



**SpeedTracer**  
*User Guide*

Version 4



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AutoEnginuity, L.L.C.  
Mesa, AZ  
1-480-827-TOOL

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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

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## ***SECTION I: Installation***

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### ***Minimum Requirements***

<b>Operating System</b>	Windows® 2000 / XP / Vista
<b>Processor</b>	90 Mhz Intel Pentium® or AMD Athlon®
<b>Memory</b>	32 MB RAM
<b>Free Storage Space</b>	3 MB
<b>CD- or DVD-ROM</b>	1x Speed
<b>USB or Serial Port</b>	capable of at least 19200 baud

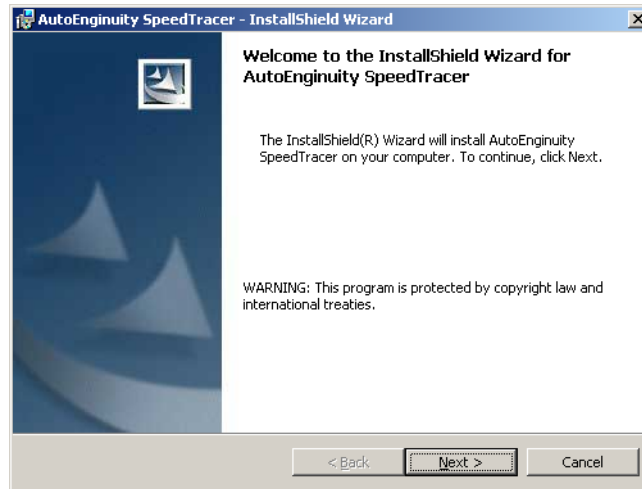


SpeedTracer will NOT work on vehicles that do not report MPH and RPM through the OBD-II interface.

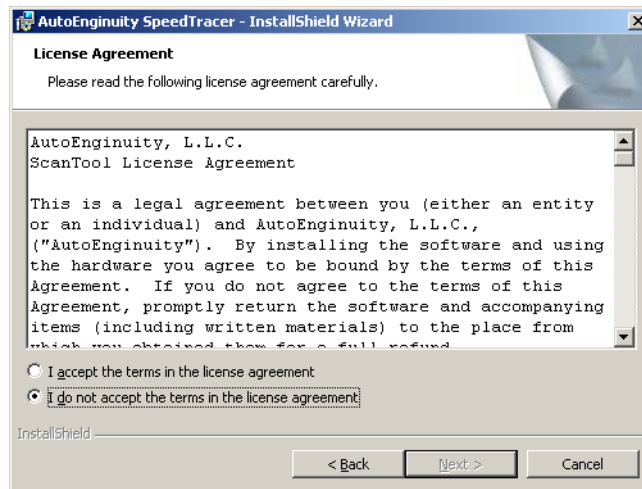
### ***Installation Instructions***

Follow the step-by-step instructions below to install AutoEnginuity's SpeedTracer onto your personal computer.

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.



- 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.



- Enter the user and organization name that the product

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should be registered to. Select whether this installation is for a single user, or all users of the computer. Select *Next* when you are done.

AutoEnginuity SpeedTracer - InstallShield Wizard

**Customer Information**  
Please enter your information.

User Name:  
Jay Horak

Organization:  
AutoEnginuity

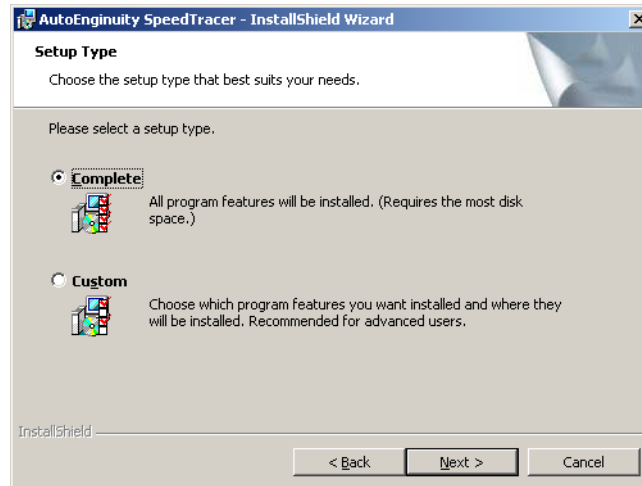
Install this application for:

Anyone who uses this computer (all users)  
 Only for me (Jay Horak)

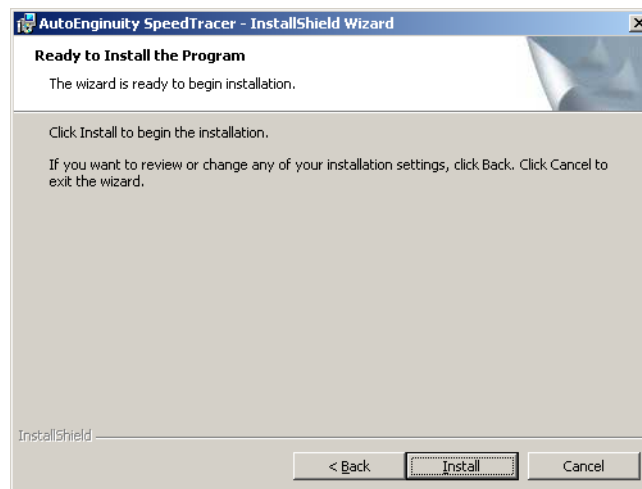
InstallShield

< Back   Next >   Cancel

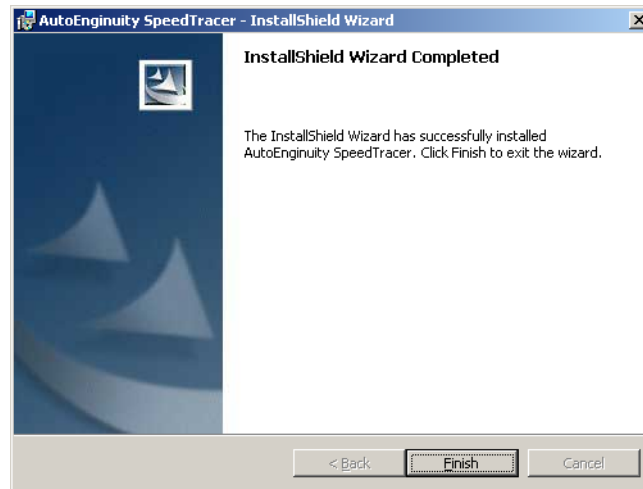
6. Select *Complete* to install all of the required and optional components. This is the typical installation for most users. If you have used AutoEnginuity's SpeedTracer before, or do not require anything but the program itself, select *Custom*. The Custom option will allow you to choose individual components to install. Select *Next* when you are done.



7. If you have changes to make to your installation settings (such as a different Registered User Name, etc.) now is the time to do so by selecting *Back*. If no changes are necessary, select *Install* to complete the installation process. Once *Install* is selected, a progress bar will reflect how far along in the installation your computer is.



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



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## *SECTION II: Using the Software*

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### *Connecting to the Vehicle*

Connecting AutoEnginuity's ScanTool to the vehicle is a simple process. You will need your AutoEnginuity OBD-II connector, and, for serial versions, the provided serial cable. You will be required to locate your vehicle's DLC (Data Link Connector) and your computing device's communications port.

The first step is to locate the 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).



The DLC is usually exposed and accessible without a tool. (Notable exceptions being BMW which requires a flat-head screwdriver to remove a plastic cover, and MINI which hides the DLC under a cover.) Exceptions to the standard location include the ash-tray/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 details. Once you locate the DLC, plug the AutoEnginuity OBD-II connector firmly into it.

Next, connect the cable between the OBD-II connector and the PC. If you are working with a serial version, note which serial/COM port you connect to in the rare case that the Auto Detect algo-

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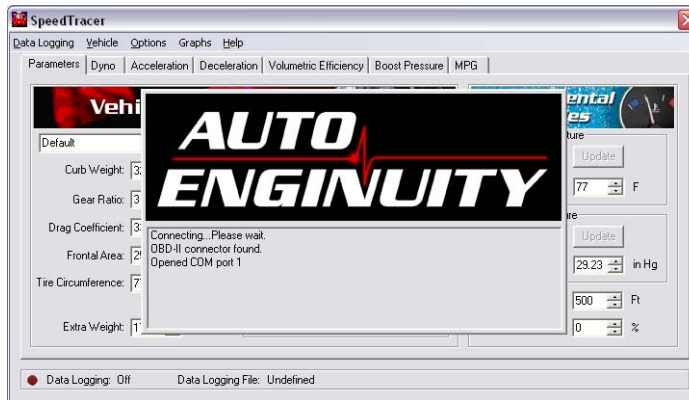
rithm runs into trouble and requires you to manually configure the serial/COM port.

Once the vehicle is physically connected to the PC, place the key in the ignition and turn it forward to the "ON" position. If you would like to monitor onboard test results or view live vehicle sensor data, you will be required to start your vehicle.



**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 vehicle is connecting for the first time or when reconnecting if the connection was lost. If this window is not present, press F2 or select *Vehicle / Connect* to manually initiate the connection process.



The Connection Status window will show whether your communications port has been opened by the software and what vehicle interface type is used to connect to the vehicle. If the Connection Status window doesn't go away, either your serial/COM port can't be opened, or the vehicle interface type is incorrect or cannot be

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discovered automatically. In either of those cases, you may be required to manually configure these settings to proceed. See *Communication Configuration* below for more details on correcting connection settings. For most applications the default settings are recommended.



A connection should not take longer than one minute

When both the serial/COM port and Vehicle Interface Type settings have been correctly selected, click *OK*. If the settings are correct, the Connection Status window will place a check next to each of the connection steps, and the connection will finalize. The Connection Status window will enumerate the settings used to make the connection and the general connection data returned from the vehicle. If everything is correct and the Vehicle Selection window appears, skip this next section and proceed to *Vehicle Selection*.

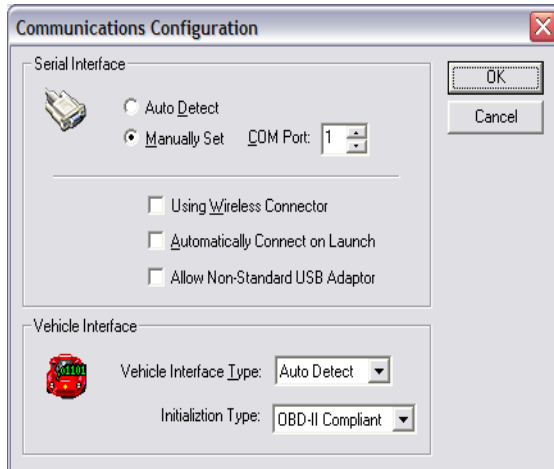
### **Communications Configuration**

Communications Configuration is where you will configure vehicle specific connection settings or set your computer interface settings.

To open the Communications Configuration window, click the AutoEnginuity logo or select the *Vehicle* menu and then select *Communications Configuration*.

### **Computer Interface**

This is the interface used to connect the OBD-II connector to your computing device. There are two ways to configure the computer interface: 1) Auto Detect Serial Port; or, 2) USB or Manually Set Serial Port.



*Auto Detect Serial Port* is for serial versions of the OBD-II connector only. It is slower, but allows the computer to find the serial/COM port for you. If the serial/COM port is not automatically discovered within one minute, then try setting the serial/COM port manually.

*USB or Manually Set Serial Port* is used to manually select USB or to select the serial/COM port manually. If you are using a serial version of the OBD-II connector, first determine the serial port that the OBD-II connector is connected to, then change the 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.

#### Allow Non-Standard USB Adaptors

The *Allow Non-Standard USB* option will prevent the ScanTool from qualifying the serial port. Two serial/COM settings are required for the ScanTool to operate properly: 1) 19200 baud; and, 2) RS-232C compliance. Since some USB-to-serial adaptors

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enumerate to the operating system as Modems instead of a serial/COM ports (i.e., Belkin), they won't meet the second requirement. If your USB-to-serial adaptor is compliant, but simply doesn't enumerate properly, check this box to force the ScanTool to use it.

#### Automatically Connect on Launch

The *Automatically Connect On Launch* option configures the software to start connecting to the vehicle automatically. This is enabled by default.

#### Vehicle Interface Type

The Vehicle Interface Type selection is used to determine how to communicate with the vehicle. Typically you won't have to change this as the *Auto Detect* entry will query the correct selection from the vehicle. OBD-II does define an order to auto detect the vehicle's protocol which the ScanTool complies with; however, the specification does not dictate how a vehicle manufacturer has to respond to protocols it doesn't support. Because of this lack of specificity, auto detecting can't be guaranteed. In those cases where the software can't complete a connection after a few attempts, we recommend selecting the vehicle's protocol manually.

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:

**TABLE 1. Typical Interface Type Per Manufacturer**

<b>Interface Type</b>	<b>Manufacturer</b>
J1850 PWM	Ford*, Lincoln, Mercury, Jaguar, Mazda, Panoz, Saleen
J1850 VPW	Buick, Cadillac, Chevrolet, Chrysler, Dodge, GMC, Hummer, Isuzu, Oldsmobile, Pontiac, Saturn
ISO 9141-2	Asian (Acura, Honda, Infinity, Lexus, Nissan, Toyota*, etc.), European (Audi, BMW, Mercedes, MINI, Porsche, etc.), and early Chrysler*, Dodge, Eagle, and Plymouth

**TABLE 1. Typical Interface Type Per Manufacturer**

Interface Type	Manufacturer
KWP2000	Daewoo, Hyundai, KIA, Subaru STi, and some Mercedes
CAN	2004 and newer Ford, Jaguar, Mazda, Mercedes, Nissan, and Toyota
*Exceptions	'98+ Concorde, Intrepid, LHS, 300M, 2000+ Neon, '96-97 Toyota, all Celica, Supra Turbo '96-99 use J1850 VPW; '96, '97 Probe 2.5L, '96 Tracer 1.8L, '96 Escort 1.8L, Triumph, Geo, Catera, '97 Paseo, Camry, Avalon use ISO 9141-2

#### Initialization Type

The *Initialization Type* option enables the user to select the startup packet formatting required to begin communications with the vehicle. The Initialization Type is set to *OBD-II Compliant* by default.

The *OBD-II Compliant* option will go through the standard initialization process of retrieving live data and freeze frame sensor coverage, Mode 6 coverage, Inspection/Maintenance monitor states, and whether there is an active MIL before completing a connection. This is a much more in-depth process than a simple code reader and can therefore take longer.

The *Non-OBD-II Only* option is not available due to the requires of OBD-II compliance for the SpeedTracer program to operate.

The *KWP2000 ECM Forced Init* option is used to force a connection to very specific vehicle models. Use this only with direction from AutoEnginuity support.

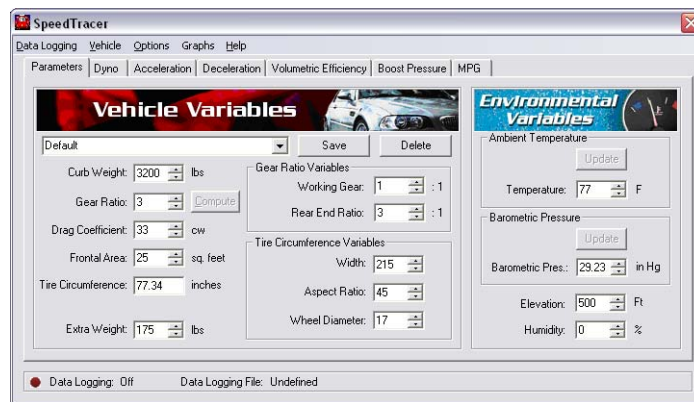
The *CAN Physical Addressing* option is used to force a connection with a CAN controller that does not support the SAE default of functional addressing. Use this with the Nissan '08 and Subaru'08 models.

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# Using the Software

## Parameters

The Parameters window is used to input the variables required for the performance analysis computations. All of the variables have default entries. The environmental variables are pre-set to the SAE defaults. The more accurate these entries are, the more accurate your results will be. The Parameters window is broken 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 click 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

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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 clicking 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 Parameters window will be changed (except Environmental Variables) to reflect the new vehicle's profile.

The variables on the left-hand side of the Vehicle Profile group (weight, gear ratio, frontal area, and tire circumference) are required for performance analysis.

### 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.

#### **Vehicle Weight Terminology**

Curb weight is the weight of the vehicle only.

GVWR is the maximum allowable sum of the vehicle's curb weight, all passengers, and cargo.

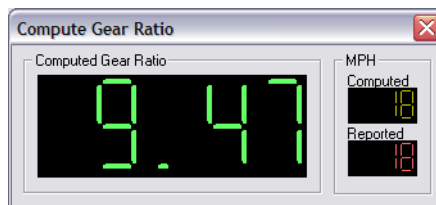
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## Gear Ratio

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, click 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 will take approximately thirty seconds.



The currently computed gear ratio is reported on the left-hand side of the window. This value will slowly change. The Computed MPH on the right-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

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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 values.

#### Drag Coefficient

Drag Coefficient ( $C_d$ ) is the aerodynamic drag coefficient and is representative of 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.

You can use the Coast Down option in the Deceleration tab to compute this value.



**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 fascia. Do not include the tires, or start from the ground. We won't be operating at speeds where this will be factored in.

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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 edit this field manually.

#### 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 performance test in the Working Gear edit field. Usually this is 3rd or 4th gear. Now that you have entered the working gearing, enter the final drive for the vehicle; this is the differential gear ratio.

Once the working gear and the final drive values are entered, click 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 left 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 left. This is optional if you

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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.

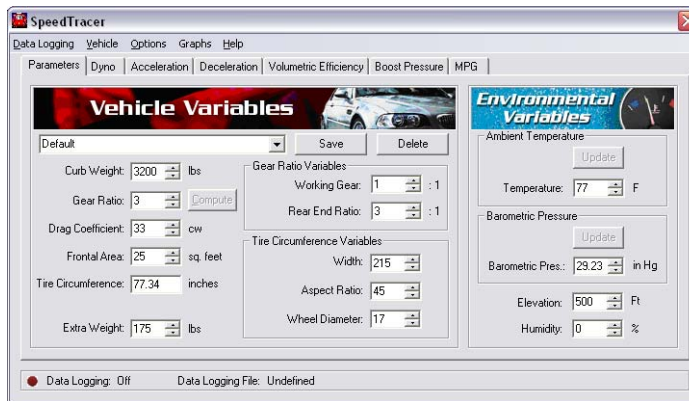
Aspect Ratio is the sectional width of the tire. This is a ratio between the width of the tire and the height of the side wall, from the wheel to the top of the tire. Using the previous example of 225/40/17, 40 would be the aspect ratio of the tire.

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

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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, click 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.

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

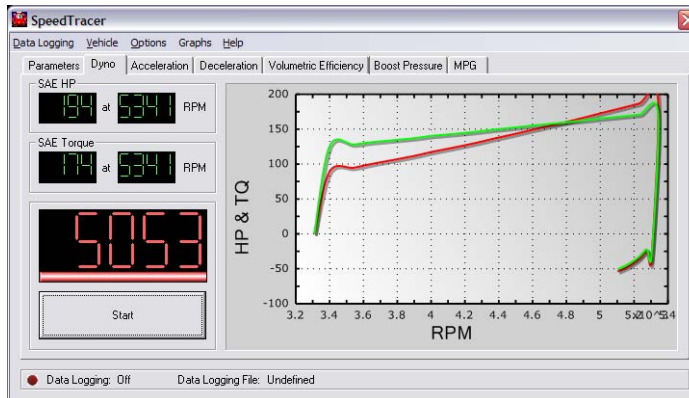
Barometric pressure is the air pressure of the atmosphere. If your vehicle supports reporting the barometric pressure, this value will be set automatically. The SAE baseline for this value is 29.235.

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

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## 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

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similar 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 Parameters 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. 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

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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.)

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### **Torque Convertor Slippage for Automatic Transmissions**

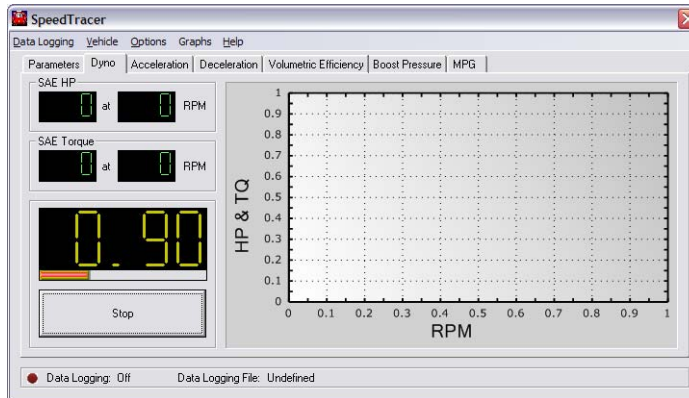
The torque convertor serves the same purpose as the clutch in a manual transmission. The torque convertor's job is to replace the clutch. Using hydraulics, a spinning impeller pushes hydraulic fluid against the turbine. The turbine is connected to the output shaft of the transmission. If the vehicle's 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.

Click 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 emanates.

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 clicking 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.

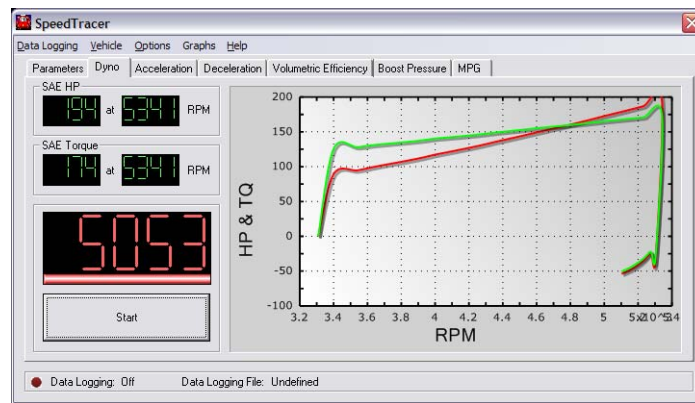
During the performance analysis, do not look at the computing device's screen. Instead, focus on the road and your vehicle's engine RPMs. If you really want to see these values, you have the option of recording the live sensors during the analysis for later

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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.

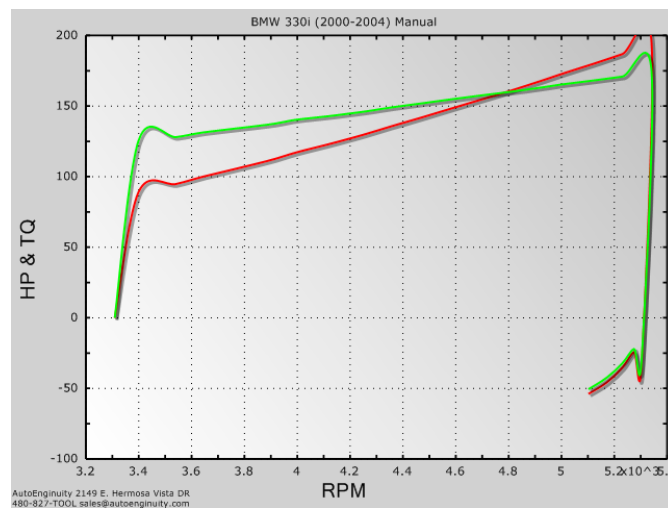
To convert net WHP (also known as RWHP for rear wheel drive vehicles) to horsepower readings from the crankshaft (BHP), multiply your final numbers by 1.15% for 2 wheel drive manual

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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 testing.

The graph can be cleared of any run results. To save or zoom in on your results, use any of these options, right-click the graph area and select the menu item.

The graphed plot data can be saved for viewing and printing. Saving allows for the Shop Information from the *Settings* window to be displayed in the lower left-hand corner of the file. The Vehicle Profile will be used as the label on top of the saved graph.



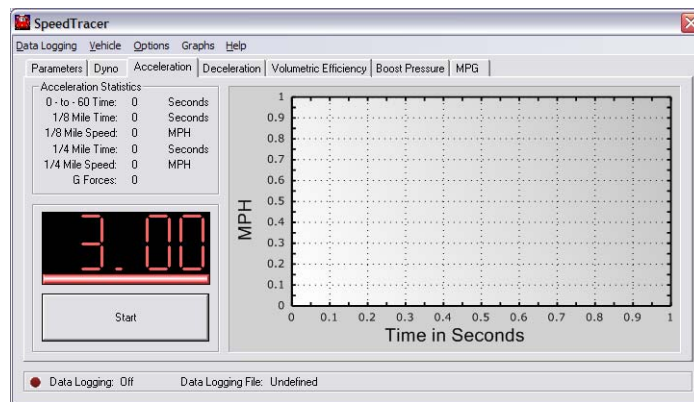
To save a graph, right click on the graph area and select *Save Graph*. A window will appear that will require you to name your file. At this time you can also choose to save the file as a BMP, PNG, EMF, EPS, or TIF file.

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## 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."

Up to three runs can be plotted on the same graph. Each plot will have a different color that can be set in the *Graphs / Customize Graphs* menu selection.



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 Parameters window. They are required for the mathematical computations. Environmental variables are not important

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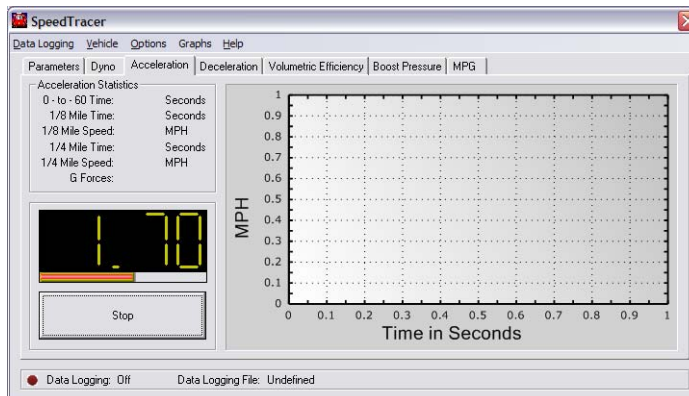
for the Acceleration analysis.



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

Click 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

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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.

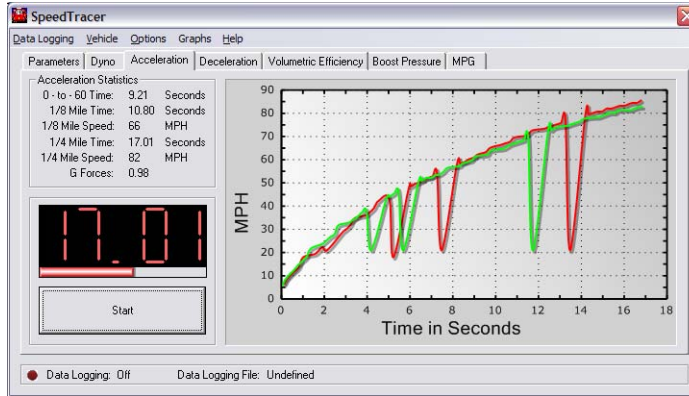
Excessive wheel slip or spinning will artificially reduce your resulting times if your vehicle does not use wheel speed sensors but instead samples the differential or output shaft.

You can stop the analysis at any time by clicking 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.



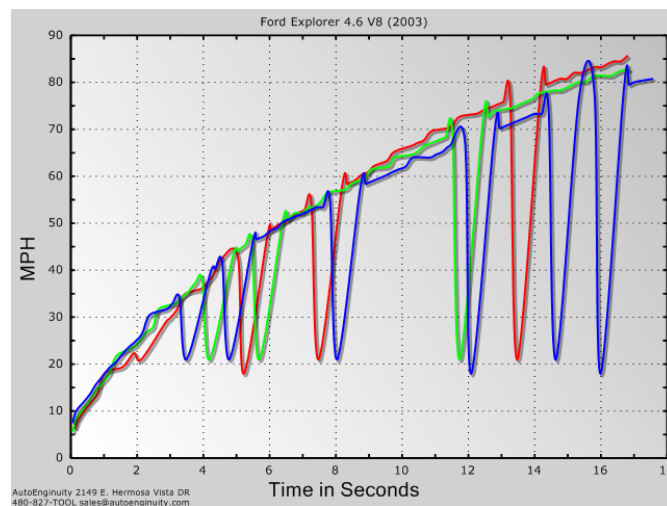
Most vehicle wings are non-functional or introduce more drag at normal speeds. A wing that doesn't equal or exceed the height of the roof-line will do more harm than good in the case of acceleration runs. Wings are only effective for high-speed cornering where downforce is required to keep the vehicle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

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. Finally, the counter now reports the final 1/4 mile speed. If the vehicle did not achieve 60 MPH, no value for the 60 MPH field will report.



To clear, save, or zoom in on your results, right-click the graph area and select the menu item. In case of saving a graph, a window will appear that will require you to name the file. At this time you can also choose to save the file as a BMP, PNG, EMF, EPS, or TIF file. The BMP file format is selected by default.

The graphed plot data can be saved for viewing and printing. Saving allows for the Shop Information from the *Settings* window to be displayed in the lower left-hand corner of the file. The Vehicle Profile will be used as the label on top of the saved graph.



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### **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.

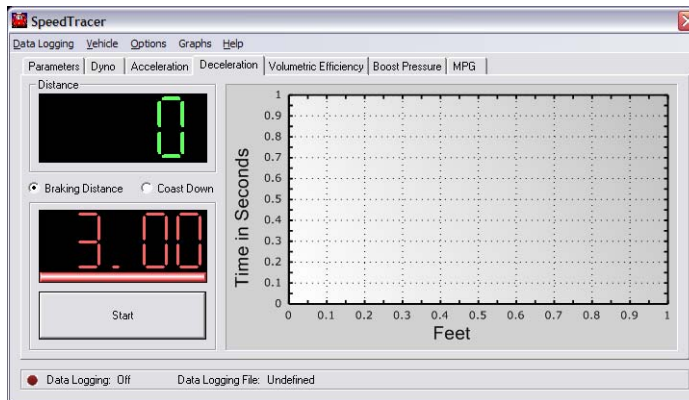
When you stage a vehicle for a drag strip run, the spot at which the vehicle registers Staged can be several inches behind the starting line. The distance between the starting line and the staging line is called the rollout distance. This distance can be several inches or up two feet.

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.

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## Deceleration

Deceleration is used to analyze a vehicle's braking distance and time, coast down, and Cd value. Two types of deceleration analysis are available: 1) braking; and, 2) coast down. Braking is used to determine the stopping power of the vehicle.



The Braking Distance selection will record the vehicle's distance travelled and the time it takes. Three runs can be plotted on the graph simultaneously.

The Coast Down selection will help determine the vehicle's aerodynamic drag forces (Cd). The time between 60 MPH and 50 MPH will be used to determine the aerodynamic drag force and can be used to input in the Parameters window to be used in the Dyno algorithm.

To make your results accurate and consistent:

- Perform the tests on a flat, dry, and even surface.
- Wind can influence the air resistance your vehicle experiences.
- Run the tests in both directions on the surface to negate any slope bias.

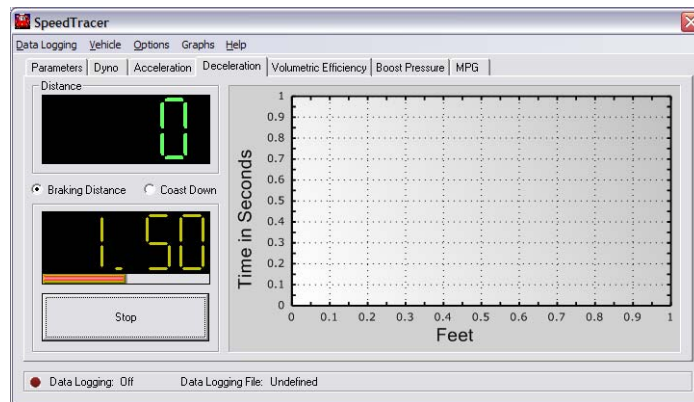


No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times. A passenger should be enlisted to observe the performance analysis if necessary.

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

The final speed to begin the run will be based on whether you are trying to do a braking or a coast down analysis. For coast down, to compute the Cd, the speed must exceed 60 MPH.

Once you are maintaining the chosen speed, click 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 if you are performing a braking analysis or place the vehicle in neutral and allow the vehicle to decelerate under its own power if you are performing a coast down analysis. During your deceleration, a counter will show how

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much time has transpired since the start of the analysis.

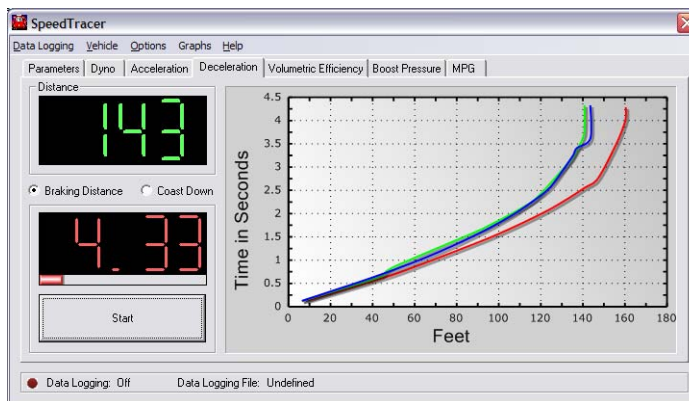


Excessive wheel lock up will artificially reduce your resulting time and distances if your vehicle samples the differential or output shaft instead of using wheel speed sensors. For the most accurate results, use the threshold braking technique and don't allow the wheels to lock up or skid. Not only is this the most accurate way for SpeedTracer to perform braking analyses, but it is the best braking technique.

You can stop the analysis at any time by clicking 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.

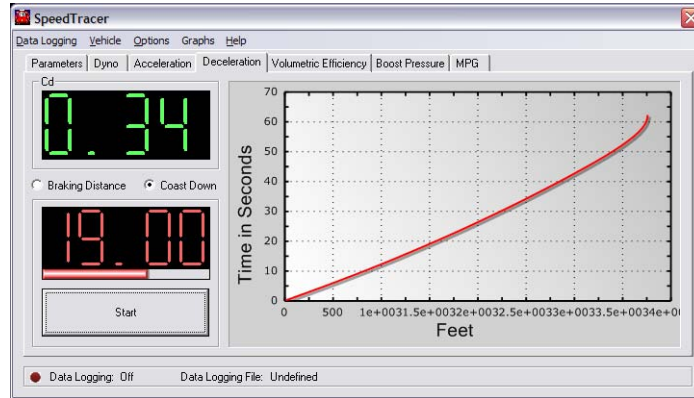
If Braking Distance was chosen, the top-most counter will show the final distance and the bottom-most counter will show the elapsed time.



If Coast Down was selected, the top-most counter will show the final computed Cd value. The bottom-most counter will show

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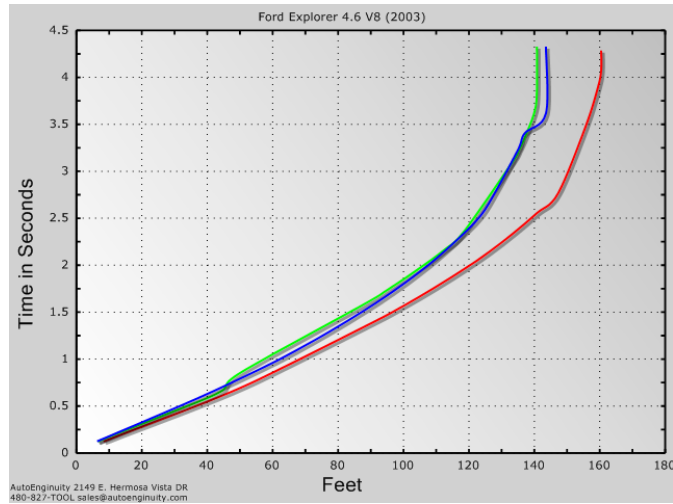
the time elapsed between 60 and 50 MPH.



Up to three runs can be plotted on the same graph. Each plot will have a different color that can be set in the *Graphs / Customize Graphs* menu selection.

To clear, save, or zoom in on your results, right-click the graph area and select the menu item. In case of saving a graph, a window will appear that will require you to name the file. At this time you can also choose to save the file as a BMP, PNG, EMF, EPS, or TIF file. The BMP file format is selected by default.

The graphed plot data can be saved for viewing and printing. Saving allows for the Shop Information from the *Settings* window to be displayed in the lower left-hand corner of the file. The Vehicle Profile will be used as the label on top of the saved graph.

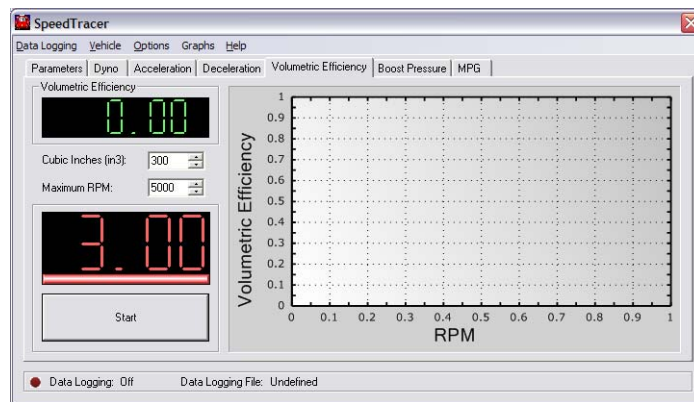


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## Volumetric Efficiency

Volumetric Efficiency is used to analyze how efficient the vehicle's engine is operating minus the usual frictional losses, cylinder leakage, and build tolerances of the engine. This will be the measured "actual flow rate" as opposed to the "theoretical flow rate" of the engine design.

This algorithm requires a MAF sensor and that the vehicle is using the stock MAF and MAF screen. Alterations to these components will affect your results.



No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times. A passenger should be enlisted to observe the performance analysis if necessary.

Begin by determining the cubic inch displacement of your vehicle's engine. Enter that value in the Cubic Inches edit field.

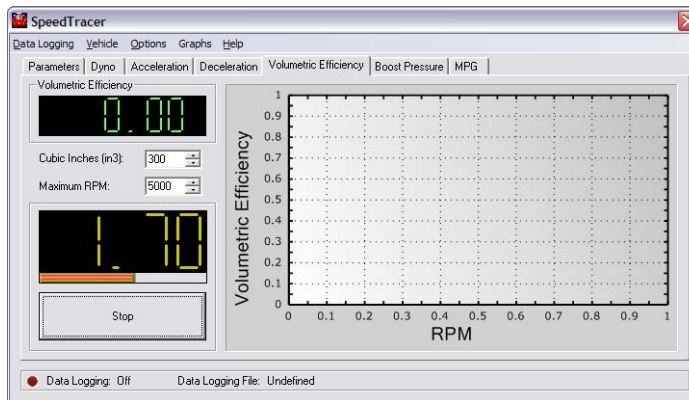
Next, determine the RPM in which you want to run your test.

In third gear, drive the vehicle to 500 RPMs below the Maximum RPM. The test can also be performed on a vehicle without a load. The results for stationary analysis will be less than those of a

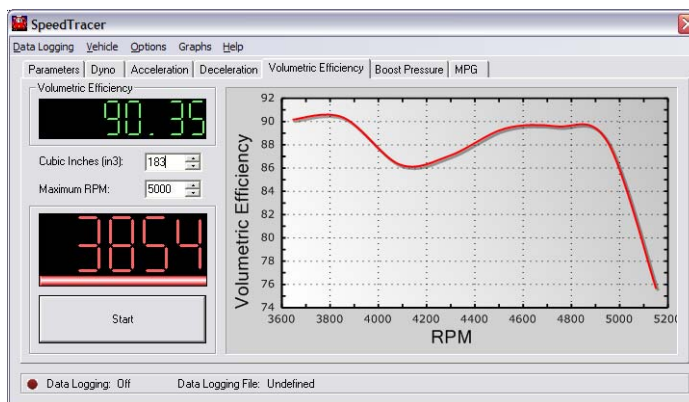
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vehicle under load. Stationary analysis should only be used as a reference for air flow changes.

Once you are maintaining the chosen RPM, click 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.



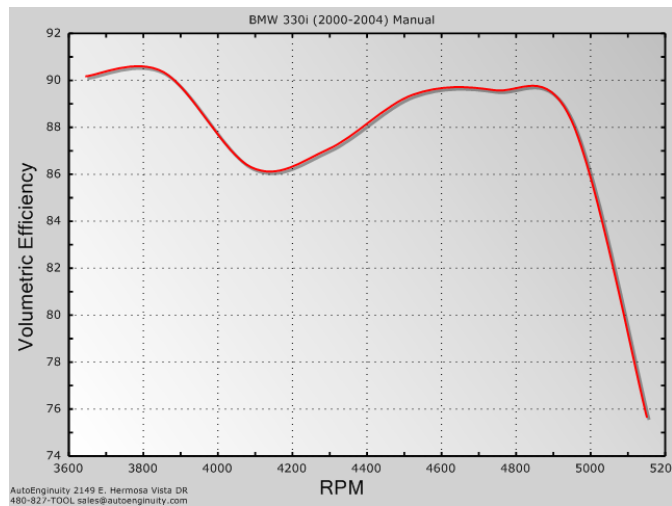
Accelerate the vehicle to WOT until you reach the desired maximum RPMs. A graph will be plotted with the resulting data. The graph will display the vehicle's computed "actual flow rate."



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To clear, save, or zoom in on your results, right-click the graph area and select the menu item. In case of saving a graph, a window will appear that will require you to name the file. At this time you can also choose to save the file as a BMP, PNG, EMF, EPS, or TIF file. The BMP file format is selected by default.

The graphed plot data can be saved for viewing and printing. Saving allows for the Shop Information from the *Settings* window to be displayed in the lower left-hand corner of the file. The Vehicle Profile will be used as the label on top of the saved graph.

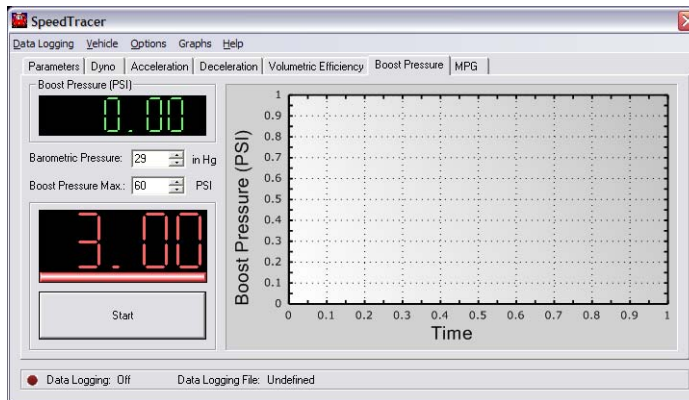


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## Boost Pressure

Boost Pressure is used to monitor a vehicle's boost pressure readings computed from the vehicle's MAP sensor (corrected for barometric pressure). Forced-induction vehicles, like the Subaru WRX, can use this to determine their turbo performance and/or to monitor their blow-off valve settings.

This algorithm requires a MAP sensor. Alterations to this component will affect your results.



No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times. A passenger should be enlisted to observe the performance analysis if necessary.

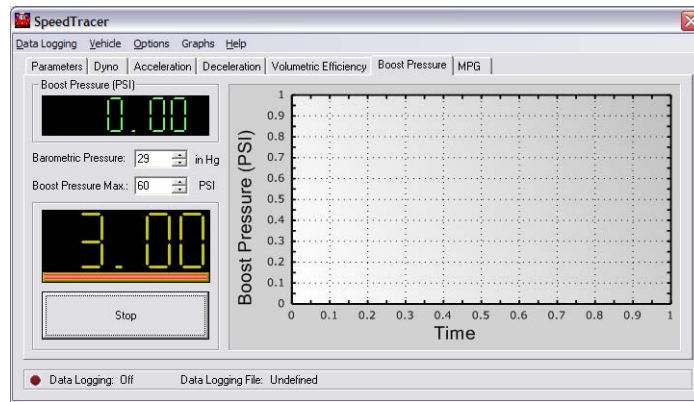
Begin by setting the current barometric pressure. If your vehicle has this sensor, it will already have been set by SpeedTracer according to what the vehicle reported; otherwise, it will use the default value of 29.23 inHg. If your vehicle doesn't support a barometric pressure sensor, this value can be found in your local weather forecast.

Next, determine the maximum boost pressure range you'd like

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to have the graph plot into. The default range is -10 to 60 PSI. The maximum setting is 100 PSI. A typical example is the stock Subaru WRX which can range from -10 to as much 16 PSI.

Start the engine and maintain your chosen RPM. Click 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.



Depress the throttle to view the vehicle's current boost pressure readings. The current boost pressure will be displayed in the upper left-hand counter with the graph plotting the same value. The count down counter will show your current RPM reading.

Boost pressure is graphed against Time. When the sixty seconds is reached, the graph will pan over in ten second increments.

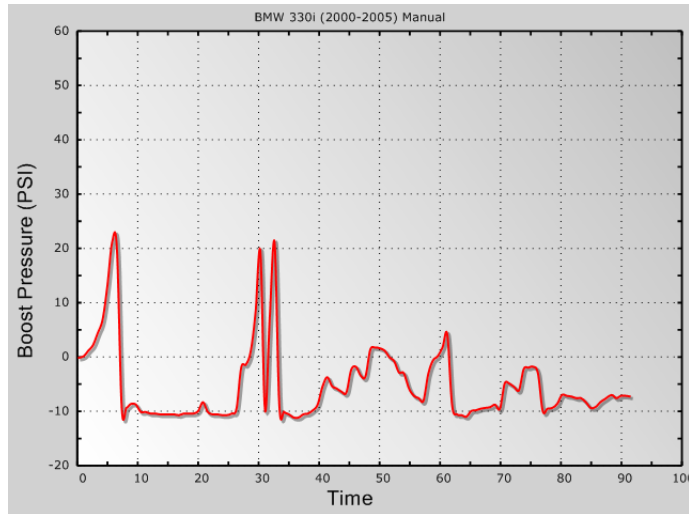
When you are finished, click the *Stop* button.

To clear, save, or zoom in on your results, right-click the graph area and select the menu item. In case of saving a graph, a window will appear that will require you to name the file. At this time you can also choose to save the file as a BMP, PNG, EMF, EPS, or TIF file. The BMP file format is selected by default.

The graphed plot data can be saved for viewing and printing. Saving allows for the Shop Information from the *Settings* window

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to be displayed in the lower left-hand corner of the file. The Vehicle Profile will be used as the label on top of the saved graph.

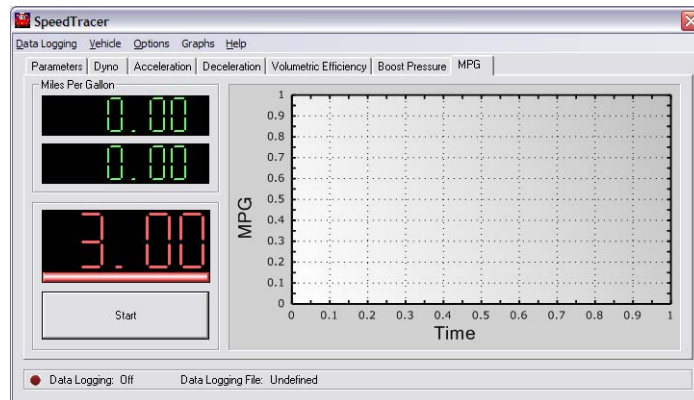


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## MPG

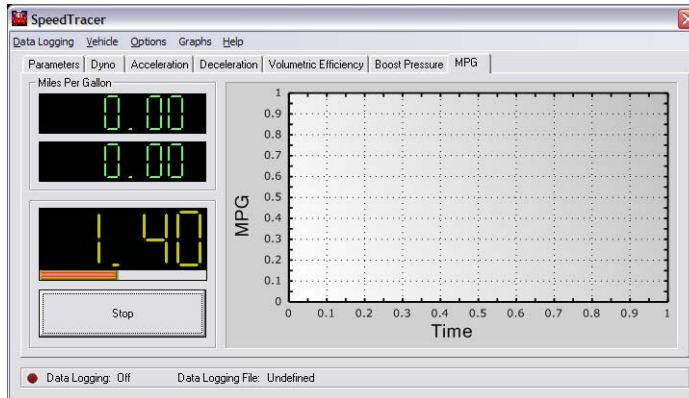
Miles Per Gallon is used to analyze how efficient the vehicle's powertrain is operating and/or to analyze someone's driving habits. Two types of MPG readings are reported: 1) current MPG; and, 2) computed running average.

This algorithm requires a MAF sensor and that the vehicle is using the stock MAF and MAF screen. Alterations to these components will affect your results.



No performance analysis should be performed under unsafe or illegal conditions. Please observe local speed limits and traffic regulations at all times. A passenger should be enlisted to observe the performance analysis if necessary.

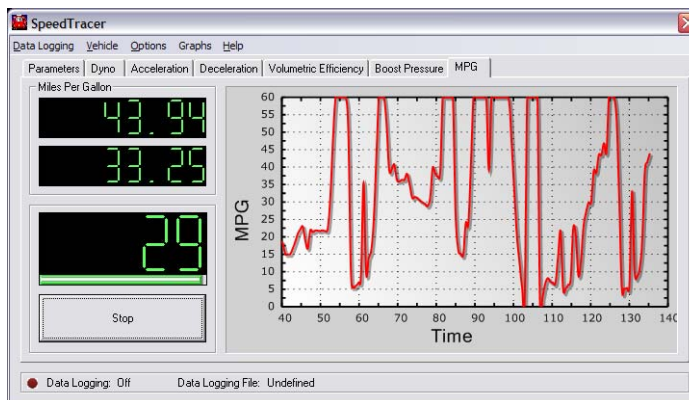
Begin by clicking the *Start* button, or press the spacebar, and wait for the count down to reach zero. The counter will change colors from red to yellow to green during the count down.



Operate the vehicle in the manner you would like to use to compute the MPG. The current MPG will display in the left top-most counter. Just below it will be the computed running average MPG. The graph will plot the current MPG value. The count down counter will show your current vehicle speed.

MPG is graphed against Time. When the one hundred seconds is reached, the graph will pan over ten second increments.

In the case of the computed running average MPG, only while the vehicle is actually moving will the computed value change. The computation is calculated by averaging the last 100 samples.

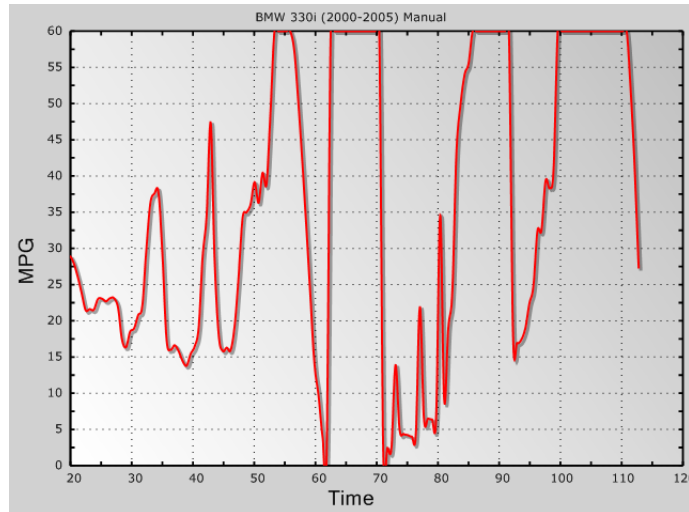


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Once you have completed your sampling, click the *Stop* button.

To clear, save, or zoom in on your results, right-click the graph area and select the menu item. In case of saving a graph, a window will appear that will require you to name the file. At this time you can also choose to save the file as a BMP, PNG, EMF, EPS, or TIF file. The BMP file format is selected by default.

The graphed plot data can be saved for viewing and printing. Saving allows for the Shop Information from the *Settings* window to be displayed in the lower left-hand corner of the file. The Vehicle Profile will be used as the label on top of the saved graph.



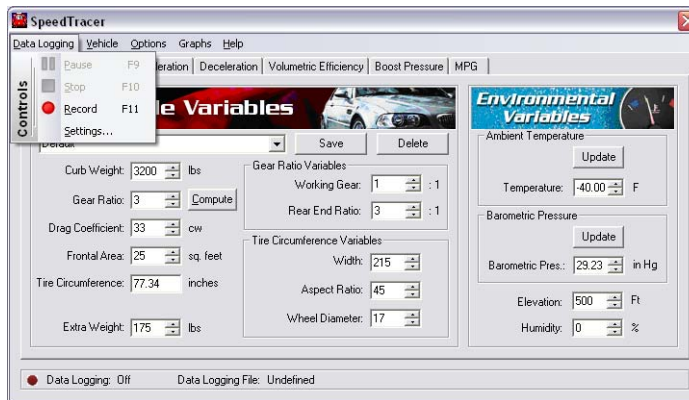
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## Data Logging

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.

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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

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"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.

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 logged data.

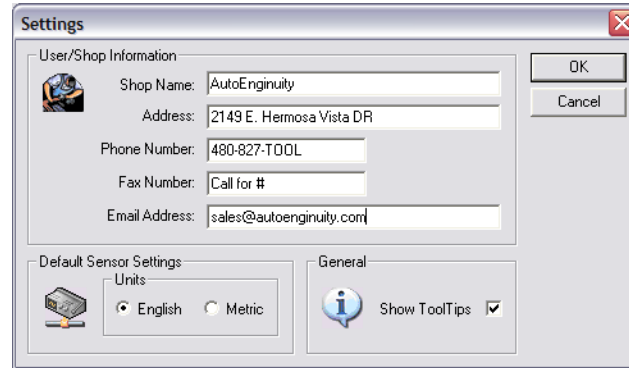
The fields that can be logged are listed with a check box so that they can be enabled and disabled as you see fit. The fields that cannot be disabled are grayed out and the check box is disabled.

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

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## Settings

The Settings window is used to change overall SpeedTracer parameters. This window allows you to change the saved graph information, default sensor units, and whether ToolTips are shown.



### User/Shop Information

The User/Shop Information is used to label the bottom of the saved graphs. If any of the fields have data, it will print in the lower-left corner of the graph. This allows the creator of the graph to label it with their shops information.

### Units

This is the default unit of measure for all sensors and the inputting fields. At this time, only English units are available.

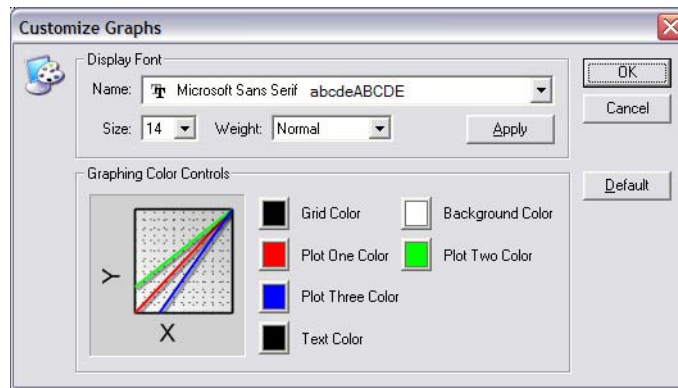
### Show ToolTips

This option will disable or enable the showing of the helper information displayed when you mouse over a section of the user-interface. Enabled is the default setting.

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## Customize Graphs

The Dyno, Acceleration, Deceleration, and Volumetric Efficiency graphing color schemes can be changed to better suit your tastes or needs. The default colors are used to best suit the needs of the graph with respect to contrast and visual clarity.



### Display Font

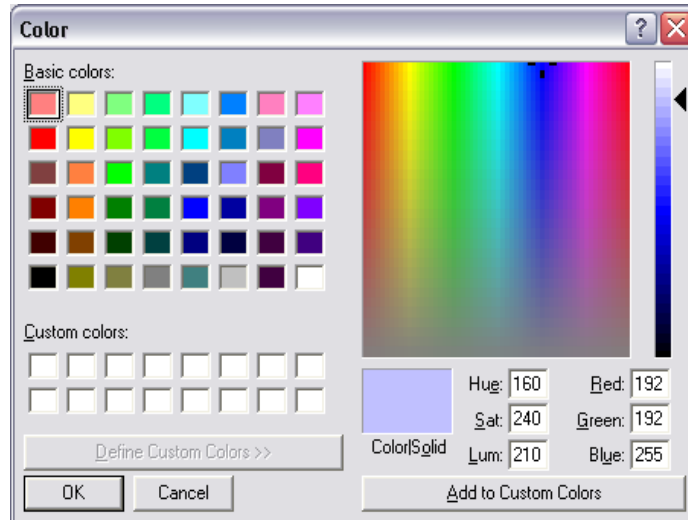
The Display Font is used in the graphs. You can change the display font by selecting a new font from the Name drop-down list. This list will show all the active fonts on your system in their respective font style. You can also change the size and the weight to make the display font more or less prominent.

### Graphing Color Controls

To the right of the graph are the color icons and the control parameter that uses the color. By clicking on the color icon, a color selector will appear. You can choose a color that views better on your screen or that fits your computer's color scheme. Basic colors are provided for simple color selection. If you require a custom color you can "mix" the color manually by entering the values which represent the color, or by moving your cursor over a specific color you would like and left-clicking. Selecting *Color / Solid* will show you the color that is currently selected and how the Windows

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operating system will display the color on your screen.



Choose a new color and click *OK*. The graph colors will change immediately when *OK* is selected. This color scheme will be saved and reused when the SpeedTracer is started again.

If, after changing the colors, you don't find them usable or would prefer to stay with the default color scheme, you can restore the default colors by clicking *Default Colors* in the Customize Display window.

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## Appendix A: Hard-to-Find DLCs

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**TABLE 2.**

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 passenger 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	Cabriolet 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 passenger 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 2.**

Manufacturer	Year	Model	Location*/ Accessibility	Comments
Ford	1996, 1997	Thunderbird/Cougar	7/cover	
Ford	1996, 1997	Thunderbird/Cougar	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 passenger dash
Honda	1996-1999	Del Sol/Hybrid	7/open	under passenger 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 passenger 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 passenger 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 2.**

Manufacturer	Year	Model	Location*/ Accessibility	Comments
Rover	1997	Defender	6/cover	under parcel tray
Rover	1996-2003	Range Rover	7/open	under passenger dash
Subaru	1996-2003	Legacy	2/cover	behind plastic hinged cover
Subaru	1996, 1997	SVX	1/cover	right side of steering column
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.

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Figure 1.



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## ***Appendix B: Terminology***

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### **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<sup>2</sup>.

### **HP or Horsepower**

A unit of measure where 550lb 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.

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**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.  $\text{Torque} = (\text{HP} * 5252) / \text{RPM}$ .

**WOT or Wide Open Throttle**

When the throttle is fully depressed at its maximum capacity.

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## ***Appendix C: Troubleshooting***

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### ***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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