinent O2S parameters for the specific test.

Continuous and Non-Continuous Monitored Systems

Designated OBD Mode $06, this selection opens a menu of available tests:

- Continuously monitored systems—those that impact vehicle emissions, and are required to be monitored by OBD regulations.
- Non-continuously monitored systems—those that do not directly impact vehicle emissions, and are required to be monitored by OBD regulations.

Making a selection displays monitor information for that specific test.
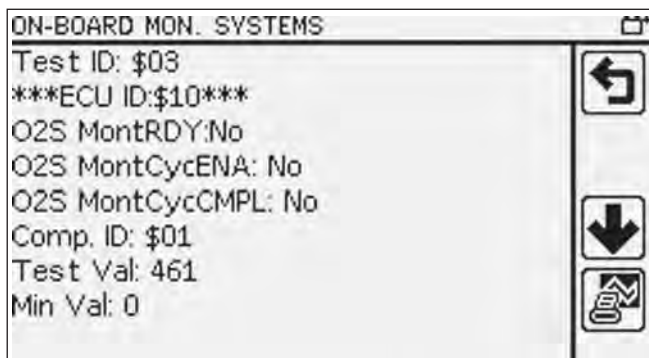
Figure 6-11 *Sample monitor test data*

Control of On-board Systems

Designated OBD Mode $08, this selection enables bidirectional control of the ECM, if the test vehicle supports this mode. In this mode the scan tool transmits control commands to operate the vehicle system.

Vehicle Information

Designated OBD Mode $09, this selection provides vehicle-specific information, if the test vehicle supports this mode. When supported, selecting opens a sub-menu that includes:

- Read vehicle identification
- In-use performance tracking

Read vehicle identification displays the vehicle identification number (VIN), the calibration identification, the calibration verification number (CVN), the engine serial number (ESN), and the exhaust regulation or type approval number (EROTAN) of the test vehicle.

In-use performance tracking displays a record of monitored data. It is basically shows the number of times each of the monitor tests have been completed.

6.1.2 OBD-I

This Main Menu option for communicating with older vehicles that are not OBD-II/EOBD compliant is only available for North America. Optional Data cable adapters are required to connect to these vehicles. Contact you sales agent for details and availability.

6.1.3 Make Specific Enhanced

This Main Menu option allows access to manufacturer specific data. Selecting opens a list of manufacturers. Select from the list to begin a test session.

Some late-model vehicles use a new UDS software protocol, which prevents gathering enhanced codes. Enhanced codes are not available to the scan tool on these models with UDS.

6.1.4 Antilock Brake Systems

This main Menu option, which is not available in all markets, allows the scan tool to communicate with the antilock brake system (ABS) control module. Selecting opens a list of manufacturers.

Some late-model vehicles use a new UDS software protocol, which prevents gathering enhanced codes. Enhanced codes are not available to the scan tool on these models with UDS.

6.1.5 Global OBD-2/EOBD Help

This main menu option allows you to access information designed to assist you in making a quick and accurate diagnosis. Selecting opens a menu with two options:

- Code Tips—information on code setting conditions, diagnostic tips, and probable causes.
- Mode Definitions—descriptions of operating modes and procedures for performing tests.
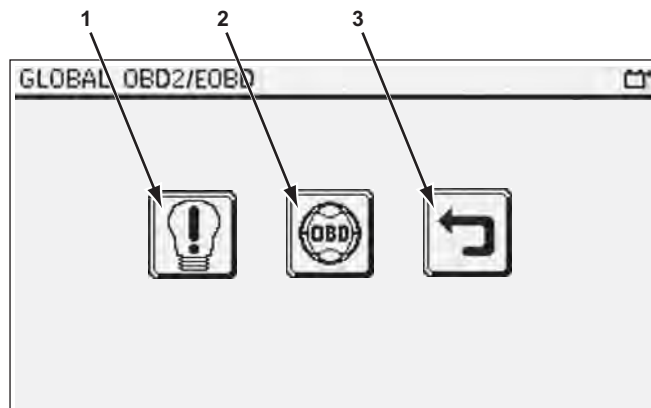
1— Code Tips
2— Mode Definitions
3— Return

Figure 6-12 *Sample Help Menu*

Code tips are arranged by groups and you need to navigate through a series of sub-menus to get to the desired code. Tip information is often more than what fits on a single screen, scroll to view the entire tip.

Selecting Mode Definitions opens a sub-menu of modes. Tap the desired mode to open the definition. Scroll, if needed, to view the entire definition.

6.1.6 Select Protocol

This main menu option allows you to select which communication protocol the scan tool uses to retrieve data from the ECM. For most instances, the scan tool software automatically determines which protocol to use based on the signals received from the ECM.

When the scan tool is connected to the DLC it transmits an inquiry signal and looks for responses from the vehicle to determine the protocol. In certain cases a non-emissions ECM may respond first on a different communication line than what is used for the emissions-related ECMs. When this happens, the scan tool cannot retrieve DTCs and other information because it is not receiving the correct data.

The Select Protocol option allows you to choose the correct communications link in the rare instances when this happens. Selecting opens a sub-menu that includes:

- Auto Select
- ISO 15765-4 (CAN)
- SAE J1939 (optional HD OBD-II)
- ISO 9141-2
- ISO 14230-4 (KWP2000)
- SAE J1850 (PWM)
- SAE J1850 (VPW)

Scroll and select from the menu.

6.1.7 Captured Movies

The Movie option on the main menu allows you to open data recordings that were saved on the scan tool. A list of saved movies displays when Movie is selected from the main menu.

The movie feature allows you to quickly capture data when symptoms occur, then play it back for review and analysis at a later time. selecting this main menu option opens a list of movies saved onto the scan tool.
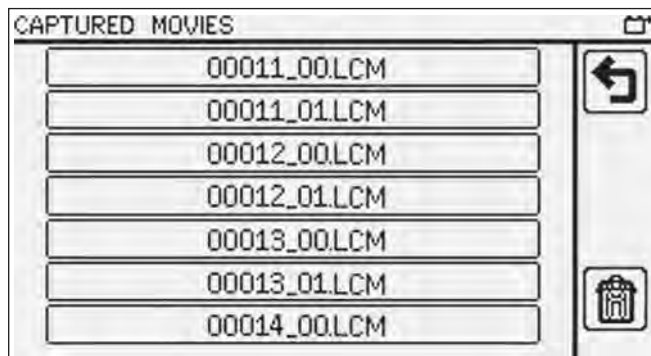
Figure 6-13 *Sample Captured Movies list*

Movies are listed on the menu in the order in which they were saved with the most recent at the top of the list. The **Delete All** button on the toolbar erases all saved files from scan tool memory. Selecting an item from the list opens a Movie menu.
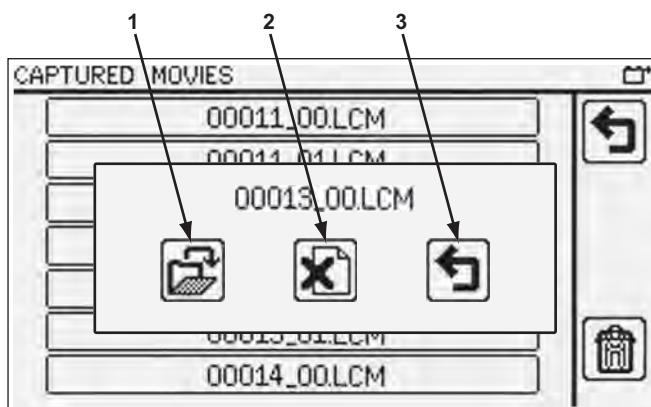
1— **Open**
2— **Delete**
3— **Return**

Figure 6-14 *Sample movie menu*

Select open to view the movie, which displays the same as when viewing current data. The Delete button erases the individual file, and Return takes you back to the menu.

To record a movie:

1. Connect the scan tool to the vehicle and begin monitoring data.
2. Allow the scan tool to gather data until the buffer is full.

3. Tap the **Save Movie** icon on the toolbar.
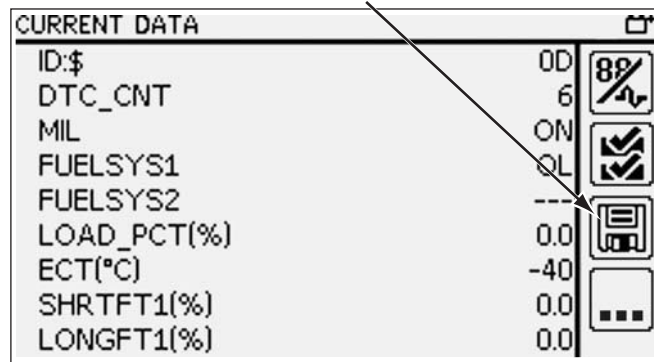
Figure 6-15 *Sample Save Movie icon*

The movie, which includes all of the buffered data, is now saved and can be retrieved from the main menu.

IMPORTANT:
You must allow the scan tool to save the movie file completely before disconnecting power to the scan tool. The movie file may be lost if the scan tool is shut down before the "save success" message displays.

6.1.8 Tools

This main menu option allows you to adjust tool settings, perform maintenance tasks, and access and manage the data stored in the tool. Selecting opens the Tools menu.
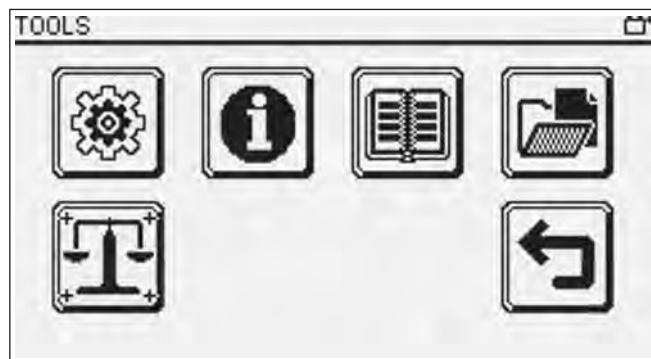
Figure 6-16 *Sample Tools menu*

Operations available from the menu are detailed below.

Settings

This selection allows you to select a language, set the date and time, determine how units of measurement display, and adjust the brightness and contrast of the touch screen.

Language

The scan tool can display data in a number of different languages. This Settings operation allows you to switch between languages. Use the following procedure to change the language setting.

To change the language setting:

1. Tap to select the **Tools** button from the Main menu
2. Select the **Settings** button from the Tools menu.
3. Select the **Languages** button (shown above).

    A sub-menu of language options displays. International country code icons show the languages available.

4. Tap an icon to select the desired language.

    A confirmation message showing the language displays.

5. From the confirmation message:

    – Select **OK** to change languages and return to the Settings menu.

    – Select **Cancel** to return to the Settings menu without changing languages.

6. Select **Return** to go back to the Tools menu.

Units of Measurement

The Units of Measurement selection is used to choose between Metric and US Standard values for certain parameters. Selecting the **Units of Measurement** button (shown at left) opens a menu.
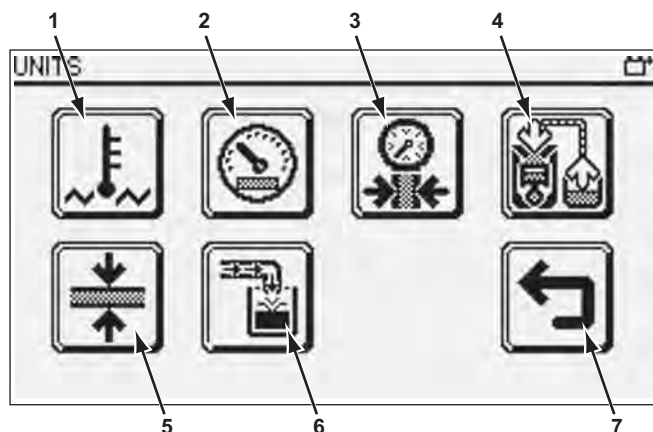
1— **Temperature:** degrees Celsius (°C) or degrees Fahrenheit (°F)

2— **Speed and distance:** kilometers (kmph/km) or miles (mph/miles)

3— **Air pressure:** kilopascal (kPa) or pounds per square inch (psi)

4— **Fuel pressure:** kilopascal (kPa) or pounds per square inch (psi)

5— **Other pressures:** pounds per square inch (psi), inches of water (inH2O), or inches of mercury (inHg)

6— **Flow rate:** grams per second (g/s) or pounds per minute (lb/min)

7— **Return**

Figure 6-17 *Sample Units of Measurement menu*

Selecting a menu item opens a choice of settings. Select a setting to close the window and return to the Units of Measurement menu, Select return to go to the Settings menu.

Screen Brightness

Selecting this option opens the brightness setting screen, which allows you to adjust the back lighting of the display. The **Plus** (+) and **Minus** (–) buttons on the toolbar change the back lighting incrementally up or down respectively. A graphic shows the relative position of the current setting within the available range. The **Return** button closes the brightness setting screen.

Screen Contrast

Selecting this option opens the contrast setting screen, which allows you to adjust the contrast of the display. The **Plus**(+) and **Minus** (–) buttons on the toolbar change the contrast incrementally up or down respectively. A graphic shows the relative position of the current setting within the available range. The **Return** button closes the contrast setting screen.

Information

This option provides basic information about the vehicle and the scan tool, such as the number of ECMs available on the vehicle, the current communication protocol being used, and the version of software currently running on the scan tool.

Tool Help

This Tools option provides definitions for all of the buttons used on the scan tool. A menu offering two lists, Main Screen Buttons and Toolbar Buttons, opens when Tool Help is selected. Make a selection and use the Up and Down buttons on the toolbar to scroll through the list.

File Manager

File Manager is used to access and organize saved data files. Selecting the **File Manager** button (shown at left) opens a menu.
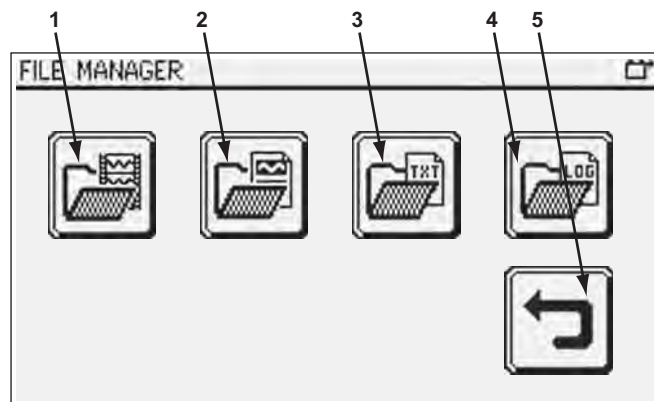
1— Saved data movies
2— Saved screen images
3— Saved data files
4— Saved file logs

Figure 6-18 *Sample File Manager menu*

Selecting an option from the menu opens a list of saved files. Tap an item on the list to open it. Up and Down arrow buttons appear if there are files listed above or below the current screen. Each arrow press advances the display one screen.

Use the Delete All button at the bottom of the toolbar to erase all of the files in the folder. To prevent accidental data loss, a confirmation screen displays when Delete All is selected.

Touch Screen Calibration

Calibrating the touch screen maintains the accuracy of the touch-sensitive display screen. Perform the following procedure when the touch screen seems out of calibration to keep your scan tool in good working order.

To calibrate the touch screen:
1. Select **Tools** from the Main menu.
2. Select **Touch Screen Calibration** from the Tools menu.

   The first of four calibration screens opens.
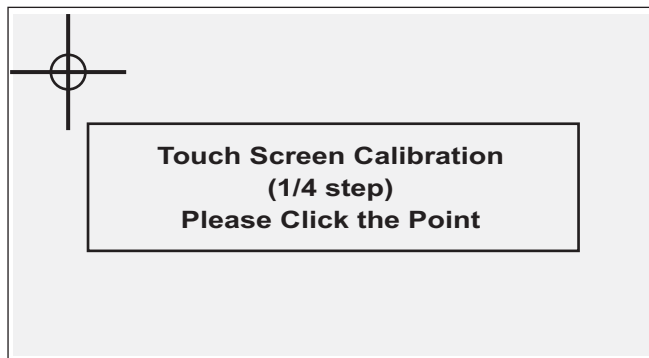
Figure 6-19 *Sample touch screen calibration screen*

3. Tap the center of the indicated area.

   The calibration target moves to a new location.
4. Repeat Step 3 for all four touch points.

   A "calibration successful" message briefly displays, then the screen returns to the Tools menu.

6.1.9 Stopping Vehicle Communication

Disconnecting the scan tool from the data link connector (DLC) while it is actively communicating with the vehicle may cause electronic control module (ECM) damage on some models. Always follow the procedure below while viewing live data to end the diagnostic session before separating the data cable from the DLC.

To stop communications with the vehicle:
1. Press the **Return** button as often as needed to get to the Main Menu.

   A "stopping communications" message briefly appears on the screen before the main menu opens to indicate the scan tool is no longer actively linked to the ECM.
2. Disconnect the data cable from the vehicle DLC.

6.2   USB Power Menu

Connecting a USB cable between a powered USB port on a personal computer (PC) and the scan tool powers up the scan tool and opens the USB Communications menu. The three buttons available on the menu are defined in the table below:

Table 6-2 *USB menu graphic definitions*

Name	Button	Description
Connect to PC		Opens a link to transfer files from the scan tool to a personal computer (PC). The PC sees the scan tool as a mass storage device (MSD).
Software Update		Downloads and installs operating system software updates to the scan tool if they are available.
Tools		Opens the USB Tools menu.

6.2.1 Connect to PC

The **Connect to PC** selection is used with the optional ShopStream Connect™ software. which lets you view data files on a personal computer, transfer files between the scan tool and PC, and download software updates from the PC to the scan tool. ShopStream Connect is a free software program that can be downloaded from the Internet at: http://diagnostics.snapon.com/SSC.

All operations are controlled through the PC when operating in this mode. Tap anywhere on the scan tool screen to disconnect it from the PC and return to the USB Menu.

6.2.2 Software Update

Select Software Update and the scan tool searches the internet for any software updates that are available for the unit. An "Install Wizard" window opens on the PC if software updates are found. Follow the on-screen instructions to install the update.

6.2.3 Tools

The Selecting **Tools** opens a menu of special functions for performing test and repair procedures on the scan tool. With the exception of Touch Screen Calibration (see Touch Screen Calibration on page 45) these features should only be used when instructed to do so by a Customer Care representative. Incorrect use may severely damage the tool and make it inoperative.

Data Parameters

Mode $01 and $02 services involve evaluating the vehicle data stream parameter values. This section provides definitions for the values that display on the viewing screen, along with diagnostic tips. The information is presented in three ways:

- Long parameter names on page 47—lists parameters by their complete names
- Short parameter names on page 51—lists parameters by their common acronym
- DTC association on page 54—lists parameter names by their corresponding diagnostic trouble code (DTC)

Depending upon the vehicle being tested and other variables, the screen may display either the long or short parameter names on the data list. The numeric definitions are based on the last three characters of the diagnostic trouble code. Refer to Service $03: on page 14 for information on DTC structure.

7.1 Long Parameter Names

Table 7-1 lists data parameter definitions alphabetically by their complete name. The long name displays in a pop-up window when a parameter is selected from a list.

NOTE:
Counters (like cylinder bank or sensor position) in a parameter name are represented by a 'y' or 'x' in the table.

The vehicle ECM determines the parameter data list, not all parameters display on every vehicle.

Table 7-1 *Long parameter names (sheet 1 of 4)*

Parameter	Description for long parameter
ABSOLUTE LOAD VALUE	Value is presented as a percentage and ranges from 0 to 100 for naturally aspirated engines, and from 0 to 400 for boosted engines. On boosted engines the actual figure displayed is very much depending on how much boost is used. The higher the boost used, the higher Absolute Load Value will be.
ABSOLUTE THROTTLE POSITION–/B/C	Shows the absolute throttle position. The output signal is a proportional percentage to the input voltage (when proportional) or 100% minus the proportional percentage (when inversely proportional). See PID $45 for the relative position.
ACCELERATOR PEDAL POSITION x	Shows the absolute pedal position. The output signal is a proportional percentage to the input voltage (when proportional) or 100% minus the proportional percentage (when inversely proportional).
AIR FLOW RATE	Shows the flow rate of the intake air as measured by the Mass Air Flow (MAF) sensor.
AMBIENT AIR TEMPERATURE	Can be obtained from an AAT sensor directly or deducted by the ECM from other sensor signals.

Table 7-1 *Long parameter names (sheet 2 of 4)*

Parameter	Description for long parameter
BAROMETRIC PRESSURE	Can be obtained from a BARO or MAP sensor directly or deducted by the ECM from other sensor (MAF) signals. If the value at 'ignition key on' and certain driving conditions is stored into a memory, clearing the memory may lead to inaccurate BARO values.
CALCULATED LOAD VALUE	The ECM calculates the engine load by dividing the actual manifold airflow volume (Otto engines) or actual fuel flow (Diesel engines) by the maximum possible volume with a factor for pressure and temperature compensation. Correlates with the engine vacuum. Value is presented as a percentage and ranges from 0 to 100.
CATALYST TEMPERATURE Bx–Sy	Shows the catalyst substrate temperature for the mentioned bank or the temperature of the mentioned bank and oxygen sensor. Can be obtained from a sensor directly or deducted by the ECM from other sensor signals.
COMMANDED EGR	Shows the status of the Exhaust Gas Recirculation system between 0% (no flow) and 100% (max. flow, max. duty cycle)
COMMANDED EQUIVALENCE RATIO	Shows the Air/Fuel ratio as commanded by the ECM. To obtain the actual Air/Fuel ratio, multiply the stoichiometric Air/Fuel ratio by the equivalence ratio. Conventional oxygen sensors shows the ratio when in Open Loop only. In Closed Loop '1.0' is shown. Wide range, or linear, oxygen sensors show the ratio in Open Loop and Closed Loop.
COMMANDED EVAPORATIVE PURGE	Shows the status of the Evaporative Purge Control Valve between 0% (no flow) and 100% (max. flow, max. duty cycle)
COMMANDED SEC. AIR STATUS	Shows the position of the Secondary Air system (upstream or downstream of the first catalytic converter) and/or its status.
COMMANDED THROTTLE ACT.CONTROL	Shows the status of the Throttle Actuator Control between 0% (closed throttle) and 100% (wide open throttle)
CONTROL MODULE VOLTAGE	Shows the power input to the ECM. This is not automatically equal to the battery voltage!
DISTANCE SINCE DTCs CLEARED	Accumulated distance since the DTCs were cleared. The maximum number is 65535. To set to 0, reset all DTCs
DISTANCE WHILE MIL ACTIVE	Conditions for this counter: 1. Resets to zero when MIL state changes from 'deactivated' to 'activated' by the ECM. 2. Accumulates counts in km if MIL is activated (ON). 3. Does not change value while MIL is not activated (OFF). 4. Resets to zero if diagnostic information is cleared either by service $04 or 40 warm-up cycles without MIL activated. 5. Does not wrap to zero if value is maximum (65535).
EGR ERROR	The Exhaust Gas Recirculation system control and feedback devices differ, therefore no 'actual' or 'commanded' status can be shown. The value is (actual EGR - commanded EGR), commanded EGR. E.g. (5%-10%)/10%=-50%
ENGINE COOLANT TEMPERATURE	Shows the temperature as measured by either the engine coolant temperature sensor or the cylinder head temperature sensor. If neither of these sensors are available, the engine oil temperature may be shown instead.

Table 7-1 *Long parameter names (sheet 3 of 4)*

Parameter	Description for long parameter
ENGINE RUN WITH MIL ACTIVE	Conditions for this counter: 1. Resets to zero when MIL state changes from deactivated to activated by this ECM. 2. Accumulates counts in minutes if MIL is activated (ON) 3. Does not change value while MIL is not activated (OFF) 4. Resets to zero if diagnostic information is cleared either by service $04 or 40 warm-up cycles without MIL activated 5. Does not wrap to zero if value is maximum (65535).
ENGINE SPEED	Engine speed as calculated by the ECM, based on various signals.
EQUIVALENCE RATIO Bx-Sy	Status of the oxygen sensor in V or as a ratio. Designed for linear or wide-ratio oxygen sensors. See also PID $14 and up or $34 and up.
EVAP SYSTEM VAPOR PRESSURE	Evaporative system vapor pressure, if used by the control module. Can be obtained from a fuel pressure sensor in the tank or in the evaporative system vapor line.
FUEL LEVEL INPUT	Shows the nominal fuel tank liquid fill capacity. For gaseous fuels the percentage of usable fuel capacity is shown. May either be obtained directly from a dedicated sensor, or calculated by the ECM based on other sensor signals.
FUEL PRESSURE GAUGE	Shows the fuel rail pressure at the engine relative to the atmosphere (gauge pressure).
FUEL SYSTEM x	Fuel System 'x' does not normally refer to injector banks. It is intended to represent different fuel systems (for multi-fuel vehicles) that can independently enter and exit 'Closed Loop'. 'Closed Loop' means the fuel control system uses the oxygen sensor signal. Banks of injectors on a V engine are generally not independent and use the same closed loop criteria.
IGNITION TIMING ADVANCE	Ignition timing spark advance for cylinder #1. If timing is retarded, the value will be negative.
INTAKE AIR TEMPERATURE	Shows the intake manifold air temperature as obtained from a sensor or as calculated by the ECM (using other inputs).
INTAKE MAP	Shows the absolute pressure in the intake manifold as measured by the MAP sensor.
LONG TERM FUEL TRIM BANK x	Shows the correction used by the Closed Loop and Open Loop fuel algorithm at the moment this parameter is requested. Negative values indicate a 'lean' condition, positive values a 'rich' condition. 0% correction will be shown if no correction is used in Open Loop.
NR OF WARM-UPS SINCE DTCs CLEARED	A warm-up cycle is valid if the coolant temperature rises, after starting the engine, at least 22 °C/40 °F and reaches at least 70 °C/160 °F (60 °C/140 °F for Diesel engines). The maximum number is 255. To set to 0, reset all DTCs.
O2S BANK x, SENSOR y	Shows the presence of oxygen sensor number 'y' per bank 'x' (group of cylinders). Sensor 1 is closest to the engine
O2S CURRENT BANK x, SENSOR y	Status of the oxygen sensor in mA or as a ratio. Designed for linear or wide-ratio oxygen sensors. See also PID $14 and up or $24 and up.

Table 7-1 *Long parameter names (sheet 4 of 4)*

Parameter	Description for long parameter
O2S VOLTAGE BANK x, SENSOR y	Shows the status of the oxygen sensor in V or percentages. Designed for conventional 0 - 1 V oxygen sensors. Sensors with a different full scale will be adapted. Negative percentages or 0 V indicate a 'lean' condition. Positive percentages or 1 V indicate a 'rich' condition. See also PID $24 and up or $34 and up.
OBD REQUIREMENTS	Shows the OBD requirements that the vehicle was designed for
POWER TAKE OFF (PTO) STATUS	Shows Power Take Off (PTO) status.
RELATIVE FUEL PRESSURE	Shows the fuel rail pressure at the engine relative to the manifold vacuum.
RELATIVE THROTTLE POSITION	Shows the 'learned' throttle position. Due to the 'closed throttle offset', Wide Open Throttle will be much less than 100%. See PID $11, $47 and $48 for the absolute position.
SHORT TERM FUEL TRIM BANK x	Shows the correction used by the Closed Loop fuel algorithm. Negative values indicate a 'lean' condition, positive values a 'rich' condition. A 0% correction is shown if the fuel system is operating in Open Loop.
SHORT TERM FUEL TRIM Bx-Sy	Shows the status of the oxygen sensor in V or percentages. Designed for conventional 0 - 1 V oxygen sensors. Sensors with a different full scale will be adapted. Negative percentages or 0 V indicate a 'lean' condition. Positive percentages or 1 V indicate a 'rich' condition. See also PID $24 and up or $34 and up.
TIME SINCE DTCs CLEARED	Accumulated time since the DTCs were cleared. The maximum number is 65535. To set to 0, reset all DTCs
TIME SINCE ENGINE START	The incrementing counter starts when the engine runs. It freezes if the engine stalls. It resets if the ECM powers up and when the ignition key enters the 'key-on, engine off' position.
VEHICLE SPEED	Shows the vehicle speed as obtained from a sensor or as calculated by the ECM (using other inputs).

7.1.1 Short Parameter Names

Table 7-2 lists data parameter definitions alphabetically by their abbreviated name. The short, or abbreviated, parameter name displays on most data lists.

NOTE:
Counters (like cylinder bank or sensor position) in a parameter name are represented by a 'y' or 'x' in the table.

The vehicle ECM determines the parameter data list, not all parameters display on every vehicle.

Table 7-2 *Short parameter names (sheet 1 of 3)*

Parameter	Description for short parameter
AAT	Can be obtained from an AAT sensor directly or deducted by the ECM from other sensor signals.
AIR_STAT	Shows the position of the Secondary Air system (upstream or downstream of the first catalytic converter) and/or its status.
APP_x	Shows the absolute pedal position. The output signal is a proportional percentage to the input voltage (when proportional) or 100% minus the proportional percentage (when inversely proportional).
BARO	Can be obtained from a BARO or MAP sensor directly or deducted by the ECM from other sensor (MAF) signals. If the value at 'ignition key on' and certain driving conditions is stored into a memory, clearing the memory may lead to inaccurate BARO values.
CATEMPx/y	Shows the catalyst substrate temperature for the mentioned bank or the temperature of the mentioned bank and oxygen sensor. Can be obtained from a sensor directly or deducted by the ECM from other sensor signals.
CLR_DIST	Accumulated distance since the DTCs were cleared. The maximum number is 65535. To set to 0, reset all DTCs
CLR_TIME	Accumulated time since the DTCs were cleared. The maximum number is 65535. To set to 0, reset all DTCs
ECT	Shows the temperature as measured by either the engine coolant temperature sensor or the cylinder head temperature sensor. If these sensors are not available,engine oil temperature may be shown instead.
ECT_ERR	The Exhaust Gas Recirculation system control and feedback devices differ, therefore no 'actual' or 'commanded' status can be shown. The value is (actual EGR - commanded EGR), commanded EGR. Example; (5%-10%)/10%=-50%
ECT_PCT	Shows the status of the Exhaust Gas Recirculation system between 0% (no flow) and 100% (max. flow, max. duty cycle)
EQ_RAT	Shows the Air/Fuel ratio as commanded by the ECM. To obtain the actual Air/Fuel ratio, multiply the stoichiometric Air/Fuel ratio by the equivalence ratio. Conventional oxygen sensors shows the ration when in Open Loop only. In Closed Loop '1.0' is shown. Wide range or linear oxygen sensors show the ratio in Open Loop and Closed Loop.
EQ_RATxy	Status of the oxygen sensor in V or as a ratio. Designed for linear or wide-ratio oxygen sensors. See also PID $14 and up or $34 and up.
EVAP_PCT	Shows the status of the Evaporative Purge Control Valve between 0% (no flow) and 100% (max. flow, max. duty cycle)
EVAP_VP	Evaporative system vapor pressure, if used by the control module. Can be obtained from a fuel pressure sensor in the tank or in the evaporative system vapor line.

Table 7-2 *Short parameter names (sheet 2 of 3)*

Parameter	Description for short parameter
FLI	Shows the nominal fuel tank liquid fill capacity. For gaseous fuels the percentage of usable fuel capacity is shown. Can be obtained directly from a dedicated sensor or calculated by the ECM from other sensor signals.
FRP	Shows the fuel rail pressure at the engine relative to the atmosphere (gauge pressure).
FRP_REL	Shows the fuel rail pressure measured at the engine relative to the intake manifold vacuum.
FUELSYSx	Fuel System 'x' does not normally refer to injector banks. It is intended to represent different fuel systems (for multi-fuel vehicles) that independently enter and exit 'Closed Loop'. 'Closed Loop' means the fuel control system uses the oxygen sensor signal. Banks of injectors on a V-type engine are generally not independent and use the same closed loop criteria.
IAT	Shows the intake manifold air temperature as obtained from a sensor or as calculated by the ECM (using other inputs).
LOAD_ABS	Value is presented as a percentage and ranges from 0 to 100 for naturally aspirated engines, and from 0 to 400 for boosted engines. On boosted engines the actual figure displayed depends upon how much boost is used. The higher the boost used, the higher the Absolute Load Value will be.
LOAD_PCT	The ECM calculates the engine load by dividing the actual manifold airflow volume (Otto engines) or actual fuel flow (Diesel engines) by the maximum possible volume with a factor for pressure and temperature compensation. Correlates with the engine vacuum. Value is presented as a percentage and ranges from 0 to 100.
LONGFTx	Shows the correction used by the Closed Loop and Open Loop fuel algorithm at the moment this parameter is requested. Negative values indicate a 'lean' condition, positive values a 'rich' condition. 0% correction will be shown if no correction is used in Open Loop.
MAF	Shows the flow rate of the intake air as measured by the Mass Air Flow (MAF) sensor.
MAP	Shows the absolute pressure in the intake manifold as measured by the MAP sensor.
MIL_DIST	Conditions for this counter: 1. Resets to zero when MIL state changes from 'deactivated' to 'activated' by the ECM. 2. Accumulates counts in km if MIL is activated (ON) 3. Does not change value while MIL is not activated (OFF) 4. Resets to zero if diagnostic information is cleared either by service $04 or 40 warm-up cycles without MIL activated 5. Does not wrap to zero if value is maximum (65535).
MIL_TIME	Conditions for this counter: 1. Resets to zero when MIL state changes from deactivated to activated by the ECM. 2. Accumulates counts in minutes if MIL is activated (ON). 3. Does not change value while MIL is not activated (OFF). 4. Resets to zero if diagnostic information is cleared either by service $04 or 40 warm-up cycles without MIL activated. 5. Does not wrap to zero if value is maximum (65535).
O2SLOCxy	Shows the presence of oxygen sensor number 'y' per bank 'x' (group of cylinders). Sensor 1 is closest to the engine

Table 7-2 *Short parameter names (sheet 3 of 3)*

Parameter	Description for short parameter
O2Sxy	Shows the status of the oxygen sensor (O2S) in voltage or percentages. This parameter is designed for a conventional (0 to 1 V range) O2S. Sensors with a different full scale will be adapted. Negative percentages or below 0.5 V indicates a 'lean' operating condition. Positive percentages or above 0.5 V indicates a 'rich' operating condition. See also PID $24 and up or $34 and up.
O2Sxy	Status of the oxygen sensor in mA or as a ratio. Designed for linear or wide-ratio oxygen sensors. See also PID $14 and up or $24 and up.
OBDSUP	Shows the OBD requirements that the vehicle was designed for.
PTO_STAT	Shows Power Take Off (PTO) status.
RPM	Engine speed as calculated by the ECM, based on various signals.
RUNTM	The incrementing counter starts when the engine runs. It freezes if the engine stalls. It resets if the ECM powers up and when the ignition key enters the 'key-on, engine off' position.
SHRTFTx	Shows the correction used by the Closed Loop fuel algorithm. Negative values indicate a 'lean' condition, positive values indicate a 'rich' condition. A 0% correction is shown if the fuel system is operating in Open Loop.
SHRTFTxy	Shows the status of the oxygen sensor (O2S) in voltage or percentages. This parameter is designed for a conventional (0 to 1 V range) O2S. Sensors with a different full scale will be adapted. Negative percentages or below 0.5 V indicates a 'lean' operating condition. Positive percentages or above 0.5 V indicates a 'rich' operating condition. See also PID $24 and up or $34 and up.
SPARKADV	Ignition timing spark advance for cylinder #1. If timing is retarded, the displayed value is negative.
TAC_PCT	Shows the status of the Throttle Actuator Control between 0% (closed throttle) and 100% (wide open throttle)
TP/TP_B/TP_C	Shows the absolute throttle position. The output signal is a proportional percentage to the input voltage (when proportional) or 100% minus the proportional percentage (when inversely proportional). See PID $45 for the relative position.
TP_R	Shows the 'learned' throttle position. Due to the 'closed throttle offset', Wide Open Throttle will be much less than 100%. See PID $11, $47 and $48 for the absolute position.
VPWR	Shows the power input to the ECM. This value is not automatically equal to the battery voltage!
VSS	Shows the vehicle speed as obtained from a sensor or as calculated by the ECM (using other inputs).
WARM_UPS	A warm-up cycle is valid if the coolant temperature rises, after starting the engine, at least 22 °C/40 °F and reaches at least 70 °C/160 °F (60 °C/140 °F Diesel). The maximum number is 255. To set to 0, reset all DTCs.

7.1.2 DTC Association

Table 7-3 lists parameter names (short and long) by their associated diagnostic trouble code (DTC) in numerically ascending order.

NOTE:
The value listed is the last three characters of the DTC, a "$" indicates a variable value.

Table 7-3 *DTC association (sheet 1 of 4)*

DTC	Name, short	Parameter Name, long
$03	FUELSYS1	FUEL SYSTEM 1
$03	FUELSYS2	FUEL SYSTEM 2
$04	LOAD_PCT (%)	CALCULATED LOAD VALUE (%)
$05	ECT (°C)	ENGINE COOLANT TEMPERATURE (°C)
$06	SHRTFT1 (%)	SHORT TERM FUEL TRIM BANK 1 (%)
$07	LONGFT1 (%)	LONG TERM FUEL TRIM BANK 1 (%)
$08	SHRTFT2 (%)	SHORT TERM FUEL TRIM BANK 2 (%)
$09	LONGFT2 (%)	LONG TERM FUEL TRIM BANK 2 (%)
$0A	FRP (kPa)	FUEL PRESSURE GAUGE (kPa)
$0B	MAP (kPa)	INTAKE MAP (kPa)
$0C	RPM (1/min.)	ENGINE SPEED (1/min.)
$0D	VSS (km/h)	VEHICLE SPEED (km/h)
$0E	SPARKADV (°)	IGNITION TIMING ADVANCE (°)
$0F	IAT (°C)	INTAKE AIR TEMPERATURE (°C)
$10	MAF (g/s)	AIR FLOW RATE (g/s)
$11	TP (%)	ABSOLUTE THROTTLE POSITION (%)
$12	AIR_STAT	COMMANDED SEC. AIR STATUS
$13	O2SLOC11	O2S BANK 1 - SENSOR 1
$13	O2SLOC12	O2S BANK 1 - SENSOR 2
$13	O2SLOC13	O2S BANK 1 - SENSOR 3
$13	O2SLOC14	O2S BANK 1 - SENSOR 4
$13	O2SLOC21	O2S BANK 2 - SENSOR 1
$13	O2SLOC22	O2S BANK 2 - SENSOR 2
$13	O2SLOC23	O2S BANK 2 - SENSOR 3
$13	O2SLOC24	O2S BANK 2 - SENSOR 4
$14	O2S11 (V)	O2S VOLTAGE BANK 1 - SENSOR 1 (V)
$14	SHRTFT11 (%)	SHORT TERM FUEL TRIM B1-S1 (%)
$15	O2S12 (V)	O2S VOLTAGE BANK 1 - SENSOR 2 (V)
$15	SHRTFT12 (%)	SHORT TERM FUEL TRIM B1-S2 (%)
$16	O2S13 (V)	O2S VOLTAGE BANK 1 - SENSOR 3 (V)
$16	SHRTFT13 (%)	SHORT TERM FUEL TRIM B1-S3 (%)

Table 7-3 *DTC association (sheet 2 of 4)*

DTC	Name, short	Parameter Name, long
$17	O2S14 (V)	O2S VOLTAGE BANK 1 - SENSOR 4 (V)
$17	SHRTFT14 (%)	SHORT TERM FUEL TRIM B1-S4 (%)
$18	O2S21 (V)	O2S VOLTAGE BANK 2 - SENSOR 1 (V)
$18	O2S31 (V)	O2S VOLTAGE BANK 3 - SENSOR 1 (V)
$18	SHRTFT21 (%)	SHORT TERM FUEL TRIM B2-S1 (%)
$18	SHRTFT31 (%)	SHORT TERM FUEL TRIM B3-S1 (%)
$19	O2S22 (V)	O2S VOLTAGE BANK 2 - SENSOR 2 (V)
$19	O2S32 (V)	O2S VOLTAGE BANK 3 - SENSOR 2 (V)
$19	SHRTFT22 (%)	SHORT TERM FUEL TRIM B2-S2 (%)
$19	SHRTFT32 (%)	SHORT TERM FUEL TRIM B3-S2 (%)
$1A	O2S23 (V)	O2S VOLTAGE BANK 2 - SENSOR 3 (V)
$1A	O2S41 (V)	O2S VOLTAGE BANK 4 - SENSOR 1 (V)
$1A	SHRTFT23 (%)	SHORT TERM FUEL TRIM B2-S3 (%)
$1A	SHRTFT41 (%)	SHORT TERM FUEL TRIM B4-S1 (%)
$1B	O2S24 (V)	O2S VOLTAGE BANK 2 - SENSOR 4 (V)
$1B	O2S42 (V)	O2S VOLTAGE BANK 4 - SENSOR 2 (V)
$1B	SHRTFT24 (%)	SHORT TERM FUEL TRIM B2-S4 (%)
$1B	SHRTFT42 (%)	SHORT TERM FUEL TRIM B4-S2 (%)
$1C	OBDSUP	OBD REQUIREMENTS
$1D	O2SLOC11	O2S BANK 1 - SENSOR 1
$1D	O2SLOC12	O2S BANK 1 - SENSOR 2
$1D	O2SLOC21	O2S BANK 2 - SENSOR 1
$1D	O2SLOC22	O2S BANK 2 - SENSOR 1
$1D	O2SLOC31	O2S BANK 3 - SENSOR 1
$1D	O2SLOC32	O2S BANK 3 - SENSOR 2
$1D	O2SLOC41	O2S BANK 4 - SENSOR 1
$1D	O2SLOC42	O2S BANK 4 - SENSOR 2
$1E	PTO_STAT	POWER TAKE OFF (PTO) STATUS
$1F	RUNTM (s)	TIME SINCE ENGINE START (s)
$21	MILL_DIST (km)	DISTANCE WHILE MIL ACTIVE (km or miles)
$22	FRP_REL (kPa)	RELATIVE FUEL PRESSURE (kPa)
$23	FRP (kPa)	FUEL PRESSURE GAUGE (kPa)
$24	EQ_RAT11	EQUIVALENCE RATIO B1-S1 (:1)
$25	EQ_RAT12	EQUIVALENCE RATIO B1-S2 (:1)
$26	EQ_RAT13	EQUIVALENCE RATIO B1-S3 (:1)
$27	EQ_RAT14	EQUIVALENCE RATIO B1-S4 (:1)
$28	EQ_RAT21	EQUIVALENCE RATIO B2-S1 (:1)
$28	EQ_RAT31	EQUIVALENCE RATIO B3-S1 (:1)

Table 7-3 *DTC association (sheet 3 of 4)*

DTC	Name, short	Parameter Name, long
$29	EQ_RAT22	EQUIVALENCE RATIO B2-S2 (:1)
$29	EQ_RAT32	EQUIVALENCE RATIO B3-S2 (:1)
$2A	EQ_RAT23	EQUIVALENCE RATIO B2-S3 (:1)
$2A	EQ_RAT41	EQUIVALENCE RATIO B4-S1 (:1)
$2B	EQ_RAT24	EQUIVALENCE RATIO B2-S4 (:1)
$2B	EQ_RAT42	EQUIVALENCE RATIO B4-S2 (:1)
$2C	EGR_PCT (%)	COMMANDED EGR (%)
$2D	EGR_ERR (%)	EGR ERROR (%)
$2E	EVAP_PCT (%)	COMMANDED EVAPORATIVE PURGE (%)
$2F	FLI (%)	FUEL LEVEL INPUT (%)
$30	WARM_UPS	NR OF WARM-UPS SINCE DTCs CLEARED
$31	CLR_DIST	DISTANCE SINCE DTCs CLEARED
$32	EVAP_VP (Pa)	EVAP SYSTEM VAPOR PRESSURE (Pa)
$33	BARO (kPa)	BAROMETRIC PRESSURE (kPa)
$34	O2S11 (mA)	O2S CURRENT BANK 1 - SENSOR 1 (mA)
$35	O2S12 (mA)	O2S CURRENT BANK 1 - SENSOR 2 (mA)
$36	O2S13 (mA)	O2S CURRENT BANK 1 - SENSOR 3 (mA)
$37	O2S14 (mA)	O2S CURRENT BANK 1 - SENSOR 4 (mA)
$38	O2S21 (mA)	O2S CURRENT BANK 2 - SENSOR 1 (mA)
$38	O2S31 (mA)	O2S CURRENT BANK 3 - SENSOR 1 (mA)
$39	O2S22 (mA)	O2S CURRENT BANK 2 - SENSOR 2 (mA)
$39	O2S32 (mA)	O2S CURRENT BANK 3 - SENSOR 2 (mA)
$3A	O2S23 (mA)	O2S CURRENT BANK 2 - SENSOR 3 (mA)
$3A	O2S41 (mA)	O2S CURRENT BANK 4 - SENSOR 1 (mA)
$3B	O2S24 (mA)	O2S CURRENT BANK 2 - SENSOR 4 (mA)
$3B	O2S42 (mA)	O2S CURRENT BANK 4 - SENSOR 2 (mA)
$3C	CATEMP11 (°C)	CATALYST TEMPERATURE B1-S1 (°C)
$3D	CATEMP21 (°C)	CATALYST TEMPERATURE B2-S1 (°C)
$3E	CATEMP12 (°C)	CATALYST TEMPERATURE B1-S2 (°C)
$3F	CATEMP22 (°C)	CATALYST TEMPERATURE B2-S2 (°C)
$42	VPWR (V)	CONTROL MODULE VOLTAGE (V)
$43	LOAD_ABS (%)	ABSOLUTE LOAD VALUE (%)
$44	EQ_RAT	COMMANDED EQUIVALENCE RATIO
$45	TP_R (%)	RELATIVE THROTTLE POSITION (%)
$46	AAT (°C)	AMBIENT AIR TEMPERATURE (°C)
$47	TP_B (%)	ABSOLUTE THROTTLE POSITION B (%)
$48	TP_C (%)	ABSOLUTE THROTTLE POSITION C (%)
$49	APP_D (%)	ACCELERATOR PEDAL POSITION D (%)

Table 7-3 *DTC association (sheet 4 of 4)*

DTC	Name, short	Parameter Name, long
$4A	APP_E (%)	ACCELERATOR PEDAL POSITION E (%)
$4B	APP_F (%)	ACCELERATOR PEDAL POSITION F (%)
$4C	TAC_PCT (%)	COMMANDED THROTTLE ACT.CONTROL (%)
$4D	MIL_TIME (min.)	ENGINE RUN WITH MIL ACTIVE (min.)
$4E	CLR_TIME (min.)	TIME SINCE DTCs CLEARED (min.)

Maintenance

This section covers the following maintenance issues:

- Cleaning and Damage Inspection
- Storage Tips

8.1 Cleaning and Damage Inspection

When using this scan tool, make sure to do the following:

- Before and after each use, check the housing, wiring, and connectors for dirt and damage.
- At the end of each working day, clean the housing, wiring, and connectors with a damp cloth.

IMPORTANT:
Do not use any abrasive cleansers or caustic chemicals to clean the scanner housing, display screen, cables, connectors, and adapters.

8.2 Storage Tips

When storing your scanner, remember to make sure the tool will be kept within the recommended storage temperature range. See Technical Specifications on page 4 for details.

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Except as otherwise provided herein, Snap-on warrants the product for twelve (12) months from the date of original purchase against defects in workmanship and materials that prevent their use. Consumable parts are warranted, at the time of sale, against defects in workmanship and materials that prevent their use. Consumable parts are goods reasonably expected to be used up or damaged during use, including but not limited to, cables, sensors and batteries. This warranty only extends to the original Buyer and cannot be transferred or assigned. In the event that Buyer fails to make continued payments on the product in accordance with the purchase contract for the product, this warranty will no longer be in effect.

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Snap-on does NOT provide any warranty for (i) recalibration; or (ii) product subjected to "abnormal use". "Abnormal use" includes misuse, accident, modification, alteration, unreasonable or improper use, abuse, neglect, lack of maintenance, use in product-related service, or use after the product is significantly worn. Further, this warranty does NOT cover any damage to, or inoperability or improper operation of the product caused by, resulting from or attributable to (1) installation or maintenance; (2) improper installation of software; (3) fire, water, wind, lightning or other natural causes; (4) damage caused by adverse environmental conditions, including without limitation, extreme temperatures, moisture, corrosive elements, dust or other air contaminants, radio frequency interference, electric power failure, power line voltages beyond those specified for the product, unusual physical, electrical or electromagnetic stress and/or any other condition outside of Snap-on's environmental specifications; (5) use of the product in combination or connection with other product, attachments, supplies or consumables not manufactured or distributed by Snap-on; or (6) failure to comply with any applicable federal, state or local regulation, requirement or specification governing emission analyzers and related supplies or consumables.   Parts and labor needed to maintain your product and any replacement parts necessary due to normal wear and tear are not covered by this written warranty and are the Buyer's responsibility.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND SETS FORTH THE SOLE AND EXCLUSIVE REMEDY IN CONTRACT, TORT, STRICT LIABILITY OR OTHERWISE. SNAP-ON DOES NOT GRANT ANY OTHER PERSON OR ENTITY PERMISSION TO CREATE FOR IT ANY WARRANTY, LIABILITY OR OBLIGATION IN CONNECTION WITH ITS PRODUCTS.

Snap-on and its affiliated companies shall not be liable for any incidental, special or consequential losses, costs or damages incurred by Buyer or others, directly or indirectly arising from the sale, handling or use of the products, or from any other cause with respect to the products or this warranty, whether such claim is based upon breach of contract, breach of warranty, strict liability in tort, negligence or any other legal theory (including without limitation, lost profits, revenues, anticipated sales, business opportunities, goodwill, or interruption of business or other injury or damage).

To the extent allowed by applicable law, this warranty and all rights and obligations hereunder, including matters of construction, validity and performance, shall be governed by the substantive laws of the State of Wisconsin, without giving effect to the principles of conflicts of law thereof.

Snap-on Diagnostics Warranty Information Center
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