Dyno-Scan™ for Palm OS
Version 5.2
User Guide

Auterra, LLC
320 East 2nd Ave, Suite 111
Escondido, CA 92025

www.auterraweb.com

Sales e-mail: sales@auterraweb.com
Support e-mail: support@auterraweb.com

Warnings

The exclamation point within the triangle is a warning sign alerting you of important instructions accompanying the product. Please observe all warnings.

Do not operate the vehicle indoors. A running engine produces lethal carbon monoxide exhaust fumes that can seriously harm or kill you if inhaled. Only run the vehicle motor outdoors with proper ventilation. Most scan tool operations do not require a running motor.

Do not attempt to operate or observe the scan tool while driving a vehicle. Driving requires the full attention of the driver. Operating or observing the scan tool will cause driver distraction and could cause a fatal accident.

Ensure the Palm, cable, and OBD II adapter do not interfere with the vehicle controls. A cable dangling in front of the foot pedals, gear shifter, or steering wheel can interferer with vehicle operation and cause a fatal accident. Always ensure the Palm, cable, and OBD II adapter are securely fastened out of the way. If the scan tool cannot be safely attached as to not interfere with the vehicle controls, then do not drive the vehicle with the OBD II adapter connected to the vehicle.

Never race or exceed the posted speed limit while on public highways. The dynamometer operations require accelerating to high speeds. Always uses a closed course raceway when performing dynamometer and acceleration tests.

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CHAPTER 1

Preface

Congratulations on your purchase of an Auterra's Dyno-Scan™ for Palm OS. Please take time to read through these operating instructions and become familiar with the operating procedure.

The Auterra Dyno-Scan™ for Palm OS, in conjunction with a Palm handheld computer, enables access to your vehicle's diagnostic information.

The scan tool offers features such as read and clear trouble codes, turn off the "Check Engine" light, and display live sensor data from the vehicle. The Dyno software adds a performance-measuring package that includes a dynamometer, acceleration tests, and fuel economy measurements.

Key Features

The Dyno-Scan™ for Palm OS offers a multitude of diagnostic and performance-measuring features:

- All 1996 and later vehicles supported, including American, Asian, and European
- Read and clear diagnostic trouble codes (DTCs)
- Integrated DTC description databases including enhanced and generic definitions
- Turn off the vehicle's Check Engine or Service Engine Soon light
- Read and clear freeze frame data
- Monitor live data with line graphs, bar graphs, and meters
- Graphically zoom in/out and pan within a virtual trace buffer
- View multiple sensors simultaneously with variable sample rates
- Record and playback live sensor data streams
- Upload recordings to a PC for further analysis
- Oxygen sensor monitoring and on-board test results
- I/M readiness. Metric and English units of measure
- Horsepower and torque measurements
- 0-60 time, 1/8 and 1/4 mile time and speed, MPG, and top speed
- Supports most Palm OS devices version 3.0 and later.

- Color and black-and-white screens supported
- 1-year warranty

Auterra Dyno-Scan™ for Palm OS

The Dyno-Scan™ for Palm OS is comprised of four components:

1. OBD II Adapter and Software
2. OBD II Cable
3. HotSync cable
4. Palm handheld (purchased separately)

The Auterra software runs on a Palm handheld computer. The HotSync cable connects the Palm and the Auterra OBD II Adapter together. Once connected, the OBD II software communicates through the OBD II Adapter to the vehicle. The battery powered Palm handheld is slightly larger than a deck of cards making the scan tool very portable and easily used within a garage setting.

Figure 1: Auterra Dyno-Scan™ for Palm OS

What is OBD II?

OBD II stands for On-Board Diagnostics second generation. OBD II was incorporated for some 1994 and 1995 model-year vehicles and was required for all 1996-and-later vehicles.

OBD II is a series of government regulations intended to reduce in-use vehicle emissions by continually monitoring for failure and/or deterioration of the powertrain and its emission-control systems. A Malfunction Indicator Light (i.e. Check Engine light or Service

Engine Soon light) visible to the vehicle operator must be illuminated and a Diagnostic Trouble Code set when either there is a failure of a monitored component/system or any of the sensed parameters deteriorates such that the vehicle's emissions would exceed the relevant standard by approximately 50 percent.

The OBD II standard makes the Auterra Dyno-Scan™ for Palm OS universal to all automobiles since all newer vehicles sold must conform to these government regulations.

OBD II standardizes a vehicle communication protocol and the external computer connector. The Auterra Dyno-Scan™ for Palm OS uses this connector located under the dash to communicate with the vehicle's on-board computer systems.

Where is the vehicle's OBD II connector?

OBD II compliant vehicles must have a 16-pin connector located in plain sight underneath the dash near the driver's seat (see Figure 2). Alternatively, it may be behind ashtrays or concealed by an easily removed plastic cover, sometimes with the letters "OBD" stamped on the outside. Some 1994 and 1995 vehicles have this connector and are only OBD I compliant. These OBD I vehicles are not supported by the scan tool.

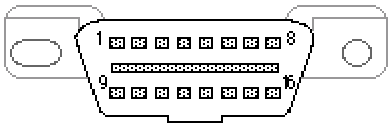


Figure 2: Vehicle OBD II Connector (Front View)

What is a Scan Tool?

Modern automobiles rely upon computers to control and monitor all aspects of vehicle operation. When most people think of computers, they think of a desktop system such as an Apple Macintosh or an IBM PC-compatible. However, small computer microchips silently perform many mundane tasks without the average person being aware of their existence. Today's automobile contains numerous on-board computer chips responsible for many systems such as the engine, transmission, and antilock brakes to name a few.

The automobile computer relies upon a variety of sensors to monitor vehicle operation such as speed, engine RPM, coolant temperature, and oxygen sensors. While driving, if the vehicle's on-board computer system detects a problem, the computer reports the error using a Diagnostic Trouble Code (DTC). A Diagnostic Trouble Code number indicates the problem with the vehicle. For instance, Diagnostic Trouble Code P0503 means the vehicle speed sensor is intermittently not providing the correct reading.

The scan tool connects to the vehicle using a standard, easy-to-locate electrical connector. No tools are required to access the connector. Once connected, the scan tool communicates with the vehicle's computer to obtain diagnostic information, such as a Diagnostic Trouble Code.

If the vehicle computer detects a problem, the driver is informed using the "Check Engine" or "Service Engine Soon" light on the vehicle's dashboard. This light is also known

as the Malfunction Indicator Light (MIL). When this light illuminates, a Diagnostic Trouble Code is saved into the computer memory ready for the Auterra Dyno-Scan™ for Palm OS to read out the value.

Not all Diagnostic Trouble Codes illuminate the Check Engine light. Sometimes the vehicle needs to see an error a few times to ensure the problem isn't just a temporary glitch. Other times the computer determines the problem isn't emission related and the driver is not notified. Therefore, periodic checking of the Diagnostic Trouble Codes helps detect problems early before becoming more costly to repair. For instance, the computer may detect a problem with the automatic transmission but since the failure is not emission related the computer may not illuminate the Check Engine light. The transmission failure may also be difficult for the driver to detect just by driving the vehicle. Only a scan tool can reveal that a problem exists and the cause.

What is a Palm handheld computer?

Palm handheld devices are general-purpose computer platforms with thousands of aftermarket software applications. This makes owning an Auterra Palm-based scan tool even more valuable since the Palm handheld is useful beyond just a scan tool.

The battery powered Palm is controlled using a touch screen instead of a keyboard. Commands are tapped into the unit using a small plastic stylus. Handwriting recognition software using a simplified means of writing letters and numbers, called Graffiti, is built into the unit for entering text.

Palm, Inc. has sold millions of handheld computers and is the most popular handheld device on the market today. It's an electronic organizer, day-timer, address book, and so much more. Information about Palm handheld computers can be found on the Internet at www.palm.com.

Specifications

The OBD II Adapter conforms to these specifications.

Table 1: Hardware Specifications

Input:	VPW, PWM, ISO, Keyword Protocol (KWP) 2000, and CAN[1].
External Power:	None. Draws power from vehicle.
Weight:	4 oz
Dimensions (H x W x D):	3.5" x 1.75" x .875"
Temperature:	32° to 158° F (0° to 70° C) non-condensing

Required Components

The Auterra Dyno-Scan™ for Palm OS requires four components: HotSync cable, OBD II Adapter, OBD II cable, and a Palm handheld computer (purchased separately).

[1] Not all OBD II adapters are equipped with CAN.

Figure 3: Palm, HotSync Cable, OBD II Adapter, and OBD II Cable

Supported Vehicles

The Auterra Dyno-Scan™ for Palm OS supports all 1996 and newer vehicles including American, European, and Asian. Some 1994 and 1995 vehicles are also supported with a sticker under the hood indicating OBD II compliance. All vehicles sold in the US model year 1996 and newer are OBD II compliant and do not require the under hood sticker.

The OBD II Adapter supports the following automotive standard interfaces: VPW, PWM, ISO, Keyword Protocol (KWP) 2000, and optionally CAN.

Supported Palm Handheld Devices

The Auterra Dyno-Scan™ for Palm OS supports most Palm devices with operating system 3.0 or higher. Palm handhelds sold today are 3.x and later. The Palm OS version is located either:

Palm OS version 3.x and later

1. Tap the Applications button in the lower-left corner of your screen. The applications launcher appears.
2. Tap the Menu button in the lower-left corner of your screen. A dropdown list appears.
3. Select Info. The Info screen appears.
4. Tap the Version button at the bottom of the screen. Your current Palm OS version appears at the top of the screen.

Palm OS version 2.x and earlier

1. Tap the Applications button in the lower-left corner of your screen. The applications launcher appears.
2. Tap the Memory application icon
3. Your current Palm OS version appears in the top left of the screen.

Starting with Auterra software version 3.0, only Palm OS versions 3.0 and later are supported. Palm 2.x series handhelds should use Auterra software version 2.5.

Abbreviations

Some item descriptions are abbreviated to fit within the Palm's screen.

BX – designates a bank number (e.g. B1 means bank 1)

SX – designates a sensor number (e.g. S1 means sensor 1)

BX-SX – designates a bank-sensor combination (e.g. B1-S2 means bank 1 – sensor 2)

OBD I – On-Board Diagnostics I

OBD II – On-Board Diagnostics II

OBDII Calif - OBD II (California ARB)

OBD Federal - OBD (Federal EPA)

No OBD - not intended to meet any OBD requirements.

OLoop NoSat - Open Loop – has not yet satisfied conditions to go closed loop.

CLoop O2 - Closed Loop – using oxygen sensor(s) as feedback for fuel control.

OLoop Drive - Open loop due to driving conditions (power enrichment, deceleration enleanment)

OLoop Fault - Open loop due to detected system fault.

CLoop Fault - Closed loop, but fault with at least one oxygen sensor – may be using single oxygen sensor control.

Upstream Cat - upstream of first catalytic converter.

Dnstream Cat - downstream of first catalytic converter.

Atmosphere - atmosphere/off.

PTO NtActive – Power Take-Off Not Active

PTO Active – Power Take-Off Active

C - complete

I - incomplete

- - not supported

Abbreviations and Definitions

A/F – Air Fuel

A/T – Automatic Transmission

Check Engine Light – also known as a MIL light.

CHT – Cylinder Head Temperature

Closed Loop – In closed loop operation the oxygen sensors are used to adjust the fuel mixture. See open loop.

DTC – Diagnostic Trouble Code

Dyno - Dynamometer

EBCM – Electronic Brake Control Module

EBTCM – Electronic Brake Traction Control Module

ECU – Emission Control Unit (i.e. the vehicle's on-board computer)

EGR – Exhaust Gas Recirculation

EFI – Electronic Fuel Injection

EMR – Electronic Module Retard

ESC – Electronic Spark Control

EST – Electronic Spark Timing

EVAP – Evaporative Emission

Fuel Trim – engine computer function that keeps the air/fuel mixture close to ideal.

HC – Hydrocarbons

HEI – High Energy Ignition

HO2S – Heated Oxygen Sensor

Horsepower – a unit of measure to express the rate at which mechanical energy is expended.

HP – Horsepower

M/T – Manual Transmission

MAF – Mass Air Flow

MIL – Malfunction Indicator Light (i.e. "Check Engine" or "Service Engine Soon" light on the vehicle's instrument panel).

NOx – Oxides of Nitrogen

O2 – Oxygen

Open Loop – used to describe the fuel mixture when the oxygen sensors are not being used, usually when the engine is cold or if a malfunction is detected. See closed loop.

PCM – Power Control Module

PID – Parameter ID is a number used to designate a particular vehicle sensor.

PTO – Power Take-Off

RPM – Revolutions per Minute

SAE – Society of Automotive Engineers

Scan Tool – a computer that reads out OBD II values from the vehicle.

Service Engine Soon – also known as a MIL light.

SFI – Sequential Fuel Injection

TBI – Throttle Body Injection

TCM – Transmission Control Module

TCS – Traction Control Switch

TFT – Transmission Fluid Temperature

Torque - Torque is a measure of how much a force acting on an object causes that object to rotate.

TP – Throttle Position

TPS – Throttle Position Sensor

VAC – Vacuum

VIN – Vehicle Identification Number

VSS – Vehicle Speed Sensor

CHAPTER 2

Loading Palm Software

Loading the Auterra OBD II Palm Software onto the Palm handheld is easy. This section shows you how.

Your Palm Desktop Software may look slightly different from shown here. Refer to your Palm documentation on loading software applications if you have trouble.

Step 1: Start Palm Desktop Software

1. Start the Palm Desktop software (Figure 4), included with your Palm, on your personal computer.

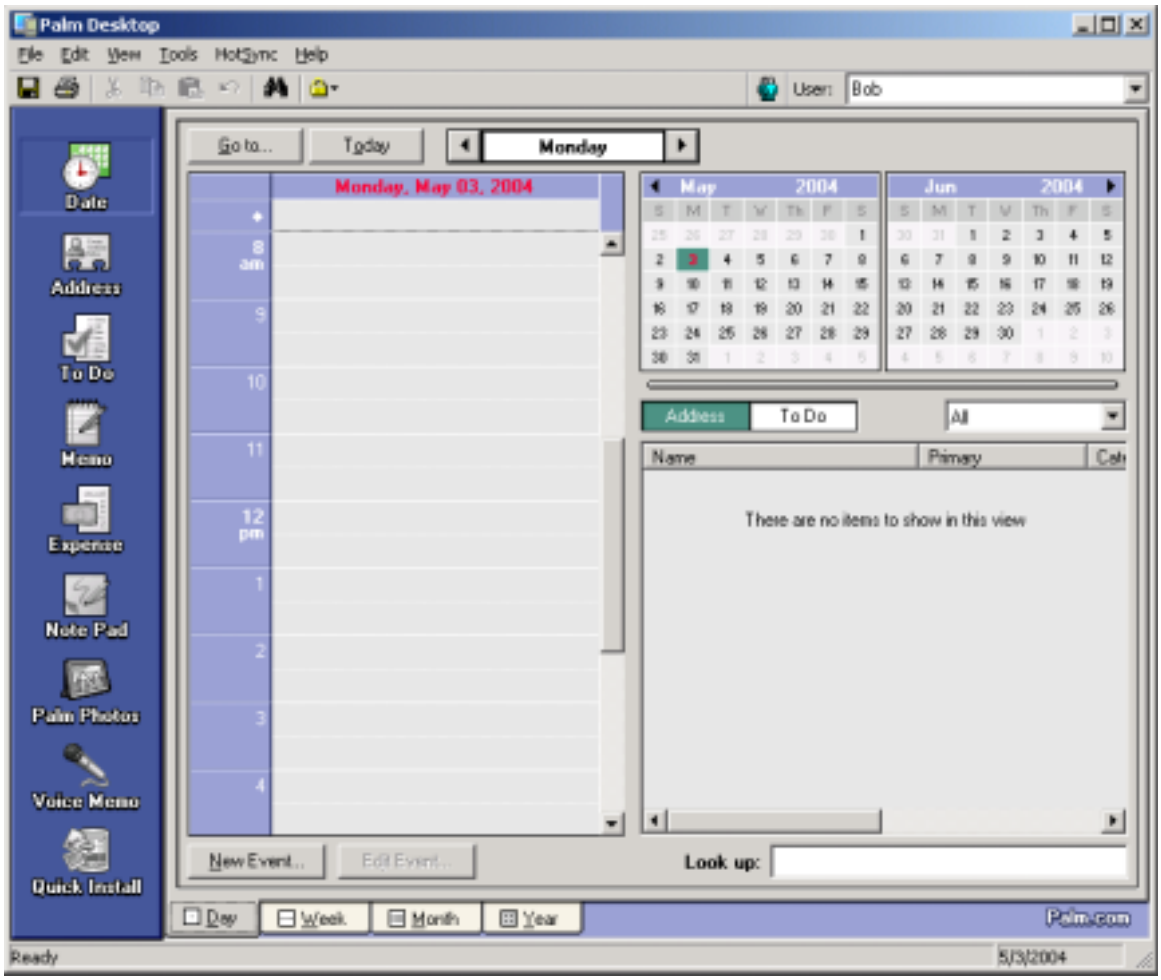


Figure 4: Palm Desktop Software

Step 2: Install Software

1. Press the Quick Install button on the Palm Desktop software.

2. Press the Add... button on the Palm Quick Install dialog (Figure 5) and locate the DynoScan.prc and MathLib.prc files located on the Auterra CD ROM, or on the hard disk if the software was download from the web[2].

3. Optionally add one or more trouble code databases. Auterra recommends at least installing Generic.pdb, which has all the generic trouble codes common to all manufacturers. All databases have the file extension pdb.

[2] The files must be installed to the Handheld, not the Expansion Card.

4. Press the Done button on the dialog once the DynoScan.prc, Mathlib.prc and optional database files, if any, are selected.

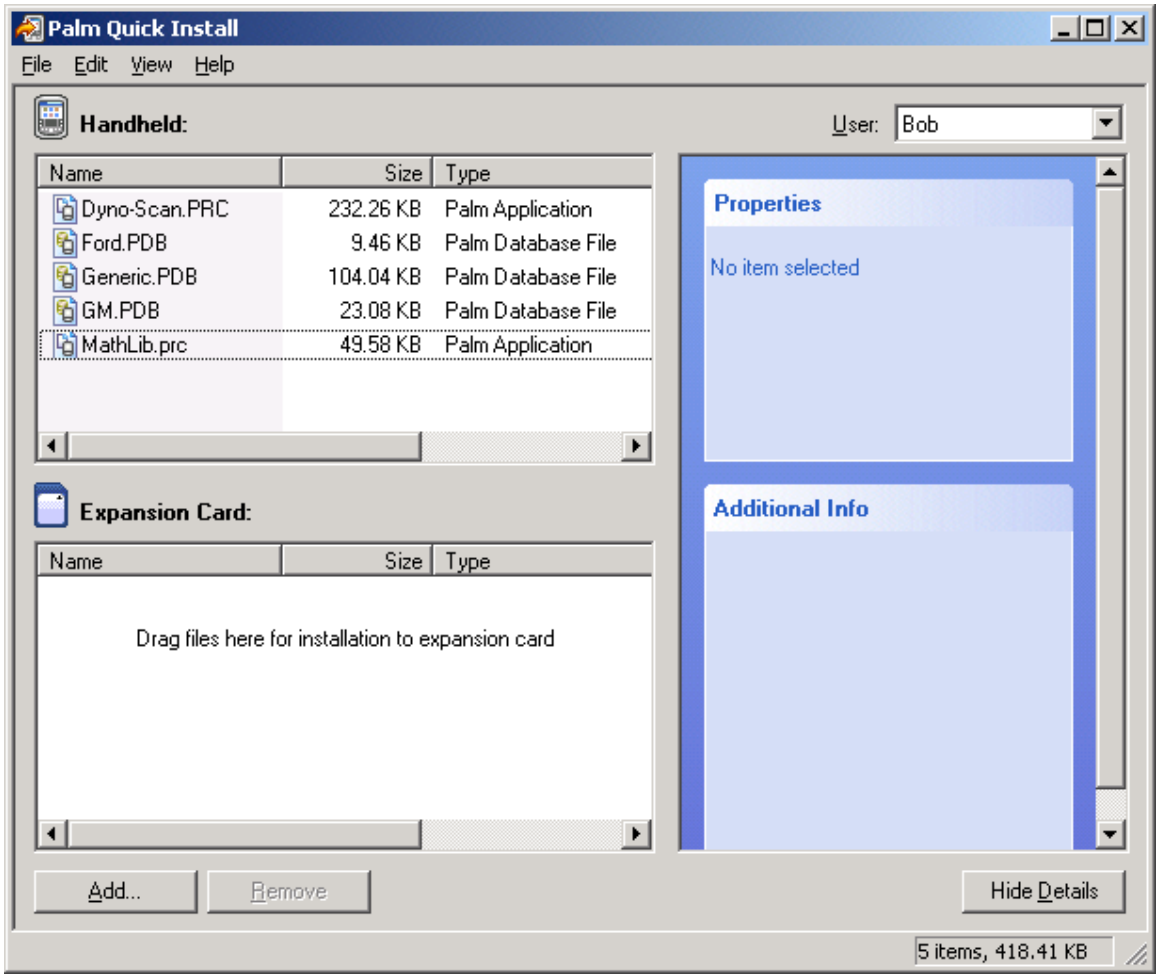


Figure 5: Palm Quick Install Dialog

Step 3: Perform HotSync

1. Place the Palm into the HotSync cradle.

2. Press the HotSync button on the cradle base.

3. HotSync is complete. The software is loaded and ready for use on a live vehicle or standalone in demo mode (see Demo Mode).

Software Updates

Check the Auterra website periodically to download software updates at www.auterraweb.com.

CHAPTER 3

Connections

Connecting your Auterra Dyno-Scan™ for Palm OS to the vehicle is easy. This section shows you how.

Connect your Dyno-Scan™ to the Palm Handheld

A Plug the HotSync cable into the Palm handheld.

B Connect the HotSync cable to the OBD II adapter and tighten the two thumbscrews.

C Connect the OBD II cable to the OBD II adapter and tighten the two thumbscrews.

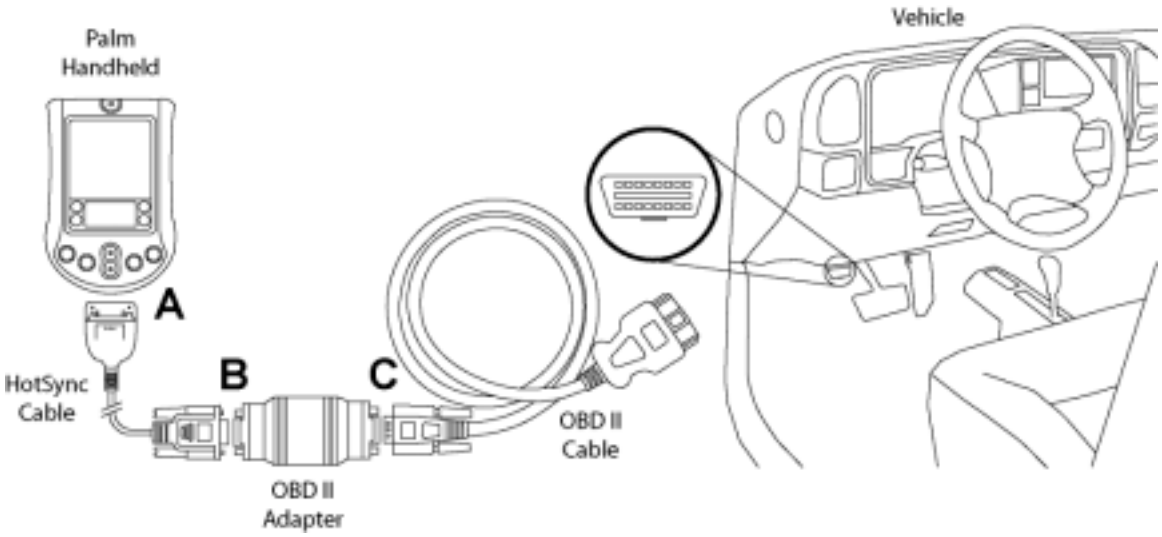


Figure 6: Dyno-Scan™ Connections

Connect the Dyno-Scan™ to your Vehicle

Locate the OBD II connector on the vehicle. OBD II compliant vehicles have the 16-pin connector located in plain sight underneath the dash near the driver's seat (see Figure 6). It may also be behind ashtrays.

Connect the male OBD II Cable connector to the vehicle's female OBD II connector. Ensure the connectors are fully engaged.

CHAPTER 4

Scan Tool Operation

The Dyno-Scan™ software is designed for easy operation. This section shows how to operate the software and describes the features on each screen.

Not every vehicle is equipped will all sensor types supported by the scan tool. Therefore, the scan tool interrogates the vehicle and creates a custom list of sensors and options unique to the vehicle connected.

Ensure the Palm, cable, and OBD II adapter do not Interfere with the vehicle controls. A cable dangling in front of the foot pedals, gear shifter, or steering wheel can interferer with vehicle operation and cause a fatal accident. Always ensure the Palm, cable, and OBD II adapter are securely fastened out of the way. If the scan tool cannot be safely attached as to not interfere with the vehicle controls, then do not drive the vehicle with the OBD II adapter connected to the vehicle.

Connect Scan Tool to Vehicle

The scan tool must be connected to the vehicle's diagnostic connector, except in demonstration mode where the vehicle data is simulated. See Demo Mode for more information about the demo mode.

1. Turn the vehicle ignition off.

2. Connect the OBD II cable to the vehicle's OBDII connector. Normally the vehicle connector is located under the dash on the driver's side in plain sight.

3. Turn the vehicle's ignition on. Vehicle does not have to be running. For engine running tests, the vehicle can be started and idling.

Do not operate the vehicle indoors. A running engine produces lethal carbon monoxide exhaust fumes that can seriously harm or kill you if inhaled. Only run the vehicle motor outdoors with proper ventilation.

Start Dyno-Scan™ Software

1. Start the Dyno-Scan™ software on the Palm by tapping the Dyno-Scan™ icon.

Figure 7: Dyno-Scan™ Icon

2. On the Connect screen, press the "Connect to Vehicle" button to connect to the vehicle. Pressing "Enter (No Connect)" enters the software without actually connecting to a vehicle. Useful to review previously recorded Scan Data files (see Record/Playback). To enable Demo mode see Demo Mode.

Figure 8: Connect Screen

3. After a few seconds, the scan tool will detect the vehicle and display the General Info screen.

Palm Built-in Help

Most Palm popup dialogs contain user help. If help is available, the dialog's upper right corner will have a letter 'i' inside a circle. Tap the 'i' for help.

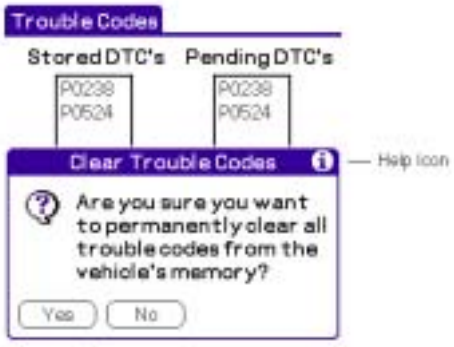


Figure 9: Help Icon

Preferences Dialog

The **Default Units of Measure** setting changes between English or Metric units. Not all sensors use English units of measure, in which case the Metric units are used.

The **Fast Sampling** option enables a faster than normal sampling frequency on some vehicles. If you notice on some vehicles that the live sensor monitoring doesn't function or the sensor measurements update sporadically, disable this feature.

With Fast Sampling enabled, the scan tool cannot target a particular vehicle computer module. To obtain live sensor data from a specific computer module, turn Fast Sampling off. For instance, if a vehicle has two computer modules, 16 and 26, and both modules monitor engine RPM. With Fast Sampling enabled, the first module to respond, either 16 or 26, with the RPM data is displayed. With Fast Sampling disabled, the software waits for the exact module selected to respond before displaying the data. This is helpful for targeting measurement problems on a specific computer module.

The **CAN 6x Communication** options enables or disables the high-speed six-samples-per-query communication mode. Normally, one sensor at a time is polled from the vehicle. If the vehicle supports CAN bus, then the vehicle may support polling up to six parameters at once speeding the transfer of data.

The **Auto-Off Timer** feature prevents the Palm from powering off when actively querying the vehicle. Only when software is communicating with the vehicle is the disable Auto-Off actually enforced. Demonstration mode never utilizes the Auto-Off feature. The Disable Auto-Off Timer option is always deactivated when the Dyno-Scan™ software is exited.

NOTE

The Auto-Off feature prevents the Palm from powering down. If left unattended the Palm battery will run down and may lose all data stored on the device.

Figure 10: Preferences Dialog

General Information Screen

The General Information screen shows general information about the vehicle's test systems. If a system test is not supported by the vehicle, the display shows a dash '-' next to the status name.

Table 2: General Information Values

Status	Purpose	Possible Values
OBD Requirement	OBD requirement to which the vehicle is designed.	OBD2 Calif OBD2 Federal OBD OBD2 OBD1 No OBD EOBD EOBD OBD2 EOBD OBD EOBD OBD OBD2 JOBD JOBD OBD2 JOBD EOBD JOBD EOBD OBD2 -
Fuel System 1 Status	Status of the vehicle's fuel system 1.	OLoop NoSat CLoop O2 OLoop Drive OLoop Fault CLoop Fault -
Fuel System 2 Status	Status of the vehicle's fuel system 2.	OLoop NoSat CLoop O2 OLoop Drive OLoop Fault CLoop Fault -
Secondary Air Status	Status of the commanded secondary air system.	Upstream Cat Dnstream Cat Atmosphere -
Auxiliary Input Status	Status of the auxiliary input.	PTO NtActive PTO Active -
Vehicle Monitor Status (all)	Status of the vehicle test monitors, either complete (C), incomplete (I), or not supported (-).	C I -

The scan tool continually queries the vehicle to display the current status of values on the General Info screen.

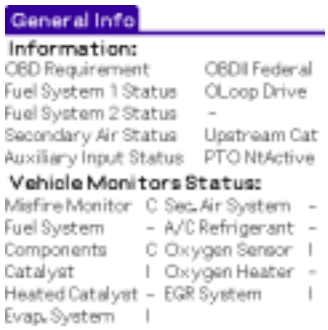


Figure 11: General Info Screen

Switching Screens

The scan tool has numerous screens. This procedure demonstrates how to switch between them.

1. Pressing the Palm's silk-screened dropdown menu button displays the dropdown menu.

Figure 12: Palm Silk-Screen Buttons

2. From the dropdown menu, any one of the other screens or options can be selected.

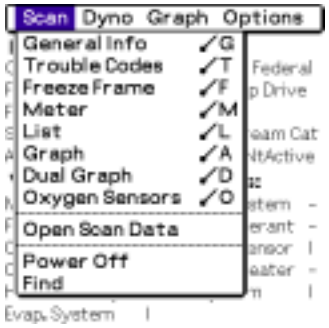


Figure 13: Dropdown Menu

3. The diagonal line and letter next to each screen name is called a shortcut. Instead of pressing the MENU button and selecting a screen from the dropdown menu, alternatively a Graffiti shortcut can be executed. In the Graffiti writing area, draw a diagonal line starting from the lower left and ending at the upper right (the shortcut command) followed by the letter of the screen. This enables quick transitions between screens.

   See your Palm documentation for more information about Graffiti and Palm shortcuts.

Trouble Codes Screen

The Trouble Codes screen shows the pending and stored Diagnostic Trouble Codes (DTC), if any. The Trouble Codes screen continually scans for new DTCs, even if some DTCs are already shown.

All DTCs are displayed within 10 to 20 seconds. If the vehicle's Check Engine or Service Engine Soon light on the instrument panel is illuminated, a Stored DTC is displayed. Pending DTCs do not necessarily indicate a faulty component/system. If the vehicles test results indicate a failure after additional driving, then the Check Engine light is illuminated and a DTC is set in the Stored DTC's column.

Version 2.5 and later requires loading separate DTC databases. These databases contain the textual code definitions for numeric trouble codes.

Two categories of trouble codes exist: Generic and enhanced. Generic codes are standardized and common to all vehicle manufacturers. Enhanced codes are not unique and may overlap with another manufacture, or even the same manufacturer. For instance, multiple definitions may exist for code P1234. Ford may define it as "Engine Oil Pressure Too Low", but Toyota's definition could mean something different like "System Voltage Unstable". The Trouble Codes screen reads and clears both generic and enhanced codes.

There are four types of trouble codes: P (Powertrain), B (Body), C (Chassis), and U (Network Communication). The scan tool reads and clears all P-codes and, depending on the vehicle, B, C, and U-codes as well[3].

1. Switch to the Trouble Codes screen as described in the section Switching Screens.

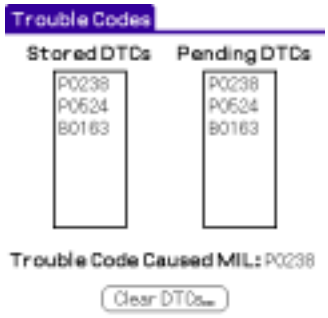


Figure 14: Trouble Codes Screen

2. If the vehicle has detected a Diagnostic Trouble Code(s) (DTC) they will be listed in either the Stored DTC's or Pending DTC's column. Not all Diagnostic Trouble Codes cause the MIL light (i.e. Check Engine) to illuminate.

   If the MIL light is on, the Diagnostic Trouble Code that caused the light to illuminate is listed after the Trouble Code Caused MIL prompt. The freeze frame will contain a snapshot of the sensor values at the time the error occurred (see Freeze Frame Screen).

3. Press the Clear DTCs... button to clear all DTCs from the vehicle's memory. Wait a few seconds after pressing Yes on the Clear Trouble Codes screen for the scan tool to complete the clear command.

4. Pressing Yes will clear the DTC from vehicle memory. Once cleared, the error codes cannot be recovered. Clearing also extinguishes the vehicle's MIL (i.e. Check Engine) light and erases the vehicle's freeze frame log. Sometimes the vehicle's ignition must be turned off and on again before the Check Engine light turns off.

[3] Not all vehicles support retrieving and clearing B, C, and U-codes.

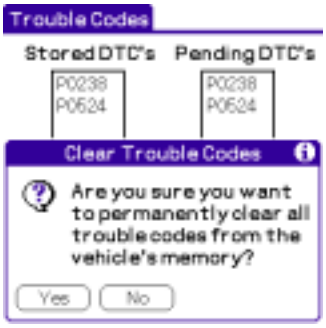


Figure 15: Clear Trouble Codes

5. Tapping a trouble code number will display the DTC Lookup dialog. This dialog will display a textual description for the numeric DTC value. The software may not contain a description for every possible trouble code. If the software cannot find a description, please refer to you vehicle's repair manual. See Diagnostic Trouble Codes for more information.

Figure 16: DTC Lookup Dialog

6. The DTC Lookup dialog searches through all installed DTC databases. If multiple DTC descriptions exist for a single code, scroll through all available definitions using the Next and Prev buttons until your vehicle make is displayed. The Vehicle and Description will automatically update as necessary when the Next/Prev buttons are pressed.

   The "1 of 1" display shows the current DTC and total DTCs respectively. For instance, "1 of 2" means the dialog is displaying the first DTC definition out of the two possible. If multiple descriptions exist for a single vehicle manufacturer, consult your vehicle's repair manual to determine which definition matches your model car.

Freeze Frame Screen

The Freeze Frame screen displays the vehicle's freeze frame log. Select the sensor's units of measure, either English or Metric, using the Preferences screen (see Preferences Dialog). When a Diagnostic Trouble Code occurs that illuminates the Check Engine light, the vehicle's computer saves the current values of the vehicle sensors at the instant the

error occurred. If a freeze frame exists, it will display within a few seconds. This screen remains blank if no freeze frame information is available from the vehicle.

1. Switch to the Freeze Frame screen as described in the section Switching Screens.

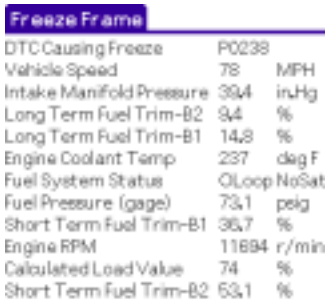


Figure 17: Freeze Frame Screen

2. Each vehicle supports a different complement of sensors. The freeze frame screen displays only sensors appropriate for the vehicle under test.

Record/Playback

The Graph, Dual Graph, List, and Meter screens can record and playback live sensor data. The Playback control is located on the upper right drop down control.

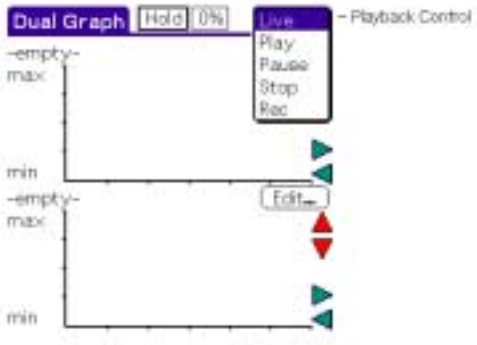


Figure 18: Playback Control

The Record/Playback settings are:

Live – display live data.

Play – playback a previously recorded file.

Pause – pause a file during playback.

Stop – stop a playing file.

Rec – start recording.

The scan tool live data screens have two modes of operation: Live and Play. When the Playback control is set to Live, all displayed parameters are live from the vehicle. If the Playback control is set to Play, Pause, Stop, or Rec the scan tool in Play mode.

The recorded data is saved in a Scan Data file. The Scan Data files are managed via the Open Scan Data dialog located on the Scan | Open Scan Data menu option.

Once a file is opened, selecting Rec from the Playback control saves the data into the currently opened file. Similarly, Play plays back the currently opened file.

New parameters must be selected while in Live mode. Once the mode has switched to Play mode, new parameters cannot be added; always switch to Live mode to add/remove parameters via the Parameter Select dialog.

A Scan Data file may be played/recorded on any of the live data screens: Graph, Dual Graph, List, and Meter. The playback speed does not have the same time-base as the original recording. Therefore, playback will be faster than when recorded.

Playback position is controlled using the Playback Position control. Tap this control to adjust the playback position; 0% is the beginning of the file and 100% is the end. During playback, the Playback Position control updates to reflect the current playback position with the file.

Figure 19: Playback Position

A Scan Data file saves the list of parameters recorded. The Parameter Select dialog shows recorded parameters in the Parameter list box and the word “Play” is displayed as the Module. The Speed buttons are hidden when in play mode. See Parameter Select Dialog for more information.

Figure 20: Parameter Select Dialog (Play Mode)

A typical Scan Data record session proceeds as follows:

1. Switch to the Meter screen as described in the section Switching Screens.
2. Ensure the Playback control is set to Live.
3. Create and open a Scan Data file by selecting Scan | Open Scan Data.
4. Press New, enter a file name, and press OK.
5. Highlight the file name within the Scan Data Files list box and press OK. A new file has been created and now open.
6. Press one of the Edit... buttons on the Meter screen to select a sensor to monitor.
7. Press OK to accept settings.
8. Press OK to start the sampling. The numeric display will update at the Speed interval selected.
9. Set the Playback control to Rec to start recording.
10. Select Stop from the Playback control after a few seconds of recording.
11. Select Play from the Playback control to playback the previously recorded file.

Scan Tool Files

The Scan Tool feature uses one storage file type:

Scan Data – stores data from the scan tool record operation.

The Scan Data files are managed using the Open Scan Data dialog. See Dyno Files for information regarding other file types.

Open Scan Data Dialog

The Scan Data files are managed using the Open Scan Data dialog. Creating, deleting, and editing of these files are performed on this screen.

Figure 21: Open Scan Data Dialog

The Scan Data Files list box shows all the files currently stored on the device, sorted alphabetically. If a file is already open, the list box will highlight the open file. A new file is created by pressing the New button. The Delete... button deletes the actively selected file. And Edit edits the files attributes.

Edit File Attributes Dialog

The Edit File Attributes screen edits a Scan Data file.

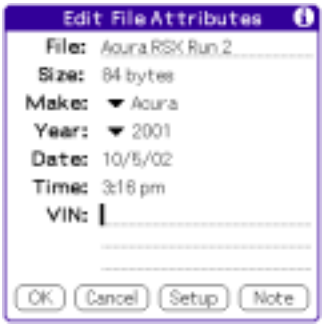


Figure 22: Edit File Attributes Dialog

The file attributes are:

File – file name.

Size – file size.

Make – make of the vehicle (e.g. Toyota).

Year – year of the vehicle (e.g. 2001).

Date –date of file creation.

Time – time of file creation.

VIN – the VIN number of the vehicle.

Setup – the Dyno setup data used when the scan data file was recorded, if any.

Note – an optional text note.

The Note button displays the text note. The VIN field is where the vehicle identification number is manually entered.

File Backup

All scan tool files are saved to the desktop computer upon HotSync. The file name on the desktop is the same name as on the Palm with the addition of three letters to designate the file type.

File Type	Appended Three Letters
Scan Data	-SD
Power Torque	-PT
Dyno Setup	-SE
Acceleration	-AC

For instance, a scan data file on the Palm named TestRun upon HotSync will save a file called TestRun-SD.pdb onto the desktop computer's hard drive in a directory called Backup.

To archive a file for a later date, copy the files from the Backup directory to a new directory. Once a copy has been made on the desktop, the file can be deleted from the Palm to free storage space. To reload the scan data file, HotSync the file onto the Palm as described in Loading Palm Software.

Parameter Select Dialog

The Dyno-Scan™ software currently supports up to 60 separate live vehicle parameters on the Meter, Graph, Dual Graph, and List screens. The Parameter Select dialog selects a parameter to monitor, record, or playback.

Not every vehicle is equipped will all sensor types and not every vehicle supports every parameter type. Therefore, the scan tool interrogates the vehicle and creates a custom, alphabetical listing of the parameters unique to the vehicle and module selected.

Some vehicles are equipped with multiple computer modules. When switching between modules using the Module popup control, the Parameter list box will refresh showing only parameters supported by the selected module.

Figure 23: Parameter Select Dialog

Module – selects a vehicle's computer module. Some vehicles have more than one computer module. See Preferences Dialog for information on how the Fast Sampling setting affects data returned from a module.

Speed – selects the sampling speed for the sensor. High samples at up to 40mS[4], Med is about 3 seconds, and Low is about every 10 seconds per sample.

Units – selects the units of measure for the sensor reading, either English or Metric.

Enabled – disables the sensor sampling when unchecked.

Parameter – selects the vehicle parameter to monitor. The list of sensors is dynamically created depending on the types of sensors supported by the vehicle. If the vehicle has more than one computer module, when the Module setting is changed the Parameter list is updated to reflect the sensors supported by that module.

Supported Parameters

The following is a list of all the live parameters supported by the software and a brief description of each parameter. Other non-live parameters, such as statuses or test results, are not listed here.

Air Flow Rate From MAF – indicates the airflow rate as measured by the mass air flow sensor.

Absolute Throttle Position – the absolute throttle position (not the relative or learned) throttle position. Usually above 0% at idle and less than 100% at full throttle.

Calculated Load Value – indicates a percentage of peak available torque. Reaches 100% at wide open throttle at any altitude or RPM for both naturally aspirated and boosted engines.

[4] Actual sampling speed is vehicle dependant.

Engine Coolant Temp – engine coolant temperature derived from an engine coolant temperature sensor or a cylinder head temperature sensor.

Engine RPM – displays the current engine revolutions per minute value.

Fuel Rail Pressure (gauge) – displays the fuel rail pressure at the engine when the reading is referenced to atmosphere (gauge pressure).

Ignition Timing Advance – ignition timing advance for #1 cylinder (not including mechanical advance).

Intake Manifold Pressure – indicates the manifold pressure derived from a Manifold Absolute Pressure sensor.

Long Term Fuel Trim-BX (up to 2) – indicates the correction being used by the fuel control system in both open and closed loop modes of operation.

O2 Sensor BX-SX (up to 8) – indicates the voltage for conventional 0 to 1V oxygen sensors. O2 sensors with a different full-scale voltage shall be normalized to this range or, if a wide range sensor, may use the wide range parameters instead.

Short Term Fuel Trim-BX (up to 2) – indicates the correction being used by the closed loop fuel algorithm. If the fuel system is open loop, 0% correction should be reported.

Time Since Engine Start – shall increment the time since the engine was started while the engine is running.

Vehicle Speed – displays the vehicle road speed.

Absolute Load Value – is the normalized value of air mass per intake stroke displayed as a percent.

Absolute Throttle Position (up to 3) – the absolute throttle position (not the relative or learned) throttle position. Usually above 0% at idle and less than 100% at full throttle.

Accelerator Pedal Position (up to 3) - the absolute pedal position (not the relative or learned) pedal position. Usually above 0% at idle and less than 100% at full throttle.

Ambient Air Temperature – displays the ambient air temperature.

Barometric Pressure – barometric pressure normally obtained from a dedicated barometric sensor. Note some whether services report barometric pressure adjusted to sea level. In these cases, the reported value may not match the displayed value.

Catalyst Temp Bank X – Sensor X (up to 4) – displays the catalyst substrate temperature.

Commanded EGR – display 0% when the EGR is commanded off, 100% when the EGR system is commanded on, and if the EGR is duty cycled somewhere between 0% and 100%.

Commanded Equivalence Ratio – fuel systems that use conventional oxygen sensor displays the commanded open loop equivalence ratio while the system is in open loop. Should report 100% when in closed loop fuel. To obtain the actual air/fuel ratio being commanded, multiply the stoichiometric A/F ratio by the equivalence ratio. For example, gasoline, stoichiometric is 14.64:1 ratio. If the fuel control system was command an equivalence ratio of 0.95, the commanded A/F ratio to the engine would be 14.64 * 0.95 = 13.9 A/F.

Commanded Evaporative Purge – displays 0% when no purge is commanded and 100% at the maximum commanded purge position/flow.

Commanded Throttle Actuator – displays 0% when the throttle is commanded closed and 100% when the throttle commanded open.

Control Module Voltage – power input to the control module. Normally the battery voltage, less any voltage drop between the battery and the control module.

Distance Since DTCs Cleared – distance accumulated since DTCs where cleared with a scan tool.

Distance Traveled While MIL On – accumulates the vehicle distance traveled while the MIL light is illuminated.

EGR Error – error as percent of actual commanded EGR. Negative percent is less than commanded and positive is more than commanded.

Evap System Vapor Pressure – evaporative system vapor pressure normally obtained from a sensor located in the fuel tank.

Fuel Level Input – indicates the nominal fuel tank liquid fill capacity as a percent of maximum.

Fuel Rail Pressure – indicates the fuel rail pressure at the engine referenced to atmosphere (gauge pressure).

Fuel Rail Pressure Rel Manifold – displays the fuel rail pressure referenced to the manifold vacuum (relative pressure).

Intake Air Temperature – displays the intake manifold air temperature.

Minutes Run with MIL On – accumulated minutes of engine run time while the MIL light is on.

O2 Sensor BX-SX Wide Range mA (up to 8) – shows milliamps for linear or wide-ratio oxygen sensors.

O2 Sensor BX-SX Wide Range V (up to 8) – shows voltage for linear or wide-ratio oxygen sensors.

Relative Throttle Position – relative or “learned” throttle position.

Time Since DTCs Cleared – accumulated time since DTCs where cleared with a scan tool.

Warm-ups Since DTCs Cleared – number of warm-up cycles since all DTCs were cleared via a scan tool. A warm-up is defined as the coolant temperature rising by at least 22°C (40°F) and the engine temperature reaches at a minimum 70°C (160°F) (60°C (140°F) for diesels).

Meter Screen

The Meter screen displays real-time sensor readings from the vehicle in large, easy-to-read numbers for viewing at a distance. Up to two sensors can be monitored simultaneously. When switching between screens, the Meter screen remembers the last sensor(s) monitored.

The Meter screen supports recording and playback of live data. See Record/Playback for more information.

1. Switch to the Meter screen as described in the section Switching Screens.

Figure 24: Meter Screen

2. Press one of the Edit... buttons to select a parameter to monitor as described in Parameter Select Dialog.

Figure 25: Parameter Select Dialog

3. Press OK to accept settings or Cancel to revert to the previous screen.

4. Pressing OK starts the parameter reading display. The numeric display will update at the Speed interval selected.

5. The horizontal bar graph shows where the current parameter reading lies in relation to the absolute minimum and maximum sensor values. This is useful to determine if a parameter is pinned high, pinned low, or somewhere in between. The parameter name and units of measure are also displayed. For oxygen sensors, an additional rich/lean percentage is shown (-100% lean to 99.2% rich).

6. Pressing Hold temporarily suspends the Live display. Pressing Hold again resumes sensor sampling.

List Screen

The List screen displays real-time sensor readings from the vehicle in a list format. Up to five sensors can be monitored simultaneously. When switching between screens, the List screen remembers the last sensor(s) monitored.

The List screen supports recording and playback of live data. See Record/Playback for more information.

1. Switch to the List screen as described in the section Switching Screens.

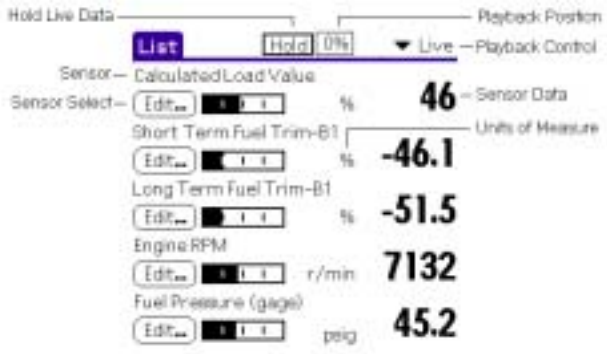


Figure 26: List Screen

2. Press one of the Edit... buttons to select a parameter to monitor as described in Parameter Select Dialog.

3. The horizontal bar graph for each sensor shows where the current sensor reading lies in relation to the absolute minimum and maximum sensor values.

4. Pressing Hold temporarily suspends the Live display. Pressing Hold again resumes sensor sampling.

Graph Screen

The Graph screen displays two real-time sensor measurements in a line graph format. When switching between screens, the Graph screen remembers the last sensors monitored.

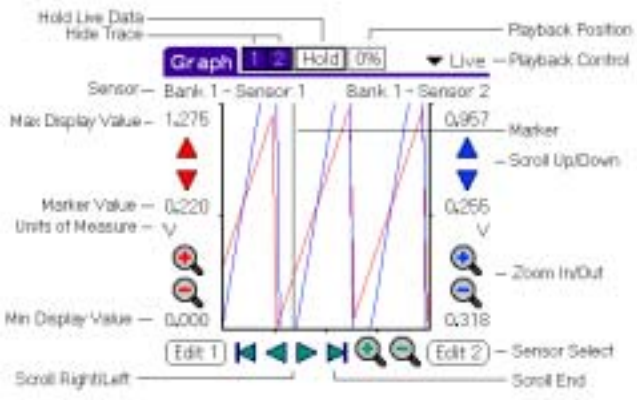


Figure 27: Graph Screen

Each line on the graph is called a trace. The Hide Trace buttons 1 and 2 toggles between showing and hiding each trace. On Palm's with a black and white display, this makes it easy to differentiate between traces.

The Zoom In and Zoom Out buttons zoom the graph in out both vertically and horizontally. Each trace can be zoomed on the vertical axis independent of the other. The horizontal axis zooms both traces together. Alternative zoom controls are located off the Graph dropdown menu (e.g. Graph | Horizontal Zoom In).

The Up Scroll and Down Scroll arrows scroll a trace up and down when zoomed in. The Scroll Right and Scroll Left buttons scroll right and left. The Scroll End buttons scroll full right and full left.

When changing vertical zoom levels, the minimum and maximum display value labels change to reflect the new range. The current sensor reading will always display the correct value irrespective of the zoom range or graphical clipping.

Data values exceeding the vertical graph limits, either high or low, will be clipped at the vertical maximum/minimum graph value.

The graph control has a virtual trace buffer that stores many pages of graph information. The scroll right and left button allow viewing all the data within the trace buffer.

TIP: The physical scroll up/down buttons on the bottom of every Palm scroll both traces in unison. If the Palm is equipped with a thumb scroll wheel, this too can vertically scroll both traces simultaneously.

Each vertical axis displays the minimum and maximum values. As the traces are scrolled and zoomed the min/max display values will update as required.

An exact measurement value for any data point along the trace can be shown using the marker, enabled by selecting Graph | Show Marker. The marker is a vertical dashed line within the graphing area. Using the Palm's stylus, drag the marker within the graph window. The data point under the marker for each axis will update as the marker is moved about the graphing area. To hide the marker, select Graph | Hide Marker.

With the marker displayed, pressing zoom in will center the horizontal axis display around the marker. This facilitates selecting a point of interest with the marker, then zooming in the horizontal axis to examine the data point.

If the Palm is equipped with a color screen, the scroll and zoom controls are color-coded: red for trace 1 and blue for trace 2.

The Sample Speed (High, Medium, or Low) for each trace must be the same on the Graph screen. The software enforces identical sample speeds.

If only a single trace is desired, use trace 1 selected via the Edit 1 button. Trace 2 cannot be used by itself.

The Graph screen supports recording and playback of live data. See Record/Playback for more information.

1. Switch to the Graph screen as described in the section Switching Screens.

2. Press the Edit 1 buttons to select a sensor to monitor. See Meter Screen for more information regarding the Parameter Select dialog.

3. Pressing Hold temporarily suspends the graphical Live display. Pressing Hold again resumes graphing.

4. Pressing the Zoom In and Zoom Out buttons zoom the traces in and out.

5. The Graph dropdown menu offers alternative horizontal and vertical zoom control for the line graphs. '1' designates trace 1 and '2' is trace 2.

6. Pressing the Scroll Right and Scroll Left buttons scroll through the trace buffer.

7. Pressing the Scroll Up and Scroll Down buttons scroll the trace up and down when zoomed in.

Dual Graph Screen

The Dual Graph screen displays two real-time sensor measurements in a line graph format. When switching between screens, the Dual Graph screen remembers the last sensors monitored.

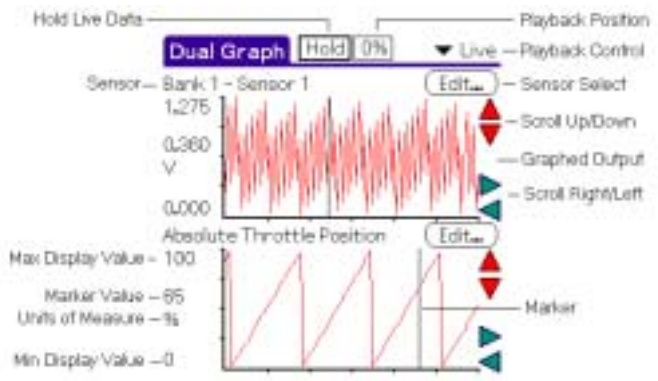


Figure 28: Dual Graph Screen

The graph controls support many features such as zoom and scroll. See Graph Screen for information on the usage of the graph controls. Unlike the Graph screen, the Sample Speed (High, Medium, or Low) for each trace can be selected independently.

The Dual Graph screen supports recording and playback of live data. See Record/Playback for more information.

1. Switch to the Dual Graph screen as described in the section Switching Screens.

2. Press one of the Edit... buttons to select a parameter to monitor as described in Parameter Select Dialog.

3. Pressing Hold temporarily suspends the graphical Live display. Pressing Hold again resumes graphing.

4. The Graph dropdown menu offers horizontal and vertical zoom control for the line graphs. '1' designates the upper graph and '2' is the lower.

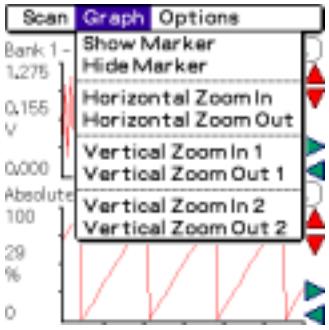


Figure 29: Graph Menu

Horizontal zoom-in/out operates the both upper and lower graphs together. Zoom-in expands the graphical output and zoom-out compresses it. Vertical zoom-in/out operates upper and lower graphs independently.

Oxygen Sensors

The Oxygen Sensor screen displays the vehicle's oxygen sensor test results. The results displayed here are computed/measured by the vehicle's on-board computer (ECU) last successful test and not the scan tool. These are not live values but instead the results of the ECU's last O2 sensor test. For live O2 sensor readings, refer to any of the live sensor screens such as Graph Screen.

For these test results to accurate, the Oxygen Sensor test on the in the Vehicle Monitor Status section within the General Information Screen should be 'C' for complete.

Not all test values are applicable to all vehicles. Therefore, the list generated will vary depending on the vehicle. In addition, not all vehicles support the Oxygen Sensors screen. If the vehicle or a particular sensor does not support this feature, the screen list will be blank.

The test values measured by the ECU correspond to certain attributes of the O2 sensor voltage over time waveform as shown in Figure 30: Oxygen Screens Screen Test Values.

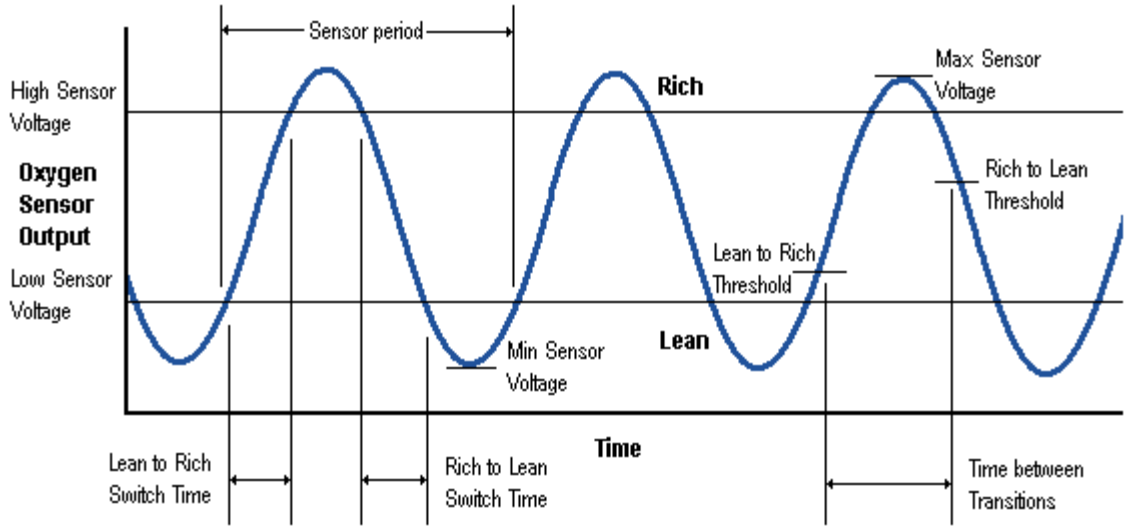


Figure 30: Oxygen Screens Screen Test Values

1. Switch to the Oxygen Sensors screen as described in the section Switching Screens.

Figure 31: Oxygen Sensors Screen

2. The Sensor Position indicates which oxygen sensor's test results are being displayed.

3. Tap any line with a note icon to display the O2 Limits screen showing the test result and test limits applied to result.

   Name – test name.

   Measured – the ECU measured test result.

   Minimum Limit – the minimum test limit for which the measured test result is compared.

   Maximum Limit – the maximum test limit for which the measured test result is compared.

Figure 32: O2 Limits Dialog

4. Pressing the Next Sensor button displays the results for the next sensor, if any. When the last sensor is reached, the display wraps around to the first sensor.

Test Results Screen

The Test Results screen shows the results for on-board diagnostic monitoring test of specific components / systems that are continuously monitored (e.g. mis-fire monitoring) and non-continuously monitored (e.g. catalyst system).

The Test Results screen displays the vehicle ECU's test results. The results displayed here are computed/measured by the vehicle's on-board computer (ECU) last successful test. These tests are performed internally by the vehicle and are not initiated by the scan tool. These are not live values but instead the results of the ECU's last test.

Not all test values are applicable to all vehicles. Therefore, the list generated will vary depending on the vehicle. In addition, only vehicles using CAN communication protocol are supported on this screen. If the vehicle or a particular sensor does not support this feature, the screen list will be blank.

Figure 33: Test Results Screen

The Test Results displays these values:

Name – a test result parameter.

Measured – the ECU measured test result

Minimum Limit - the minimum test limit for which the measured test result is compared.

Maximum Limit - the maximum test limit for which the measured test result is compared.

Vehicle Info Screen

The Vehicle Information screen shows vehicle specific information such as Vehicle Identification Number (VIN), Calibration IDs and Performance Tracking counters. Press the Note icon to display detailed information about each entry.

Not every vehicle supports this screen. If the vehicle does not support this feature, the Vehicle Info screen will remain blank.

Figure 34: Vehicle Info Screen

On-Board Tests Screen

The On-Board Tests screen shows the bi-directional controls supported by the vehicle. Bi-directional on-board tests are commands sent by the scan tool to the vehicle to perform some action.

If the vehicle does not support any bi-directional controls, the screen will remain blank. To run an on-board test, select the test to run then press the Run Selected On-Board Test. The vehicle will respond to the command with a status shown in the Status column.

Table 3: Status Messages

Status	Meaning
Complete	Indicates the vehicle completed the requested action successfully.
General Reject	Indicates that the service requested was rejected but the vehicle ECU did not specify the reason of the rejection.
Service Not Supported	Indicates that the requested action will not be taken because the vehicle ECU does not support the requested service.
Sub Function Not Supported – Invalid Format	Indicates that the requested action will not be taken because the vehicle ECU does not support the arguments of the requested message.
Busy – Repeat Request	Indicates the vehicle ECU is temporarily too busy to perform he requested operation.
Conditions Not Correct Or Request Sequence Error	Indicates that the requested action will not be taken because the vehicle ECU prerequisite conditions are not met. May also occur when sequence sensitive requests are issued in the wrong order.

Figure 35: On-Board Tests Screen

Code Search Screen

The Code Search screen provides an interactive search of diagnostic trouble codes (DTCs). Generic codes and enhanced codes have predefined numeric ranges as shown in Table 4: DTC Groupings.

Table 4: DTC Groupings

ISO/SAE Controlled (Generic)	Manufacturer Controlled (Enhanced)
P0000 to P0999	P1000 to P1999
P2000 to P2999	P3000 to P3399
P3400 to P3999	

Generic codes are applicable to all vehicle makes and models. Generic definitions are only displayed if the Generic database is selected. Enhanced codes are stored within each manufacturer's unique DTC database (e.g. Ford.pdb).

When selecting an enhanced code, use the enhanced code ranges and select a manufacturer database. For codes within the generic ranges, select the Generic database.

1. Switch to the Code Search screen as described in the section Switching Screens.

Figure 36: Code Search

2. Select a vehicle manufacturer using the Vehicle popup list. The list shows all installed vehicle DTC databases.

3. Select the code by using the up and down arrows above each number. The Description field will automatically update with each new code selected.

4. If a code cannot be located for that manufacturer, try selecting a different manufacturer. If a description cannot be located, the software recommends referring to the repair manual. Note, not every DTC number is a valid trouble code.

5. If a duplicate definition from the same vehicle manufacturer is found, right/left arrows display. Pressing the arrows traverse through all multiple definitions for the selected vehicle manufacturer. To determine which duplicate definition is applicable to your vehicle, refer to your vehicle's repair manual. It's uncommon for a DTC to have duplicate meanings by the same manufacturer. Most DTCs are unique from a given manufacturer.

Quit Application

Pressing the home silkscreen button exits the Auterra OBD II software and returns to the Palm desktop.

Figure 37: Quit Application

CHAPTER 5

Dyno Operation

The Dyno software is designed for easy operation. This section shows how to operate the Dyno features and describes the features on each screen.

Dyno operations require driving the vehicle while the Palm software records performance data. For increased safety, the software does not require user intervention during the test runs. All data is recorded for later analysis and audible tones are used to convey instructions to the user while driving.

All Dyno features are accessed via the Dyno menu bar.

Ensure the Palm, cable, and OBD II adapter do not interfere with the vehicle controls. A cable dangling in front of the foot pedals, gear shifter, or steering wheel can interferer with vehicle operation and cause a fatal accident. Always ensure the Palm, cable, and OBD II adapter are securely fastened out of the way. If the scan tool cannot be safely attached as to not interfere with the vehicle controls, then do not drive the vehicle with the OBD II adapter connected to the vehicle.

Never race or exceed the posted speed limit while on public highways. The dynamometer operations require accelerating to high speeds. Always uses a closed course raceway when performing dynamometer and acceleration tests.

Do not attempt to operate or observe the scan tool while driving a vehicle. Driving requires the full attention of the driver. Operating or observing the scan tool will cause driver distraction and could cause a fatal accident.

Theory of Operation

A dynamometer, or dyno for short, is used to measure the power produced by an engine. Up until now, automotive dynos used were either crankshaft dynamometers or chassis dynamometers.

Crankshaft dynos require the motor to be removed from the vehicle. The power is measured directly at the crankshaft, or flywheel, and is not affected by transmission and axle powertrain losses. Vehicle manufacturers spec crankshaft power on new cars and trucks.

Chassis dynos test the entire vehicle. The vehicle is tied down to a large machine and the drive wheels are placed over a rotating drum. The chassis dyno tests the entire powertrain system, not just the crankshaft power. This is a more realistic test since it measures the power delivered to the wheels, not just the crankshaft. As such, the power figures measured are always less than with a crankshaft dyno since the powertrain robs some power from the vehicle.

Clearly pulling the motor to use a crankshaft dyno is beyond most people, and chassis dynos can run $150 and hour or more to operate.

Auterra Dyno-Scan™ for Palm OS

The Auterra Dyno-Scan™ for Palm OS software is a newly developed device designed expressly for the automotive enthusiast. It uses the OBD II computer port located on all 1996 and newer automobiles to compute engine power, acceleration times, fuel economy, and more.

The Dyno-Scan™ for Palm OS is the only dyno to test the vehicle in a completely real world situation that includes powertrain losses, drag from disk brakes and wheel bearings, tire rolling resistance, etc. – everything a vehicle sees on the street.

Aerodynamic drag is compensated for within the calculations. So, whether your vehicle has the aerodynamics of a Chevy Suburban or a Porsche 911, the power calculations will correct for losses due to wind drag.

Weather conditions affect the output of an internal combustion motor. A correction factor is applied to compensate the measurements for weather conditions and elevation. The industry standard for horsepower and torque corrections is SAE J1349. The Dyno-Scan™ for Palm OS software applies this correction factor to all horsepower and torque measurements.

By applying these correction factors to the dyno results, a vehicle dyno'd in Denver on a hot day will give the same results as a chilly day in San Diego. Using the Dyno-Scan™ for Palm OS, measurements generated are comparable with one another the world over.

The dyno runs are performed in a single gear. Any gear will work, however increased accuracy is obtained if the software has an increased measurement duration. For instance, the time to accelerate from 1000 RPM to 5000 RPM in 1st gear is a shorter duration than in would be in 3rd gear. Therefore, using 2nd or 3rd gear for dyno runs offers longer test durations for greater accuracy.

Extensive comparison testing on the Dynojet chassis dynamometer has shown the Dyno-Scan™ for Palm OS to be extremely accurate.

Automatic Transmissions

All automatic transmissions are equipped with a torque converter. The torque converter slips under certain conditions, such as at low RPM and under heavy load. When the torque converter slips, the gear ratio is artificially lower and the RPM higher than if the torque converter is locked up in direct drive. At cruising speeds and low load requirements, the torque converter locks up for increased fuel economy.

Under heavy acceleration, the slippage is greatest below 3000 RPM. Above 3000 RPM the slippage is still evident but to a lesser degree.

A slipping torque converter is perfectly normal. Automatic transmissions are designed to slip, which gives them some advantages when towing a heavy load. However, this causes an anomaly known to all the chassis dynos and the Dyno-Scan™ for Palm OS.

Since the RPM is higher than normal while the torque converter is slipping below 3000 RPM, the power vs. torque graphs may display an unnaturally large swell below 3000 RPM. This swell is the torque converter multiplying the engines available torque. The swell is normal and all dynos exhibit this behavior. The power torque figures above 3000 RPM are the real numbers used for evaluation.

Figure 38: Power Torque Run Automatic Transmission

Fast Sampling

The Fast Sampling preference on the Preferences dialog must be enabled to achieve accurate dyno operation. Ensure this option is selected whenever using Dyno features.

Very old versions of the Auterra OBD II adapter may not support fast sampling on all vehicles. All Auterra adapters sold today support fast sampling on all vehicles.

Dyno Files

The Dyno features use three storage file types:

Power Torque – stores Power and Torque run data.

Acceleration – stores Acceleration run data.

Dyno Setup – stores Dyno setup variables such as vehicle weight, elevation, humidity, etc.

See Scan Tool Files and File Backup for information regarding other file types and desktop backup.

Open Power vs. Torque Run Dialog

The Power Torque files are managed using the Open Power vs. Torque Run dialog. From this dialog, Power Torque files can be created, deleted, and edited.

Figure 39: Open Power vs. Torque Run Dialog

The Power vs. Torque Files list box shows all the files currently stored on the device. If a file is already open, the list box will initially highlight the currently open file. A new file is created by pressing the New button. The Delete... button deletes the actively highlighted file. To modify the file attributes, highlight a file and press the Edit button to display the Edit File Attributes dialog. Pressing OK opens the currently selected file and dismisses the Open Power vs. Torque dialog.

Open Acceleration Run Dialog

The Acceleration files are managed using the Open Acceleration Run dialog. From this dialog, Acceleration files are created, deleted, and edited.

Figure 40: Open Acceleration Run Dialog

See Open Power vs. Torque Run Dialog for more information regarding managing files.

Edit File Attributes Dialog

The Edit File Attributes dialog edits a Power Torque or Acceleration file.

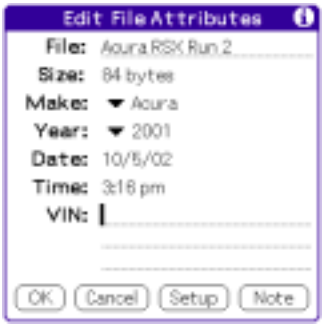


Figure 41: Edit File Attributes Dialog

File – file name.

Size – file size.

Make – make of the vehicle (e.g. Toyota).

Year – year of the vehicle (e.g. 2001).

Date –date of file creation.

Time – time of file creation.

VIN – the VIN number of the vehicle.

Note – an optional text note.

The Note button displays the text note for viewing and editing. The Setup button displays the Dyno Setup Used On Run dialog, which shows the Dyno Setup parameters used for the run.

Pressing OK saves the file attributes or Cancel discards any changes.

Dyno Setup Used On Run Dialog

The Dyno Setup Used On Run dialog shows the Dyno Setup parameters used on a run. Dyno parameters such as vehicle weight, elevation and humidity are all saved at the time the run was performed. If a run has yet to be performed, the File name field is blank and all other entries are set to default values.

Figure 42: Dyno Setup Used On Run Dialog

The parameters on this screen are not tied to the Dyno Setup file. If the user modifies the Dyno Setup file attributes, the software does not update all instances where Dyno Setup Used On Run used that file. Updating a Dyno Setup files does not affect any stored Dyno Setup Used On Run values.

See Edit Dyno Setup Dialog for information on Dyno Setup parameters.

Open Dyno Setup Dialog

The Dyno Setup files are managed using the Open Dyno Setup dialog. From this dialog Dyno Setup files are created, deleted, and edited.

Figure 43: Edit Dyno Setup Dialog

See Open Power vs. Torque Run Dialog for more information regarding managing files.

Edit Dyno Setup Dialog

The Edit Dyno Setup dialog edits the attributes within a Dyno Setup file. The file attributes are:

Figure 44; Edit Dyno Setup Dialog

File – file name.

Weight – weight of the vehicle including passengers.

Gear Ratio – the overall gear ratio of the vehicle, which includes transmission and axle.

Tire Diameter – the vehicle tire diameter.

Temp – current outside temperature.

Elevation – current elevation.

Humidity – current outside humidity.

Pressure – current outside altimeter pressure available from www.nws.noaa.gov. Altimeter pressure is different than barometric pressure.

Drag – drag coefficient of vehicle.

Frontal Area – the frontal area of the vehicle.

Note – an optional text note.

Pressing OK will save the new Dyno Setup or Cancel will discard any changes. The Note button allows entering a text note.

The software measures the gear ratio and computes the tire diameter for you. See Gear Ratio Screen for more information.

Common drag coefficients are usually in the range of 0.25 to 0.45 – the lower the number the less wind drag on the vehicle.

Frontal areas are usually in the range of 17 to 28 sq. ft – the lower the number the less frontal area. Smaller vehicles have lower frontal areas.

To get an understanding for these numbers, Table 5: Drag Coefficients and Frontal Areas list the values for different vehicle types.

Table 5: Drag Coefficients and Frontal Areas

Vehicle	Drag Coefficient	Frontal Area (sq/ft)
1999 Chevy Cavalier	0.36	21.5
2000 Ford Taurus	0.32	23.7
2000 Chevy Silverado 1500 2WD	0.45	28.0
2000 Ford Explorer	0.45	25.8
2002 Honda Insight	0.25	20.5
2002 Honda Civic Hatchback	0.36	20.5
2000 Acura Integra	0.32	20.1
2000 Volvo S40	0.32	20.9
2000 Mercedes E320	0.29	22.3
2000 Chrysler LHS	0.31	23.1

See the Auterra Vehicle Specifications document for more information on your specific vehicle make and model.

An Internet search is another good source of drag coefficients and frontal areas for your exact vehicle type.

Calculation of Frontal Area

Frontal area can be calculated for any car. The frontal area represents the front projection area of the vehicle. If one takes a picture of the front of a vehicle, it is the area included in the outline. Use the following to calculate:

1. Calculate the area of a rectangle, which would encompass the front of the vehicle (multiply width by the height).

2. Adjust the figure obtained above for areas not included, such as top rounded corners, etc. Typical adjusting values are 85 percent for cars, and 100 percent for trucks.

Gear Ratio Screen

The Gear Ratio screen measures the overall gear ratio of the vehicle and computes a tire diameter given the tire size.

Figure 45: Gear Ratio Screen

Tire Diameter

Computing a tire diameter requires entering the tire size. Most passenger car tire sizes are listed as width, ratio, and rim diameter (e.g. 205/65 R15).

Enter the tire size using the Width, Ratio, and Rim Dia drop down lists. Once entered, press the Compute Tire Diameter to calculate the tire diameter in inches.

Many large truck tire sizes are sized differently. These tires are listed as diameter, width, and rim diameter (e.g. 31x10.5 R16). In this case, the first number is used as the tire diameter, in inches (e.g. 31”), and entered directly into the Tire Diameter field.

Manufacturers are usually off very slightly from the indicated tire size. Many manufactures list the exact tire diameter on their website. If available, use the tire diameter listed on the manufacturer’s datasheet.

Measuring Overall Gear Ratio

Measuring the vehicle gear ratio involves keeping the vehicle speed steady while the software computes an overall gear ratio. The gear ratio changes with each transmission gear. Therefore, the software computes one overall gear ratio per gear ratio run (e.g. overall gear ratio for 2nd gear). The overall gear ratio is the combination of the transmission gear ratio and the final drive gear ratio.

The Status field lists the status of the gear ratio run, either:

Idle – no data is being gathered.

Countdown to Start – shows the number of seconds until data collection begins.

Collecting Data – vehicle data is being recorded.

A tire diameter must be entered in the Tire Diameter field before performing a gear ratio run. Pressing Measure Gear Ratio will start a gear ratio run.

Once a tire diameter is entered, pressing the Measure Gear Ratio button starts the 10-second countdown. During this time, get the vehicle moving in the gear the run is going to be performed in (e.g. 2nd gear). The vehicle RPM should be between 3000 and 4000

RPM for best results. Once the gear and RPM is achieved, keep the throttle steady and clutch out (if a manual transmission).

At the end of the countdown, the Palm will beep. After the beep continue to keep the throttle steady until a second beep is heard (about 10 seconds). The second beep indicates the gear ratio run is over.

Bring the vehicle to a complete stop. The measured overall gear ratio is displayed.

Calculating Overall Gear Ratio

The overall gear ratio can also be computed if the tire diameter and RPM at a speed is known. The following formula computes the overall vehicle gear ratio used by the dyno software:

overall gear ratio = RPM x tire diameter / MPH x 336

Example car:

3.57 = 3000 RPM x 26" / 65 MPH x 336

The preferred method is to use the Dyno-Scan™ to compute the overall gear ratio. If calculating, always confirm your ratio calculation is correct by performing the procedure in section Confirming Gear Ratio Result.

Confirming Gear Ratio Result

At the bottom of the Gear Ratio screen are three live values:

RPM – current measured RPM.

MPH (c) – computed MPH using only RPM and the gear ratio.

MPH (r) – real MPH measured via the vehicle's on-board computer.

MPH (c) will only display if values are entered into the Tire Diameter and Gear Ratio fields. If the computed MPH and real MPH values match throughout the RPM range then the gear ratio and tire diameter values are correct for this vehicle. If they do not match, adjust the Gear Ratio field up or down until the computed and real MPH match.

A computed verses real MPH check in a single gear might be:

1. Keep a steady speed at 2000 RPM.
2. Confirm the computed and real MPH values match.
3. Increase speed to a steady 4000 RPM.
4. Confirm the computed and real MPH values match.

Always have a passenger confirm the computed and real MPH readings match. Driving requires the full attention of the driver. Operating or observing the scan tool while driving will cause driver distraction and could cause a fatal accident.

Computing a gear ratio requires an accurate speedometer. If the vehicle's tire size is either smaller or larger than stock and the speedometer has not been recalibrated to the new wheel size, then the computed gear ratio will be incorrect. This will make the horsepower and torque figures higher or lower than expected.

Using Tire Diameter and Gear Ratio

After obtaining the tire diameter and gear ratio, the values are entered into the Gear Ratio and Tire Dia fields within a Dyno Setup file. See Edit Dyno Setup Dialog for more information.

TIP: To have multiple gear ratio setups for the same car, create a Dyno Setup files for each gear with file names like Ford1stGear, Ford2ndGear, etc.

Automatic Transmissions

The Palm software uses the gear ratio on the power torque run, which is performed under heavy acceleration. The gear ratio run, however, is performed under essentially a no-load condition where the torque converter slippage is negligible. Therefore, for automatic transmissions the measured gear ratio may have to be lowered by 5 to 15% to account for the torque converter slippage. Otherwise, the power and torque curves will show lower than expected results.

Power vs. Torque Screen

The Power vs. Torque screen analyzes power and torque data gathered from a vehicle run.

Figure 46: Power vs. Torque Screen

The power torque graph shows the relationship between horsepower/torque and engine RPM. The vertical axis 1 shows the power from 0 to 500 HP. The vertical axis 2 shows the torque from 0 to 500 torque. The horizontal axis shows the engine RPM from 1000 to 11000 RPM.

The graph control support many features such as zoom and scroll. See Graph Screen information on the usage of the graph control.

The Run button displays the Power Torque Run dialog for starting a dyno run. After a run is complete, the Stats button shows horsepower and torque statistics on the Power Torque Statistics dialog.

Previously stored Power Torque files can be viewed on the Power vs. Torque Screen by opening the file using the Open Power vs. Torque dialog located on the menu bar at Dyno | Open Power vs. Torque.

The Power Torque Run dialog is used to perform a power torque run.

Power Torque Run Dialog

The Power Torque Run dialog acquires the data from a power torque run.

Figure 47: Power Torque Run

Two files are required to perform a power torque run: a Power Torque file and a Dyno Setup file. The Power Torque file is the destination for the collected run data. The Dyno Setup file provides the operational parameters used by the software to compute horsepower and torque.

The File and Setup popup triggers are initially set to the currently open files, if any. Tap the File popup trigger to select the Power Torque file. Then tap the Setup popup trigger to select the Dyno Setup file. The Overwrite File checkbox prevents the software from asking the user to overwrite a file when the run starts. Any previous run data stored within the file is lost when overwriting a file.

The Status field shows the status of the run, either:

Idle – no data is being gathered.

Countdown to Start – shows the number of seconds until data collection begins.

Collecting Data – vehicle data is being recorded.

Performing a Power Torque Run

Before the run, ensure the Palm, HotSync cable, and OBD II adapter are securely fastened out of the way and do not interfere with vehicle operation.

Once the Power Torque file and Dyno Setup files are selected, pressing the Start Power Torque button starts the 10-second countdown.

During the countdown, get the vehicle moving in the gear the run is going to be performed in (e.g. 2nd gear). The vehicle RPM during the countdown should be relatively low, under 2000 RPM, the throttle steady, and clutch out (if a manual transmission).

At the end of the countdown, the Palm will beep. At the beep, floor the accelerator to achieve maximum acceleration.

Once maximum RPM is reached, either shift to the next higher gear or decelerate the vehicle by letting off the accelerator. Bring the vehicle to a complete stop and press the Start Power Torque button again to stop data collection.

Press the OK button to dismiss the Power Torque Run dialog and view the power/torque graph.

Power Torque Run Do's and Don'ts

For safety and the most accuracy from the Dyno software, please follow the guidelines below.

Keep your attention on driving – the software is designed to require no user intervention when a run is performed. Start the power torque run while the vehicle is stopped. During the countdown, accelerate to the correct gear and starting RPM. Audible tones signal when to accelerate the vehicle.

Consistent vehicle setup – use the same tire pressure, same number of passengers, no A/C, windows rolled up, low beams on, radio and other accessories off.

Automatic transmission – most automatic transmissions will want to downshift under hard acceleration. Experiment with higher starting RPM or roll the throttle on slowly at first to prevent a downshift.

Manual transmission – ensure the clutch is completely out when the data collection starts.

Steady throttle – do not "blip" the throttle during the countdown period. Keep the throttle and RPM steady.

Maximum throttle – keep the throttle fully floored until maximum RPM is achieved. A dip in the RPM will cause the power torque graphs to terminate early[5].

[5] Use common sense – let off the accelerator if something gets in the way of the vehicle.

Dyno setup – try to obtain current temperature, humidity, elevation, and altimeter pressure before each day of runs.

Head/Tail Wind – a windy day will skew the power/torque results higher or lower depending on the wind direction. A relatively calm day provides the best results.

Level Ground – an uphill climb will make the power/torque lower and conversely a downhill run will have higher than expected values. Level ground provides the best results.

Heat soak – repeated runs will cause the intake manifold temperature to increase. Hot air is less dense and causes a reduction in power/torque. Just note that the first run may have slightly higher values than subsequent runs if performed back-to-back.

Power Torque Statistics Dialog

The Power Torque Statistics dialog calculates the peak horsepower and torque at RPM values for the currently opened Power Torque file.

Figure 48: Power Torque Statistics Dialog

File – Power Torque file name.

Peak Power – peak horsepower output during the run.

Peak Power RPM – the RPM peak power was achieved.

Peak Torque – peak torque output during during the run.

Peak Torque RPM – the RPM peak torque was achieved.

Acceleration Screen

The Acceleration screen analyzes acceleration data gathered from a vehicle run.

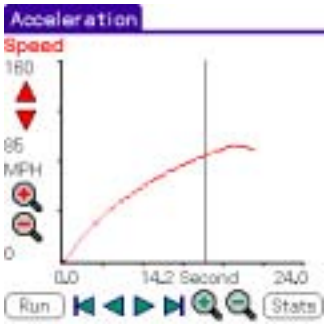


Figure 49: Acceleration Screen

The acceleration graph shows the relationship between vehicle speed over time. The vertical axis shows the vehicle speed from 0 to 160 MPH. The horizontal axis shows the time from 0 to 24 seconds.

The graph control support many features such as zoom and scroll. See Graph Screen information on the usage of the graph control.

The Acceleration Run dialog is used to perform an acceleration run.

Acceleration Run Dialog

The Acceleration Run dialog acquires the data from an acceleration run.

Figure 50: Acceleration Run Dialog

Two files are required to perform a power torque run: an Acceleration file and a Dyno Setup file. The Acceleration file is the destination for the collected run data. The Dyno Setup file provides the operational parameters used by the software to compute a 1/4-mile horsepower figure.

The File and Setup popup triggers are initially set to the currently open files, if any. Tap the File popup trigger to select the Acceleration file. Then tap the Setup popup trigger to select the Dyno Setup file. The Overwrite File checkbox prevents the software from asking the user to overwrite a file when the run starts. Any previous run data stored within the file is lost when overwriting a file.

The Status field shows the current status of the run, either:

Idle – no data is being gathered.

Waiting to Start – waiting for the vehicle to start moving.

Collecting Data – vehicle data is being recorded.

Performing an Acceleration Run

Before the run, ensure the Palm, HotSync cable, and OBD II adapter are securely fastened out of the way and do not interfere with vehicle operation.

Once the Acceleration file and Dyno Setup files are selected, press the Start Acceleration button.

The acceleration run is performed from a standing start. Once the Status field says "Waiting to Start", the Palm software is waiting for the vehicle to start accelerating. The acceleration run does not use RPM like a power torque run does. Therefore, while waiting to accelerate you may rev the motor or do whatever else you think will achieve the quickest acceleration time.

As you accelerate down the track, you may stop the acceleration run at different data points depending on the data you're trying to collect.

60 MPH – if acceleration stops after 60 MPH is reached, the 0-60 time will be computed.

1/8 mile – if acceleration stops after 1/8 mile reached, the 1/8-mile time and speed is computed.

1/4 mile – if acceleration stops after 1/4 mile reached, the 1/4-mile time and speed is computed. In addition, a 1/4-mile horsepower value is computed.

Its best to accelerate slightly beyond a data point to ensure the software captures the vehicle passing through the data point at maximum acceleration. For instance, don't let off the accelerator at exactly 60 MPH. Accelerate just beyond 60, say for a ½ second, will achieve the best results.

Bring the vehicle to a complete stop and press the Start Acceleration button again to stop data collection.

Press the OK button to dismiss the Acceleration Run dialog and view the acceleration graph.

Acceleration Run Do's and Don'ts

For safety and the most accuracy from the Dyno software, please follow the guidelines below.

Keep your attention on driving – the software is designed to require no user intervention when a run is performed.

Consistent vehicle setup – use the same tire pressure, same number of passengers, no A/C, windows rolled up, low beams on, radio and other accessories off.

Head/Tail Wind – a windy day will skew the acceleration results higher or lower depending on the wind direction. A relatively calm day provides the best results.

Level Ground – an uphill climb will make the acceleration lower and conversely a downhill run will have higher than expected values. Level ground provides the best results.

Heat soak – repeated runs will cause the intake manifold temperature to increase. Hot air is less dense and causes a reduction in power/torque. Just note that the first run may have slightly faster values than subsequent runs if performed back-to-back.

Accelerate Just Past Data Point - accelerate slightly beyond a data point (e.g. 60 MPH, 1/8 mile, or 1/4 mile) to ensure the software captures the vehicle passing through the data point at maximum acceleration

If the vehicle's tire size is either smaller or larger than stock and the speedometer has not been recalibrated to the new wheel size, then the computed acceleration figures will be incorrect. Acceleration runs require an accurate speedometer.

Acceleration Statistics

The Acceleration Statistics screen computes times and horsepower values based upon how fast the vehicle accelerates.

Figure 51: Acceleration Statistics Dialog

File – Acceleration run file name.

Top Speed – maximum speed achieved during the run.

0 to 60 Time – how fast in seconds the vehicle traveled from 0 to 60 MPH.

1/8 Mile Speed – how fast in MPH the vehicle was traveling at the 1/8-mile mark.

1/8 Mile Time – time in seconds, the vehicle traveled a 1/8-mile.

1/4 Mile Speed – how fast in MPH the vehicle was traveling at the 1/4-mile mark.

1/4 Mile Time – time in seconds, the vehicle traveled a 1/4-mile.

1/4 Mile HP – a rough calculation of horsepower based strictly on 1/4-mile time and vehicle weight.

N/A will be displayed in a column if the vehicle didn't travel far enough to compute the statistic.

Fuel Economy

The Fuel Economy screen computes instantaneous and trip MPG. Another sensor can also be monitored along with Fuel Economy.

Figure 52: Fuel Economy Screen

Pressing the Trip button toggles the Miles Per Gallon view between instantaneous mode and trip mode. When the Trip button is highlighted, the Miles Per Gallon view is displaying the trip mode. Un-highlighted the MPG display is in instantaneous mode.

The software remembers the trip MPG when switching between screens and even when the software exits. The only time the trip MPG is reset is when the Fuel Economy screen Reset button is pressed[6]. However, the trip MPG is only updated while the Fuel Economy screen is being displayed. When instantaneous mode is being viewed, the trip mode MPG is still being updated.

The instantaneous mode MPG mode is very dynamic. As the accelerator is depressed, the fuel economy will immediately drop. Coasting down hill may result in a very high MPG. A "---" indicates the MPG is higher than 99.9 MPG.

The trip mode MPG mode averages all the instantaneous readings. Over time, the trip mode MPG becomes less dynamic as more samples are averaged.

The fuel economy feature is only available on vehicles equipped with a mass airflow sensor (MAF). The Parameter Select screen has a list of sensors supported by your vehicle.

[6] Loss of Palm battery power will reset the trip mode MPG to 0.

CHAPTER 6

Demo Mode

Demonstration mode simulates all vehicle data. This mode facilitates learning about the scan tool features without connecting to a live vehicle.

Enable Demo Mode

Demo mode is enabled from the Connect screen.

1. Select the "Connect to Vehicle Demo" checkbox on the Connect screen.

Figure 53: Connect to Vehicle Demo

2. Press the "Connect to Vehicle" button. With demo mode enabled, all vehicle data is simulated – even if the scan tool is connected to a vehicle.

CHAPTER 7

PDB Export

The PDB Export Windows application converts Palm scan tool databases into a CSV file suitable for import into a spreadsheet application such as Microsoft Excel. The file format is a comma delimited file and, as such, almost any spreadsheet package should be able to import the data.

Once the data is imported into the spreadsheet, numerous data manipulations are possible such as graphing data.

The PDB Export application will run on Windows 95, 98, ME, NT, 2000, and XP.

Recorded Data

Recorded data can be a Scan Data file, Power Torque File, or an Acceleration file. During a HotSync, recorded files are copied to the desktop in a Palm directory called Backup. Usually this directory is contained under the Program Files directory. The file will have a PDB (Palm Database) extension. For instance, on one machine the Backup directory might be located at:

c:\Program Files\Sony Handheld\Dave\Backup

Presently PDB Export only reads Scan Data files.

PDB Export

The PDB Export application is a single executable: PDBExport.exe. The program does not need to be installed.

The PDB Export controls are:

Open File – opens a Palm PDB file.

Convert – converts the selected PDB file.

Close – closes the application.

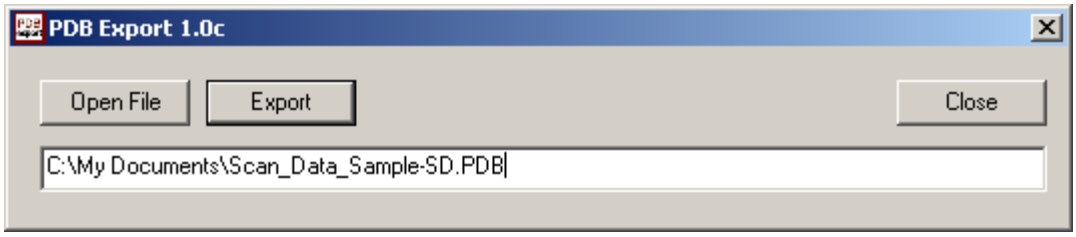


Figure 54: PDB Export

1. Start PDB Export by double clicking PDBExport.exe.
2. Press the Open File button to open a Palm PDB file.
3. Using the Open dialog find and select the PDB file to convert (e.g. TestFile.pdb).
4. Press the Convert button to convert the Palm PDB to a CSV file.
5. Using the Save As dialog, select the directory and a file name for the CSV file (e.g. TestFile.csv).
6. Open the CSV file with your spreadsheet application.

CSV File Format

The CSV file is a tabular format of data placed into rows and columns. The first row contains basic file information as saved on the Palm:

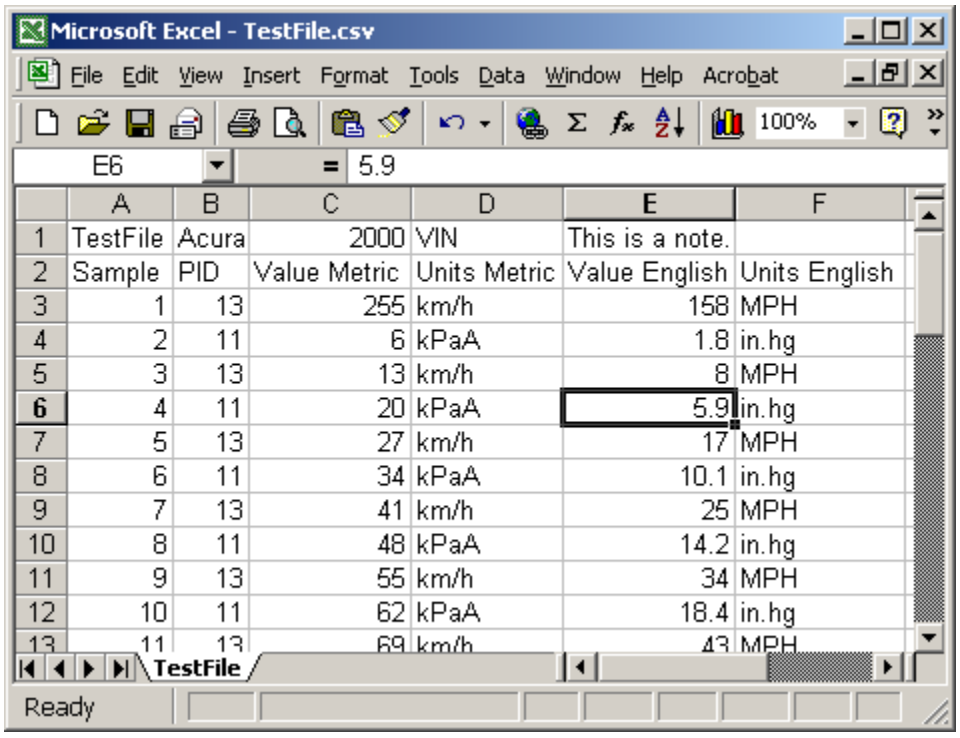
File Name – the name of the PDB file.

Make – make of the vehicle.

Year – the year of the vehicle.

VIN – the optional VIN number field.

Note – the optional note field.



	A	B	C	D	E	F
1	TestFile	Acura	2000	VIN	This is a note.	
2	Sample	PID	Value Metric	Units Metric	Value English	Units English
3	1	13	255	km/h	158	MPH
4	2	11	6	kPaA	1.8	in.hg
5	3	13	13	km/h	8	MPH
6	4	11	20	kPaA	5.9	in.hg
7	5	13	27	km/h	17	MPH
8	6	11	34	kPaA	10.1	in.hg
9	7	13	41	km/h	25	MPH
10	8	11	48	kPaA	14.2	in.hg
11	9	13	55	km/h	34	MPH
12	10	11	62	kPaA	18.4	in.hg
13	11	13	69	km/h	43	MPH

Figure 55: CSV File in Excel

The second row contains the column headings for the scan data. Metric values are always included in the CSV file, however if there is no corresponding English units of measure for a sensor then no conversion is shown.

Sample – the sample number.

PID – the sensor PID (see Table 6: PID to Parameter Mapping).

Value Metric – the sensor value in Metric units.

Units Metric – the Metric units of measure.

Value English – the sensor value in English units.

Units English – the English units of measure.

Sensor PID

A PID (parameter ID) is a numbers that corresponds to a parameter. The following table maps parameter IDs to parameters.

Table 6: PID to Parameter Mapping

PID	Parameter	PID	Parameter
4	Calculated Load Value	44	Commanded EGR
5	Engine Coolant Temp	45	EGR Error
6	Short Term Fuel Trim-B1	46	Evaporative Purge
7	Long Term Fuel Trim-B1	47	Fuel Level Input
8	Short Term Fuel Trim-B2	48	Warm-ups Since DTCs Cleared
9	Long Term Fuel Trim-B2	49	Distance Since DTCs Cleared
10	Fuel Rail Pressure (gauge)	50	Evap System Vapor Pressure
11	Intake Manifold Pressure	51	Barometric Pressure
12	Engine RPM	52	O2 Sensor B1-S1 Wide Range mA
13	Vehicle Speed	53	O2 Sensor B1-S2 Wide Range mA
14	Ignition Timing Advance	54	O2 Sensor B1-S3 Wide Range mA
15	Air Intake Temperature	55	O2 Sensor B1-S4 Wide Range mA
16	Air Flow Rate from MAF	56	O2 Sensor B2-S1 Wide Range mA
17	Absolute Throttle Position	57	O2 Sensor B2-S2 Wide Range mA
20	O2 Sensor B1–S1	58	O2 Sensor B2-S3 Wide Range mA
21	O2 Sensor B1–S2	59	O2 Sensor B2-S4 Wide Range mA
22	O2 Sensor B1–S3	60	Catalyst Temp Bank 1 – Sensor 1
23	O2 Sensor B1–S4	61	Catalyst Temp Bank 2 – Sensor 1
24	O2 Sensor B2–S1	62	Catalyst Temp Bank 1 – Sensor 2
25	O2 Sensor B2–S2	63	Catalyst Temp Bank 2 – Sensor 2
26	O2 Sensor B2–S3	66	Control Module Voltage
27	O2 Sensor B2–S4	67	Absolute Load Value
31	Time Since Engine Start	68	Commanded Equivalence Ratio
33	Distance Traveled While MIL On	69	Relative Throttle Position
34	Fuel Rail Pressure Rel Manifold	70	Ambient Air Temperature
35	Fuel Rail Pressure	71	Absolute Throttle Position B
36	O2 Sensor B1-S1 Wide Range V	72	Absolute Throttle Position C
37	O2 Sensor B1-S2 Wide Range V	73	Accelerator Pedal Position D
38	O2 Sensor B1-S3 Wide Range V	74	Accelerator Pedal Position E
39	O2 Sensor B1-S4 Wide Range V	75	Accelerator Pedal Position F
40	O2 Sensor B2-S1 Wide Range V	76	Commanded Throttle Actuator
41	O2 Sensor B2-S2 Wide Range V	77	Minutes Run with MIL On
42	O2 Sensor B2-S3 Wide Range V	78	Time Since DTCs Cleared
43	O2 Sensor B2-S4 Wide Range V		

CHAPTER 8

Troubleshooting

Troubleshooting contains solutions to common problems encountered with the scan tool.

Scan Tool Connects but No Sensor Data

If no Live data is displayed in the Meter, Graph, Dual Graph, or List screens, try the following remedies:

1. Disable the Fast Sampling option in the Options | Preferences dialog.
2. Disable the CAN 6x Communication option in the Options | Preferences dialog.
3. Ensure the Enabled checkbox is selected on the Parameter Select dialog.

No Communication (Scan Tool)

If the No Communication (Scan Tool) dialog appears, this means the Palm cannot communicate with the vehicle. Try the following remedies:

1. Ensure the vehicle ignition is turned on. Vehicle does not have to be running; however, it can be.
2. Try pressing the "Connect to Vehicle" button again.
3. Ensure the OBD II Adapter is securely plugged into the vehicle's OBD II connector.
4. Ensure the HotSync cable is securely plugged into the Palm.
5. Ensure the vehicle is OBD II compliant (see Supported Vehicles).
6. Ensure your Palm has fresh batteries, or if the Palm is rechargeable, that the batteries are fully charged. Extremely low batteries may fail to communicate reliably.
7. Ensure no vehicle fuses are blown. OBD II adapter power is derived from the vehicle and a blown fuse could prevent power from reaching the scan tool.
8. Using a Handspring handheld? The Auterra C-108 Handspring Data Cable is the only cable that will work. No other HotSync cable or cradle will operate.
9. If using a Handspring, try removing the springboard module.

No Communication (Vehicle)

If the No Communication (Vehicle) dialog appears, see No Communication (Scan Tool).

Lost Communication

If the Lost Communication dialog appears, this means the Palm initially established communication but subsequently lost it. Try the following remedies:

1. Ensure the OBD II Adapter is securely plugged into the vehicle's OBD II connector.

2. Ensure the HotSync cable is securely plugged into the Palm.

3. Ensure your Palm has fresh batteries, or if the Palm is rechargeable, that the batteries are fully charged. Extremely low batteries may fail to communicate reliably.

Incompatible OS Version

Your Palm operating system must be at version 3.0 or higher to run the Auterra software 3.0 and later. Upgrade your Palm OS or purchase a newer Palm handheld.

Auterra software version 2.5 will operate on Palm 2.0 series handhelds.

Serial Port in Use

Another application erroneously left the serial port open. Follow these steps to remedy the problem.

1. Gently press the Reset button on the back of the Palm using the end of bent paper clip. Do NOT press any other buttons when the Reset button is pressed. See your Palm documentation for more information about resetting your Palm.

2. Restart the Auterra Dyno-Scan™ for Palm OS application. The serial port should now be ready for use.

Oxygen Sensor Screen is Blank

Not all vehicles support the features provided by the Oxygen Sensor screen. If the vehicle does not support this feature, the data for the screen will be blank.

Freeze Frame Screen is Blank

If the vehicle has not detected a failure that caused the Check Engine to illuminate, the data for the Freeze Frame screen will be blank.

Clearing Codes Did Not Work or MIL Didn't Turn Off

There are a few possible causes for the check engine light not to extinguish or the DTCs to reappear on the scan tool. First, if the problem is not fixed the DTC may return immediately for problems such as misfires, open or shorted sensors, etc. Second, some vehicles can't be running when the memory is cleared. In these cases, ensure the key is on but the engine is off before attempting to clear the memory. Last, some vehicles

require, after the codes are cleared, for the ignition key to be turned off and then on again before the MIL light actually turns off.

APPENDIX A

Diagnostic Trouble Codes

A Diagnostic Trouble Code (DTC) is a 5-digit value starting with a letter.

The DTC's codes listed here are generic to all manufacturers. These generic Diagnostic Trouble Codes are those codes where industry uniformity has been achieved. However, each vehicle manufacturer may optionally create new codes beyond the generic ones. The Auterra Dyno-Scan™ for Palm OS can read these enhanced manufacturer specific codes. Code definitions are available from the Code Search Screen and Trouble Codes Screen within the Dyno-Scan Palm software.

The DTC database files included with the software incorporates thousands of more codes, both generic and enhanced, than listed here. The following listing simply provides an overview of the types of codes available.

Diagnostic Trouble Code Format Structure

The Diagnostic Trouble Code numbering follows a standardized structure. All Diagnostic Trouble Codes have a letter followed by a 4-digit number (e.g. P1234). The first letter indicates the type of code:

P = Powertrain
C = Chassis
B = Body
U = Network Communication

The remaining 4-digit number specifies the problem within that system.

P00XX Fuel and Air Metering and Auxiliary Emission Controls

P0010	"A" Camshaft Position Actuator Circuit	(Bank 1)
P0011	"A" Camshaft Position - Timing Over-Advanced or System Performance	(Bank 1)
P0012	"A" Camshaft Position - Timing Over-Retarded	(Bank 1)
P0013	"B" Camshaft Position - Actuator Circuit	(Bank 1)
P0014	"B" Camshaft Position - Timing Over-Advanced or System Performance	(Bank 1)
P0015	"B" Camshaft Position -Timing Over-Retarded	(Bank 1)
P0020	"A" Camshaft Position Actuator Circuit	(Bank 2)
P0021	"A" Camshaft Position - Timing Over-Advanced or System Performance	(Bank 2)
P0022	"A" Camshaft Position - Timing Over-Retarded	(Bank 2)
P0023	"B" Camshaft Position - Actuator Circuit	(Bank 2)
P0024	"B" Camshaft Position - Timing Over-Advanced or System Performance	(Bank 2)
P0025	"B" Camshaft Position - Timing Over-Retarded	(Bank 2)

P0030	HO_2S Heater Control Circuit	(Bank 1 Sensor 1)
P0031	HO_2S Heater Control Circuit Low	(Bank 1 Sensor 1)
P0032	HO_2S Heater Control Circuit High	(Bank 1 Sensor 1)
P0033	Turbo Charger Bypass Valve Control Circuit	
P0034	Turbo Charger Bypass Valve Control Circuit Low	
P0035	Turbo Charger Bypass Valve Control Circuit High	
P0036	HO_2S Heater Control Circuit	(Bank 1 Sensor 2)
P0037	HO_2S Heater Control Circuit Low	(Bank 1 Sensor 2)
P0038	HO_2S Heater Control Circuit High	(Bank 1 Sensor 2)
P0042	HO_2S Heater Control Circuit	(Bank 1 Sensor 3)
P0043	HO_2S Heater Control Circuit Low	(Bank 1 Sensor 3)
P0044	HO_2S Heater Control Circuit High	(Bank 1 Sensor 3)
P0050	HO_2S Heater Control Circuit	(Bank 2 Sensor 1)
P0051	HO_2S Heater Control Circuit Low	(Bank 2 Sensor 1)
P0052	HO_2S Heater Control Circuit High	(Bank 2 Sensor 1)
P0056	HO_2S Heater Control Circuit	(Bank 2 Sensor 2)
P0057	HO_2S Heater Control Circuit Low	(Bank 2 Sensor 2)
P0058	HO_2S Heater Control Circuit High	(Bank 2 Sensor 2)
P0062	HO_2S Heater Control Circuit	(Bank 2 Sensor 3)
P0063	HO_2S Heater Control Circuit Low	(Bank 2 Sensor 3)
P0064	HO_2S Heater Control Circuit High	(Bank 2 Sensor 3)
P0065	Air Assisted Injector Control Range/Performance	
P0066	Air Assisted Injector Control Circuit or Circuit Low	
P0067	Air Assisted Injector Control Circuit High	
P0070	Ambient Air Temperature Sensor Circuit	
P0071	Ambient Air Temperature Sensor Range/Performance	
P0072	Ambient Air Temperature Sensor Circuit Low Input	
P0073	Ambient Air Temperature Sensor Circuit High Input	
P0074	Ambient Air Temperature Sensor Circuit Intermittent	
P0075	Intake Valve Control Solenoid Circuit	(Bank 1)
P0076	Intake Valve Control Solenoid Circuit Low	(Bank 1)
P0077	Intake Valve Control Solenoid Circuit High	(Bank 1)
P0078	Exhaust Valve Control Solenoid Circuit	(Bank 1)
P0079	Exhaust Valve Control Solenoid Circuit Low	(Bank 1)
P0080	Exhaust Valve Control Solenoid Circuit High	(Bank 1)
P0081	Intake valve Control Solenoid Circuit	(Bank 2)
P0082	Intake Valve Control Solenoid Circuit Low	(Bank 2)
P0083	Intake Valve Control Solenoid Circuit High	(Bank 2)
P0084	Exhaust Valve Control Solenoid Circuit	(Bank 2)
P0085	Exhaust Valve Control Solenoid Circuit Low	(Bank 2)
P0086	Exhaust Valve Control Solenoid Circuit High	(Bank 2)

P01XX Fuel and Air Metering

P0100	Mass or Volume Air Flow Circuit
P0101	Mass or Volume Air Flow Circuit Range/Performance Problem
P0102	Mass or Volume Air Flow Circuit Low Input
P0103	Mass or Volume Air Flow Circuit High Input
P0104	Mass or Volume Air Flow Circuit Intermittent
P0105	Manifold Absolute Pressure/Barometric Pressure Circuit
P0106	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance Problem
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input
P0109	Manifold Absolute Pressure/Barometric Pressure Circuit Intermittent
P0110	Intake Air Temperature Circuit
P0111	Intake Air Temperature Circuit Range/Performance Problem
P0112	Intake Air Temperature Circuit Low Input

P0113	Intake Air Temperature Circuit High Input	
P0114	Intake Air Temperature Circuit Intermittent	
P0115	Engine Coolant Temperature Circuit	
P0116	Engine Coolant Temperature Circuit Range/Performance Problem	
P0117	Engine Coolant Temperature Circuit Low Input	
P0118	Engine Coolant Temperature Circuit High Input	
P0119	Engine Coolant Temperature Circuit Intermittent	
P0120	Throttle/Pedal Position Sensor/Switch A Circuit	
P0121	Throttle/Pedal Position Sensor/Switch A Circuit Range/Performance Problem	
P0122	Throttle/Pedal Position Sensor/Switch A Circuit Low Input	
P0123	Throttle/Pedal Position Sensor/Switch A Circuit High Input	
P0124	Throttle/Pedal Position Sensor/Switch A Circuit Intermittent	
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	
P0126	Insufficient Coolant Temperature for Stable Operation	
P0127	Intake Air Temperature Too High	
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	
P0130	O2 Sensor Circuit	(Bank 1 Sensor 1)
P0131	O2 Sensor Circuit Low Voltage	(Bank 1 Sensor 1)
P0132	O2 Sensor Circuit High Voltage	(Bank 1 Sensor 1)
P0133	O2 Sensor Circuit Slow Response	(Bank 1 Sensor 1)
P0134	O2 Sensor Circuit No Activity Detected	(Bank 1 Sensor 1)
P0135	O2 Sensor Heater Circuit	(Bank 1 Sensor 1)
P0136	O2 Sensor Circuit Malfunction	(Bank 1 Sensor 2)
P0137	O2 Sensor Circuit Low Voltage	(Bank 1 Sensor 2)
P0138	O2 Sensor Circuit High Voltage	(Bank 1 Sensor 2)
P0139	O2 Sensor Circuit Slow Response	(Bank 1 Sensor 2)
P0140	O2 Sensor Circuit No Activity Detected	(Bank 1 Sensor 2)
P0141	O2 Sensor Heater Circuit	(Bank 1 Sensor 2)
P0142	O2 Sensor Circuit Malfunction	(Bank 1 Sensor 3)
P0143	O2 Sensor Circuit Low Voltage	(Bank 1 Sensor 3)
P0144	O2 Sensor Circuit High Voltage	(Bank 1 Sensor 3)
P0145	O2 Sensor Circuit Slow Response	(Bank 1 Sensor 3)
P0146	O2 Sensor Circuit No Activity Detected	(Bank 1 Sensor 3)
P0147	O2 Sensor Heater Circuit	(Bank 1 Sensor 3)
P0148	Fuel Delivery Error	
P0149	Fuel Timing Error	
P0150	O2 Sensor Circuit	(Bank 2 Sensor 1)
P0151	O2 Sensor Circuit Low Voltage	(Bank 2 Sensor 1)
P0152	O2 Sensor Circuit High Voltage	(Bank 2 Sensor 1)
P0153	O2 Sensor Circuit Slow Response	(Bank 2 Sensor 1)
P0154	O2 Sensor Circuit No Activity Detected	(Bank 2 Sensor 1)
P0155	O2 Sensor Heater Circuit	(Bank 2 Sensor 1)
P0156	O2 Sensor Circuit Malfunction	(Bank 2 Sensor 2)
P0157	O2 Sensor Circuit Low Voltage	(Bank 2 Sensor 2)
P0158	O2 Sensor Circuit High Voltage	(Bank 2 Sensor 2)
P0159	O2 Sensor Circuit Slow Response	(Bank 2 Sensor 2)
P0160	O2 Sensor Circuit No Activity Detected	(Bank 2 Sensor 2)
P0161	O2 Sensor Heater Circuit	(Bank 2 Sensor 2)
P0162	O2 Sensor Circuit Malfunction	(Bank 2 Sensor 3)
P0163	O2 Sensor Circuit Low Voltage	(Bank 2 Sensor 3)
P0164	O2 Sensor Circuit High Voltage	(Bank 2 Sensor 3)
P0165	O2 Sensor Circuit Slow Response	(Bank 2 Sensor 3)
P0166	O2 Sensor Circuit No Activity Detected	(Bank 2 Sensor 3)
P0167	O2 Sensor Heater Circuit	(Bank 2 Sensor 3)
P0168	Fuel Temperature Too High	
P0169	Incorrect Fuel Composition	
P0170	Fuel Trim	(Bank 1)
P0171	System too Lean	(Bank 1)
P0172	System too Rich	(Bank 1)
P0173	Fuel Trim Malfunction	(Bank 2)

P0174	System too Lean	(Bank 2)
P0175	System too Rich	(Bank 2)
P0176	Fuel Composition Sensor Circuit	
P0177	Fuel Composition Sensor Circuit Range/Performance	
P0178	Fuel Composition Sensor Circuit Low Input	
P0179	Fuel Composition Sensor Circuit High Input	
P0180	Fuel Temperature Sensor A Circuit	
P0181	Fuel Temperature Sensor A Circuit Range/Performance	
P0182	Fuel Temperature Sensor A Circuit Low Input	
P0183	Fuel Temperature Sensor A Circuit High Input	
P0184	Fuel Temperature Sensor A Circuit Intermittent	
P0185	Fuel Temperature Sensor B Circuit	
P0186	Fuel Temperature Sensor B Circuit Range/Performance	
P0187	Fuel Temperature Sensor B Circuit Low Input	
P0188	Fuel Temperature Sensor B Circuit High Input	
P0189	Fuel Temperature Sensor B Circuit Intermittent	
P0190	Fuel Rail Pressure Sensor Circuit	
P0191	Fuel Rail Pressure Sensor Circuit Range/Performance	
P0192	Fuel Rail Pressure Sensor Circuit Low In put	
P0193	Fuel Rail Pressure Sensor Circuit High Input	
P0194	Fuel Rail Pressure Sensor Circuit Intermittent	
P0195	Engine Oil Temperature Sensor	
P0196	Engine Oil Temperature Sensor Range/Performance	
P0197	Engine Oil Temperature Sensor Low	
P0198	Engine Oil Temperature Sensor High	
P0199	Engine Oil Temperature Sensor Intermittent	

P02XX Fuel and Air Metering

P0200	Injector Circuit
P0201	Injector Circuit - Cylinder 1
P0202	Injector Circuit - Cylinder 2
P0203	Injector Circuit - Cylinder 3
P0204	Injector Circuit - Cylinder 4
P0205	Injector Circuit - Cylinder 5
P0206	Injector Circuit - Cylinder 6
P0207	Injector Circuit - Cylinder 7
P0208	Injector Circuit - Cylinder 8
P0209	Injector Circuit - Cylinder 9
P0210	Injector Circuit - Cylinder 10
P0211	Injector Circuit - Cylinder 11
P0212	Injector Circuit - Cylinder 12
P0213	Cold Start Injector 1
P0214	Cold Start Injector 2
P0215	Engine Shutoff Solenoid
P0216	Injector/Injection Timing Control Circuit
P0217	Engine Coolant Over Temperature Condition
P0218	Transmission Fluid Over Temperature Condition
P0219	Engine Over Speed Condition
P0220	Throttle/Pedal Position Sensor/Switch “B” Circuit
P0221	Throttle/Pedal Position Sensor/Switch “B” Circuit Range/Performance Problem
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low Input
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High Input
P0224	Throttle/Pedal Position Sensor/Switch “B” Circuit Intermittent
P0225	Throttle/Pedal Position Sensor/Switch “C” Circuit
P0226	Throttle/Pedal Position Sensor/Switch “C” Circuit Range/Performance Problem
P0227	Throttle/Pedal Position Sensor/Switch “C” Circuit Low Input
P0228	Throttle/Pedal Position Sensor/Switch “C” Circuit High Input
P0229	Throttle/Pedal Position Sensor/Switch “C” Circuit Intermittent
P0230	Fuel Pump Primary Circuit
P0231	Fuel Pump Secondary Circuit Low

P0232 Fuel Pump Secondary Circuit High
P0233 Fuel Pump Secondary Circuit Intermittent
P0234 Turbo/Super Charger Overboost Condition
P0235 Turbo/Super Charger Boost Sensor “A” Circuit
P0236 Turbo/Super Charger Boost Sensor “A” Circuit Range/Performance
P0237 Turbo/Super Charger Boost Sensor “A” Circuit Low
P0238 Turbo/Super Charger Boost Sensor “A” Circuit High
P0239 Turbo/Super Charger Boost Sensor “B” Circuit
P0240 Turbo/Super Charger Boost Sensor “B” Circuit Range/Performance
P0241 Turbo/Super Charger Boost Sensor “B” Circuit Low
P0242 Turbo/Super Charger Boost Sensor “B” Circuit High
P0243 Turbo/Super Charger Wastegate Solenoid “A”
P0244 Turbo/Super Charger Wastegate Solenoid “A” Range/Performance
P0245 Turbo/Super Charger Wastegate Solenoid “A” Low
P0246 Turbo/Super Charger Wastegate Solenoid “A” High
P0247 Turbo/Super Charger Wastegate Solenoid “B”
P0248 Turbo/Super Charger Wastegate Solenoid “B” Range/Performance
P0249 Turbo/Super Charger Wastegate Solenoid “B” Low
P0250 Turbo/Super Charger Wastegate Solenoid “B” High
P0251 Injection Pump Fuel Metering Control “A” (Cam/rotor/Injector)
P0252 Injection Pump Fuel Metering Control “A” Range/Performance (Cam/Rotor/Injector)
P0253 Injection Pump Fuel Metering Control “A” Low (Cam/Rotor/Injector)
P0254 Injection Pump Fuel Metering Control “A” High (Cam/Rotor/Injector)
P0255 Injection Pump Fuel Metering Control “A” Intermittent (Cam/Rotor/Injector)
P0256 Injection Pump Fuel Metering Control “B” (Cam/Rotor/Injector)
P0257 Injection Pump Fuel Metering Control “B” Range/Performance (Cam/Rotor/Injector)
P0258 Injection Pump Fuel Metering Control “B” Low (Cam/Rotor/Injector)
P0259 Injection Pump Fuel Metering Control “B” High (Cam/Rotor/Injector)
P0260 Injection Pump Fuel Metering Control “B” Intermittent (Cam/Rotor/Injector)
P0261 Cylinder 1 Injector Circuit Low
P0262 Cylinder 1 Injector Circuit High
P0263 Cylinder 1 Contribution/Balance
P0264 Cylinder 2 Injector Circuit Low
P0265 Cylinder 2 Injector Circuit High
P0266 Cylinder 2 Contribution/Balance
P0267 Cylinder 3 Injector Circuit Low
P0268 Cylinder 3 Injector Circuit High
P0269 Cylinder 4 Contribution/Balance
P0270 Cylinder 4 Injector Circuit Low
P0271 Cylinder 4 Injector Circuit High
P0272 Cylinder 4 Contribution/Balance
P0273 Cylinder 5 Injector Circuit Low
P0274 Cylinder 5 Injector Circuit High
P0275 Cylinder 5 Contribution/Balance
P0276 Cylinder 6Injector Circuit Low
P0277 Cylinder 6 Injector Circuit High
P0278 Cylinder 6 Contribution/Balance
P0279 Cylinder 7 Injector Circuit Low
P0280 Cylinder 7 Injector Circuit High
P0281 Cylinder 7 Contribution/Balance
P0282 Cylinder 8 Injector Circuit Low
P0283 Cylinder 8 Injector Circuit High
P0284 Cylinder 8 Contribution/Balance
P0285 Cylinder 9 Injector Circuit Low
P0286 Cylinder 9 Injector Circuit High
P0287 Cylinder 9 Contribution/Balance
P0288 Cylinder 10 Injector Circuit Low
P0289 Cylinder 10 Injector Circuit High
P0290 Cylinder 10 Contribution/Balance
P0291 Cylinder 11 Injector Circuit Low
P0292 Cylinder 11 Injector Circuit High
P0293 Cylinder 11 Contribution/Balance

P0294 Cylinder 12 Injector Circuit Low
P0295 Cylinder 12 Injector Circuit High
P0296 Cylinder 12 Contribution/Balance

P0298 Engine Oil Over Temperature

P03XX Ignition System or Misfire

P0300 Random/Multiple Cylinder Misfire Detected
P0301 Cylinder 1 Misfire Detected
P0302 Cylinder 2 Misfire Detected
P0303 Cylinder 3 Misfire Detected
P0304 Cylinder 4 Misfire Detected
P0305 Cylinder 5 Misfire Detected
P0306 Cylinder 6 Misfire Detected
P0307 Cylinder 7 Misfire Detected
P0308 Cylinder 8 Misfire Detected
P0309 Cylinder 9 Misfire Detected
P0310 Cylinder 10 Misfire Detected
P0311 Cylinder 11 Misfire Detected
P0312 Cylinder 12 Misfire Detected
P0313 Misfire Detected with Low Fuel
P0314 Single Cylinder Misfire (Cylinder not Specified)

P0320 Ignition/Distributor Engine Speed Input Circuit
P0321 Ignition/Distributor Engine Speed Input Circuit Range/Performance
P0322 Ignition/Distributor Engine Speed Input Circuit No Signal
P0323 Ignition/Distributor Engine Speed Input Circuit Intermittent
P0324 Knock Control System Error
P0325 Knock Sensor 1 Circuit (Bank 1 or Single Sensor)
P0326 Knock Sensor 1 Circuit Range/Performance (Bank 1 or Single Sensor)
P0327 Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)
P0328 Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)
P0329 Knock Sensor 1 Circuit Input Intermittent (Bank 1 or Single Sensor)
P0330 Knock Sensor 2 Circuit (Bank 2)
P0331 Knock Sensor 2 Circuit Range/Performance (Bank 2)
P0332 Knock Sensor 2 Circuit Low Input (Bank 2)
P0333 Knock Sensor 2 Circuit High Input (Bank 2)
P0334 Knock Sensor 2 Circuit Input Intermittent (Bank 2)
P0335 Crankshaft Position Sensor A Circuit
P0336 Crankshaft Position Sensor A Circuit Range/Performance
P0337 Crankshaft Position Sensor A Circuit Low Input
P0338 Crankshaft Position Sensor A Circuit High Input
P0339 Crankshaft Position Sensor A Circuit Intermittent
P0340 Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)
P0341 Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)
P0342 Camshaft Position Sensor “A” Circuit Low Input (Bank 1 or Single Sensor)
P0343 Camshaft Position Sensor “A” Circuit High Input (Bank 1 or Single Sensor)
P0344 Camshaft Position Sensor “A” Circuit Intermittent (Bank 1 or Single Sensor)
P0345 Camshaft Position Sensor “A” Circuit (Bank 2)
P0348 Camshaft Position Sensor “A” Circuit Range/Performance (Bank 2)
P0347 Camshaft Position Sensor “A” Circuit Low Input (Bank 2)
P0348 Camshaft Position Sensor “A” Circuit High Input (Bank 2)
P0349 Camshaft Position Sensor “A” Circuit Intermittent (Bank 2)
P0350 Ignition Coil Primary/Secondary Circuit
P0351 Ignition Coil “A” Primary/Secondary Circuit
P0352 Ignition Coil “B” Primary/Secondary Circuit
P0353 Ignition Coil “C” Primary/Secondary Circuit
P0354 Ignition Coil “D” Primary/Secondary Circuit
P0355 Ignition Coil “F” Primary/Secondary Circuit
P0356 Ignition Coil “F” Primary/Secondary Circuit
P0357 Ignition Coil “G” Primary/Secondary Circuit

P0358	Ignition Coil “H” Primary/Secondary Circuit	
P0359	Ignition Coil “I” Primary/Secondary Circuit	
P0360	Ignition Coil “J” Primary/Secondary Circuit	
P0361	Ignition Coil “K Primary/Secondary Circuit	
P0362	Ignition Coil “L’ Primary/Secondary Circuit	
P0365	Camshaft Position Sensor “B” Circuit	(Bank 1)
P0366	Camshaft Position Sensor “B” Circuit Range/Performance	(Bank 1)
P0367	Camshaft Position Sensor “B” Circuit Low Input	(Bank 1)
P0368	Camshaft Position Sensor “B” Circuit High Input	(Bank 1)
P0369	Camshaft Position Sensor “B” Circuit Intermittent	(Bank 1)
P0370	Timing Reference High Resolution Signal “A”	
P0371	Timing Reference High Resolution Signal “A” Too Many Pulses	
P0372	Timing Reference High Resolution Signal “A” Too Few Pulses	
P0373	Timing Reference High Resolution Signal “A” Intermittent/Erratic Pulses	
P0374	Timing Reference High Resolution Signal “A” No Pulse	
P0375	Timing Reference High Resolution Signal “B”	
P0376	Timing Reference High Resolution Signal “B” Too Many Pulses	
P0377	Timing Reference High Resolution Signal “B” Too Few Pulses	
P0378	Timing Reference High Resolution Signal “B” Intermittent/Erratic Pulses	
P0379	Timing Reference High Resolution Signal “B” No Pulses	
P0380	Glow Plug/Heater Circuit “A”	
P0381	Glow Plug/Heater Indicator Circuit	
P0382	Glow Plug/Heater Circuit “B”	
P0385	Crankshaft Position Sensor “B” Circuit	
P0386	Crankshaft Position Sensor “B” Circuit Range/Performance	
P0387	Crankshaft Position Sensor “B” Circuit Low Input	
P0388	Crankshaft Position Sensor “B” Circuit High Input	
P0389	Crankshaft Position Sensor “B” Circuit Intermittent	
P0390	camshaft Position Sensor “B” Circuit	
P0391	Camshaft Position Sensor “B” circuit Range/Performance	(Bank 2)
P0392	Camshaft Position Sensor “B” Circuit Low Input	(Bank 2)
P0393	Camshaft Position Sensor “B” Circuit High Input	(Bank 2)
P0394	Camshaft Position Sensor “B” Circuit Intermittent	(Bank 2)

P04XX Auxiliary Emission Controls

P0400	Exhaust Gas Recirculation Flow	
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	
P0402	Exhaust Gas Recirculation Flow Excessive Detected	
P0403	Exhaust Gas Recirculation Control Circuit	
P0404	Exhaust Gas Recirculation Control Circuit Range/Performance	
P0405	Exhaust Gas Recirculation Sensor “A” Circuit Low	
P0406	Exhaust Gas Recirculation Sensor “A” Circuit High	
P0407	Exhaust Gas Recirculation Sensor “B” Circuit Low	
P0408	Exhaust Gas Recirculation Sensor “B” Circuit High	
P0409	Exhaust Gas Recirculation Sensor “A” Circuit	
P0410	Secondary Air Injection System	
P0411	Secondary Air Injection System Incorrect Flow Detected	
P0412	Secondary Air Injection System Switching Valve “A” Circuit	
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	
P0415	Secondary Air Injection System Switching Valve “B” Circuit	
P0416	secondary Air Injection System Switching Valve “B’ Circuit Open	
P0417	secondary Air Injection System Switching Valve “B” Circuit Shorted	
P0416	Secondary Air Injection System Relay “A” Circuit	
P0419	Secondary Air injection System Relay “B” Circuit	
P0420	Catalyst System Efficiency Below Threshold	(Bank 1)
P0421	Warm Up Catalyst Efficiency Below Threshold	(Bank 1)
P0422	Main Catalyst Efficiency Below Threshold	(Bank 1)
P0423	Heated Catalyst Efficiency Below Threshold	(Bank 1)

P0424	Heated Catalyst Temperature Below Threshold	(Bank 1)
P0425	Catalyst Temperature Sensor	(Bank 1)
P0426	Catalyst Temperature Sensor Range/Performance	(Bank 1)
P0427	Catalyst Temperature Sensor Low Input	(Bank 1)
P0428	Catalyst Temperature Sensor High Input	(Bank 1)
P0429	Catalyst Heater Control Circuit	(Bank 1)
P0430	Catalyst System Efficiency Below Threshold	(Bank 2)
P0431	Warm Up Catalyst Efficiency Below Threshold	(Bank 2)
P0432	Main Catalyst Efficiency Below Threshold	(Bank 2)
P0433	Heated Catalyst Efficiency Below Threshold	(Bank 2)
P0434	Heated Catalyst Temperature Below Threshold	(Bank 2)
P0435	Catalyst Temperature Sensor	(Bank 2)
P0436	Catalyst Temperature Sensor Range/Performance	(Bank 2)
P0437	Catalyst Temperature Sensor Low Input	(Bank 2)
P0438	Catalyst Temperature Sensor High Input	(Bank 2)
P0439	Catalyst Heater Control Circuit	(Bank 2)
P0440	Evaporative Emission Control System	
P0441	Evaporative Emission Control System Incorrect Purge Flow	
P0442	Evaporative Emission Control System Leak Detected (small leak)	
P0443	Evaporative Emission Control System Purge Control Valve Circuit	
P0444	Evaporative Emission Control System Purge Control Valve Circuit Open	
P0445	Evaporative Emission Control System Purge Control Valve Circuit Shorted	
P0446	Evaporative Emission Control System Vent Control Circuit	
P0447	Evaporative Emission Control System Vent Control Circuit Open	
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	
P0449	Evaporative Emission Control System Vent Valve/Solenoid Circuit	
P0450	Evaporative Emission Control System Pressure Sensor	
P0451	Evaporative Emission Control System Pressure Sensor Range/Performance	
P0452	Evaporative Emission Control System Pressure Sensor Low Input	
P0453	Evaporative Emission Control System Pressure Sensor High input	
P0454	Evaporative Emission Control System Pressure Sensor Intermittent	
P0455	Evaporative Emission Control System Leak Detected (gross leak)	
P0456	Evaporative Emission Control System Leak Detected (very small leak)	
P0457	Evaporative Emission Control System Leak Detected (fuel cap loose/off)	
P0460	Fuel Level Sensor Circuit	
P0461	Fuel Level Sensor Circuit Range/Performance	
P0462	Fuel Level Sensor Circuit Low Input	
P0463	Fuel Level Sensor Circuit High Input	
P0464	Fuel Level Sensor Circuit Intermittent	
P0465	EVAP Purge Flow Sensor Circuit	
P0466	EVAP Purge Flow Sensor Circuit Range/Performance	
P0467	EVAP Purge Flow Sensor Circuit Low Input	
P0468	EVAP Purge Flow Sensor Circuit High Input	
P0469	EVAP Purge Flow Sensor Circuit Intermittent	
P0470	Exhaust Pressure Sensor	
P0471	Exhaust Pressure Sensor Range/Performance	
P0472	Exhaust Pressure Sensor Low	
P0473	Exhaust Pressure Sensor High	
P0474	Exhaust Pressure Sensor Intermittent	
P0475	Exhaust Pressure Control Valve	
P0476	Exhaust Pressure Control Valve Range/Performance	
P0477	Exhaust Pressure Control Valve Low	
P0478	Exhaust Pressure Control Valve High	
P0479	Exhaust Pressure Control Valve Intermittent	
P0480	Cooling Fan 1 Control Circuit	
P0481	Cooling Fan 2 Control Circuit	
P0482	Cooling Fan 3 Control Circuit	
P0483	Cooling Fan Rationality Check	
P0484	Cooling Fan Circuit Over Current	
P0485	Cooling Fan Power/Ground Circuit	
P0486	Exhaust Gas Recirculation Sensor “B” Circuit	
P0487	Exhaust Gas Recirculation Throttle Position Control Circuit	

P0488	Exhaust Gas Recirculation Throttle Position Control Range/Performance	
P0491	Secondary Air Injection System	(Bank 1)
P0492	Secondary Air Injection System	(Bank 2)

P05XX Vehicle Speed, Idle Control, and Auxiliary Inputs

P0500	Vehicle Speed Sensor	
P0501	Vehicle Speed Sensor Range/Performance	
P0502	Vehicle Speed Sensor Circuit Low Input	
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	
P0505	Idle Control System	
P0506	Idle Control System RPM Lower Than Expected	
P0507	Idle Control System RPM Higher Than Expected	
P0508	Idle Control System Circuit Low	
P0509	Idle Control System Circuit High	
P0510	Closed Throttle Position Switch	
P0512	Starter Request Circuit	
P0513	Incorrect Irnmobilizer Key (“Immobilizer pending SAE J1930 approval)	
P0515	Battery Temperature Sensor Circuit	
P0516	Battery Temperature Sensor Circuit Low	
P0517	Battery Temperature Sensor Circuit High	
P0520	Engine Oil Pressure Sensor/Switch Circuit	
P0521	Engine Oil Pressure Sensor/Switch Range/Performance	
P0522	Engine Oil Pressure Sensor/Switch Low Voltage	
P0523	Engine Oil Pressure Sensor/Switch High Voltage	
P0524	Engine Oil Pressure Too Low	
P0530	A/C Refrigerant Pressure Sensor Circuit	
P0531	A/C Refrigerant Pressure Sensor Circuit Range/Performance	
P0532	A/C Refrigerant Pressure Sensor Circuit Low Input	
P0533	A/C Refrigerant Pressure Sensor Circuit High Input	
P0534	Air Conditioner Refrigerant Charge Loss	
P0540	Intake Air Heater Circuit	
P0541	Intake Air Heater Circuit Low	
P0542	Intake Air Heater Circuit High	
P0544	Exhaust Gas Temperature Sensor Circuit	(Bank 1)
P0545	Exhaust Gas Temperature Sensor Circuit Low	(Bank 1)
P0546	Exhaust Gas Temperature Sensor Circuit High	(Bank 1)
P0547	Exhaust Gas Temperature Sensor Circuit	(Bank 2)
P0548	Exhaust Gas Temperature Sensor Circuit Low	(Bank 2)
P0549	Exhaust Gas Temperature Sensor Circuit High	(Bank 2)
P0550	Power Steering Pressure Sensor Circuit	
P0551	Power Steering Pressure Sensor Circuit Range/Performance	
P0552	Power Steering Pressure Sensor Circuit Low Input	
P0553	Power Steering Pressure Sensor Circuit High Input	
P0554	Power Steering Pressure Sensor Circuit Intermittent	
P0560	System Voltage	
P0561	System Voltage Unstable	
P0562	System Voltage Low	
P0563	System Voltage High	
P0564	Cruise Control Multi-Function Input Signal	
P0565	Cruise Control On Signal	
P0566	Cruise Control Off Signal	
P0567	Cruise Control Resume Signal	
P0568	Cruise Control Set Signal	
P0569	Cruise Control Coast Signal	
P0570	Cruise Control Accel Signal	

P0571 Cruise Control/Brake Switch A Circuit
P0572 Cruise Control/Brake Switch A Circuit Low
P0573 Cruise Control/Brake Switch A Circuit High
P0574 Cruise Control System - Vehicle Speed Too High
P0575 Cruise Control Input Circuit
P0576 Cruise Control Input Circuit Low
P0577 Cruise Control input Circuit High
P0578 through P0580 Reserved for Cruise Control Codes

P06XX Computer and Auxiliary Inputs

P0600 Serial Communication Link
P0601 Internal Control Module Memory Check Sum Error
P0602 Control Module Programming Error
P0603 Internal Control Module Keep Alive Memory (KAM) Error
P0604 Internal Control Module Random Access Memory (RAM) Error
P0605 Internal Control Module Read Only Memory (ROM) Error (Module Identification Defined by SAE J1979)

P0606 ECM/PCM Processor
P0607 Control Module Performance
P0608 Control Module VSS Output "A"
P0609 Control Module VSS Output "B"
P0610 Control Module Vehicle Options Error

P0615 Starter Relay Circuit
P0616 Starter Relay Circuit Low
P0617 Starter Relay Circuit High
P0618 Alternative Fuel Control Module KAM Error
P0619 Alternative Fuel Control Module RAM/ROM Error
P0620 Generator Control Circuit
P0621 Generator Lamp "L" Terminal Control Circuit
P0622 Generator Field "F" Terminal Control Circuit
P0623 Generator Lamp Control Circuit
P0624 Fuel Cap Lamp Control Circuit

P0630 VIN Not Programmed or Mismatch - ECM/PCM
P0631 VIN Not Programmed or Mismatch - TCM

P0635 Power Steering Control Circuit
P0836 Power Steering Control Circuit Low
P0637 Power Steering Control Circuit High
P0638 Throttle Actuator Control Range/Performance (Bank 1)
P0639 Throttle Actuator Control Range/Performance (Bank 2)
P0640 Intake Air Heater Control Circuit

P0645 A/C Clutch Relay Control Circuit
P0646 A/C Clutch Relay Control Circuit Low
P0647 A/C Clutch Relay Control Circuit High
P0648 Immobilizer Lamp Control Circuit ("Immobilizer" pending SAE J1930 approval)
P0649 Speed Control Lamp Control Circuit
P0650 Malfunction Indicator Lamp (ML) Control Circuit

P0654 Engine RPM Output Circuit
P0655 Engine Hot Lamp Output Control Circuit
P0656 Fuel Level Output Circuit

P0660 Intake Manifold Tuning Valve Control Circuit (Bank 1)
P0661 Intake Manifold Tuning Valve Control Circuit Low (Bank 1)
P0662 Intake Manifold Tuning Valve Control Circuit High (Bank 1)
P0663 Intake Manifold Tuning Valve Control Circuit (Bank 2)
P0664 Intake Manifold Tuning Valve Control Circuit Low (Bank 2)
P0665 Intake Manifold Tuning Valve Control Circuit High (Bank 2)

P07XX Transmission

P0700 Transmission Control System (MIL Request)
P0701 Transmission Control System Range/Performance
P0702 Transmission Control System Electrical
P0703 Torque Converter/Brake Switch B Circuit
P0704 Clutch Switch In put Circuit Malfunction
P0705 Transmission Range Sensor Circuit Malfunction (PRNDL Input)
P0706 Transmission Range Sensor Circuit Range/Performance
P0707 Transmission Range Sensor Circuit Low Input
P0708 Transmission Range Sensor Circuit High Input
P0709 Transmission Range Sensor Circuit intermittent
P0710 Transmission Fluid Temperature Sensor Circuit
P0711 Transmission Fluid Temperature Sensor Circuit Range/Performance
P0712 Transmission Fluid Temperature Sensor Circuit Low Input
P0713 Transmission Fluid Temperature Sensor Circuit High Input
P0714 Transmission Fluid Temperature Sensor Circuit Intermittent
P0715 Input/Turbine Speed Sensor Circuit
P0716 input/Turbine Speed Sensor Circuit Range/Performance
P0717 Input/Turbine Speed Sensor Circuit No Signal
P0718 Input/Turbine Speed Sensor Circuit Intermittent
P0719 Torque Converter/Brake Switch B Circuit Low
P0720 Output Speed Sensor Circuit
P0721 Output Speed Sensor Circuit Range/Performance
P0722 Output Speed Sensor Circuit No Signal
P0723 Output Speed Sensor Circuit Intermittent
P0724 Torque Converter/Brake Switch B Circuit High
P0725 Engine Speed Input Circuit
P0726 Engine Speed Input Circuit Range/Performance
P0727 Engine Speed Input Circuit No Signal
P0728 Engine Speed Input Circuit Intermittent
P0730 Incorrect Gear Ratio
P0731 Gear 1 Incorrect Ratio
P0732 Gear 2 Incorrect Ratio
P0733 Gear 3 Incorrect Ratio
P0734 Gear 4 Incorrect Ratio
P0735 Gear 5 Incorrect Ratio
P0736 Reverse Incorrect Ratio
P0737 TCM Engine Speed Output Circuit
P0739 TCM Engine Speed Output Circuit Low
P0739 TCM Engine Speed Output Circuit High
P0740 Torque Converter Clutch Circuit
P0741 Torque Converter Clutch Circuit Performance or Stuck Off
P0742 Torque Converter Clutch Circuit Stuck On
P0743 Torque Converter Clutch Circuit Electrical
P0744 Torque Converter Clutch Circuit Intermittent
P0745 Pressure Control Solenoid “A”
P0746 Pressure Control Solenoid “A” Performance or Stuck Off
P0747 Pressure Control Solenoid “A” Stuck On
P0748 Pressure Control Solenoid “A” Electrical
P0749 Pressure Control Solenoid “A” Intermittent
P0750 Shift Solenoid “A”
P0751 Shift Solenoid “A” Performance or Stuck Off
P0752 Shift Solenoid “A” Stuck On
P0753 Shift Solenoid “A” Electrical
P0754 Shift Solenoid “A” Intermittent
P0765 Shift Solenoid “B”
P0756 Shift Solenoid “B” Performance or Stuck Off
P0757 Shift Solenoid “B” Stuck On
P0758 Shift Solenoid “B” Electrical
P0759 Shift Solenoid “B” Intermittent
P0760 Shift Solenoid “C”

P0761 Shift Solenoid “C” Performance or Stuck Off
P0762 Shift Solenoid “C” Stuck On
P0763 Shift Solenoid “C” Electrical
P0764 Shift Solenoid “C” Intermittent
P0765 Shift Solenoid “C”
P0766 Shift Solenoid “D” Performance or Stuck Off
P0767 Shift Solenoid “D” Stuck On
P0768 Shift Solenoid “D” Electrical
P0769 Shift Solenoid “D” Intermittent
P0770 Shift Solenoid “E”
P0771 Shift Solenoid “E” Performance or Stuck Off
P0772 Shift Solenoid “E” Stuck On
P0773 Shift Solenoid “E” Electrical
P0774 Shift Solenoid “E” Intermittent
P0775 Pressure Control Solenoid “B”
P0776 Pressure Control Solenoid “B” Performance or Stuck Off
P0777 Pressure Control Solenoid “B” Stuck On
P0778 Pressure Control Solenoid “B” Electrical
P0779 Pressure Control Solenoid “B” Intermittent
P0780 Shift
P0781 1-2 Shift
P0782 2-3 Shift
P0783 3-4 Shift
P0784 4-5 Shift
P0785 Shift/Timing Solenoid
P0786 Shift/Timing Solenoid Range/Performance
P0787 Shift/Timing Solenoid Low
P0788 Shift/Timing Solenoid High
P0789 Shift/Timing Solenoid Intermittent
P0790 Normal/Performance Switch Circuit
P0791 Intermediate Shaft Speed Sensor Circuit
P0792 Intermediate Shaft Speed Sensor Circuit Range/Performance
P0793 Intermediate Shaft Speed Sensor Circuit No Signal
P0794 Intermediate Shaft Speed Sensor Circuit Intermittent
P0795 Pressure Control Solenoid “C”
P0796 Pressure Control Solenoid “C” Performance or Stuck off
P0797 Pressure Control Solenoid “C” Stuck On
P0798 Pressure Control Solenoid “C” Electrical
P0799 Pressure Control Solenoid “C” Intermittent

P08XX Transmission

P0801 Reverse Inhibit Control Circuit

P0803 1-4 Upshift (Skip Shift) Solenoid Control Circuit
P0804 1-4 Upshift (Skip Shift) Lamp Control Circuit
P0805 Clutch Position Sensor Circuit
P0806 Clutch Position Sensor Circuit Range/Performance
P0807 Clutch Position Sensor Circuit Low
P0808 Clutch Position Sensor Circuit High
P0809 Clutch Position Sensor Circuit Intermittent
P0810 Clutch Position Control Error
P0811 Excessive Clutch Slippage
P0812 Reverse Input Circuit
P0813 Reverse Output Circuit
P0814 Transmission Range Display Circuit
P0815 Upshift Switch Circuit
P0816 Downshift Switch Circuit
P0817 Starter Disable Circuit
P0818 Driveline Disconnect Switch Input Circuit

P0820 Gear Lever X-Y Position Sensor Circuit

P0821 Gear Lever X Position Circuit
P0822 Gear Lever Y Position Circuit
P0823 Gear Lever X Position Circuit Intermittent
P0824 Gear Lever Y Position Circuit Intermittent
P0825 Gear Lever Push-Pull Switch (Shift Anticipate)

P0830 Clutch Pedal Switch "A" Circuit
P0831 Clutch Pedal Switch "A" Circuit Low
P0832 Clutch Pedal Switch "A" Circuit High
P0833 Clutch Pedal Switch "B" Circuit
P0834 Clutch Pedal Switch "B" Circuit Low
P0835 Clutch Pedal Switch "B" Circuit High
P0836 Four Wheel Drive (4WD) Switch Circuit
P0837 Four Wheel Drive (4WD) Switch Circuit Range/Performance
P0838 Four Wheel Drive (4WD) Switch Circuit Low
P0839 Four Wheel Drive (4WD) Switch Circuit High
P0840 Transmission Fluid Pressure Sensor/Switch "A" Circuit
P0841 Transmission Fluid Pressure Sensor/Switch "A" Circuit Range/Performance
P0842 Transmission Fluid Pressure Sensor/Switch "A" Circuit Low
P0843 Transmission Fluid Pressure Sensor/Switch "A" Circuit High
P0844 Transmission Fluid Pressure Sensor/Switch "A" Circuit Intermittent
P0845 Transmission Fluid Pressure Sensor/Switch "B" Circuit
P0846 Transmission Fluid Pressure Sensor/Switch "B" Circuit Range/Performance
P0847 Transmission Fluid Pressure Sensor/Switch "B" Circuit Low
P0848 Transmission Fluid Pressure Sensor/Switch "B" Circuit High
P0849 Transmission Fluid Pressure Sensor/Switch "B" Circuit Intermittent

Additional Diagnostic Trouble Code Ranges

Other DTC ranges are defined for either manufacturer specific codes or under the control of SAE (Society of Automotive Engineers) and not yet defined. This section documents these additional ranges. Refer to your vehicle's repair manual for manufacturer specific Diagnostic Trouble Codes.

P09XX Transmission

P1XXX Manufacturer Controlled

P10XX Fuel and Air Metering and Auxiliary Emission Controls

P11XX Fuel and Air Metering

P12XX Fuel and Air Metering

P13XX Ignition System or Misfire

P14XX Auxiliary Emission Controls

P15XX Vehicle Speed, Idle Control, and Auxiliary Inputs

P16XX Computer and Auxiliary Outputs

P17XX Transmission

P18XX Transmission

P19XX Transmission

P2XXX SAE Controlled DTCs

P20XX Fuel and Air Metering and Auxiliary Emission Controls

P21XX Fuel and Air Metering and Auxiliary Emission Controls

P22XX Fuel and Air Metering and Auxiliary Emission Controls

P23XX Ignition System or Misfire

P24XX SAE Reserved

P25XX SAE Reserved

P26XX SAE Reserved

P27XX SAE Reserved

P28XX SAE Reserved

P29XX SAE Reserved

P3XX Manufacturer Controlled and SAE Reserved

P30XX Fuel and Air Metering and Auxiliary Emission Controls

P31XX Fuel and Air Metering and Auxiliary Emission Controls

P32XX Fuel and Air Metering and Auxiliary Emission Controls

P33XX Ignition System Misfire

P34XX SAE Reserved

P35XX SAE Reserved

P36XX SAE Reserved

P37XX SAE Reserved

P38XX SAE Reserved

P39XX SAE Reserved

APPENDIX B

Support

Technical support is offered on our products via email. Please note technical support cannot assist you in diagnosing and repairing your vehicle. Support is limited to operation of the scan tool only.

When contacting technical support please provide the following information:

- Year of Vehicle (e.g. 1997)
- Make (e.g. Chevrolet)
- Model (e.g. K1500 Pickup Extended Cab)
- Palm handheld used (e.g. Palm V)
- Problem encountered, be specific as possible. List any error messages displayed by the software.
- Version of Auterra OBD II Software (located on the Options | About menu).

Figure 56: About Dialog

Technical support is provided at: support@auterraweb.com.

APPENDIX C

Warranty Information

Auterra warranties the Dyno-Scan™ for Palm OS hardware for 1 year. Damage caused by misuse or modification is not covered.

Auterra is not responsible for damage to vehicle caused by misuse or otherwise. Auterra's sole liability is limited to the repair or replacement of the scan tool while under warranty.

30-day money back guarantee. If for any reason you are not satisfied with the Auterra Dyno-Scan™ for Palm OS, you can return it to Auterra for a refund less shipping charges. Auterra does not accept returns on Palm HotSync cables that have the packaging opened. The 30-day money back guarantee only applies to purchases made from our website. Auterra resellers have there own return policies.

The scan tool must be undamaged and contain all original packing, supplied materials, and the original receipt or packing slip. No refunds if the scan tool arrives at Auterra after 30-days. Email or write Auterra for a RMA before returning. Returns received without an RMA number will be refused.

When contacting Auterra for an RMA please provide the following information:

- Reason for returning the scan tool
- Year of Vehicle (e.g. 1997)
- Make (e.g. Chevrolet)
- Model (e.g. K1500 Pickup Extended Cab)
- Palm handheld used (e.g. Palm V)
- Problem encountered, if any.

Auterra
320 East 2nd, Suite 111
Escondido, CA 92025
ATTN: RMA Request

Or email for an RMA at: support@auterraweb.com.