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## **Requirements**

WinTEC v4 requires a few things to run properly on your computer.

Windows 98 or later, Windows XP is recommended

1024x768 resolution or better

Serial port

Most laptops made in the last 5 years meet the resolution requirement. If you do not meet this requirement, the software will still run, but will not fit on the screen. Additionally, if you are using a large font to make your display easier to read; things may appear strange or misaligned. It is strongly recommended that you use the normal font size with WinTEC.

If you don't have a serial port on your computer, PCMCIA adapters are available from a number of places online. USB adapters are also widely available and tend to cost considerably less, but some work well and others do not work at all. We have found that the Sabrent part# SBT-USC1M, works well.

## Using WinTEC v4

WinTEC v4 is designed to be easy to navigate and use for most people without reading the manual. But there are always useful pointers in the manual and if you have read this far, you are a rare breed and I commend your effort to educate yourself.

### Installing the software

To install WinTEC, simply insert the CD into your CD ROM drive, open the drive in Windows Explorer and double click "Setup.exe". Desktop CDROM drives will have a ridge in the tray for the small CD. You will actually see two files called "setup", look for the file with ".exe" on the end, . The file you want is highlighted in Figure 1.

Once setup begins follow the on screen instructions. You may change the installation directory if

necessary, but the default directory is recommended.

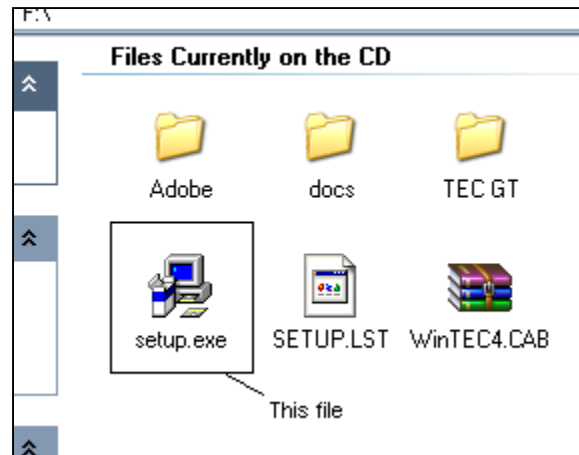


Figure 1: The Setup file for installation

### Configuring the software

#### Selecting your Serial Port

Chances are, before you will be able to communicate with your Electromotive system, you will need to change the communications port WinTEC is using. You can change the port in the Control Panel by clicking on "Tools->Options->Control Panel" (Figure 2) and then clicking on the communications tab in the configuration screen (Figure 3).

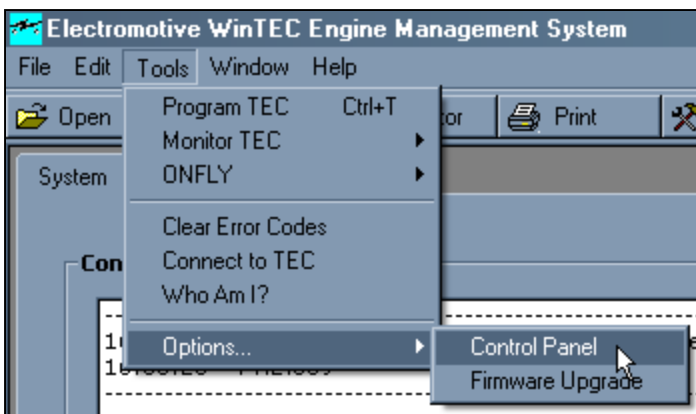


Figure 2: Bringing up the Control Panel

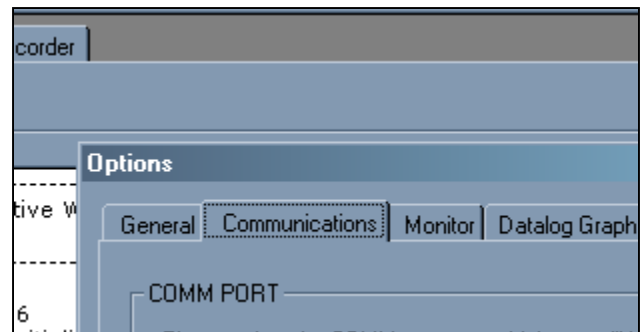
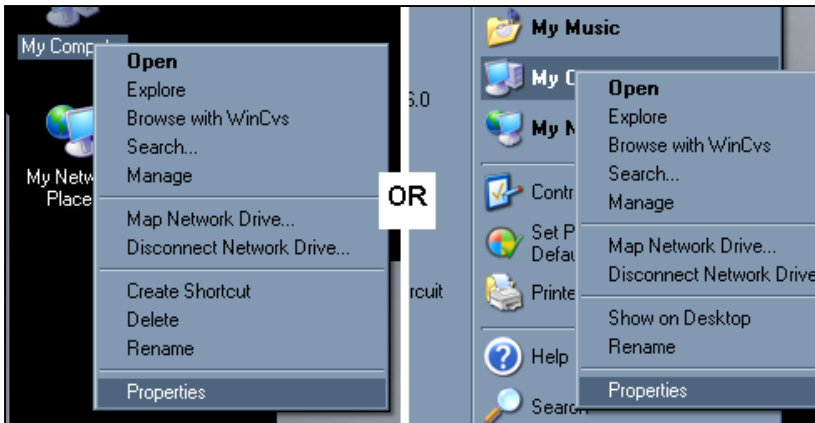
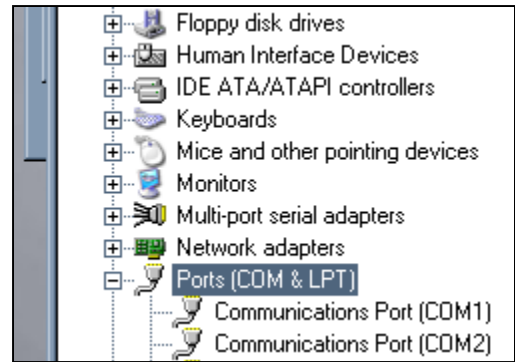


Figure 3: Communications Tab

When you have a serial port on your computer, this is usually 1. If you have a PCMCIA adapter, the port is often 3 or 4. If you are using a USB adapter, the port number is different on almost every computer. To find out what port number your COM port is, plug in your COM adapter if needed. Right click on "My Computer", click properties (Figure 4), select the Hardware tab and then click "Device Manager". You will see a tree that lists all the hardware in your computer. Near the bottom there is a



**Figure 4:** Right-click 'My Computer' and then select Properties



**Figure 5:** COM ports listed in Device Manager

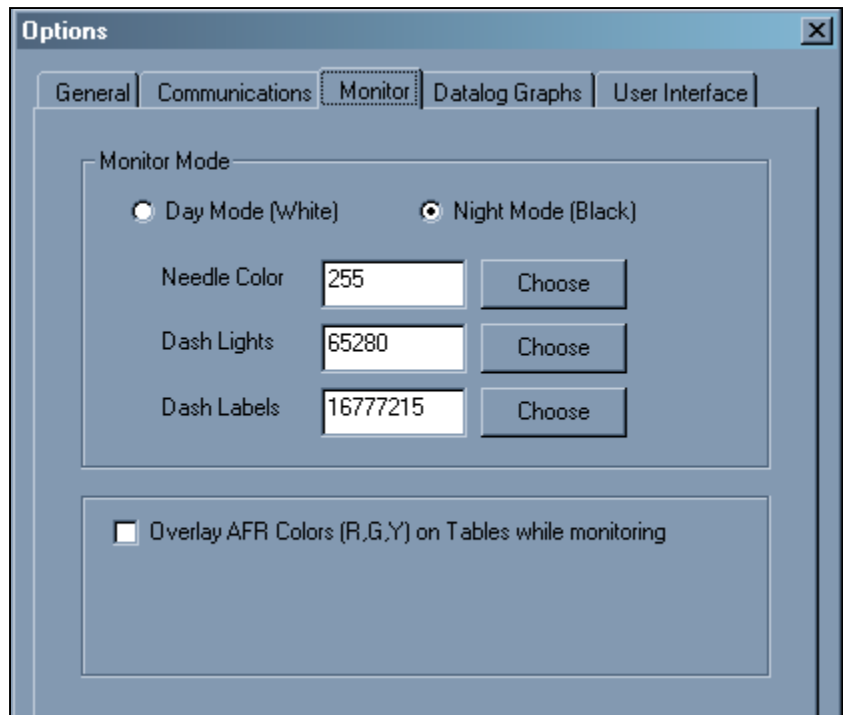
group called 'Ports (COM & LPT)' (Figure 5). Double click on that item and you will see your port(s) listed along with the port number. Note the number there (i.e. COM7) and close the device manager. Then go into WinTEC and select the port using the directions above.

**Changing the Dashboard appearance**

The appearance of the dashboard can be configured in the Control Panel by clicking on the Monitor tab (Figure 6). The Day and Night mode radio buttons select the background for the dashboard. Day mode (Figure 7) has a white background and defaults to black numbers and needles. Night mode (Figure 8) has a black background and defaults to red needles and green numbers.

Both day and night modes have default colors for the numbers and gauge needles, but both can be changed. By clicking the Choose button next to the item you would like to change, you will be shown a color palette to select a color.

By default, the cell in each table currently being used by the unit is highlighted in yellow. Checking the option "Overlay AFR colors in Tables" makes the box highlight match the color of the AFR needle by default. This option has no effect on the XDI<sup>2</sup>. This option is described in more detail in the section on using the tables.



**Figure 6:** Monitor Options Screen

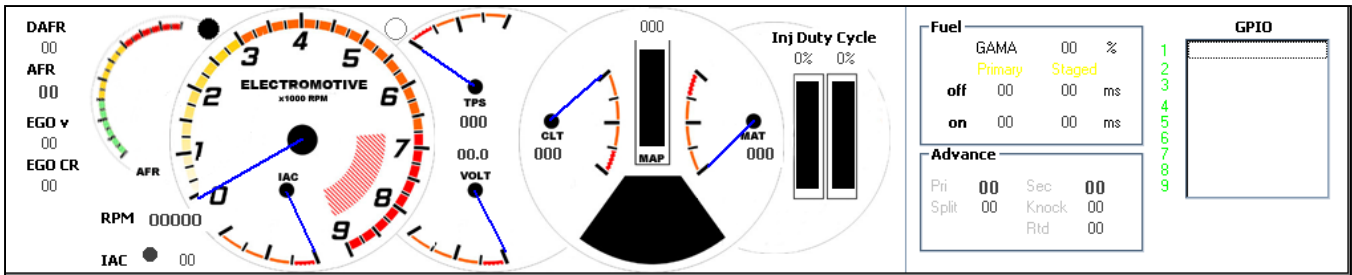


Figure 7: Dashboard Day Mode

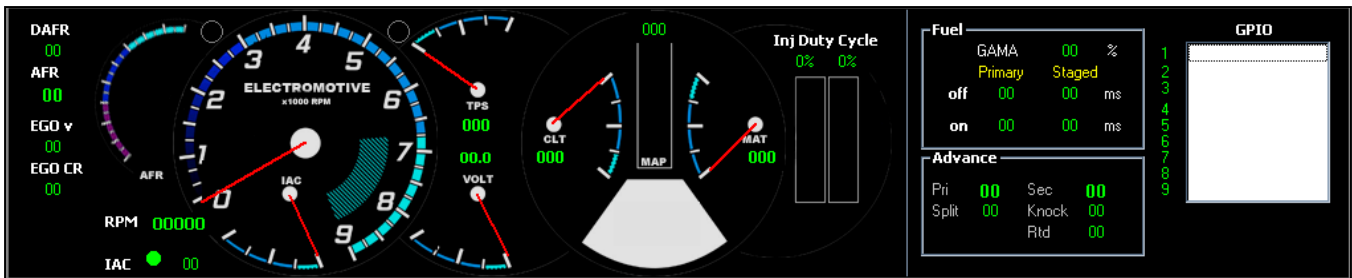


Figure 8: Dashboard Night Mode

### User Interface options

When checked, the “Dock 2D Graphs in the lower portion of the screen” option forces the 2D graphs for tables such as the Warm-up enrichments over the dashboard (Figure 9). While it covers the dashboard, it does prevent the window from covering any of the tuning options. When unchecked, the graph is in a free floating window (Figure 10). This is useful for large monitors because the graphs can be placed off to the side where they will not cover any tuning boxes.

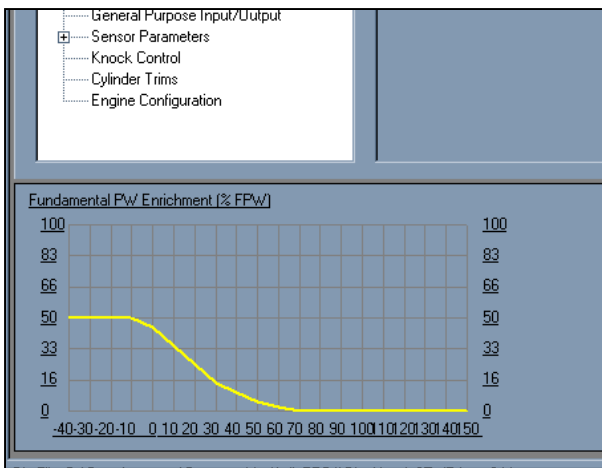


Figure 9: 2-D Graph Docked

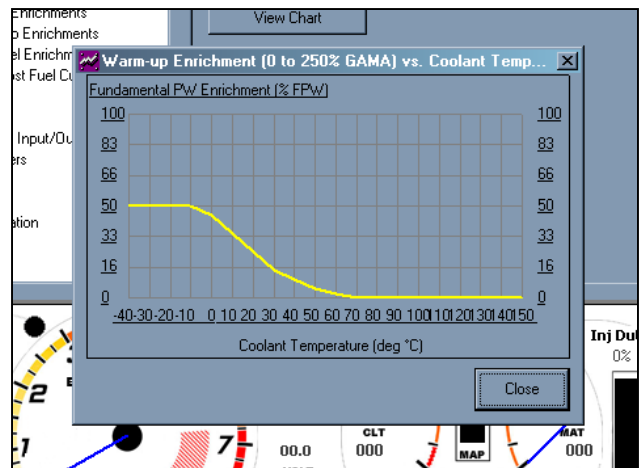


Figure 10: 2-D Graph Undocked

### Selecting Datalog Graphs

The datalog graph tab allows the selection of up to 10 channels to view in the flight recorder. These settings are covered in the Flight Recorder section.

## Fundamentals

### Save Often

There are a few good habits to implement when doing anything on a computer. These are especially good habits when tuning a car. A computer crash in the middle of your work can be very frustrating. You've been working for two hours, finally feel like you're getting somewhere, when the computer stops responding. We've all had this happen at some time or another. The best, and in fact the only way to prevent loss of your work before a crash occurs is to **save often**. Really, you can't save too often. Ctrl + S (the quick key to save your file) should be your best friend. After you make a few changes, save the file by either clicking the save button or pressing Ctrl + S. This minimizes the chances of losing work on the computer in any application.

### Choose a new name at milestones

Another good habit to have is to save the file with a new name when you reach a milestone. For example, you have gotten your car to the point where wide-open throttle is right, but you still have drivability issues to work out. Before you begin making changes, save the file with a new name by clicking "File->Save As" and typing in a new name (Figure 11). This gives you the option of going back to a known point in the tune if you don't like the result of the changes or something else goes wrong. Additionally this gives you multiple copies of your program in the event something happens to one of the copies.

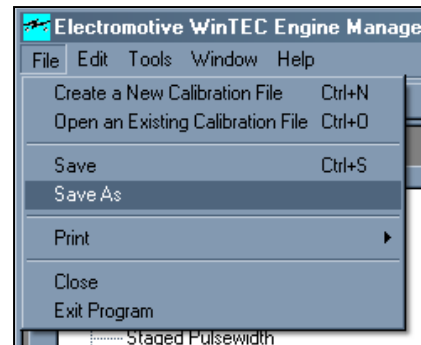


Figure 11: File -> Save As

### Know where your file is saved

Another thing that can happen occasionally is you save your file, but don't know where it is. When you wish to retrieve your BIN file, the file should be stored where it may be easily found. The best way to avoid this problem is to designate a specific place where you ALWAYS save your files. A great choice is the "My Documents" directory that appears on virtually every Windows desktop (Figure 12). Open the directory from your desktop and create a directory in there that will hold your BIN files. To do this, click File->New->Folder in the My Documents window, and call the new directory: BINS (Figure 13). When you save your file in WinTEC, save it to this location (Figure 14). After doing this once, WinTEC will default to your designated directory every time, but you should still check to be sure of where your files are going.

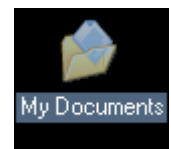


Figure 12: My Documents Folder

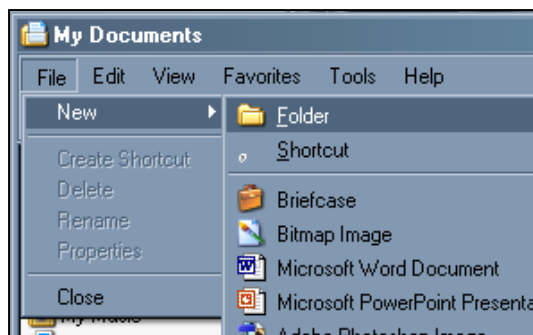


Figure 13: File → New → Folder

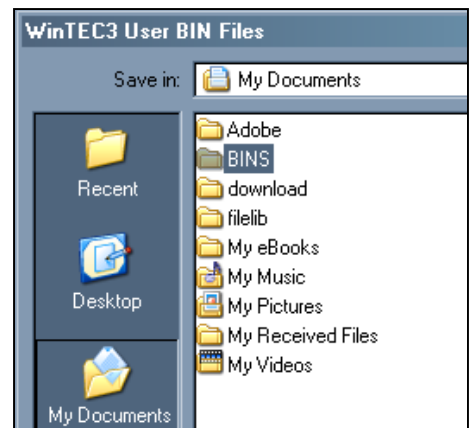


Figure 14: → Save in My Documents\BINS

### **Tips on Naming files**

The name of the file is very important. It should tell you something about that file. This is even more important when you deal with many BIN files or multiple applications in different vehicles because there may be a lot of information that must be conveyed. The unit will store up to 24 characters, which should allow for plenty of description. Don't forget that the names must be helpful to you, but not necessarily to anyone else. So if you deal with only your own car, "turbo initial tune" is probably enough. If you change your cam, "turbo new cam" will work. Adding the date is only useful if it will have meaning for you. Someone who tunes many vehicles needs to be more careful. The last name of the owner should probably be in the file name. The date might be useful here so it can be matched up with a dyno sheet or even a bill.

### **Backups**

Backups are very important. If your computer is stolen or breaks down you need to have another copy of your BIN file somewhere separate so that you still have your data. In the long run, the data is what makes the computer valuable. Therefore, having a backup is essential.

How often you need to backup is somewhat dependant on how often your data changes. When working with a lot of files everyday, a backup every week is fine, but a backup every day would be better. If you work with WinTEC only sporadically, backing up the data after you use it is a good idea. Simply copying your data to another disk or CD is all that is needed. Do not keep your backups in your laptop bag. Keep them in a desk or a safe somewhere separate. This way if your laptop and bag are stolen, you don't lose your backups with it.

What you use to backup your data is also important. Floppy disks are inexpensive, widely available and often large enough to hold the data you need to backup, but tend to be very unreliable. Any magnetic field near by can cause data corruption. They also have a limited shelf life. CD's are much more reliable, and hold far more data allowing you to backup more data at once. They also cannot be accidentally erased.

## Creating a New Calibration file

Creating a new BIN file only requires filling out a form to get started. To begin Click File -> Create a New BIN file. This brings up the Create BIN wizard (Figure 15). Follow this order for the best results:

1. Select the unit type (TEC<sup>GT</sup>, XDI<sup>2</sup>).
2. Select the engine type
3. Enter a maximum RPM. This will be your default primary rev-limit.
4. Enter the MAP sensor type. IF you have an XDI2, skip to the end.
5. Enter a Minimum Injector Turn-On time (MIT). 1.5 ms is a good starting point.
6. Enter a TPS fully closed voltage. You probably won't know this, if this is a new installation. If you know the value, enter it here. If not, enter .75v and change it in the sensor parameters when you have the monitor up and running.
7. Select the camshaft style. This only makes a minor difference in the estimated TOG that will be calculated and will not affect operation of the system.
8. Enter the number of injectors.
9. Select the injector current. When running a single injector per channel, the 2-amp setting is the most common. The 4-amp setting is generally used for two injectors per channel.
10. Enter the estimated horsepower at the **crank** for your engine. This may be just a guess, but the better your guess is, the closer to correct the TOG will be.
11. Check the alcohol fuel check box if you are running methanol or ethanol.
12. When you click the injector size box, the minimum size injector required will appear. Your actual injectors should be bigger than this. Enter the actual size in place of the minimum size.
13. After entering the injector size and pressing enter, the suggested estimate for TOG will appear at the bottom of the window. Enter this value in the TOG box.
14. Leave IOT at 0 for now.

After completing the form, click "Create BIN file". This will complete the process and load the file. This file should be good enough to program into your unit and start the engine. The tune will not be good, but, if your wiring is correct and you have no other problems the car should start and run well enough to get the car to a tuner or to begin tuning yourself.

The screenshot shows the 'General Engine Configuration' window with the following settings:

- TEC UNIT: [Dropdown]
- Engine Type: [Dropdown]
- Maximum Engine Rev Limit (1000 to 20000): 7000 RPM
- Maximum Controllable PulseWidth: 0 ms
- Time for One Gamma (TOG): 0 ms
- Injector Offset Time (IOT): 0 ms
- Minimum Injector Turn-on Time (MIT): 0 ms
- TPS Fully Closed Throttle Voltage: 0 Volts
- Camshaft Style: [Dropdown]
- MAP Sensor Installed # (1,2, 3 or 4 BAR): 1
- Max Boost Pressure (0 to 1 BAR): 0
- Number of Injectors (1 to 24): 1
  - 2 Amp Inj Peak
  - 4 Amp Inj Peak
- Estimated Brake HorsePower: 0 HP
- Check Box if Engine Alcohol Fueled
- [ ] 0 lb/hr

At the bottom of the window, it displays: WinTEC Calculated TOG [ 0 ] ms

Figure 15: Creating a BIN file



## Opening an existing file

If you already have a file you want to work with, click the Open button in the upper left of the screen (Figure 16), or press Ctrl + O. If the file has not been opened in your copy of WinTEC before, you will be asked for the system type (TEC<sup>GT</sup> or XDI<sup>2</sup>).

If you have a file open already, you will be prompted to save the file before opening the new file.



Figure 16: Open a file

## Loading a Calibration into the unit

Once you have the BIN file you are going to use established, you must program your TEC<sup>GT</sup> or XDI<sup>2</sup> before starting your engine for the first time. With the BIN file open and the unit connected to the PC and powered on, click the Program button at the top of the screen (Figure 17). The unit will begin to program. You will be instructed to cycle the power on the unit once the process is complete. Pressing Ctrl + T will have the same effect as clicking the Program button.

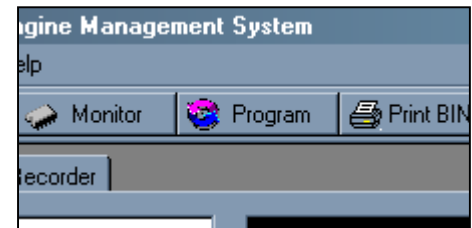


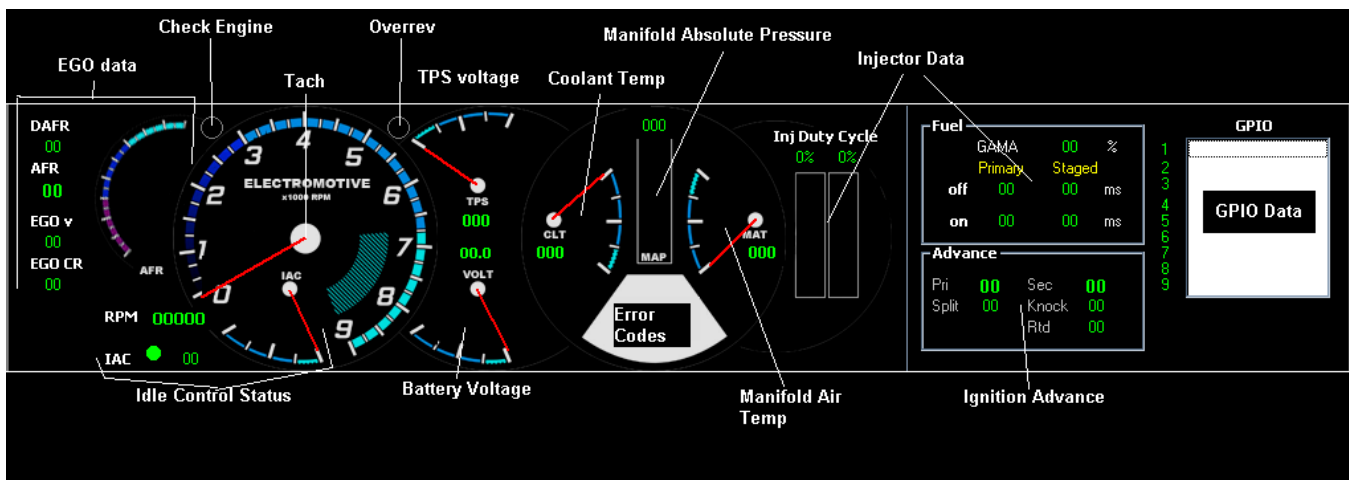
Figure 17: Program Button

If a program operation fails, first make sure that your engine is off. Attempts to program a BIN file with the engine running will immediately fail. If the engine is not running, check your connections and ensure that the unit is communicating with WinTEC.

## Editing a Calibration file

### Monitoring

WinTEC does not automatically begin showing data from the connected system. Clicking the Monitor button or pressing Ctrl + M will start or stop monitoring. A BIN file must be open for monitoring to work. If the unit is turned off or otherwise loses connection while monitoring, a "No Connect" message will appear in the lower right of the dashboard. The "No Connect" message will disappear and monitoring will resume when the connection is re-established.



## ONFLY tuning

The ONFLY tuning feature allows changes to be made to the calibration while the engine is running so you can immediately see the effects. Changes made ONFLY are temporary.

With the exception of the GPIO options and the tables, all values that can be changed ONFLY will be highlighted with yellow. If the boxes for the values are not yellow, and the unit is connected, monitoring must be enabled. This will establish communication and enable ONFLY tuning.

If you save the file with the unit connected, either by clicking “Save” or by pressing Ctrl + S, any ONFLY changes will be made permanent in the unit. The engine may stumble very briefly when the changes are saved, this is normal and will not cause any damage. If the unit is turned off without saving the changes to the PC, the unit will restart with your old settings. You will need to program the unit to apply the new settings and make them permanent.

Some settings cannot be changed ONFLY. Here is the list of settings that must be changed and then programmed to take effect:

- Engine type
- TDC tooth
- Injector Peak current
- GPIO function
- Idle speed control valve type (2-wire, 4-wire)
- Any setting to enable/disable a subsystem or sensor (i.e. Idle Control On/Off, MAT Enable/Disable, etc)
- Turn IAC off at Minimum duty

## Editing a Table

Changing a single cell in the table is very simple. Click on the cell you wish to edit or use the arrow keys to move to the cell you wish to change, type the new value and press enter. The value may also be incremented up or down by using the “<” key for a decrement and the “>” key for an increment.

Clicking and dragging over several cells or holding the shift key while moving the cursor with the arrow keys will select multiple cells (Figure 18). Once the cells are selected, typing a new value will fill all of the cells with that value. Multiple cells can be incremented or decremented with the “<” and “>” keys as well. The cells may be incremented as many times as you like, but you will be warned if any of the values hit a limit (i.e. 60 degrees is maximum in the ignition table).

	900	1300	1700	2100	2500	2900	3300	3700	4100	4500	4900
99	16	22	24	25	25	27	28	29	29	30	30
95	16	20	22	23	22	24	26	26	27	27	27
93	16	20	21	21	22	23	23	25	26	26	26
87	16	18	19	26	26	26	26	26	26	26	26
82	16	18	18	29	29	29	29	29	29	29	29
76	16	18	18	30	30	30	30	30	30	30	30
71	16	17	18	31	31	31	31	31	31	31	31
65	16	16	18	32	32	32	32	32	32	32	32
60	16	15	18	33	33	33	33	33	33	33	33
54	16	14	18	34	34	34	34	34	34	34	34
49	16	14	14	35	35	35	35	35	35	35	35

Figure 18: Selecting multiple cells in the table

The row and column MAP and RPM points can be changed from any table (VE, Ignition, GPIO full table, etc). Double clicking an RPM or MAP value will show a dialog box that asks for a new value. Remember that any change you make affects all

tables. Clicking the Setup button brings up a screen allowing changes to all of the RPM and MAP values at once.

When a unit is being monitored, a small red dot will float over the table in the location the unit is operating. This simply shows you where the engine is operating to allow tuning to the appropriate part of the map.

When attempting to tune a set of cells, it may be helpful to see all of the cells touched by the unit. This can be done by enabling color persist. In the software, this is called overlay. This can be enabled and disabled by pressing Shift + O or clicking the down arrow next to Setup and selecting overlay ON or overlay OFF. Overlay is turned off when changes are being made and must be re-enabled after the changes have been made either with the menu or by pressing Shift + O. The color persist will carry over to other tables when switching. Clicking the options menu and selecting 'Reset to White' will clear the persist marks.

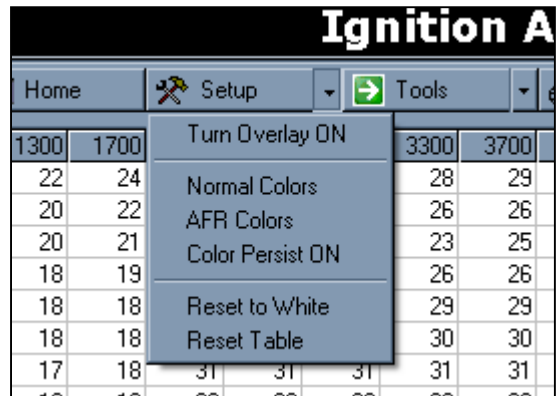


Figure 19: Table Options Menu

There is an option in the options menu called AFR colors. This makes the overlay change color with the AFR needle in the dashboard. This option combined with persist makes it very easy to see where the mixture is lean or rich while tuning. Normal Colors switches to the default yellow. AFR colors can be set as the default in the Control Panel (See the section on Changing the Dashboard Appearance).

You can view a 3-D graph of each table by clicking on the Tools menu (Figure 20) and selecting Graph. One point on the graph is highlighted and the information for that point is displayed in the upper left of the graph window.

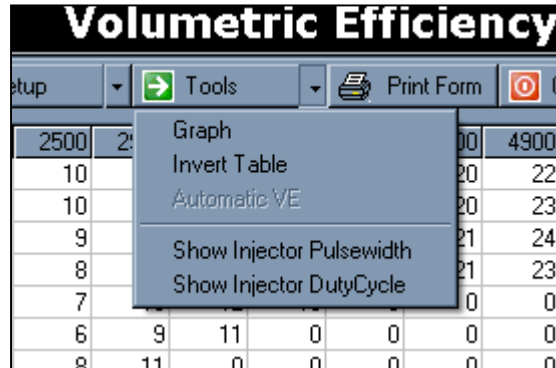


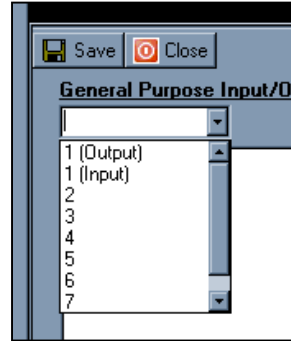
Figure 20: Table Tools Menu

Sometimes it is useful to see what the effective pulse width for each cell in the VE table will be. To do this, click on the tools menu and select Show Injector Pulse width Table. This option is only available in the VE table. When viewing the pulse width table, any cells with a pulse less than the minimum turn on time will be highlighted in red. Seeing the duty cycle in the VE table can also be quite useful. Click the tools menu and select Show Injector DutyCycle. Any cell with greater than 100% duty cycle will be highlighted in red. To return to the VE table, click the "Home" button (visible in Figure 19).

## Editing the General Purpose Input/Outputs (GPIOs)

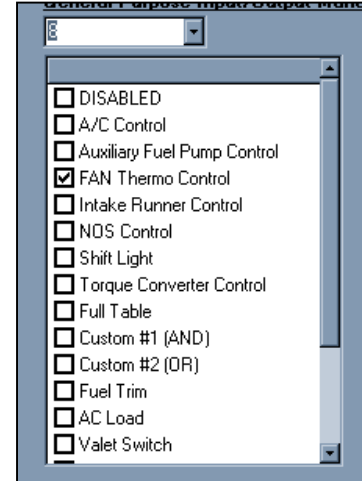
The GPIOs are very flexible and have a lot of options. To ease their configuration, the channels are shown numbered then each channel will only show the functions available to that channel.

To configure a GPIO, click on the General Purpose Input/Output option in the Navigation tree. In the configuration screen that appears, there is a drop down for selecting a GPIO channel (Figure 21). Some channels, will have an “Input” or “output” next to the number. This means that channel only has input or output functions available to it.



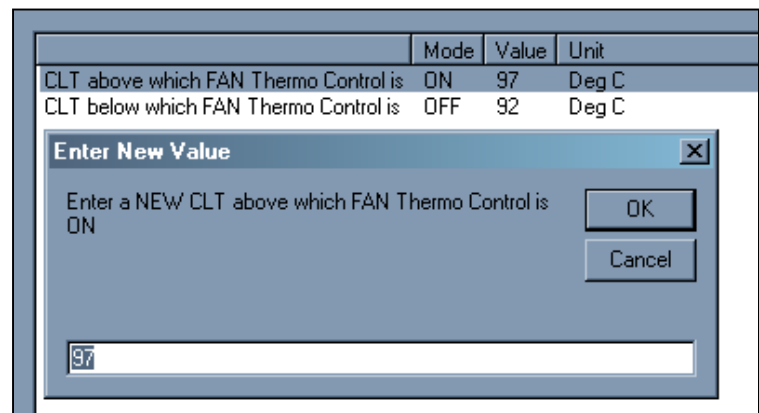
**Figure 21:** Selecting a GPIO channel (TEC<sup>GT</sup> shown)

After you select the channel you want, the list of available functions will be shown in the box below the channel drop down. To select a function click the check box next to the function you want (Figure 22). **The unit must be disconnected or powered off to change the function.**



**Figure 22:** Selecting a GPIO Function

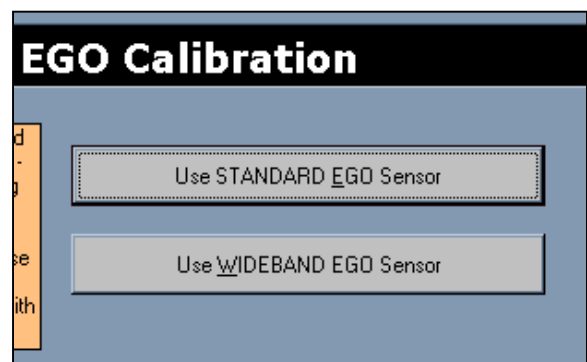
Once you have selected a function, the configuration options will appear to the right. Double click the option you want to change. A dialog box asking for the new value and showing the acceptable range will appear (Figure 23). Enter the new value here. Changes made here may be done ONFLY and will take immediate effect when the unit is connected and powered on.



**Figure 23:** Changing a GPIO Parameter

### Configuring the EGO (TEC<sup>GT</sup> only)

The TEC<sup>GT</sup> supports both narrow band and wideband O<sub>2</sub> sensors. The correct type must be selected before it will operate correctly. Click either Narrow Band or Wideband in the EGO Calibration screen to make the selection (Figure 24). Narrow band is the default.



**Figure 24:** Select the EGO type

Narrow band sensors virtually all work the same way. Therefore, the default calibration for the narrow band sensor should be fine. Wideband sensors will each likely have a different calibration. This information can typically be found in the documentation included with the sensor, or can be obtained from the manufacturer. The calibration data should be entered into the table in the middle of the screen (Figure 25). The voltages must be in ascending order; so entering the values from highest to lowest may be necessary. If the sensor calibration data is not properly entered, the AFR readings will most likely be incorrect.

		User Defined EGO Calibration Values									
<b>A/F Ratio</b>		10	11	12	13	14	14.7	15	16	17	20
<b>EGO Volts</b>	<b>0 Volts</b>	1.7	1.95	2.2	2.33	2.49	2.57	2.73	3.09	3.39	<b>5 Volts</b>

**Figure 25:**  
Calibration table for the EGO sensor

The two numbers at the bottom are failure voltages (Figure 26). If the EGO voltage is outside these two voltages for the amount of time defined in the EGO sensor parameters, a failure code will be triggered.

Minimum EGO/WideBand Voltage before Sensor is Disabled	<input type="text" value="0"/>	Volts
Maximum EGO/WideBand Voltage before Sensor is Disabled	<input type="text" value="5"/>	Volts

**Figure 26:** EGO failure voltage settings

## Flight Recorder

The flight recorder in WinTEC v4 is meant to give the user a simple tool to watch what the vehicle is doing. The flight recorder works like a VCR. The data you have recorded on the dashboard will playback in real time and show the data in graph form.

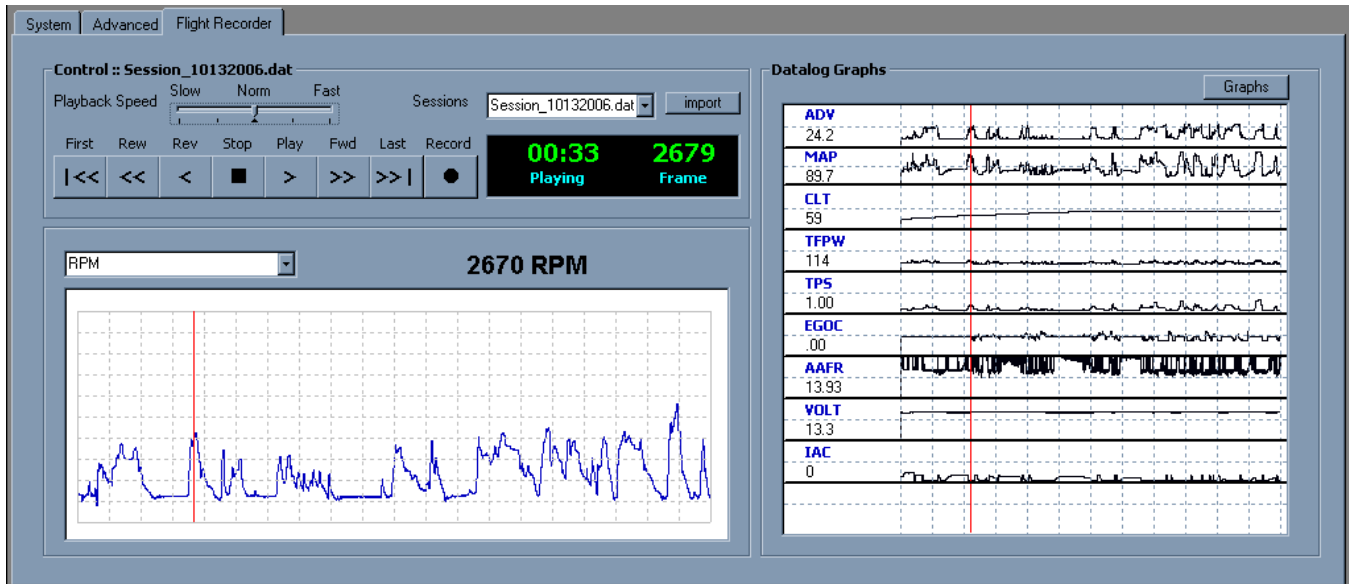


Figure 27: The Flight recorder.

## Recording

To start a new datalog, click the record button and enter a name for the session. The name of the session defaults to Session\_<date>, where <date> is today's date. Names can be long and include spaces. When the recording is complete, click the stop button. The datalog will then be loaded and ready for analysis.

## Playback

If you did not just record a session, you will need to load a datalog before doing any play back. Select a session from the 'sessions' pull down (directly above the timer). If the datalog you want to view is not listed, you will need to import the data log. See the section on importing another user's datalog.

The data will always play back on the dashboard in real time when playing a datalog, but the graphs help show trends and find anomalies. If you have not already done so, you will need to select what data will be displayed in the small graphs on the right. The graphs that will be displayed in the space at the right are selected in the Control Panel from the Datalog Graphs tab (Figure 28). These options can also be reached by clicking the "Graphs" button at the upper right of the

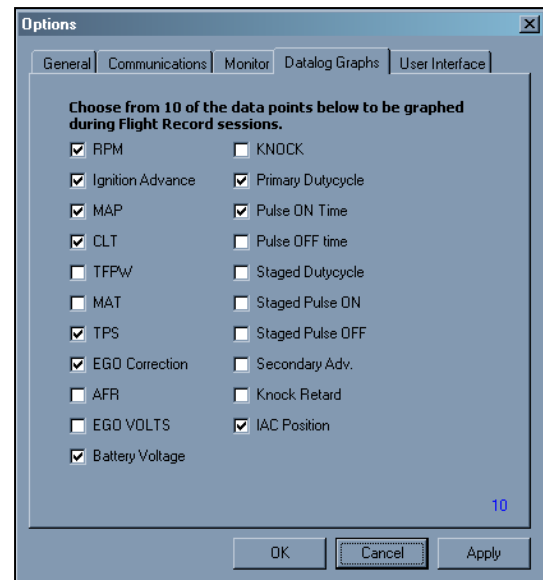


Figure 28: Datalog Graph selection

small datalog graphs. You can select up to 10 channels for display. The number of channels you have selected is the small blue number in the lower right of the select screen. These graphs can be changed at any time, including during datalog playback.

Control of the flight recorder works much like a VCR or DVD player. Here is a brief description of what each control button does:

First: Jump to the beginning of the file

Rew: Step one record back (pauses playback if playing)

Rev: Plays the file at the selected speed in reverse

Stop: Halts playback. Playback will resume from the current position. If already stopped, timers and position is reset to the beginning.

Play: Plays the file normally at the selected speed

Fwd: Step one record forward (pauses playback if playing)

Last: Jump to the end of the file

Record: Begin recording a new file

The playback speed can also be changed to quickly get to a specific point or to see a portion in more detail. The playback speed slider above the control buttons changes the playback speed. The Slowest setting is about ¼ speed and the fastest is about 4x normal speed.

### **Importing another user's datalog**

If another WinTEC user has a datalog they made in WinTEC, their file can be imported into your datalog list using the "Import" button. After selecting the file, it is read in the same way as selecting a datalog from the drop down. The file is also added to the drop down. You may then use the datalog as though you had recorded it yourself. Only datalog files made with WinTEC4 are supported.

## Firmware Upgrade

The firmware versions used with WinTEC v4 are handled a little bit differently from the past. WinTEC v4 is written to work with many different systems and firmware versions. Differences between units and firmware versions are all handled automatically. What this means is that as long as you have the newest version of WinTEC v4, you will always be able to communicate with any unit supported by WinTEC v4. Firmware version no longer prevents the ability to communicate or program any supported unit.

The firmware version does, however, dictate what features the unit supports. Having the newest firmware for your Electromotive system ensures that you will have access to all the features available.

That said, a firmware upgrade should not be taken lightly. If your vehicle is operating properly and you are satisfied with the features you have, a firmware upgrade should not be performed. If it is not broken, do not fix it.

Doing a firmware upgrade is fairly simple but does require a number of steps. If you've read to this point, and still want or need to upgrade, here are the steps:

1. Start WinTEC and connect your system. Allow WinTEC to find the unit.
2. Open you BIN file.
3. Power the unit down and disconnect the serial cable from the unit
4. Using a small Allen wrench or flat head screwdriver (no bigger than  $\frac{7}{64}$ " or 2.5 mm), press the button behind the small hole next to the serial port.
5. With this button held down, power on the unit. This should not take much effort, do NOT press too hard. You should feel the button give when pressed.
6. The LEDs should indicate that the unit is in boot loader mode. The TEC<sup>GT</sup> should show red on top and green on the bottom. XDI<sup>2</sup> will show green on top and red on the bottom. If the LEDs do not show what you expect, repeat steps 2 and 3 until the sequence is correct.
7. Once the unit is in boot loader mode, reconnect the serial cable.
8. Click on Tools -> Options -> Firmware upgrade.
9. Click OK on the warning dialog that pops up.
10. Specify the firmware upgrade file. It will end in ".EM3". A file starting in "WTL" is for a TEC<sup>GT</sup> and one beginning in "WXD" is for an XDI<sup>2</sup>.
11. Once selected, the process will begin. **Be sure not to disconnect the serial cable or turn the unit or the PC off during this process.**
12. When the process completes, turn the unit off, then back on. This completes the process. The BIN file already on the unit is kept intact.

If for some reason the process fails, the top LED will be OFF when the unit powers back on. Whether caused by a bad file, from the laptop losing power, the shop dog stepping on the serial cable or something else. All is not lost. Fix whatever may have caused the problem and start the process again from the step 3.



## Appendix: Shortcut keys

### Navigation

F5 – Ignition table

F6 – VE Table

F7 – Staged Injection Table

F8 – AFR Table

Tab – jumps to the next box or from the tree to the first box of the selected screen

Arrow Keys – Move around the navigation tree

### File Control

Ctrl + N – Create a new file

Ctrl + O – Open a file

Ctrl + S – Save the current changes, make **ONLY** changes permanent in the unit

### TEC Control

Ctrl + T – Program current BIN file into connected unit

Ctrl + M – Start/Stop Monitoring

### Table Control

Shift + O – Enable/Disable Overlay (color persist), Monitor mode only

Shift + X – Close table and return to navigation tree

Arrow Keys – move to another cell

“<” – Decrement the selected cells by one

“>” – Increment the selected cells by one

Shift + Arrow Key – Select multiple cells

## Glossary

**Advance:** As applied to ignition timing, advancing the timing refers to firing the spark plug comparatively sooner.

**Boost:** When a pressure that is greater than the ambient atmospheric pressure is forced into the intake manifold. Turbo- and superchargers create boost.

**Cam Sensor:** A device used to provide a once-per-engine cycle pulse to the TEC. This establishes the stage of engine operation that is occurring for a given TDC.

**Closed Loop:** When an oxygen sensor reading is used to correct the air-fuel mixture through the manipulation of the fuel injector pulse widths.

**Coolant Enrichment:** A coolant temperature-based fuel enrichment that is used to add fuel when an engine is cold. This feature is the electrical equivalent of the choke plate on a carburetor.

**Coolant Temperature Sensor:** A device that measures the coolant temperature of an engine.

**Crank Sensor:** A device that can “read” a crank trigger wheel, and output a voltage signal that can be used by an engine management system.

**Crank Trigger:** A device used to measure the crankshaft position and speed, typically composed of a crank trigger wheel and a crank sensor.

**Detonation:** When the air-fuel mixture is ignited by the spark plug, then a high cylinder temperature “spontaneously” ignites another portion of the unburned mixture. A knocking sound is produced when detonation occurs, and knock sensors are designed to hear this knocking. Engine damage can be caused by detonation.

**DFU:** Direct Fire Unit. Electromotive coil packs are referred to as DFUs.

**Directory:** A subsection of disk space on a computer. May be within another directory. Typically used for organization. Also called a Folder.

**Duty Cycle:** The percentage of time that a pulse width modulated output is turned on. A duty cycle of 100% indicates a fully turned-on modulation output.

**ECU:** Electronic Control Unit. A device that is used to process several inputs for the control of several outputs.

**Exhaust Gas Oxygen (EGO) Sensor:** A device that compares the oxygen content of the exhaust gases with the oxygen content of the ambient atmosphere. An air-fuel ratio approximation can be made with an EGO sensor.

**Enrichment:** A software parameter that adds injector pulse width (typically as a percentage) to the values defined by the raw fuel curve.

**Folder:** See Directory.

**Fuel Pressure Regulator:** A device that regulates the fuel rail (and thus the fuel injector) pressure. Generally equipped with a vacuum port referenced to manifold vacuum/boost to adjust fuel pressure on a 1-to-1 basis with manifold pressure. For examples, a regulator will increase fuel pressure by 1psi for every psi increase in manifold pressure.

**Gamma:** See TFPW. This number is no longer used with TEC<sub>3</sub> systems.

**General Purpose Inputs (GPI):** Input channels that the TEC<sub>3</sub> can use to process data from sensors that are not related to the core engine management sensors. Switches and vehicle speed sensors can be run to the GPIs.

**General Purpose Outputs (GPO):** Output channels from the TEC<sub>3</sub> that can be used to trigger external devices such as thermofans, torque converters, etc.

**Horsepower (HP):** A measurement of the rate at which an engine can perform work. One HP = 550 lb-ft per second.

**Idle Air Control (IAC) Motor:** A device that is used to meter air into an engine at idle. Air from the outside of the intake manifold is regulated into the intake plenum by the IAC motor.

**Ignition Timing:** The amount of degrees before Top Dead Center that a spark plug fires.

**IOT:** Injector Offset Time. This number adds or subtracts a fixed pulse width from the raw fuel curve. The value of IOT is the amount of time (in milliseconds) that will be added or subtracted to the final pulse width.

**Knock Sensor:** A device used to measure detonation.

**Knocking:** see 'Detonation'

**Lean Mixture:** An air-fuel mixture that carries less fuel than the stoichiometric air-fuel ratio.

**Manifold Air Pressure (MAP) Sensor:** A device that measures the absolute pressure of the intake charge for an engine.

**Manifold Air Temperature Enrichment:** An inlet air temperature-based enrichment that is used to add fuel when the incoming air is cold, and therefore denser than usual.

**Manifold Air Temperature (MAT) Sensor:** A device that measures the temperature of the incoming air charge for an engine.

**Millisecond (ms):** A length of time equal to one one-thousandth of a second. 1 millisecond = 0.001 second

**Mixture:** A term used to describe the air and fuel entering the engine as a single entity.

**Open Loop:** When an engine is running off of its base calibration with no EGO sensor feedback to correct the air-fuel ratio.

**Pinging:** See 'Detonation'.

**POT:** Pulse Width Offset Time (now Injector Offset Time). This number is not used with WinTEC v4 systems, but was used in WinTEC 3. 'See IOT.'

**Pre-Ignition:** When the air-fuel mixture is ignited by a hot spot in the combustion chamber BEFORE the spark plug fires. When pre-ignition occurs, it produces a similar effect to advancing the ignition timing too much. Engine damage may result.

**Pulse Width:** The amount time that an injector is turned on for a given operating scenario. Expressed in milliseconds (ms).

**Pulse Width Modulation (PWM):** When a variable pulsed voltage signal is supplied to a module, pulse width modulation is occurring. Fuel injectors are common examples of PWM-controlled modules.

**Stoichiometric Mixture:** An air-fuel mixture that has the chemically ideal ratio between incoming air and fuel. When combusted, the product of a stoichiometric mixture will carry no excess air or fuel.

**Retard:** As applied to ignition timing, retarding the timing refers to firing the spark plug comparatively later.

**Rich Mixture:** An air-fuel mixture that carries more fuel than the stoichiometric air-fuel ratio.

**Rising Rate Fuel Pressure Regulator:** A Fuel Pressure Regulator that is adjustable to provide a non 1-to-1 relationship between manifold pressure and fuel pressure. For example, a rising rate regulator may be used to supply 2psi of fuel pressure increase with every 1psi of manifold boost.

**Spark Knock:** See 'Detonation'

**TFPW:** Total Fuel Injector Pulse Width. This number defines that total modification to the raw fuel curve that is occurring at a given instant. A TFPW of 100% indicates that no modification is occurring to the raw fuel curve. A TFPW less than 100% indicates a leaner pulse width than the raw fuel curve value, while a TFPW greater than 100% indicates a mixture that is richer than the raw fuel curve value.

**Throttle Position Sensor (TPS):** A device used to measure the position of the throttle.

**TOG:** Time for One Gama. This number defines the slope of the raw fuel curve. When POT is zero, the raw fuel curve will have zero pulse width at zero MAP sensor volts. When the MAP sensor is at +5volts, the pulse width will be the number entered into TOG, expressed in milliseconds.

**Torque (TQ):** A measurement of the work that an engine can perform, typically expressed in pound-feet (lb-ft).

**TPS/MAP Blend:** A feature of the Wintec software that allows the TPS and MAP sensor readings to be blended together. Typically, this feature is used on engines with radical cams or throttle-per-cylinder setups since these engines have poor MAP signals at idle and part throttle.

**Trigger Wheel:** A device attached to the crankshaft that provides a moving reference of speed and position of an engine's crankshaft.

**UAP:** User Adjustable Pulse Width (now TOG). This number is not used with WinTEC v4 systems, but was used in WinTEC3. See 'TOG.'