Palm SpeedTracer

User Guide

Version 2.0

Limitation of Liability

Trademark References

AutoEnginuity, L.L.C.
Mesa, AZ
1-480-326-3257

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WELCOME

After buying all those aftermarket products, aren't you curious if any of them *really* improved your vehicle's performance? Maybe you're simply curious about what your vehicle is capable of? Measuring performance is as important as selecting the products that grace your vehicle. The two go hand-in-hand. With SpeedTracer, we'll help you get answers to those questions.

AutoEnginuity's SpeedTracer performs vehicle performance analyses by communicating directly with your vehicle through the OBD-II connector. It will retrieve RPM, MPH, ambient temperature, and barometric pressure. Using the weight of the vehicle, the tire circumference, and the live vehicle data, it will compute how far the vehicle has travelled in a quarter of a second. Using Newton's equation for force, SpeedTracer will use all the live and inputted data to determine the horsepower and torque. What's more, SpeedTracer uses the SAE J1349 standard for environmental variable corrections, so that these variables will no longer skew your results.

Now you can perform your dynamometer and acceleration tests at *your* leisure and on *your* schedule—without expensive hourly rates. I hope you have just as much fun using SpeedTracer as we did making it.

Jay Horak

Principal Engineer

SECTION I: Installation

Minimum Requirements

Operating System	Palm OS versions 3.5 or greater
Memory	2 MB RAM
Free Storage Space	1 MB
CD-ROM or DVD-ROM	1x Speed

SpeedTracer will NOT work on vehicles that do not report MPH and RPM through the OBDII interface.

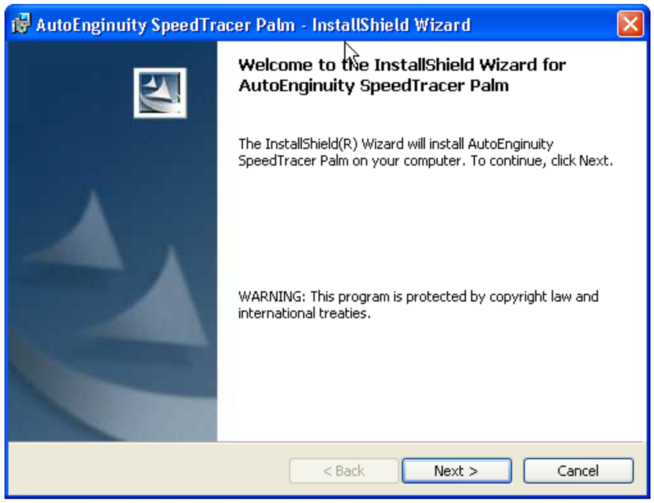
Installation Instructions

Follow the step-by-step instructions below to install AutoEnginuity's SpeedTracer onto your Palm hand-held device.

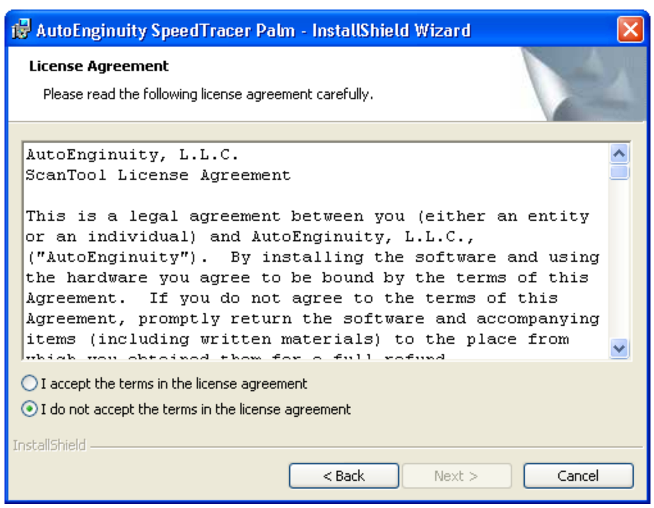
1. Place the AutoEnginuity CD-ROM into your computer's CD-ROM or DVD-ROM drive.

2. The Setup program will begin the installation process automatically. (If this doesn't happen automatically, you will be required to manually navigate to the CD-ROM or DVD-ROM drive that contains the AutoEnginuity disc, then double-click on Setup.exe.)

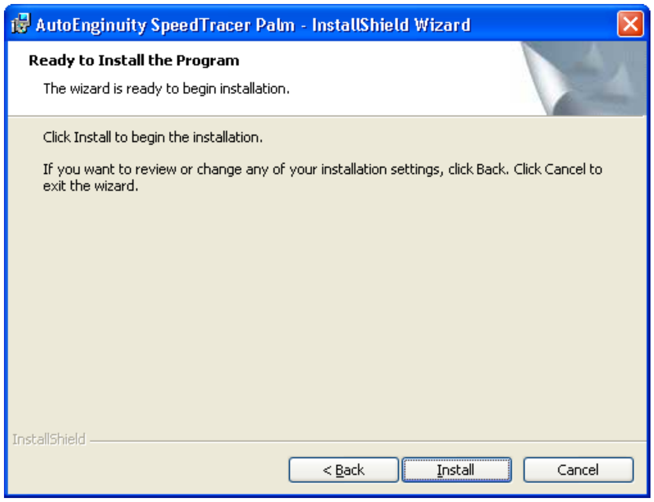
3. Select *Next* to continue the installation process.



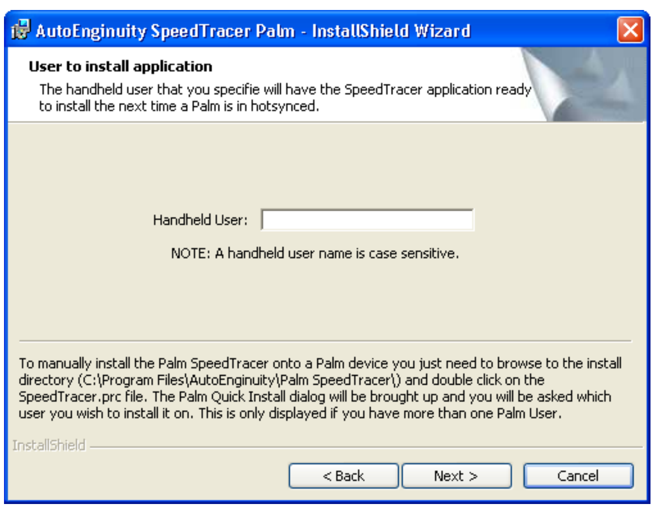
4. Carefully read the terms of the agreement. If you agree with the terms and wish to continue the installation, accept the terms of the license agreement by selecting *I accept the terms in the license agreement* and then select *Next* to continue. If you do not accept the terms of the agreement, select *Cancel* and contact AutoEnginuity to discuss the return of the product.



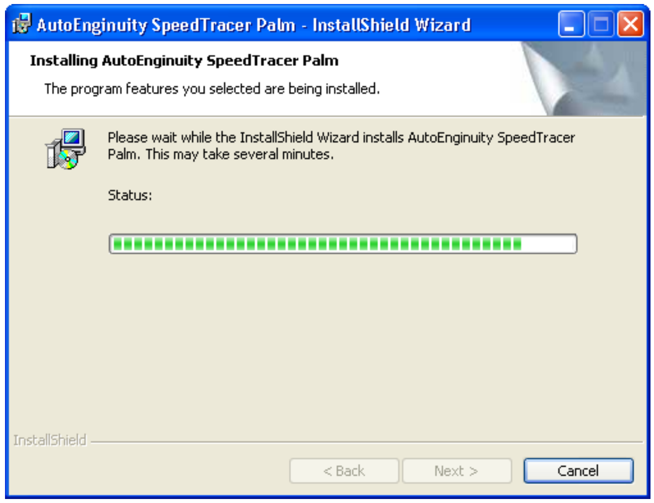
5. Select *Install* to continue the installation process.



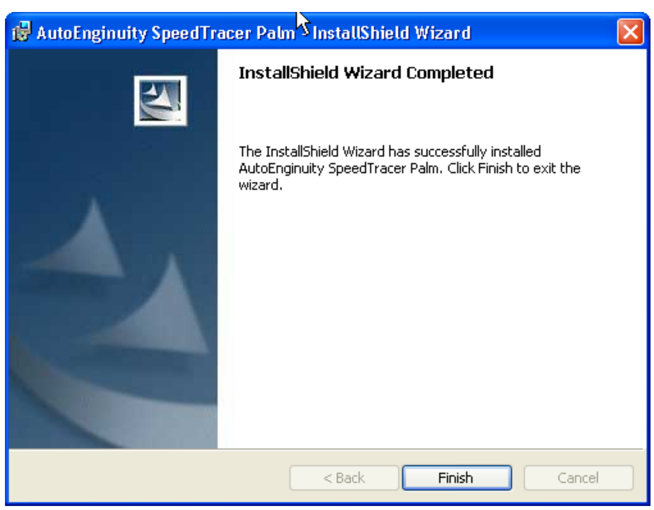
6. Identify the Handheld User so that the installation knows which user's Palm device will receive the software once the device is HotSynced.



7. The installation to the Palm will now begin.



8. Congratulations! You have successfully installed AutoEnginuity's SpeedTracer. Select *Finish* and begin using SpeedTracer.



SECTION II: Using the Software

Connecting to the Vehicle

Connecting AutoEnginuity's SpeedTracer to the vehicle is a simple process. For this you will need your AutoEnginuity OBD-II connector and the serial sync cable (not provided).

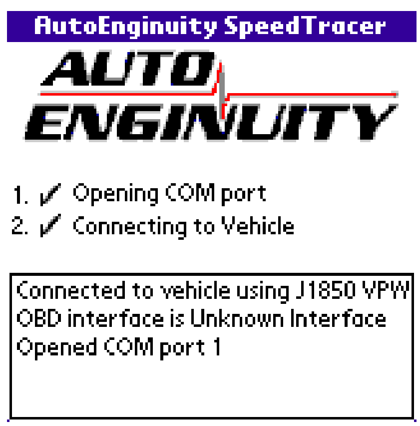
The first step is to locate the vehicle's Data Link Connector (DLC). Typically, the DLC is located in the driver's area, within reach of the driver's seat and visible by crouching (i.e., under the steering column or dash).

Exceptions to the standard location include the ashtray/console area, or in the rear seat. If you have trouble finding the DLC, see *Appendix A* or consult your vehicle's Owner's Manual for more information. The DLC is usually exposed and accessible without a tool. (Notable exceptions being BMWs, which require a flat-head screwdriver to remove a plastic cover, and MINI which hides the DLC under a cover.) Once you locate the DLC, plug the OBD-II connector firmly into it.

Next, connect the serial cable between the OBD-II connector and the computing device. Once the vehicle is physically connected to the computing device, place the key in the ignition and turn it forward to the "ON" position. Starting the motor isn't necessary at this point; however, if you have trouble getting SpeedTracer to make a connection to the vehicle, starting the vehicle can help because the alternator puts an extra ~2 Vs on the electrical bus.

Warning: Never operate a vehicle within a confined space. Vehicle emissions are dangerous. Make sure that your work area is well-ventilated.

Now you are ready to start AutoEnginuity's SpeedTracer program. The first screen that you will see is the Connection Status window. This window will be present until the vehicle has completed the "handshaking" phase of the connection process. You will see this window when your car is connecting for the first time since the software was started, or when reconnecting if the connection was lost.



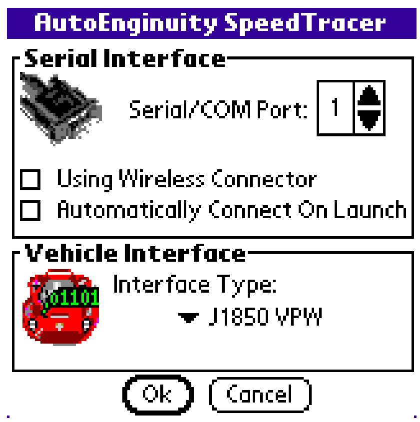
The Connection Status window will show whether or not your serial/COM port has been opened by the software, what type of vehicle interface the software is using to communicate with the vehicle, and other information regarding the vehicle interface. As each step is completed, a checkmark will appear next to it.

Be patient, the connection process can be slow.

If the Opening COM Port or Connecting to Vehicle checkmarks don't appear after thirty seconds, either your serial/COM port can't be opened, or the vehicle interface type is incorrect or cannot be discovered automatically. Open the Communications Configuration window and enter the correct settings manually. To open the Communications Configuration window, tap the AutoEnginuity logo.

Serial Interface

To manually select the serial/COM port, first determine the serial port that the OBD-II connector is connected to, then change the *COM Port* value to reflect the correct serial/COM port.



Using a Wireless Connector

The *Using Wireless Connector* option configures the software for the hardware flow control that is required for wireless communications. Select this option only if you are using a wireless connector.

Automatically Connect On Launch

The *Automatically Connect On Launch* option configures the software to connect to the vehicle upon starting the SpeedTracer software. Uncheck this option to work with SpeedTracer while not being connected to a vehicle. This option is checked by default.

Vehicle Interface Type

Selecting the correct Vehicle Interface Type depends on the make, model, and year of your vehicle. The Vehicle Interface Type drop-down menu has the following entries. Determine the correct Vehicle Interface Type and select it.

Interface Type	Manufacturer
J1850 PWM	Ford*, Lincoln, Mercury, Jaguar, Mazda, Panoz, Saleen
J1850 VPW	Buick, Cadillac, Chevrolet, GM, Isuzu, and Saturn
ISO 9141-2	Asian (Acura, Honda, Infinity, Lexus, Nissan, Toyota*, etc.), European (Audi, BMW, Mercedes, MINI, Porsche, etc.), and Chrysler, Dodge, and Eagle vehicles
KWP2000	Daewoo, Hyundai, KIA, some Mercedes
CAN	All 2004 BMW, Ford, Jaguar, Mazda, and Mercedes and some Nissan and Toyota
*Exceptions	2000+ Neon, ’96-’97 Toyota, all Celica, Supra Turbo ’96-’99, and some Jeeps use J1850 VPW; ’96, ’97 Probe 2.5L, ’96 Tracer 1.8L, ’96 Escort 1.8L, Triumph, Geo, Catera, ’97 Paseo use ISO 9141-2

Using HeartBeat

The *Use HeartBeat* option sends a request through the vehicle bus at a regular interval if there are no other communications. This is used to determine if a connection is lost. It is selected by default. Should you run into an issue with a vehicle that loses its connection after a brief period of time, try selecting or deselecting this setting.

When both the serial/COM port and Vehicle Interface Type have been correctly selected, press *OK*. If the settings are correct, the Connection Status window will check each of the connection steps, the connection will finalize, and the window will disappear.

The Connection Status window will enumerate the settings used to make the connection and the general data returned from the vehicle.

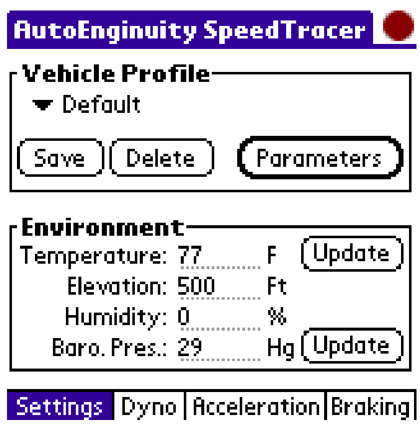
If the Connection Status window doesn't disappear, re-check your connection settings.

Some vehicles (Mercedes for example) will require the key to be placed in the "OFF" position and then back into the "ON" position if a disconnect, happens for any reason.

Using the Software

Settings

The Settings window is used to input the variables required for the performance analysis computations. All of the variables have default entries. The environmental variables use the SAE defaults. The more accurate these entries are, the more accurate your results will be. The Settings window is divided into two parts: 1) vehicle variables (known as vehicle profiles); and, 2) environmental variables.



Vehicle Profiles

Vehicle Profiles are a convenient way to store and retrieve specific vehicle information required for performance analysis. Some vehicle profiles are included with the software and more will be added as time goes on. We encourage our users to send their vehicle's profile to us. We constantly update the software and all new vehicle profiles received and validated, will be included in the next release.

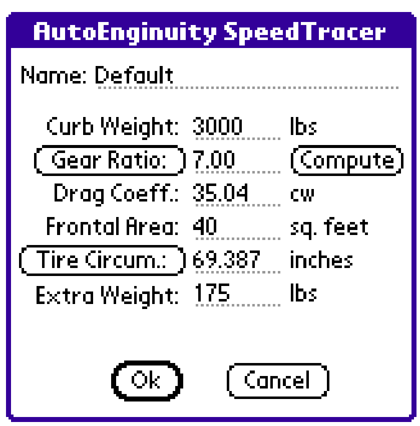
Vehicle Profiles can be created and deleted at your convenience. To create a vehicle profile simply enter the name of your new profile and tap the *Save* button. All of the vehicle's profile variables will be saved under the profile name. It is always good practice to start from an existing vehicle profile, make changes to suit your vehicle, and then append additional descriptive information in the profile name. Example: Mazda Rx8 ’04 (With CAI and Exhaust).

Deleting a vehicle profile can be performed by selecting the profile and tapping the *Delete* button. The vehicle profile will be deleted from the Vehicle Profile drop-down list and the Default profile will become the current profile.

Note: The Default vehicle profile cannot be deleted.

To change to a different vehicle profile, select the Vehicle Profile drop-down, then select a profile. Once a vehicle profile is selected, all the variables in the Settings window will be changed (except Environmental Variables) to reflect the new vehicle’s profile.

The variables specific to the Vehicle Profile group (weight, gear ratio, frontal area, and tire circumference) are required for performance analysis. To change these parameters, tap the *Parameters* button.



Weight

Weight is the vehicle's standing gross weight in pounds. You can retrieve this information from the manufacturers' specifications or from the driver's side door jam. The Vehicle Profiles that are included with the software come from manufacturers' specifications and are generally accurate except for optional equipment weight. The sticker on the driver's side door is the most accurate source, short of putting the vehicle on a scale. Also, the sticker will include the weight of the optional equipment.

Curb Weight

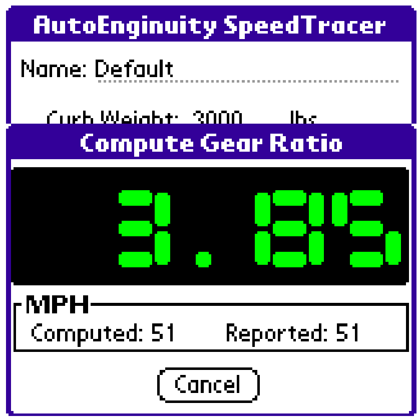
Curb weight is the vehicle's weight in pounds. You can retrieve the curb weight of the vehicle from the manufacturer's specifications, the owner's manual, and/or from the driver's side door jamb. The Vehicle Profiles that are included with the software come from manufacturers' specifications and are generally accurate except for optional equipment weight. The sticker on the driver's side door is the most accurate source—short of putting the vehicle on a scale. Also, the sticker will include the weight of the optional equipment.

Gear Ratio

Gear Ratio is the total gear reduction value that you will be using in the performance analysis. In the Dyno performance analysis, the longer the sampling period, the more accurate the results will be. Selecting too low of a gear will make it difficult to get an accurate measurement; too high will require the vehicle to travel at extremely high speeds. Typically, dynamometer testing is done in third gear. The operating speeds of the vehicle in this gear are reasonable, and the gearing allows for a long enough operating duration to be accurate.

You can enter the Gear Ratio manually or you can have it computed for you. To have this final value calculated, enter the gear ratio of your working gear and the final drive ratio in the respective Gear Ratio Variable edit fields. The final gear ratio will be calculated and the Gear Ratio edit field will be updated accordingly.

To have the gear ratio computed, tap the *Compute* button next to Gear Ratio while driving in the gear you will use for dynamometer testing. Drive the vehicle steady and without changing gears or drastic changes in speed. While driving, the gear ratio will be computed for you. This can take several seconds.



The currently computed gear ratio is reported at the top of the window. This value will slowly change. The Computed MPH on the left-hand side is the MPH that is computed from both the RPMs and the tire circumference. This value will slowly change to reflect the true MPH of the vehicle. The Reported MPH, is what the vehicle reports as its current speed.

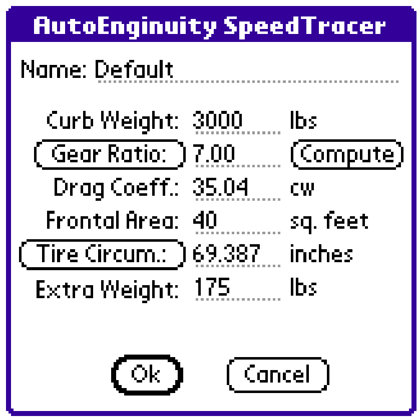
If you feel the Computed MPH and Reported MPH are close enough, and not changing, you can close the Compute Gear Ratio window and manually enter the value; otherwise, after thirty seconds this process will complete automatically.

Note: Tire wear and inflation can slightly affect the gear ratio computation. Be sure the tires are properly inflated to the vehicle manufacturer's specifications. See the driver's side door jamb or owner's manual for the correct tire pressures.

Drag Coefficient

Drag Coefficient is how much an object resists being moved through the air. This is used to compute the drag forces acting on the vehicle during the performance analysis. Low coefficients indicate low air resistance. The best source for this information is the manufacturer's specifications. A typical drag coefficient value for a passenger car is between .30 and .40.

Note: Since the drag coefficient is a percentage, it is not necessary to enter the decimal place. It is always assumed to be in the same position.



Frontal Area

Frontal area represents the forward facing projection area of the vehicle. This is used to compute the drag forces acting on the vehicle during the performance analysis. Frontal area is the width and height of the vehicle in square feet. The best source for this information is the manufacturer's specifications. Use the following to compute frontal area:

1. Measure the distance in feet from one side of the vehicle to the other. Do not include the mirrors in the measurement.
2. Multiply the measured width by the height of the lowest leading edge of the vehicle's front facia. Do not include the tires, or start from the ground. We won't be operating at speeds where this will be factored in.

The software will correct that value by reducing it 15% for round leading edges. A truck's frontal area is usually more vertical than a car's and requires less reduction. **In the case that your test**

vehicle is a truck, please add 10% to your final computation to account for the automatic reduction.

Tire Circumference

Tire Circumference is the circumference of the tire in inches. You can compute this by entering the tire width, ratio, and the wheel size. Once these values are entered, the Tire Circumference field will update with the final value. If you already know the tire circumference value, you can enter it directly.

Extra Weight

Extra Weight is used to account for the weight of the optional equipment and/or all occupants of the vehicle during the performance analysis. This is a convenient way of keeping your original manufacturer's curb weight specifications.

Gear Ratio Variables

Gear Ratio variables are used only to calculate the Gear Ratio that is used in the performance analysis. You are not required to enter working gear ratio or final drive ratio if you already know the final Gear Ratio.

To calculate a Gear Ratio, enter the ratio for the transmission gear that you will use in your peformance test in the Working Gear edit field. Usually this is 3rd or 4th gear. Now that you have entered the working gearing, enter the rear end drive ratio (sometimes called the differential gear or final drive) for the vehicle.

Once the working gear and the final drive values are entered, tap on another item on the screen to allow the software to see that you are done. If all of the values are within range, the Gear Ratio on the Vehilce Profile window will be the final value used in the performance analysis.

Tire Circumference Variables

The Tire Circumference Variables are the variables required to compute the Tire Circumference on the Vehicle Profile window. This is optional if you already know the tire circumference in inches.

Width is the tire width in centimeters. On the side wall of the tire will be a value, typically 175 - 325. A typical tire label might show the values 225/40/17. The first value is the tire width.

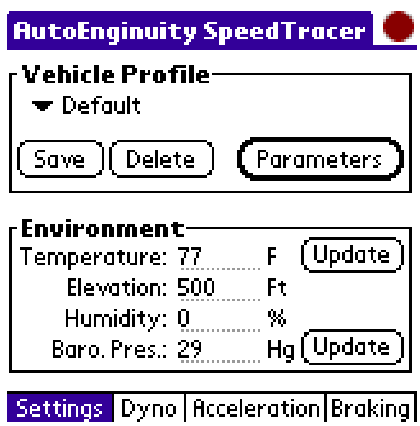
Aspect Ratio is the sectional width of the tire. This is a ratio between the width of the tire and the height of the side wall, from the wheel to the top of the tire. Using the previous example of 225/40/17, 40 would be the aspect ratio of the tire.

The Wheel Size is the diameter of the wheel in inches. Again, using the previous example of 225/40/17, 17 would be the size of the wheel.

Environmental Variables

The Environmental Variables are used to correct the performance analysis results against the current weather conditions. Using the SAE J1349 standard, we can set a baseline for dynamometer testing that will reduce or remove the variations introduced by air pressure, humidity, and temperature.

All of the environmental variables can be found on weather web sites or in your local newspaper.



Temperature should reflect the local ambient temperature of the area that the performance analysis will be performed in. If your vehicle supports reporting the ambient temperature, the temperature value will be set automatically. Alternately, if the ambient temperature sensor is not available and the intake air temperature is, it is used. The value reported from the ambient temperature or intake air temperature sensors might not reflect the correct outside temperature because the temperature sensor's locations are usually in the engine compartment. A "heat soaked" motor or having cold metal parts will skew the readings. The best time for performance analysis is predicated by this value. The colder the air, the better. The SAE baseline for this value is 77.

Temperature is only sampled automatically from the vehicle at the start of the SpeedTracer program. To manually update the temperature, tap the *Update* button in the temperature area. Also, updating while the vehicle is moving prevents motor heat from skewing the results.

Elevation is used to correct for air pressure. The higher the elevation, the less air pressure and the tougher time your vehicle will have producing power. The baseline elevation is sea level.

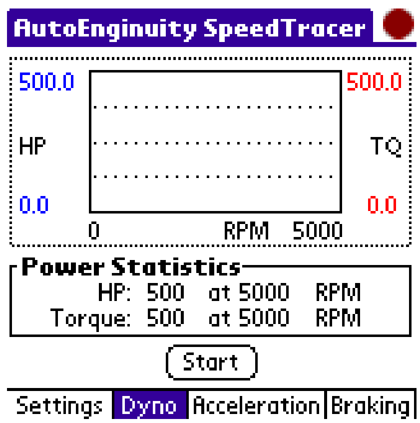
Humidty is the amount of moisture in the air. The SAE baseline for this value is 0.

Barometric pressure is the air pressure of the atmosphere. If your vehicle supports reporting the barometric pressure, this value will be set automatically. The SAE baseline for this value is 29.235.

Barometric pressure is only sampled automatically from the vehicle at the start of the SpeedTracer program. To manually update the barometric pressure, tap the *Update* button in the barometric pressure area.

Dyno

Dyno allows you to run horsepower and torque analyses on your vehicle. This feature simulates the results of hooking your engine or vehicle to a dynamometer. All resulting data is SAE corrected to remove the effects of air pressure and local weather conditions.



The two most common methods of performing a dynamometer measurement on a vehicle engine are: 1) the crankshaft; and, 2) the chassis methods.

The crankshaft method requires the motor to be removed from the vehicle and attached directly to the dynamometer. This method is the most costly and the results do not account for any powertrain loss. For the latter reason, manufacturers prefer to use it to measure their horsepower ratings.

The chassis method is done by securing the vehicle to a roller assembly. The driven wheels are tested directly by the dynamometer. This method will report the results that are truly being put out at the contact patch of the driven wheels. This will include the reductions from the entire powertrain's frictional loss.

SpeedTracer will perform its dynamometer testing using a chassis technique called a "rolling dynamometer." This method is similiar to a standard chassis dynamometer, but because the vehicle will be in motion, the effects of rolling resistance and drag forces will be added to the powertrain's frictional loss. The results of a rolling chassis dynamometer are called "net wheel" horsepower and torque ratings. Net wheel horsepower and torque ratings will be less than a typical chassis dynamometer because of the additional opposing forces.

How accurate will the "rolling dynamometer" method be? Very accurate. A lot of variables are involved and the results will vary from run to run. After all, you are measuring a mechanical process that is very susceptible to environmental inputs. To make your results accurate and consistent:

- Perform the test on flat and even surfaces.
- Turn off all vehicle accessories (radio, air conditioning, etc.). These are distractions as much as they are parasitic to the vehicle's performance.
- Use the same total weight for each test.
- Wind can influence the air resistance your vehicle experiences. Sixty miles-per-hour winds can reduce horsepower by as much as twenty horsepower.

Before you can begin, all of your vehicle's settings must be entered in the Settings window. They are required for the mathematical computations.

No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times.

Pay attention to your driving and your vehicle. Do not exceed your, or your vehicle's, ability. A passenger should be enlisted to observe the performance analysis if necessary.

Begin by placing your vehicle in gear. Which gear you choose is very important to the results. If the gear is too low, it will be difficult to get an accurate measurement; too high will require the vehicle to travel at extremely high speeds. Typically, dynamometer testing is done in third gear because the operating speeds of the vehicle in this gear are reasonable and the gearing allows for a long enough operating duration to be accurate. The longer the analysis, the more accurate the results will be.

Automatic Transmissions

If you have an automatic transmission, place the vehicle in a single gear (e.g., 2nd or 3rd). Accelerate the vehicle until it has shifted through to that final gear. Now you can continue to follow the remaining instructions. Keep in mind that upshifting will completely skew the results

Line the vehicle up with a clear path for at least 1/2 mile. (Remember: you still have to stop.) Accelerate the vehicle to the start of its powerband; typically this is around 2500 RPMs. (In the case of automatic transmissions, this should be higher than the torque convertor’s stall speed.)

Torque Convertor Slippage with Automatic Transmissions

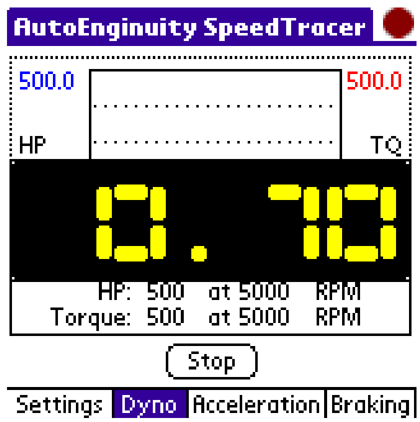
The torque convertor serves the same purpose as the clutch in a manual transmission. The torque convertor's job is to replace the clutch. Using hydraulics, a spinning impeller pushes hydraulic fluid against the turbine. The turbine is connected to the output shaft of the transmission. If the vehicle's brakes are applied, the turbine stops, but the impeller continues to spin. Once the brakes are released, the turbine will spin as fast as the impeller can push hydraulic fluid through it.

Using hydraulic fluids allows for no direct connection between the impeller and the turbine. Because the turbine requires the impeller to force hydraulic fluid to drive it, the frictional loss will allow the impeller to always rotate faster. This is what is known as "slippage." To prevent slippage from never allowing the vehicle to move, a stall speed is designed into all torque convertors. Typically the stall speed is below the RPM where the vehicle makes most of its power. For example, on a Ford Mustang the stall speed of the torque convertor is 1800 RPMs, and its powerband starts around 3200 RPMs.

The stall speed is the point at which, if the vehicle isn't moving at that rated RPM, it will either begin to move or the engine RPMs will stop increasing. When this happens the dynamometer results will be skewed.

To properly perform dynamometer tests on your vehicle with an automatic transmission, begin your dynamometer run above your vehicle's rated stall speed. If you don't know your vehicle's stall speed, begin your dynamometer testing above 2500 RPMs or where the powerband begins.

Tap the *Start* button, or press the spacebar, and wait for the count down to reach zero. The counter will change colors from red to yellow to green during the count down.



Audible beeps will denote the count down status; one audible beep for each second before reaching zero. The performance analysis begins when the counter reaches zero, changes color to green, and a third beep eminates.

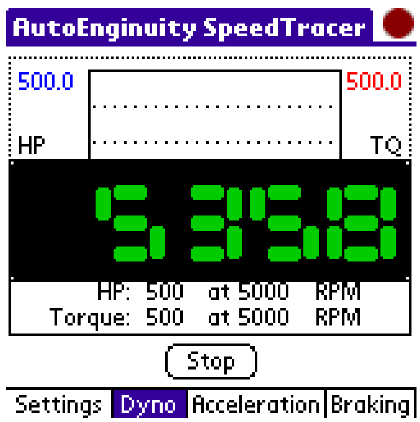
Hold the throttle position wide open (WOT) until you reach your chosen maximum RPM. Once that RPM is reached, DO NOT put the vehicle in neutral or a higher gear; the increase in RPMs will skew the torque reading. Instead, decelerate by braking or allowing drag forces to slow the vehicle. Either way, when the engine RPMs are 250 below your maximum reading, the performance analysis will stop automatically.

Engines are expensive. Most vehicles make all their power before the redline. Redlining the vehicle does more harm than good.

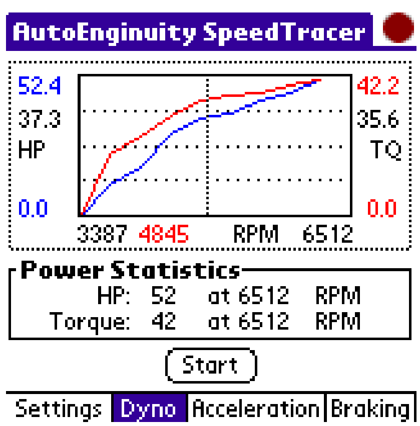
You can also stop the analysis at any time by tapping the *Stop* button. The counter's color will change to red and a beep will sound two times to signify that the performance analysis has stopped.

During the performance analysis, do not look at the computing device's screen. Instead, focus on the road and your vehicle's engine RPMs. If you really want to see these values, you have the option of recording the live sensors during the analysis for later review. *See Recording for more details.*

During the analysis, the counter will report the vehicle's engine RPMs. This will allow a passenger to verify the vehicle's operating conditions.



Once the analysis is complete, a graph will be plotted with the resulting data. The maximum horsepower and torque will be reported along with the RPM in which they were achieved.



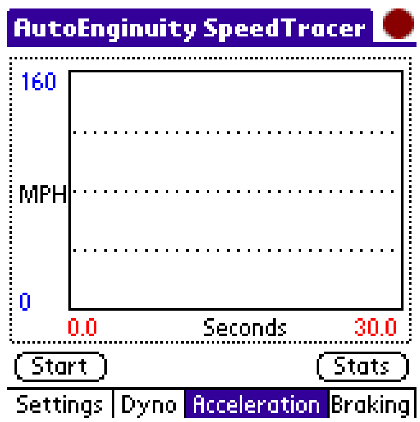
Although the SAE corrections remove local weather conditions from the results, your results will be different for different days and times. Keep in mind that you are sampling a mechanical process that is heavily influenced by vehicle operating conditions. Several analyses should be performed and averaged to get the most accurate results.

The horsepower and torque reported are net wheel horsepower and torque (WHP and WTQ). These numbers represent the resulting power after the gear reductions, frictional loss through the powertrain, and from the wheels and drag forces. This is the most accurate way to determine how much power your vehicle can produce.

To convert net WHP (also known as RWHP for rear wheel drive vehicles) to horsepower readings from the crankshaft (BHP), multiply your final numbers by 1.15% for 2 wheel drive manual transmissions and 1.25% for 2 wheel drive automatic transmissions. In the case of 4 wheel drive vehicles, add another 5%. Some manufacturers will require less adjustment because their drivelines are much more efficient. BMW for example, will require the use of 1.10% for manual transmissions and 1.15% for automatic transmissions. These corrections are not exact; they are typical driveline loss percentages seen after years of dynamometer testings.

Acceleration

Acceleration is used to analyze a vehicle's time and speed-based performance. The acceleration analysis is done without using a rollout or reaction time. All starts are perfect every time. This is what we like to call "Perfect Launch."



To make your results accurate and consistent:

- Perform the test on a flat, dry, and even surface.
- Turn off all vehicle accessories (radio, air conditioning, etc.). These are distractions as much as they are parasitic to the vehicle's performance.
- Use the same total weight for each test.
- Wind can influence the air resistance your vehicle experiences. Sixty miles-per-hour winds can reduce horsepower by as much as twenty horsepower.

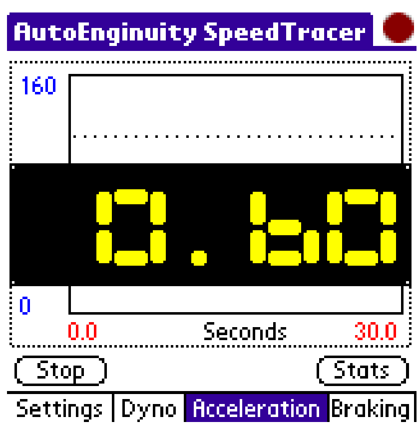
Before you can begin, all of your vehicle's settings must be entered in the Settings window. They are required for the mathematical computations. Environmental variables are not important for the Acceleration analysis.

No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times.

Pay attention to your driving and your vehicle. Do not exceed your, or your vehicle's ability. A passenger should be enlisted to observe the performance analysis if necessary.

Begin by lining the vehicle up with a clear path for at least 1/2 mile. You will require some distance to decelerate the vehicle as well as perform the 1/4 mile test. Place your vehicle in gear with the clutch engaged for manual transmissions, or in gear with the brakes pressed for automatic transmissions. Bring the vehicle's RPMs to between 2000 and 2500. By revving the motor, we can start the performance analysis closer to the vehicle's powerband and, in the case of automatic transmissions, prevent the torque convertor from stalling.

Tap the *Start* button, or press the spacebar, and wait for the count down to reach zero. The counter will change colors from red to yellow to green during the count down.

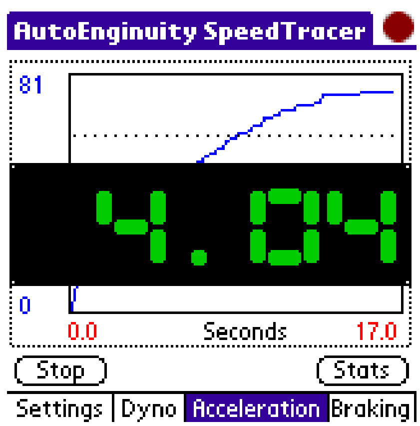


Carefully disengage the clutch, or disengage the brakes, while rolling on the throttle and preventing the driven wheels from breaking free. Hold the throttle position to the floor once the vehicle is in motion. Continue accelerating through the gears until you hear a beep from the computer signifying the run has completed. Decelerate the vehicle to a complete stop.

SpeedTracer will allow for you to have a "perfect" launch because it will not start the clock until vehicular motion is sensed. SpeedTracer uses the MPH sensor to determine vehicular movement. Doing this eliminates driver reaction times from the final results.

Excessive wheel slip or spinning will artificially reduce your resulting times if your vehicle does not use wheel speed sensors but instead samples the differential or output shaft

During the run, your current time will be displayed.

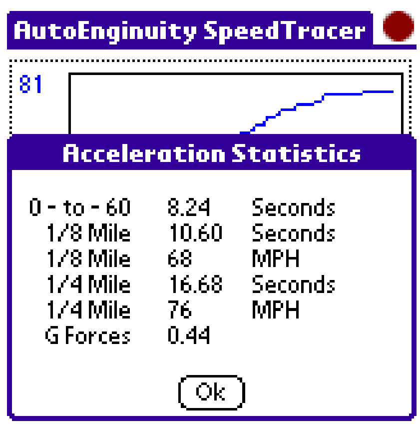


You can stop the analysis at any time by tapping the *Stop* button. Also, the analysis will automatically stop if the time exceeds thirty seconds. When the analysis is stopped, the counter's color will subsequently change to red and a beep will sound two times.

Most vehicle wings are non-functional or introduce more drag at normal speeds. A wing that doesn't equal or exceed the height of the roof-line will do more harm than good in the case of acceleration runs. Wings are only effective for high-speed cornering.

Once the analysis is complete, a graph will be plotted with the resulting data. The graph will display the vehicle's speed over the time it took to travel 1/4 mile.

To view all the acceleration statistics, tap *Stats*. A window will display your 0-to-60, 1/8 mile speed and time, 1/4 speed and time, and acceleration G forces. If the vehicle did not achieve 60 MPH, no value for the 0-to-60 field will report.



How Important is Rollout and Reaction Time?

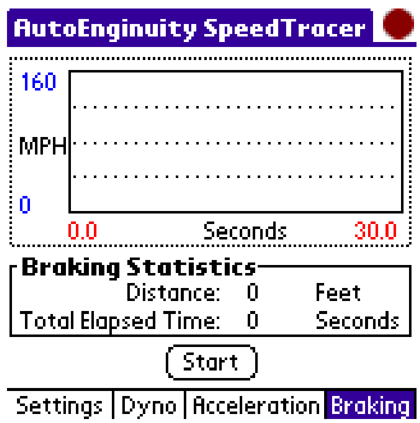
If you took your vehicle out to the drag strip and performed a timed-based acceleration run, you'd probably get slightly better results. Especially if you have learned the secrets of rollout.

When you stage a vehicle for a drag strip run, the spot at which the vehicle registers Staged can be several inches behind the starting line. The distance between the starting line and the staging line is called the rollout distance. This distance can be several inches or up to two feet.

How much do those inches impact your times? Quite significantly as a matter of fact. Depending on your vehicle's acceleration in Gs, you could see differences in your times between .1 and .5 seconds.

Braking

Braking Distance is used to analyze a vehicle’s time and braking-based performance.



To make your results accurate and consistent:

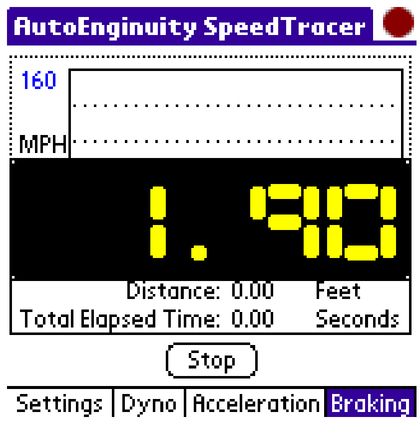
- Perform the test on a flat, dry, and even surface.
- Wind can influence the air resistance your vehicle experiences.

No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times.

Pay attention to your driving and your vehicle. Do not exceed your, or your vehicle’s ability. A passenger should be enlisted to observe the performance analysis if necessary.

Begin by lining the vehicle up with a clear path for at least 1/2 mile. Place your vehicle in gear and accelerate to the speed at which you want to perform your braking analysis. Cruise control can be used to maintain your speed.

Tap the *Start* button, or press the spacebar, and wait for the count down to reach zero. The counter will change colors from red to yellow to green during the count down.



Decelerate the vehicle to a complete stop. During your deceleration, a counter will show how much time has transpired since the start of the braking analysis.

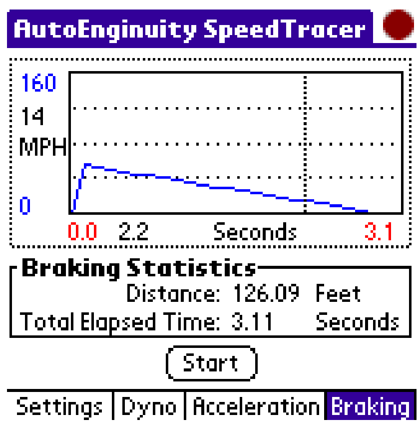
You can stop the analysis at any time by tapping the *Stop* button. The counter's color will subsequently change to red and two beeps will sound to signify that the performance analysis has stopped.

Once the analysis is complete, a graph will be plotted with the resulting data. The graph will display the vehicle's speed over the time it took to come to a complete stop.

Excessive wheel lock up will artificially reduce your resulting time and distances if your vehicle samples the differential or output shaft instead of using wheel speed sensors.

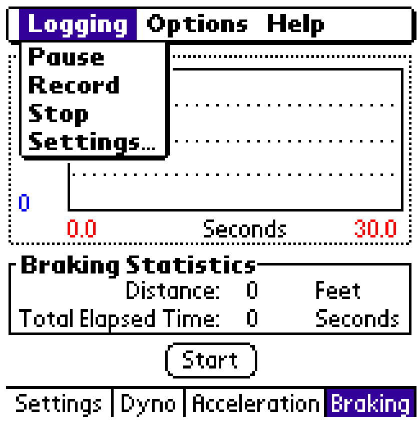
For the most accurate results, use the threshold braking technique and don't allow the wheels to lock up or skid. Not only is this the most accurate way for SpeedTracer to perform braking analyses, but it is the best braking technique.

The counter now reports the final time it took for the vehicle to come to a complete stop. The total distance travelled in feet will be displayed in the top-most counter.



Data Logging

Data logging is a very useful and simple-to-use feature of SpeedTracer. With data logging you can drive the vehicle and examine the data later for further analysis. You can also send the data to others for them to analyze. SpeedTracer will log MPH and RPMs only.



Two methods for storing the logged data are: 1) delimited text for traditional spreadsheet-like formatting; and, 2) XML for use with Internet browsers. (*See: Data Logging Settings*.)

The information to be logged is completely configurable. You can select which fields to record along with the mandatory sensor value. The data will be logged using the unit of measure that is currently selected.

Record

To start recording vehicle data, select the *Record* menu item from the Data Logging menu. If Record isn't already active, you will be given the chance to select the filename and path where the data logging will occur. Make sure that you have enough space available on the drive you select; data logging doesn't take much memory, but it will add up if you record multiple sensors for long periods of time. Once the output filename is set, data logging will begin.

When data logging is in the recording state, a checkmark will be placed next to the Record menu item to signify that recording is active. At the bottom of the main window, the Data Logging status will read Recording and the LED will illuminate bright red. The Data Logging File will reflect the output filename and path that you set earlier.

Stop

Once you are done recording, you can select *Stop* from the Data Logging menu. When you select *Stop*, the Data Logging File changes to none, a checkmark is placed next to *Stop*, and the file is closed.

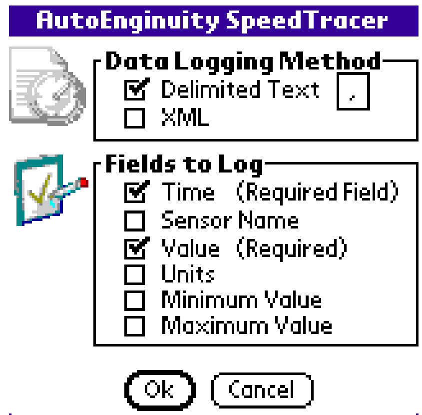
If the connection to the vehicle is lost, the data logging is stopped and the file is closed as if *Stop* had been selected from the Data Logging menu.

Pause

You have the ability to pause the recording. For example, if you are waiting for an oxygen sensor to warm up and don't need to record until it starts switching. Pausing can be done by selecting *Pause* from the Data Logging menu. Pausing keeps the current file active but stops logging data until the logging state is changed. Select *Pause* again to continue recording.

Data Logging Settings

Selecting the format in which the data is logged is as simple as selecting the Data Logging menu, and then the *Settings* menu item. You can choose either Delimited Text or XML as the format to log data. Which you choose depends largely on where you would like to view the resulting data. In the case that you would like to import the data into a spreadsheet program, select Delimited Text. If you would like to view the resulting data with a standard Internet browser or would like to be able to customize the recording style to include your company's information, select XML.



A delimited text file is the most common way to log data for spreadsheets. A delimiter is a character used to separate each of the data fields. The delimiter can only be one character. The default character is a comma (hence the formatting technique called "comma-delimited").

A delimiter should be a character that is not alphanumeric (1 - 10 or A -Z). Otherwise, regular data will be confused with the delimiter.

An XML file can be viewed with Internet browsers such as Netscape and Internet Explorer. XML is the acronym for Extensible Markup Language, and is best described as a means of structuring data. XML provides rules for placing text and other media into structures and allows you to manage and manipulate the results. This formatting method is more sophisticated than delimited text files because of the power and control that a user has over the resulting document. With XML there is no need for a single delimiter to separate fields. Each field will have an individual tag to denote its start and end. XML uses a file called a style sheet to help format the data in a browser. The *AutoEnginuity SpeedTracer XML Template.xsl* is the default style sheet for XML output created with AutoEnginuity's SpeedTracer. **The style sheet file must be in the same directory as the data logging file for the data logging file**

to be viewed correctly. By default, the style sheet is installed in the same directory as the SpeedTracer program. If you create XML-formatted data logging files in other directories, you will have to copy the style sheet to that directory for the data logging files to view correctly.

XML also gives you the unique ability to create your own custom style sheets to format the logged data. In the case that you will show the resulting data to your customers, you might want your company's logo at the top of the time and data.

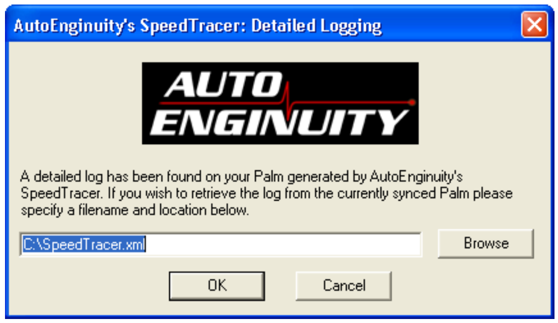
The fields that can be logged are listed with a check box so that they can be enabled and disabled as you see fit. The fields that cannot be disabled are grayed out and the check box is disabled.

To preview what will be logged, look at the sample at the bottom of the window. Tap *Apply* and examine the resulting sample text. Once you have determined what fields will be logged, tap OK.

HotSyncing To Retrieve Data Logging

To retrieve a data logging session, all that is required is for the user to HotSync the Palm device to a PC which has installed the AutoEnginuity SpeedTracer Palm application.

A window will appear requesting where on your PC the file will be transfered to.



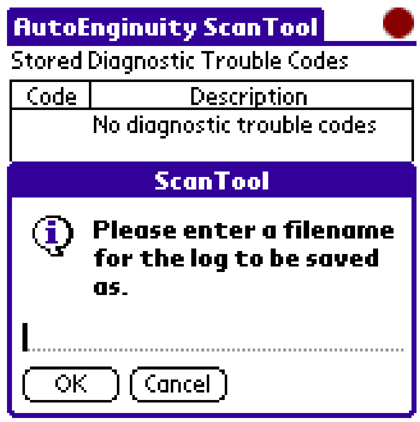
Once the file has been moved to the PC, you are given the option to remove it from the Palm device. Only one data logging file can exist on the Palm device at a time; so each subsequent logging session will overwrite the previous one.

The file is now available on the PC for previewing.

Retrieve Data Log

When you select *Retrieve Data Log* from the menu item under options, SpeedTracer will allow you to download a data log file which is stored on the Palm device's internal memory onto a memory card. The SpeedTracer will check to see if it detects a memory card in a Palm expansion slot (This feature is only available with Palms that contain expansion slots). SpeedTracer will also check to see if you have a data log file present on the Palm.

If a memory card is found and you are not currently logging, or you are logging to the memory card, SpeedTracer will prompt you with a message box asking for the name of the newly created file.



Once a filename has been entered, SpeedTracer will begin retrieving the data log file and place it onto the inserted memory card.

Appendix A: Hard-to-Find DLCs

TABLE 1.

Manufacturer	Year	Model	Location*/ Accessibility	Comments
Acura	1996-1998	CL	7/open	under shifter
Acura	1999	CL	8/cover	above shifter
Acura	1996-2001	NSX	7/cover	under passen-ger dash
Acura	1996-1998	RL	7/open	passenger side center console
Acura	1999-2001	RL	8/cover	in front of shifter behind ashtray
Acura	1996-1998	TL	8/open	behind ashtray
Acura	1999-2001	TL	6/cover	below radio next to seat heater
Audi	1996, 1997	Cabrolet A6	9/cover	rear ashtray
Bentley	1996-2000	All	9/cover	in glove box
BMW	1996-2003	3 Series (also M3)	2/cover	1/4 turn slot head screw to expose
BMW	1996-2003	5 Series	2/cover	1/4 turn slot head screw to expose
BMW	1996-2003	7 Series	6/cover	under stereo controls
BMW	1996-2000	X3/M Roadsters	7/cover	passenger side of console
BMW	1996-2001	Z3 Series	9/cover	under passen-ger dash
BMW	2000-2002	Z8	2/cover	
Daewoo	1999-2000	Lanos	6/open	
Ferrari	1996-2000	All	3/open	up high under dash
Ford	1996	Bronco	7/cover	
Ford	1996	F Series	7/cover	

TABLE 1.

Manufacturer	Year	Model	Location*/ Accessibility	Comments
Ford	1996, 1997	Thunder-bird/Cou-gar	7/cover	
Ford	1996, 1997	Thunder-bird/Cou-gar	7/cover	
Honda	1996-1998	Accent	2/open	in coin box
Honda	1996, 1997	Accord	6/cover	behind ashtray
Honda	1997-2003	CR-V	7/open	under passen-ger dash
Honda	1996-1999	Del Sol/ Hybrid	7/open	under passen-ger dash
Honda	1996-1998	Odyssey	7/cover	console under passenger dash
Honda	1996	Prelude	8/open	above shifter
Honda	1997-1998	Prelude	7/open	passenger side dash
Honda	2000-2003	S2000	7/open	under passen-ger dash
Land Rover	1997	Defender 90	8/cover	behind fuse box
Land Rover	1996-2001	Range Rover	7/open	next to console
Lexus	1996	ES300	2/cover	behind fuse box panel
Lexus	1996-2003	LS400	2/cover	above parking brake
Lotus	1997-2003	Esprit	7/open	above passen-ger dash
Mazda	1998, 1999	Miata	2/cover	behind fuse box panel
MINI	2002-2003	MINI	2/cover	pull cover away to expose
Mitsubishi	1996	Expo	2/open	behind fuse box
Porsche	1996	All	6/cover	driver’s side of console
Rolls-Royce	1996-2003	All	9/cover	glove box

TABLE 1.

Manufacturer	Year	Model	Location*/ Accessibility	Comments
Rover	1997	Defender	6/cover	under parcel tray
Rover	1996-2003	Range Rover	7/open	under passen-ger dash
Subaru	1996-2003	Legacy	2/cover	behind plastic hinged cover
Subaru	1996, 1997	SVX	1/cover	right side of steering col-umn
Toyota	1996	Avalon	2/cover	behind fuse box panel
Toyota	1996	Camry	2/cover	behind coin box
Toyota	2000	New Hybrid	7/open	
Toyota	1996, 1997	Previa (2/ 4WD)	6/cover	top instrument panel
Toyota	1996-1998	Tercel	2/cover	behind fuse box panel
Volvo	1997, 1998	850	8/cover	in front of shifter coin tray
Volvo	1998, 1999	All (except S80)	9/cover	hand brake area
Volvo	2001	S60	2/cover	
Volvo	2000-2003	C/S/V 70	8/cover	
Volvo	2000-2003	S/V 40	6/cover	
Volkswagon	1996-1998	Cabrio, Golf, Jetta	7/cover	right side of ashtray
Volkswagon	1996-1999	Eurovan	4/cover	on dash behind wiper lever
Volkswagon	1999	Golf, Jetta	7/cover	
Volkswagon	1996, 1997	Passat	4/cover	on dash behind wiper lever

* DLC Locations.

Figure 1.

Appendix B: Terminology

Drag Coefficient

A unit of measure used to determine how much an object resists being moved through the air. Lower coefficients indicate low air resistance.

Dyno or Dynamometer

An instrument for measuring mechanical power or force. Gearing and tire measurements do not affect the calculation of horsepower. Engine torque requires gearing and tire measurements.

Frontal Area

Frontal area represents the forward facing projection area of the vehicle. Frontal area is the width and height of the vehicle in square feet.

G Forces

The measure of acceleration. The higher the number the quicker the acceleration. A typical production car will not exceed one G in acceleration. One G = 32.174 feet per sec^2.

HP or Horsepower

A unit of measure where 550 lb is moved one foot in one second.

Rollout

The distance between pre-staging beam and the staging beam (or starting line). Usually measured in inches, with the typical values of 8 and 12 inches being used.

SAE

SAE, the Society of Automotive Engineers, is a group of nearly 80,000 engineers, business executives, educators, and students from more than 97 countries who form a network of members that share information and exchange ideas for advancing the engineering of mobility systems.

Slippage

When a torque convertor is rotating faster than the engine. The falsely increased gear RPMs will skew dynamometer results.

Staging

The act of positioning the vehicle at the starting area of the drag-strip. Shallow and deep staging reflects how far into the starting area you position your vehicle.

Torque Convertor

A hydraulic unit in an automatic transmission that serves the same purpose as the clutch in a manual transmission.

TQ or Torque

Rotational force. Torque = (HP * 5252)/RPM.

WOT or Wide Open Throttle

When the throttle is fully depressed at its maximum capacity.

Appendix C: Troubleshooting

Why is my vehicle's profile not in, or not the same as, the built-in vehicle profiles list?

Because there are too many vehicle configurations for even the same model in a single year, not all vehicle profiles will be listed. Built-in vehicle profiles are a starting point from which you can build a specific profile for your vehicle. Finally, the software is periodically updated to include new Vehicle Profiles.

Why are my SpeedTracer dyno results lower than my DynoJet results?

SpeedTracer must account for drag forces, environmental variables, frictional forces, and powertrain loss which will result in lower numbers being reported than what you will see in your DynoJet or SuperFlo testing. What this means is that the values that SpeedTracer reports is really what is required to accelerate your vehicle. The more accurate the inputted environmental values and drag coefficient values, the more accurately they will be compensated for in the results. Keep in mind, this is a different way to determine your vehicle's power. The results will be consistently reported throughout several runs. This will allow you to determine whether new parts improved your vehicle's performance.

Why are my SpeedTracer quarter mile results longer than my drag strip results?

SpeedTracer does not simulate rollout or reaction times in this version. Those can reduce your ET times by as much as .1 to .5 seconds—maybe even more. With SpeedTracer's ability to perform "perfect" launches you can concentrate on your vehicle's performance specifically, instead of reaction times and whether you need to deep or shallow stage your vehicle.

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SpeedTracer:Form04/05/04