



THUNDERMAX

EFI made simple.

SmartLink IV Tuning Manual

**SOFTWARE Version 2008.0.3+
For ThunderMax High Resolution ECM
2001-2008 Delphi®-Based
Air Cooled Motorcycles
(Except 2008 Touring Models)
Manual V.20080619**

The ThunderMax EFI controller is not legal for use or installation on motor vehicles operated on public highways in the State of California or other States where similar emission control laws may apply.

The user shall determine suitability of the product for his or her use. The user shall assume all risk and liability in violation of regulations and any incurred financial obligations due to vehicle inspections or emissions tests.

Email Technical Questions to: ProductSupport@ZippersPerformance.com
www.Thunder-Max.com

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Section 1:

Introduction

SYSTEM REQUIREMENTS

The SmartLink IV software package is designed to run on personal computers using Microsoft® Windows 2000™, Windows XP™, and Windows Vista™ operating systems. The computer system must have an adequate amount of free space on the hard drive for proper operation. SmartLink IV is approximately 94MB when installed. SmartLink IV no longer supports Windows 98™ or earlier operating systems.

An RS232 Serial Port is required on the computer to allow communication between the SmartLink IV software and the ThunderMax ECM. A special RS232 communication cable is included in this package, allowing the user to edit maps and module settings in the ThunderMax ECM. **A high speed internet connection is required for software, firmware, and Base Map Library updates.**

NOTES: *If your computer is not equipped with an RS-232 serial port, you will need to purchase a USB-to-RS232 adapter from Zipper's. Ask for Part # 372-000 (USB to Serial Port Converter). **Vista Users do not need to install the supplied drivers** for proper adapter operation. If an internet connection is available, Vista will automatically install the drivers when the adapter is first inserted into your computer.*

USER REQUIREMENTS

The Smartlink software requires basic computer skills to be able to effectively use the program and achieve your tuning goals. The operator must possess the following basic skills before attempting to use the software or calling Zipper's Technical Support:

- 1.) **Basic Windows™ Skills**
- 2.) **Ability to Copy and Paste** files from one folder to another
- 3.) **Maneuver through a typical Windows™ environment**, storing files in folders and retrieving them when needed.
- 4.) The ability to **Establish an Internet Connection** for software, firmware, and Base Map Library updates. **You must have a high speed internet connection** on the computer that you're about to install SmartLink IV on.

CONTENTS OF SUPPLIED DISC

The SmartLink IV disc includes the following:

- **SmartLink IV Software**
 - Complete Base Map Library
- **SmartLink IV Tuning Manual Instructions**, in .PDF format
 - Now accessible through the SmartLink Software.
- **AutoTune Demo File** – Watch this sample video file of the AutoTune correcting for a 20% rich and a 20% lean condition. The video was created using a ThunderMax ECM with AutoTune on a load control dynamometer.

If the SmartLink IV disc is not available, the SmartLink IV software Tuning Manual can be downloaded from the www.Thunder-Max.com website, under the Support section.

IMPORTANT NOTES

- The SmartLink IV Tuning Manual contains a Glossary of Terms as well as an Appendix with a dialog on the menus and functions of SmartLink IV. These features have been added to avoid any confusion over the terminology and functions used in SmartLink IV and in EFI tuning in general. Please refer to the end of this document for these valuable tools when needed.
- If you are using the ThunderMax controller in an open loop configuration and your application is not listed on the SmartLink Map Database, additional tuning will be required. If the bike has small variations from the original design of the base map, basic adjustments or calibration will be necessary. Please carefully review the instructions so the tune up can be performed smoothly with SmartLink IV.
- In addition, the speedometer calibration should always be confirmed during the installation for your year/model motorcycle. This is critical so that your speedometer is calibrated and functional before road testing your new ThunderMax ECM. In addition, anytime a map is reloaded or a new map is loaded onto your ECM, the speedometer calibration needs to be set to your application.



NOTICE to Dealers and Tuners: If you are a dealer, or an experienced tuner, contact your Zipper's representative to learn about the Advanced authorization. The SmartLink IV Advanced software is specifically designed for the development of base maps, or significant base map alterations.

The ThunderMax EFI controller is not legal for use or installation on motor vehicles operated on public highways, and may be restricted to closed-course competition use only, in the State of California and other States where similar emission control laws may apply.

The user shall determine suitability of the product for his or her use. Installation and use on a pollution-controlled vehicle, for highway use, constitutes tampering under the US EPA guidelines and can lead to substantial fines and penalties.

Section 2:

Hardware and Software Installation



Always pull the ECM fuse before disconnecting or reconnecting the battery! At any point if the ECM Fuse has been pulled, including battery replacement, the ThunderMax ECM must be re-initialized. See the initialization procedure on page 11.

THUNDERMAX ECM INSTALLATION



NOTE: If you are removing a post fuel devise system and your throttle blade position has been changed from the factory setting and you are unable to set the blade setting back to the original position, call Zipper's Tech Support before you install this unit.

Follow all of the instructions located in the package and attached to the ECM to properly install and initialize the ThunderMax unit. Although the mounting locations are different for each of the three families of motorcycles (Dyna[®], Softail[®], and Touring), the process is virtually the same for all models.

Please read the model specific installation instructions for your application before attempting to install the ThunderMax ECM. Also read the supplied QuickStart Manual for an abbreviated version of the installation instructions.

Touring Model Installation:

Open Loop – ThunderMax ECM Only – No AutoTune Module

- 1.) Remove the ECM fuse
- 2.) Disconnect the ECM harness
- 3.) Use a 3/16 hex key to slowly turn the mounting bolts in and out, gradually freeing the thread locking compound. (See Installation Tips on page 26)
- 4.) Remove the Stock ECM
- 5.) Attach the ThunderMax ECM to the ECM Harness.
- 6.) Install the ThunderMax ECM in the stock ECM location.
- 7.) Install the ECM fuse
- 8.) Initialize the Module (page 11).

Closed Loop System – ThunderMax ECM with AutoTune

- 1.) Remove the ECM fuse
- 2.) Disconnect the ECM harness
- 3.) Use a 3/16 hex key to slowly turn the mounting bolts in and out, gradually freeing the thread locking compound. (See Installation Troubleshooting below)
- 4.) Remove the Stock ECM
- 5.) Attach the ThunderMax ECM to the ECM Harness. *Do not install the ECM onto the motorcycle at this point. If the ECM is mounted onto the electrical caddy at this step, it is difficult to get the fuse box in place.*
- 6.) Reinstall the ECM fuse; insert the ECM Block back into position.



Installation

- 7.) Install the ThunderMax ECM in the stock ECM location.
- 8.) Wide Band Oxygen Sensor Installation

Determine if your application currently has oxygen sensors installed in the exhaust pipes. All 2007 & Up Touring models are produced with oxygen sensors in the factory head pipes. If your exhaust system does not have oxygen sensor bungs (2006 – earlier), you will either need to install sensor bungs into your current head pipes, or purchase an exhaust system that has the sensor bungs already in place. If you choose to add the sensor bungs to your current exhaust system, the bungs must be located within 4-6” of the cylinder head. If you need sensor bungs, please call Zipper’s and request **PN: 272-200** (sold individually).



Aftermarket exhaust systems may or may not have the appropriate sensor bungs welded in place. **The Bosch wide band oxygen sensors supplied with the Auto-Tune Kit fit ALL OEM head pipe systems with adequate clearance.** If you have an aftermarket exhaust system, there may or may not be ample clearance for the taller wide band oxygen sensor. Please contact the exhaust system manufacturer if a problem occurs. Zipper’s can only create bolt-on products and kits based off of factory specifications and dimensions, if an aftermarket manufacturer has not followed the factory locations, clearance issues may exist. Make sure the sensor does not rub the frame, transmission or any parts of the motorcycle that could damage the sensor.

9.) Remove the factory narrow band oxygen sensors from the exhaust pipes (if applicable). None of the factory equipped narrow band oxygen sensors were installed with an anti-seize compound, so they are generally difficult to remove. When a tight spot is detected, work the sensor back and forth without forcing it out. Generally a shot of penetrating fluid will aide in the sensor removal, carbon build up on the threads will be washed away with any penetrating fluid or carburetor cleaner.

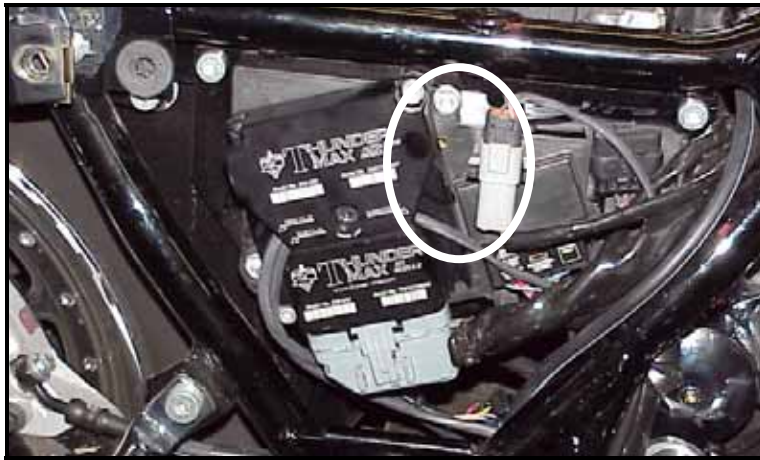
Two black connector caps are included in the Auto-Tune kit, these are supplied to protect the factory wiring harness from corrosion and to hide the yellow connectors supplied on the factory wiring harness. These wires will not be reused and should be tucked away from any heat emitting engine component.

10.) Install the supplied wide band oxygen sensors in the front and rear exhaust pipes. Check for adequate sensor clearance, the oxygen sensor, as well as the wiring at the end of the sensor, cannot directly contact any part of the engine, frame or transmission. If you are uncertain if you have adequate clearance, simply add clearance by creasing the pipe, or adding a new bung in the correct location. Take a picture and email it to ProductSupport@ZippersPerformance.com for review. Remember to route the sensor harness away from the engine and any components that emit heat.

11.) Connect the wide band oxygen sensors to the closed loop module. The sensor wiring harnesses from the Closed Loop (AutoTune) module are labeled **Front** and **Rear**. The sensor wiring harness for the rear cylinder sensor is shorter and can be

easily identified by the “Rear” label on the harness plug. It is very important to install the correct wiring harness to the appropriate oxygen sensor. **This step is critical or the engine will perform poorly!**

12.) **Plug the Auto-Tune module into the Data Link Connector on the motorcycle.** The Auto-Tune module uses the power supply from the Data Link Connector, as well as using it for data transfer to the ThunderMax ECM. A ‘Y’ harness is available to keep an open Data Link if desired, **Zipper’s PN: 309-343.**



13.) Initializing the Module



a.) Turn the ignition on for 30 seconds, making sure the “Run / OFF” Rocker switch is in the “Run” position, **DO NOT** start the engine at this point or move the throttle during initialization.

b.) After the ignition has been on for 30 seconds, turn the ignition off for 30 seconds.

c.) Repeat Steps 13 a & b two more times without starting the engine. The module is now installed and initialized.

**ThunderMax ECM
Module Initialization**

Check	“Run / Off” Handlebar Switch in "Run" Position	
DO NOT START THE ENGINE		
Cycle 1	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 2	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 3	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds

The installation is now complete for your Touring model motorcycle. Proceed to the SmartLink IV Software Installation Section, which is found on page 27.

Softail® Model Installation:

Open Loop – ThunderMax ECM Only – No AutoTune Module

- 1.) Remove the seat and the fuse box cover
- 2.) Locate and remove the ECM fuse
- 3.) Remove the stock ECM from the motorcycle. Use a 3/16 hex key to slowly turn the mounting bolts in and out, gradually freeing the thread locking compound. (See Installation Troubleshooting below)
- 4.) Disconnect the ECM harness
- 5.) Remove the Stock ECM
- 6.) Attach the ThunderMax ECM to the ECM Harness.
- 7.) Install the ThunderMax ECM in the stock ECM location.
- 8.) Install the ECM fuse
- 9.) Initialize the Module (Page 15).

Closed Loop System – ThunderMax ECM with AutoTune

Determine if your application currently has oxygen sensors installed in the exhaust pipes.

All 2007 & Up Softail® models are produced with oxygen sensors in the factory head pipes. If your exhaust system does not have oxygen sensor bungs (2006 – earlier), you will either need to install sensor bungs into your current head pipes, or purchase an exhaust system that has the sensor bungs already in place. If you choose to add the sensor bungs to your current exhaust system, the bungs must be located within 4-6” of the cylinder head. If you need sensor bungs, please call Zipper’s and request **PN: 272-200** (sold individually).



Aftermarket exhaust systems may or may not have the appropriate sensor bungs welded in place. **The Bosch wide band oxygen sensors supplied with the Auto-Tune Kit fit ALL of the OEM exhaust systems with adequate clearance.** If you have an aftermarket exhaust system, there may or may not be ample clearance for the taller wide band oxygen sensor. Please contact the exhaust system manufacturer if a problem occurs. Zipper’s can only create bolt-on products and kits based off of factory

specifications and dimensions, if an aftermarket manufacturer has not followed the factory locations, clearance issues may exist.

- 1.) Remove the seat and the fuse box cover.
- 2.) Locate and remove the ECM fuse
- 3.) Remove the stock ECM from the motorcycle. Use a 3/16 hex key to slowly turn the mounting bolts in and out, gradually freeing the thread locking compound. (See Installation Troubleshooting below)
- 4.) Disconnect the ECM harness
- 5.) Remove the Stock ECM

- 6.) Lift the battery up from the oil tank and remove the battery cables (negative first). Remove the battery.



- 7.) Remove the bolts holding the fuse block bracket to the frame and lift the bracket away from the frame to allow access to the gap between the frame and oil tank on the right side of the motorcycle.



Installation

- 8.) Connect the ThunderMax ECM to the harness and position it loosely in the ECM tray. Feed both oxygen sensor harnesses (front cylinder first) through the gap between the frame and oil tank on the right side of the motorcycle.



- 9.) At this time you may want to snake the rear oxygen sensor towards the rear exhaust pipe by starting it from the right side of the bike, under the oil tank, and around the seat post to the rear exhaust position (do not connect it to the harness until after it has been installed and tightened into the exhaust pipe, so the harness can turn freely).



- 10.) Position the harness plug for the front pipe under the transmission, along the frame rail. Install the oxygen sensors into the exhaust pipes, connect the harness plugs to the oxygen sensors and secure the harnesses to the frame above the lowest point with wire ties.



- 11.) Re-install the fuse block bracket bolts
- 12.) Attach the ThunderMax ECM to the ECM tray.
- 13.) Plug the power cable for the AutoTune module into the DataLink Connector on the motorcycle.
- 14.) Re-install the battery (positive cable first) and then install the ECM fuse.
- 15.) **Initializing the Module**



a.) Turn the ignition on for 30 seconds, making sure the “Run / OFF” Rocker switch is in the “Run” position, DO NOT start the engine at this point or move the throttle during initialization.

b.) After the ignition has been on for 30 seconds, turn the ignition off for 30 seconds.

c.) Repeat Steps 15 a & b two more times without starting the engine. The module is now installed and initialized.

ThunderMax ECM Module Initialization

Check	Run / Off Handlebar Switch in "Run" Position	
DO NOT START THE ENGINE		
Cycle 1	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 2	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 3	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds

The installation is now complete for your Softail® model motorcycle. Proceed to the SmartLink IV Software Installation Section, which is found on page 27.

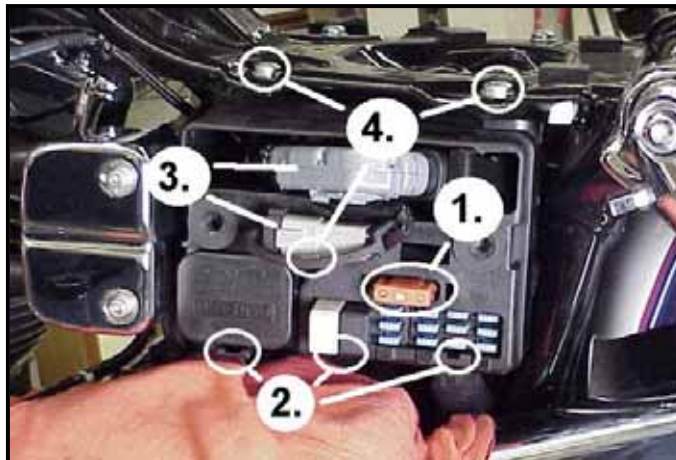
Dyna® Model Installation:



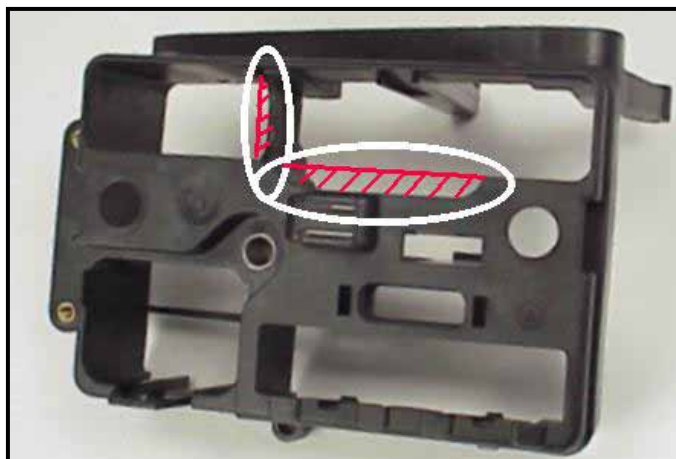
Dyna® Install (Security System with optional Siren Module) - If installing with the factory optioned siren module, you will need to program and calibrate the system before you bolt the ECM to the caddy. You cannot insert the Serial cable with the siren module in place. Complete the installation process, including starting the engine and testing the stability of the system. Install the ECM to the caddy only when you're ready for the first test ride. Then remove the serial cable before reinstalling the ECM in the caddy. If you want to leave the cable hooked to the module for future tuning access, you will need to relocate the optional siren module.

Open Loop – ThunderMax ECM Only – No AutoTune Module

- 1.) Remove the left side cover to reveal the electrical caddy. Locate and remove the main fuse
- 2.) Use a small screwdriver to release the catches holding the fuse block, relay block and TSSM module to the electrical caddy
- 3.) Unplug the main harness from the ECM and remove the data plug from its holder.
- 4.) Remove the 2 hex head and 1 socket head mounting bolts to free the caddy for removal.



- 5.) Remove the stock ECM from the electrical caddy. The caddy must be slightly modified for additional harness plug clearance. Use a Dremel or Roto-Zip tool to provide additional clearance for the harness plug catch; also remove approximately 3/8" from the partition support as shown. Clearance as needed.



- 6.) Because of the impossibility of connecting the communication cable without disassembly once assembled on FXD models, the cable should be permanently installed to the ThunderMax ECM. Feed the communication cable through the ECM plug port of the caddy and mount the ECM to the caddy as shown.



- 7.) Reinstall the caddy with fuse and relay blocks in place. Reconnect the TSSM, coil and ECM harnesses. After programming and setup, the communication cable can be coiled up and kept under the caddy cover.
- 8.) Reinstall the Main Fuse
- 9.) Initialize the Module (Page 21).



Closed Loop System – ThunderMax ECM with AutoTune

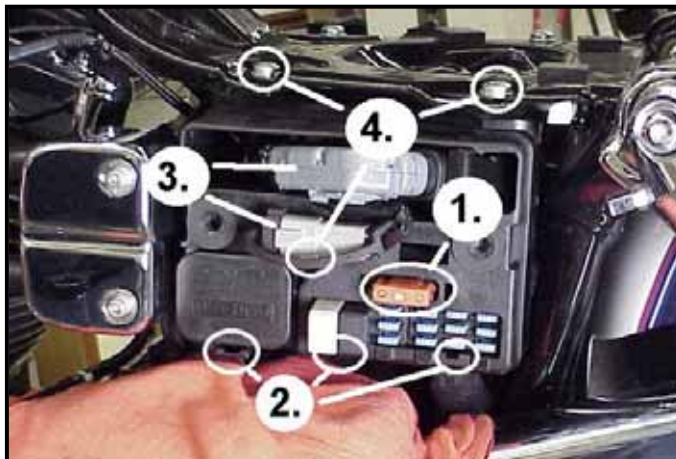
Determine if your application currently has oxygen sensors installed in the exhaust pipes. All 2006 & Up Dyna® models are produced with oxygen sensors in the factory head pipes. If your exhaust system does not have oxygen sensor bungs (2005 – earlier), you will either need to install sensor bungs into your current head pipes, or purchase an exhaust system that has the sensor bungs already in place. If you choose to add the sensor bungs to your current exhaust system, the bungs must be located within 4-6” of the cylinder head. If you need sensor bungs, please call Zipper’s and request **PN: 272-200** (sold individually).



Aftermarket exhaust systems may or may not have the appropriate sensor bungs welded in place. **The Bosch wide band oxygen sensors supplied with the Auto-Tune Kit fit ALL of the OEM exhaust systems with adequate clearance.** If you have an aftermarket exhaust system, there may or may not be ample clearance for the taller wide band oxygen sensor. Please contact the exhaust system manufacturer if a problem occurs. Zipper’s can only create bolt-on products and kits based off of factory specifications and dimensions, if an aftermarket manufacturer has not followed the factory locations, clearance issues may exist.

Installation

- 1.) Remove the left side cover to reveal the electrical caddy. Locate and remove the main fuse.
- 2.) Use a small screwdriver to release the catches holding the fuse block, relay block and TSSM module to the electrical caddy.



- 3.) Unplug the main harness from the ECM and remove the data plug from its holder.
- 4.) Remove the 2 hex head and 1 socket head mounting bolts to free the caddy for removal.
- 5.) Unplug the plug wires and harness from the coil and remove the caddy.

- 6.) Remove the stock ECM from the electrical caddy. The caddy must be slightly modified for additional harness plug clearance. Use a Dremel or Roto-Zip tool to provide additional clearance for the harness plug catch; also remove approximately 3/8" from the partition support as shown.



- 7.) Because of the impossibility of connecting the communication cable without disassembly once assembled on FXD models, the cable should be permanently installed to the ThunderMax ECM. Feed the communication cable and the AutoTune power harness through the ECM plug port of the caddy. Mount the ECM to the caddy as shown. The oxygen sensor harnesses should exit towards the opposite side of the caddy.



- 8.) Feed the front cylinder oxygen sensor harness through to the right side of the bike, over the top and to the rear of the starter motor. Reinstall the caddy with fuse and relay blocks in place. Reconnect the TSSM, coil and ECM harnesses. Plug the closed loop module into the data link on the bike. It is through the data port that data from the AutoTune module is transferred to the ThunderMax. A 'Y' harness is available (# 309-343) to keep



Installation

- an open data port if desired. After programming and setup, the communication cable can be coiled up and kept under the caddy cover.
- 9.) Install the supplied wide band oxygen sensors in the front and rear exhaust pipes. After installation, route the sensor harness away from the engine and along the frame when possible. Avoid routing harnesses where moving parts can contact and damage the harnesses or plugs.
 - 10.) Connect the sensors to the closed loop module. The sensor wiring harness for the rear cylinder sensor is shorter and can be easily identified by the labels on the harness connectors. It is very important to install these correctly or the engine will perform poorly!
 - 11.) **FXD Tips:** The rear harness mounts easily, just coil the excess wires and locate them above the transmission. The front harness should travel from the AutoTune module, over and to the rear of the starter motor, behind the exhaust support bracket and between the crossover pipe and the transmission, as shown.



- 12.) Remove the foot peg / brake pedal bracket mounting bolts and move the assembly towards the exhaust pipe. Route the front exhaust sensor harness under the cam cover exhaust support bracket and behind the brake pedal; connect it to AutoTune harness.



- 13.) The sensor plug and harness will drop down to the frame rail with a little brake pedal wiggling where it can be zip-tied to the frame rail, out of sight and out of harm's way.



- 14.) Reinstall the Main Fuse

- 15.) **Initializing the Module**



a.) Turn the ignition on for 30 seconds, making sure the "Run / OFF" Rocker switch is in the "Run" position, DO NOT start the engine at this point or move the throttle during initialization.

b.) After the ignition has been on for 30 seconds, turn the ignition off for 30 seconds.

c.) Repeat Steps 1 & 2 two more times without starting the engine. The module is now installed and initialized.

ThunderMax ECM Module Initialization

Check	Run / Off Handlebar Switch in "Run" Position	
DO NOT START THE ENGINE		
Cycle 1	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 2	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 3	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds

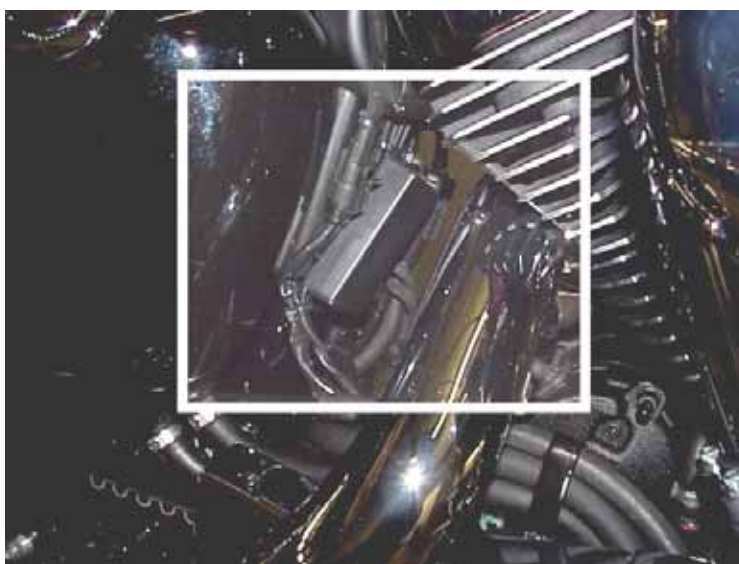
The installation is now complete for your Dyna[®] model motorcycle. Proceed to the SmartLink IV Software Installation Section, which is found on page 27.

Installation

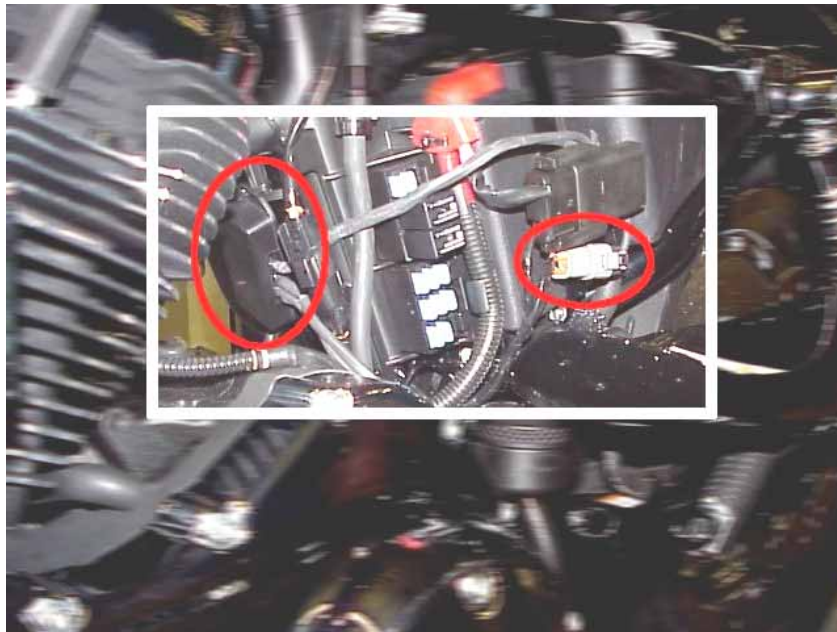
Sportster® Model Installation:

Due to the mounting location and space constraints on the Sportster® for the ECM, your ThunderMax system is supplied with a separate AutoTune module. The ThunderMax ECM mounts in the same location as the factory ECM under the seat; the AutoTune module must be mounted separately.

- 1.) Remove the Seat
- 2.) Open the side cover, remove the ECM fuse
- 3.) Disconnect the ECM harness from the ECM
- 4.) Use a 3/16 hex key to slowly turn the mounting bolts in and out, gradually freeing the thread locking compound. (See Installation Troubleshooting below)
- 5.) Remove the Stock ECM
- 6.) Attach the ThunderMax ECM to the ECM Harness.
- 7.) Install the ThunderMax ECM in the stock ECM location.
- 8.) AutoTune Module Installation – Mount the AutoTune module to the frame backbone using the supplied wire ties (right side view shown below). Position housing so wires exit to the left as shown below.



- 9.) Insert communication plug into the bike's data port (gray). The following picture shows the AutoTune Module on the left, and the Data Link Port to the right, circled in red.



- 10.) Remove the factory oxygen sensors and install the wide-band units.



Installation

- 11.) Front: route wiring along frame rail (double up harness if necessary), position harness plug at lower front primary cover area.



Rear: Route wiring down the left frame rail behind the primary housing, with the plug located along the frame turn. Double-back the wiring to the rear sensor.



12.) Reinstall the ECM Fuse, side cover, and seat.

13.) **Initializing the Module**



a.) Turn the ignition on for 30 seconds, making sure the “Run / OFF” Rocker switch is in the “Run” position, DO NOT start the engine at this point or move the throttle during initialization.

b.) After the ignition has been on for 30 seconds, turn the ignition off for 30 seconds.

c.) Repeat Steps 13 a & b two more times without starting the engine. The module is now installed and initialized.

**ThunderMax ECM
Module Initialization**

Check	Run / Off Handlebar Switch in "Run" Position	
DO NOT START THE ENGINE		
Cycle 1	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 2	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds
Cycle 3	Ignition ON	30 Seconds
	Ignition OFF	30 Seconds

The installation is now complete for your Sportster® model motorcycle. Proceed to the SmartLink IV Software Installation Section, which is found on page 27.

INSTALLATION TIPS

Frozen Hardware on Electrical Caddy - You may encounter bolts that are frozen to the brass insert in the plastic tray. In this instance, the bolt and threaded brass insert will turn together in the plastic tray. If this occurs, remove the tray from the motorcycle and apply carb cleaner in the backside of the threaded brass insert. Allow time for penetration; repeat the application if required. In severe cases you may need to drill 2-6 threads out of the bolt end in the threaded brass insert. This will introduce enough heat into the insert to break the Loctite® and allow the bolt to come free from the threaded brass insert.

Dyna® Model Electrical Caddy Modification – Pre-modified OEM plastic Electrical Caddies are available from Zipper's.

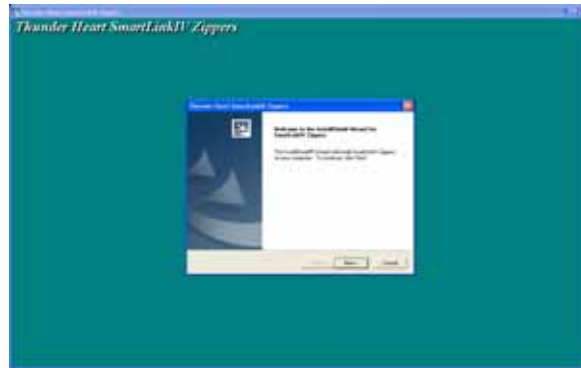
Difficult Oxygen Sensor Removal – Work the sensor back and forth, carbon from the exhaust process gets caught in the threads between the oxygen sensor and the sensor bung; it can damage the threads if forced out. If the exhaust system is cold, spray carburetor cleaner, or any penetrating fluid, at the sensor threads to help break down the carbon build up.

Wide Band Oxygen Sensor Clearance Issue – Large volume users may want to make an 18mm tool or “bending bar” which allows you to alter the angle of the sensor bungs.

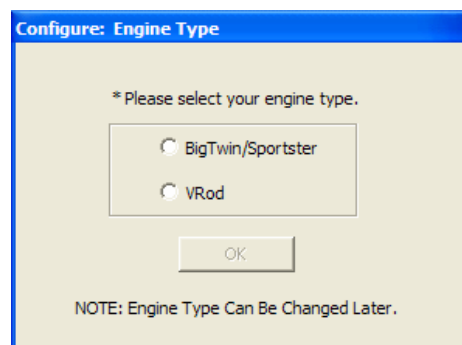
SMARTLINK IV SOFTWARE INSTALLATION

To install the software onto the computer system, take the following steps:

1. Exit any programs that are currently running.
2. Insert the SmartLink Basic Software disc into the CD-ROM drive.
3. SmartLink will automatically begin the installation process, the following window will appear:



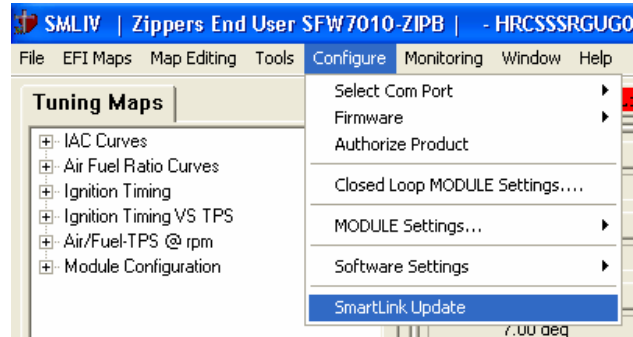
4. The SmartLink Installation Wizard will now guide you through the rest of the installation.
5. Once SmartLink IV is installed, a desktop icon named "SmartLink IV Zippers" will appear on your computer's desktop. Select this new icon to open SmartLink IV. An unlock code is no longer necessary for installing an End User version of SmartLink IV.
6. Configuring your engine type: A window titled "Configure: Engine Type" now appears with SmartLink IV versions 2008.0.2 or later. This will set the default software configuration, however at any point you may switch between a Big Twin / Sportster® or a V-Rod® configuration by selecting **Configure > Product Configurations**.



7. To ensure that you are using the latest software, after the installation is complete, open the software by selecting the "SmartLink IV Zippers" icon that is now on your

Installation

desktop. Once opened, select **Configure > SmartLink Update**, as shown in the following picture. For complete instructions, see section 6 which is titled “Updates”.



Error During Installation: Windows errors during installation are not necessarily SmartLink IV issues. Please uninstall SmartLink IV and reinsert the CD-Rom if a problem occurs during installation.

Section 3:

Learning the Basics of SmartLink IV

Although the size of the instruction manual may be intimidating, please take a moment to scan through the entire document to get a feel for the layout of the document.

The SmartLink IV Tuning Manual is meant to be a quick, but comprehensive, reference book for any skill level user.

In an effort to make the large document easier to navigate, a Table of Contents, Index, Glossary, and an Appendix with a “Visual Index” are included for quick navigation.

SMARTLINK IV SOFTWARE LAYOUT

MAP IN USE IN SMARTLINK IV

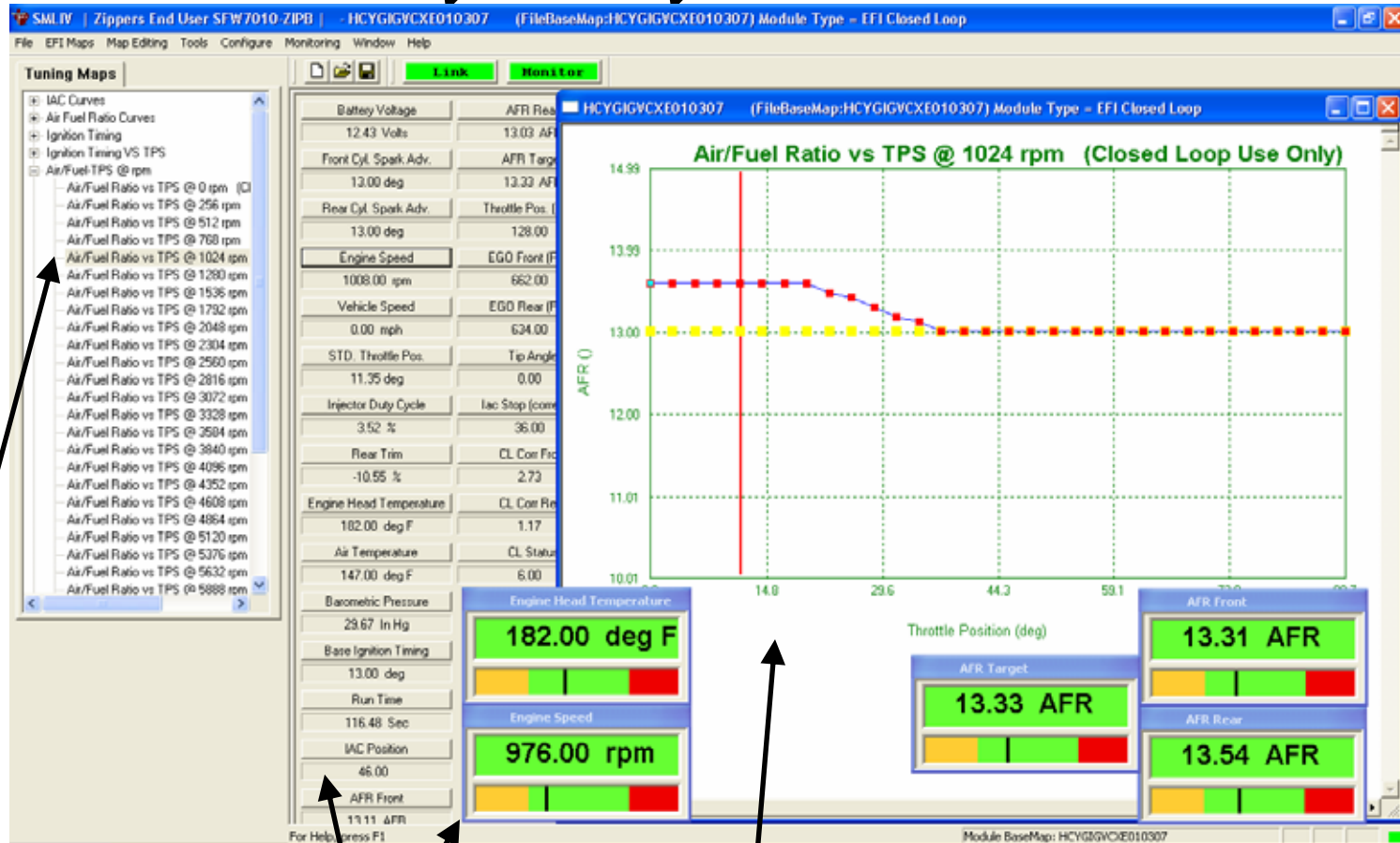
BASE MAP FILE ID

DROP DOWN MENUS →

- These menus contain valuable features which include browsing the Base Map Library, saving your tuning work, and Read / Write commands for ECM communication.

TUNING MAPS TREE

- This is always visible for quick map page selection & map toggling during tuning sessions.



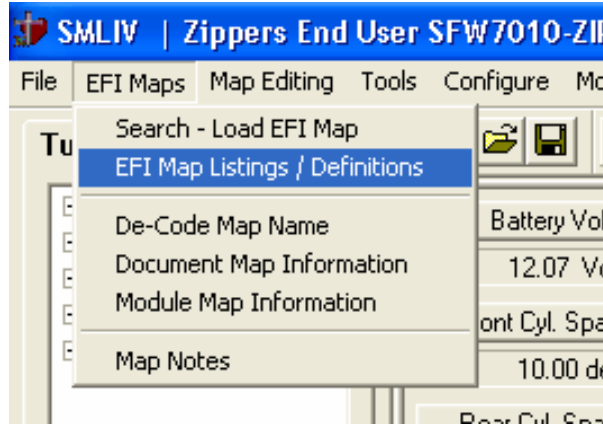
MONITOR VIEW / GAUGES – Live Data from the ThunderMax ECM – Customizable Display & Gauge Features

TUNING MAP WINDOW – Displays the Tuning Maps that are selected from the Tuning Map Tree. From this window you will be able to tune the AFR and Ignition Curves.

MODULE BASE MAP ID – When Linked to the module, the Base Map ID is displayed in the Status Bar.

SELECTING A BASE MAP FILE FROM THE SMARTLINK IV DATABASE

To load a Base Map File onto the ThunderMax ECM, the SmartLink IV Database will help you select an appropriate map to begin the tuning process. To find the Smartlink Database, select **EFI Maps > EFI Map Listings / Definitions**, as shown below.



The following box should appear, with the title “Base Map Definitions”.

Base Map Definitions						
It...	Manufacturer	EngineType	Family	Throttle	Exhaust	Muffler
101	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FXD Hd Pipe	Staggered Dual S
103	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	V&H Pro Pipe	Model = Dyr
104	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
107	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Rinehart FL True Duals	N/A
108	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Thunderheader FL Long	Model = FLT/
110	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	True Dual FL Headpipe	KW HP+100 Mu
111	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Hd Pipe	HD SE PRO FLT M
112	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	D+D Fat Cat	Model = FLT/
113	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	V&H Pro Pipe	Model = Dyr
114	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Bassani Pwr Curve T.D.	Bassani FL Muf
115	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	HD SE PRO FLT M
116	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
117	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	Stock HD Muff
118	HarleyDavidson	103ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Rinehart FL True Duals	N/A
119	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
120	HarleyDavidson	103ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	D+D Fat Cat	Model = FLT/
121	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
122	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FXST Hd Pipe	Staggered Dual S
123	HarleyDavidson	95ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
150	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
151	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Thunderheader FL Long	Model = FLT/
165	HarleyDavidson	88ci	TwinCam A&B	Stock HD 06 8° Inj	Stock HD FL Hd Pipe	KW HP+100 Mu
166	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Rinehart FL True Duals	N/A
167	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	D+D Fat Cat	Model = Soft
168	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FXST Hd Pipe	KW HP+ Muff
170	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Thunderheader Std.	Model = Soft
171	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	V&H Bio Shot w/PC	Model = Soft

Buttons at the bottom: Clear Filters, Close, Excel Export

Base Map “Key Elements”

Search for an appropriate map by the following “Key Elements”, in order of importance:

- a) **Throttle Body / Injector Size & Style** - Note that certain applications use an 8 degree spray pattern, and others use a 25 degree spray pattern.
- b) **Engine Displacement** - Bore & Stroke. A correct match to the engine’s stroke is far more important than an exact match of engine displacement. For example, a 2007 96ci engine would respond better to a 103ci map than a 2003 95ci map (modified factory 88ci engine – shorter stroke).
- c) **Exhaust System Design** – If an exact match does not appear in the Base Map library, select the Base Map with the closest style of exhaust system. Even if your brand is not an option, choosing the closest style will yield the best results. Group your exhaust system in one of the following three categories:
 - i. **Dual Exhaust** – 100% separate exhaust pipes, short or long.
 - ii. **2 into 1 Collector** – both cylinder head pipes converge into one.
 - iii. **Factory style head pipe with crossover** – dual exhaust systems with a cross over pipe that connects the front and rear exhaust pipes.

The reason for selecting a Base Map by “Key Elements” is to find the closest Base Map available for your combination, by the most critical components.

For example, let’s assume the engine combination in question is a 2006 88ci engine with 8 degree injectors. A map is found for an 88ci engine with the proper throttle body and 8 degree injectors, but there are no matches on the exhaust system. By browsing the Base Map Definitions, you find a map for an 88ci engine with the correct exhaust system; however this Base Map file uses a 2001-2005 throttle body and injectors.

The difference in the throttle body size and injector flow will make this map a bad match. In this instance, using a Base Map File with the correct (#1) Throttle Body / Injector Size, correct (#2) Engine Size, and any exhaust (#3) will be a better selection for the application. Choose the exhaust system that is closest to the design of your exhaust and proceed forward.



Please note that your engine combination’s **cranking compression and cam selection will have a significant influence on the spark map curves**. If you have aftermarket cams in your engine combination, select a Base Map that was made with aftermarket cams whenever possible.



If you’re still unsure of which map to select, please email the specifications of your Key Elements to ProductSupport@ZippersPerformance.com. Please title the email “**Base Map Selection**” for a faster response.

Base Map File Browsing / Selection

SmartLink IV is now much easier to browse through the library of maps to find the appropriate map for you. A filtering option has been added to make finding the appropriate map much quicker. If you double click on a map with the LEFT mouse button, it will select that particular map. However, if you RIGHT click on a particular element of a map, SmartLink will filter and hide all of the maps that do not match your selection.

To sort the map files by a particular key element, click on the column heading, and the maps will be sorted by that heading. If you select “Throttle”, the Base Map Definitions will be sorted by the type and size of the throttle body. This will narrow down the search and save time when searching for a map.

For example, the first Key Element that should be chosen is the Throttle Body size. If you have a Zipper’s 50 mm Throttle Body, find a map that has “’01-’05 50mm Zippers (4.22 Inj)” listed under the “Throttle” column and right click on the “’01-’05 50mm Zippers (4.22 Inj)” phrase. The Base Map Definitions will automatically hide all other maps that do not have this throttle body, as shown in the following picture.

Ite...	Manufacturer	EngineType	Family	Throttle	Exhaust	Muffler
115	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	HD SE PRO FLT M
116	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
117	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	Stock HD Muff
119	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
121	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
150	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
151	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Thunderheader FL Long	Model = FLT/
177	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Thunderheader FL Long	Model = FLT/
208	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
211	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
212	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
310	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	HD SE PRO FLT M
311	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
312	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	Stock HD Muff
314	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
316	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
317	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Thunderheader FL Long	Model = FLT/
322	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
323	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
324	HarleyDavidson	103ci	TwinCam A&B	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
360	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Rinehart FL True Duals	N/A
361	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
362	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
363	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Thunderheader FL Long	Model = FLT/
367	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	D+D Fat Cat	Model = FLT/
39	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu
40	HarleyDavidson	80ci	EVO	'01-'05 50mm Zippers (4.22 Inj)	Stock HD FL Hd Pipe	KW HP+100 Mu

Now all maps displayed are for engine combinations that use a Zipper’s 50 mm Throttle Body with 4.22 Injectors. Notice that the “Clear Filters” button is now selectable. If you made a mistake and want to return to the complete library listing, select the “Clear Filters” button and you will start over with all Base Map Files displayed.

SmartLink IV

Select an engine displacement by sorting the “Engine Type” column. Right click on a map containing a “103ci” displacement, directly on the “103ci”. The following will appear if 103ci is selected as the displacement.

Item	Manufacturer	EngineType	Family	Throttle	Exhaust	Muffler
115	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Stock HD FL Hd Pipe	HD SE PRO FLT Muffl
116	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Stock HD FL Hd Pipe	KW HP+100 Muffl
117	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Stock HD FL Hd Pipe	Stock HD Mufflers
119	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
121	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
177	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Thunderheader FL Long	Model = FLT/HT
208	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
211	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
212	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
310	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Stock HD FL Hd Pipe	HD SE PRO FLT Muffl
311	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Stock HD FL Hd Pipe	KW HP+100 Muffl
312	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Stock HD FL Hd Pipe	Stock HD Mufflers
314	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
316	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
317	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Thunderheader FL Long	Model = FLT/HT
322	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
323	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
324	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
209	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
210	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
387	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
300	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	D+D Fat Cat	Model = FLT/HT
400	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A

Now select the exhaust system that is being used by right clicking on the exhaust type, in this example choose “Rinehart FL True Duals.” The following will appear in the Base Map Definitions window.

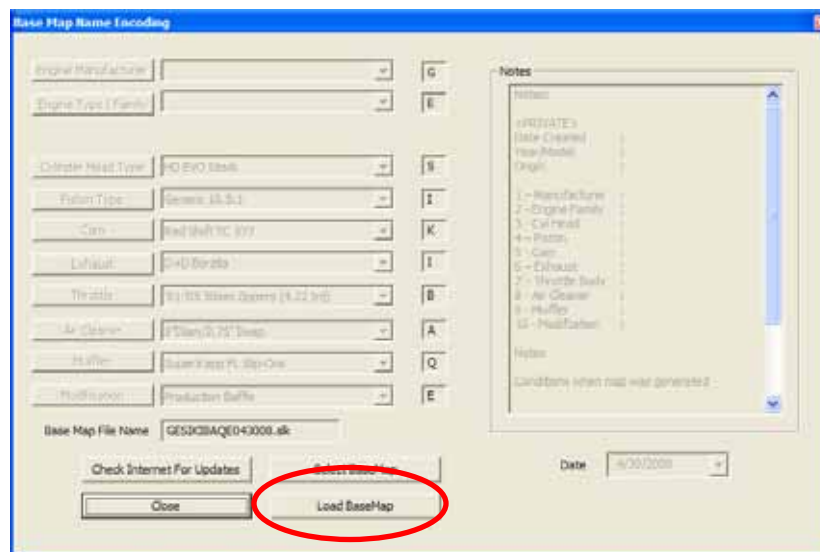
Item	Manufacturer	EngineType	Family	Throttle	Exhaust	Muffler
119	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
208	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
314	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
322	HarleyDavidson	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
209	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
387	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A
400	Zippers	103ci	TwinCam A&B	Y1-05 50mm Zippers (4.22 In)	Rinehart FL True Duals	N/A

For the combination of a 50mm Throttle Body on a 103 ci engine with Rinehart True Duals, there are seven maps filtered from the library. Continue selecting categories that

match your engine combination. You may have to experiment with the map selection if your combination does not exactly match a Zipper's Base Map File.

Once you've narrowed down the Base Map files to the closest match to your combination, check the date of the Base Map file before making the final selection. You may find that multiple Base Map files match your criteria, **always select the Base Map with the latest build date**. The date can be found at the far right of the "Base Map Definitions" window.

Once the map library has been filtered down to the map that you wish to use, double LEFT click on the map to open the "Base Map Name Encoding" window. The following window should appear on the screen.



Loading the map into SmartLink IV does not Load the map onto the ECM.

See Page 37 for an explanation of writing the map to the ECM.

Loading the Base Map File

Now that you've selected the appropriate Base Map file for your engine combination, you need to load this selected Base Map into SmartLink IV.

Select the "Load BaseMap" button on the "Base Map Name Encoding" window, as shown above. Once selected, SmartLink will load this Base Map and return to the Air / Fuel Ratio vs. TPS page.

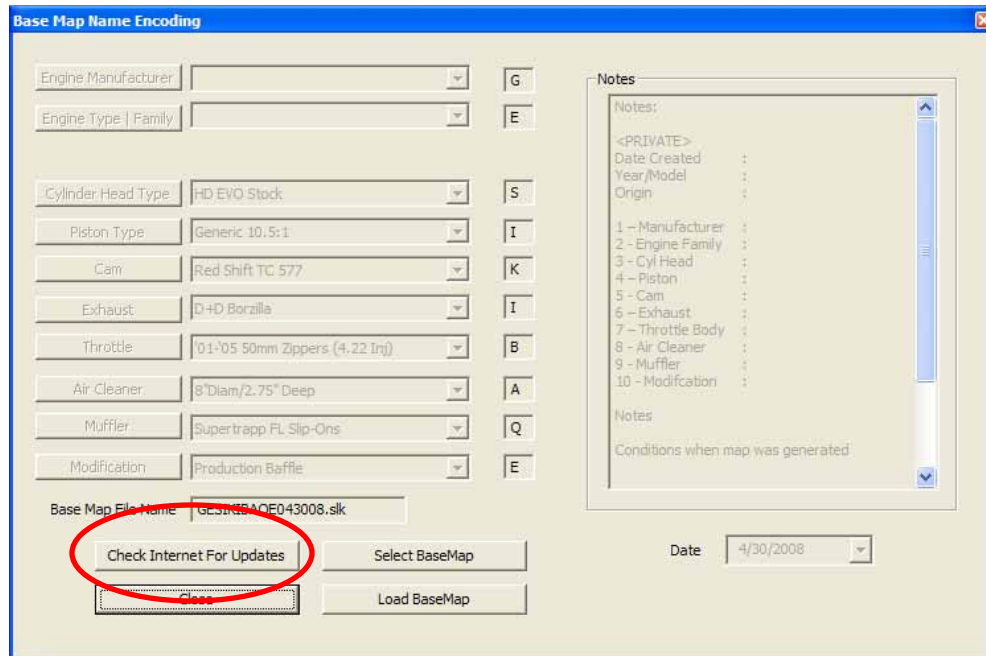
Now that the map is loaded into the SmartLink IV software, you must upload the file to your ThunderMax ECM as described on page 41. If you are installing a new Base Map in an already used ThunderMax ECM, please remember to clear all of the offsets from the module's previous Base Map, and double check the Basic Settings (page 64).



Proceed forward with the Tuning Manual, **remembering that a new base map file will require the ECM to be initialized** (page 11), the Basic Settings need to be checked (page 64), and all offsets must be cleared from the previous map.

Base Map Definitions Updates

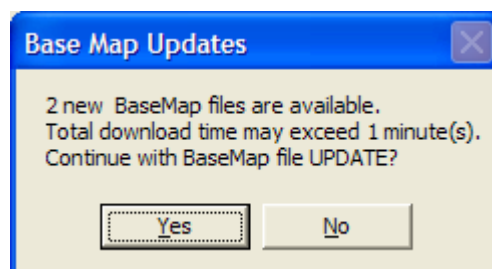
To ensure that you have the complete, and up-to-date, Base Map Library, select the “**Check Internet for Updates**” button on the “Base Map Name Encoding” window, as shown below.



Base Map Updates:

SmartLink IV now downloads all of the new base map files when you update the Base Map library. Previously only the Base Map library list was updated, so if you selected a map from an updated library list, SmartLink needed to download the map from the internet before you could proceed. Now the Base Map files are all downloaded during the update, which simply means that the newest Base Maps are always stored on your computer.

The following window will appear if any new maps exist in the Internet database, but do NOT exist on your system:



You will be provided an ESTIMATE of the download time required to perform this task.

It is simply good practice to update the definition file when searching for a new Base Map file. Not only are new maps constantly being created, but the older Base Maps are updated occasionally as well. Once updated, you may proceed with selecting an appropriate Base Map for the current engine combination you are working with.

If you are satisfied with the operation of your current Base Map, chances are a new Base Map will not make a significant difference to the operation of the motorcycle. Updated maps could contain spark curve or fuel management changes, or even fuel economy strategies.



If you are unsure how to select a map after reading this section, contact a Zipper's representative for assistance. This step is critical in the optimization of the power, economy, and overall drive-ability of your motorcycle. Zipper's Performance Products is committed to customer satisfaction, so please do not hesitate to ask for assistance.

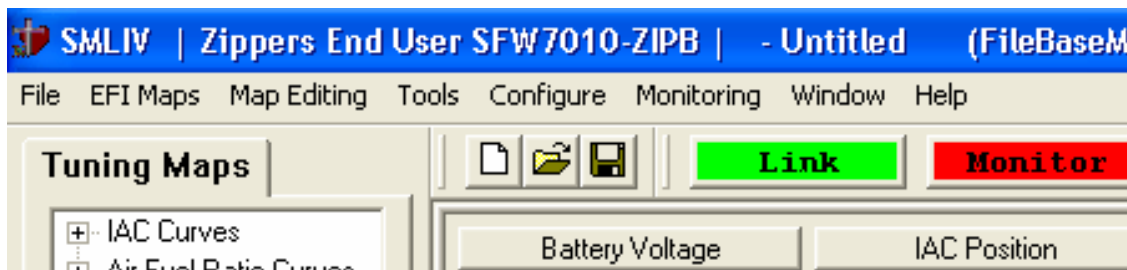
LINKING TO THE THUNDERMAX ECM

1. Install the communication cable from the PC to ECM.



NOTE: Make certain that the communication cable is not resting on or near any part of the motorcycle that generates heat.

2. Turn the ignition on, making sure the OFF/ RUN switch is in the “Run” position, but do not start the engine. Now press the **Link** button in the software. The red background will turn green when successfully linked, indicating that the PC and ECM are now ready to begin communication, see picture below.



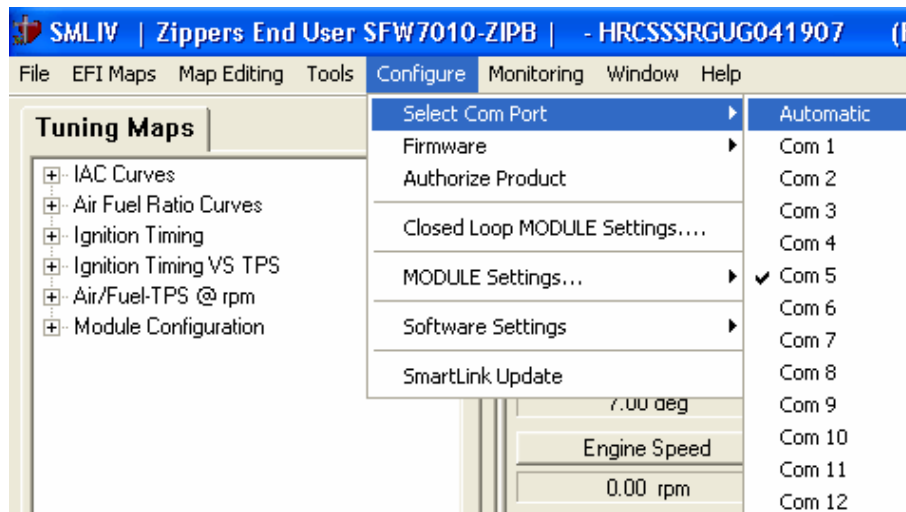
NOTE: NEVER attempt to load or reload a complete map with the engine running.

If you are **NOT** successful in linking to the module for the first time, please double check everything on the following list to verify your setup. SmartLink automatically finds the proper Com Port to use, so linking issues are generally rare and unrelated to the software itself.

- a.) Are the cables properly installed from the ECM to the serial or USB port on the computer? Remove the cables and reinstall to be certain the connection is solid.
- b.) Are you using a “specialized” extension cable or USB adapter? Standard, low cost, minimum feature, “generic” type cables and adapters are best suited for use with this system. **Zipper’s PN # 372-000 (USB to Serial Port Converter).**
- c.) Does the module have power? **Is the ignition in the “ON” position with the OFF / RUN rocker switch in the “Run” Position?**
- d.) If a USB to Serial Adapter has been used, did you install the drivers that came with the Adapter?

NOTE: Vista Users should not install the supplied driver CD with a USB to Serial Converter, just plug the converter in and let Vista find the proper drivers by itself.

- e.) Have you set the Com Port Configuration to Automatic? Select **Configure > Select Com Port > Automatic** as shown in the following picture.



- f.) If you are NOT successful linking with the Automatic configuration, have you tried each of the 12 ports to see if one works for you?
- g.) Try a new USB port on your computer.
- h.) Disable your Anti-Virus Software to see if a conflict exists.
- i.) If unable to solve the problem, please fill out the form at the end of this instruction manual and send the required data to the Zipper's Technical Support team for assistance.

USB to Serial Adapter Notes:

USB 2.0 Adapters:

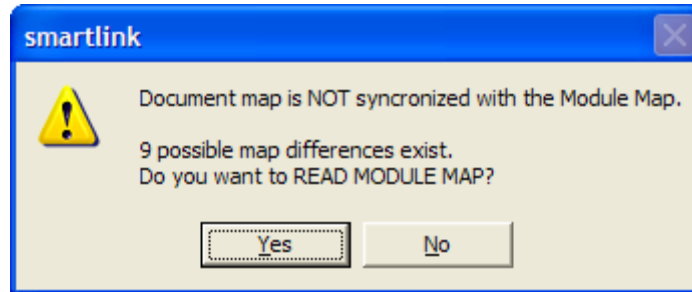
It has been found that many USB V2.0 adapters do not work properly with SmartLink IV. **If it takes over a minute to either read or write a Base Map** from the ThunderMax ECM, double check the version of the adapter you are using. USB V1.1 adapters transfer the data correctly and should be used exclusively.

64-bit Operating Systems (XP and Vista):

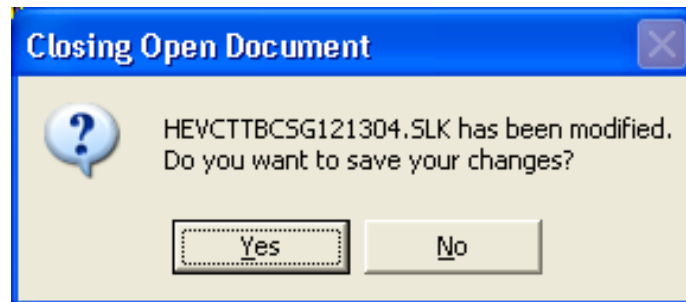
64 bit operating systems will require special drivers for any USB to serial port converters installed. Most converters do not come with drivers for the 64-bit versions of XP or Vista; however both are available online from the hardware manufacturer. Please Contact ProductSupport@ZippersPerformance.com if you're experiencing hardware issues with a 64-bit operating system.

SYNCHRONIZING SMARTLINK IV TO THE THUNDERMAX ECM

Once you have successfully linked to the ThunderMax ECM, a window will appear that alerts you of any differences between the map currently opened in SmartLink IV, and the map that's loaded in the ThunderMax ECM.



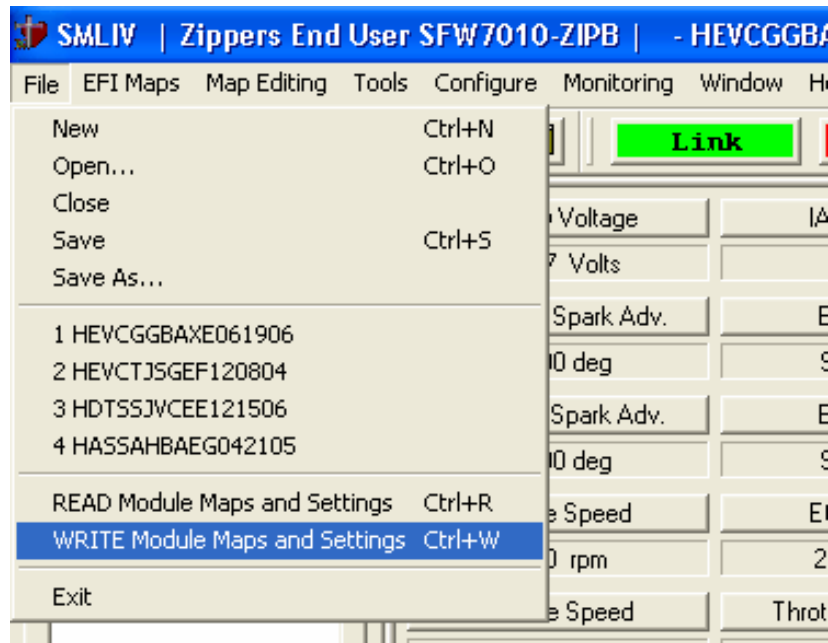
If you select "Yes," SmartLink IV will prompt you to save the map currently open in the software.



This helps prevent changes or edits being made to an OPEN MAP which may NOT have all values in synchronization with the module. This is not fool proof, but is a step in keeping your map in synchronization during the time you are editing, monitoring, or saving maps.

LOADING A BASE MAP FILE IN THE THUNDERMAX ECM

Select **File > WRITE Module Maps and Settings**, as shown in the following picture.



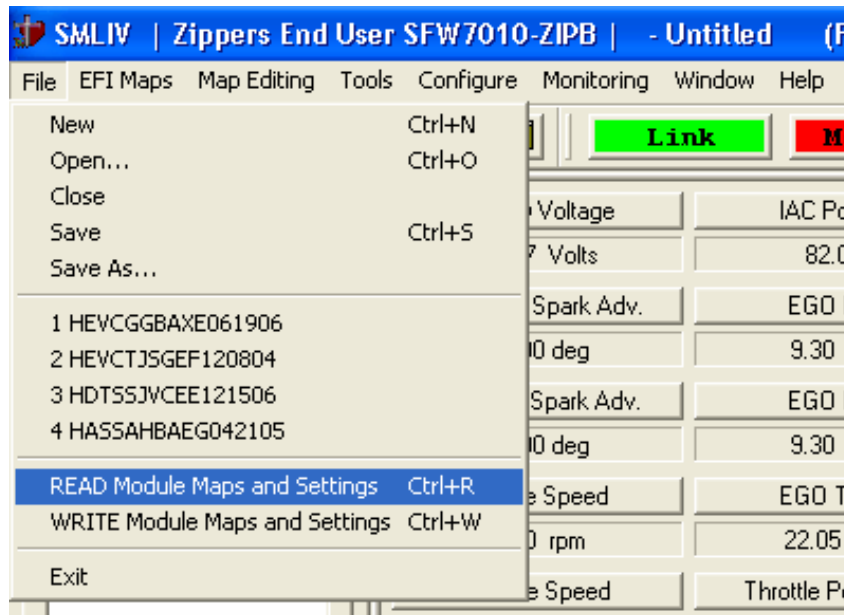
After the transfer bar completes, the map is loaded into the module. Reinitialize the module by cycling the ignition switch 3 to 4 times for the IAC to find its home position, see page 11.



DO NOT START THE ENGINE at this point or move the throttle during the initialization process, the monitor gauges still need to be set to display the parameters that you wish to watch during the run session.

READING FROM THE THUNDERMAX ECM

To read a map that was previously installed on a ThunderMax ECM, select **File > READ Module Maps and Settings**, as shown in the following picture.



This will start a Progress Bar window while the settings in the onboard ECM are being brought to the screen. Wait until the Progress Bar is complete before attempting to work in SmartLink IV. This may take 15-30 seconds depending on the speed of your computer.

Once READ, the ECM's current map and settings will be displayed in SmartLink IV. The Air/Fuel vs. TPS window automatically opens first.



IMPORTANT NOTE: Any time you are connected (linked and powered up) to the module, any changes you make are **LIVE** and affect the module settings and maps immediately. You will have effectively modified the original base map in the module, but not the base map file that is saved on your hard drive or in the Base Map data base.

This modified map with changes should be saved to your hard drive as a renamed version of the original base map file. If you unlink from the module without saving the changes to your modified maps folder, you can access/view those changes by re-linking to the module and selecting **File > READ Module Maps and Settings**.

SMARTLINK FILE MANAGEMENT

Proper file management is crucial to the success of your tuning program, whether you are an individual or a dealer regularly installing ThunderMax ECMs. Although this is a relatively simple procedure, if it is not addressed and understood before the tuning process is begun, losing maps with valuable tuning time is inevitable.

SmartLink uses “Base Map” files that save the fuel curves, ignition curves, even the basic settings for the Speedometer Calibration, idle RPM and the Rev limiter. All of this data is stored in one file which makes management of the maps relatively simple. All SmartLink map files have a file extension of “.**slk**.” Each map file name is made up of 16 characters, the first 10 letters designate the original engine combination that the map was made for, and the last six numbers refer to the date on which it was created, updated, or last modified.

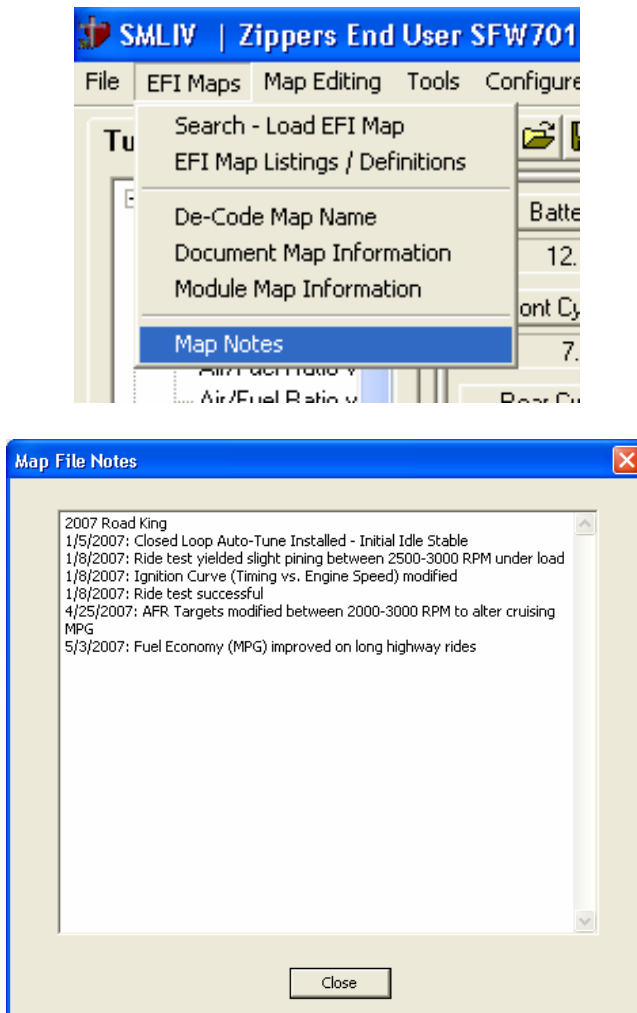
It is imperative that as changes are made to the map file, the file is renamed and saved. Zipper's retains all of the original map files if you lose or misplace the map given to you at the time of the sale. **However when changes are made to a map to tune the ECM to a specific application, it is up to the user to save this edited base map file.**

You can create subfolders inside the “Modified SmartLink Maps” folder to save each combination that is mapped with SmartLink. The more SmartLink map files that you save; the easier it will be to map different combinations in the future. Even though every engine is different, if you build a library of map files in addition to the SmartLink Map Database, chances are good that any combination that arrives at your doorstep can be mapped by altering the closest match.

As more changes are implemented, do not delete the previous modified base map file; simply create another map file with an updated date / name. This can save an Enormous amount of time if changes are made and the tune goes in the wrong direction. It will always be easier to reload a known good running map than try to manipulate a modified map back to a previous condition.

MAP NOTES

A new “Map Notes” function has been created for keeping track of tuning changes directly in the map. Select **EFI Maps > Map Notes** as shown below, to reveal the “Map Notes” window. In this window you have a clean sheet of paper to record all of your changes and testing results. This is a great way of logging the changes made to the Base Map File or values changed in the Module Configuration.

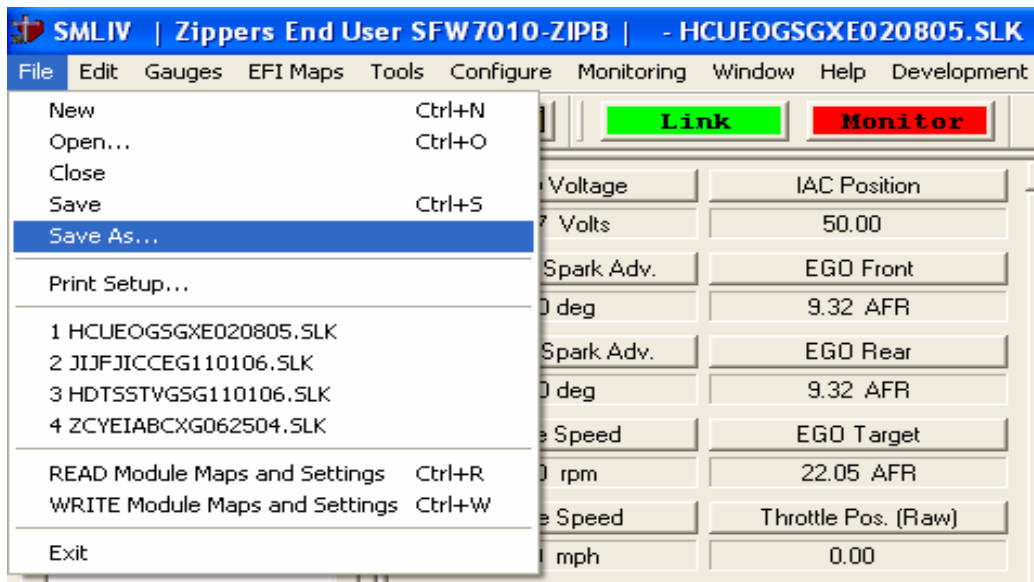


Zipper’s is constantly increasing and improving the SmartLink Map Database to aid in tuning a variety of engine combinations. However the database will never be able to contain a perfect match for every conceivable combination of custom pipes, throttle bodies, or engine modifications available on the market today. To access the latest maps, update your SmartLink software and select upgrade map definitions weekly for the latest work.

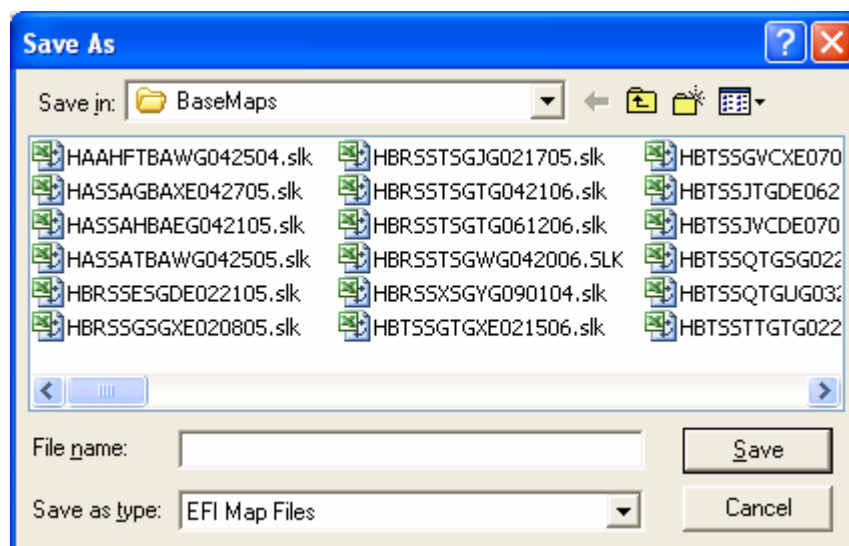
SAVING AN ALTERED MAP AS A NEW FILE

Now that you know how to load an existing map file, it is very important to know how to save the base map in a new folder. In this new folder all modified versions of the base map file can be stored for future use. This will allow you to make changes to your base map file and still have the ability to reload the original base map file if the new base map file does not operate as well as the provided base map file.

To save the loaded map as a new file, select **File > Save As...** as shown in the picture below.

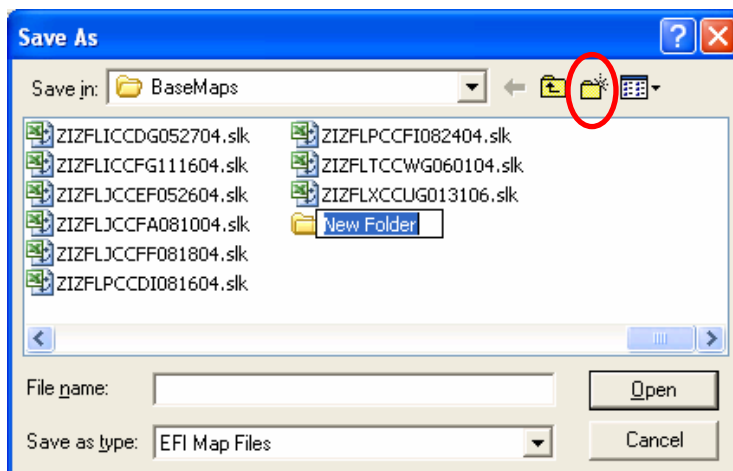


The following "Save As" window will appear:

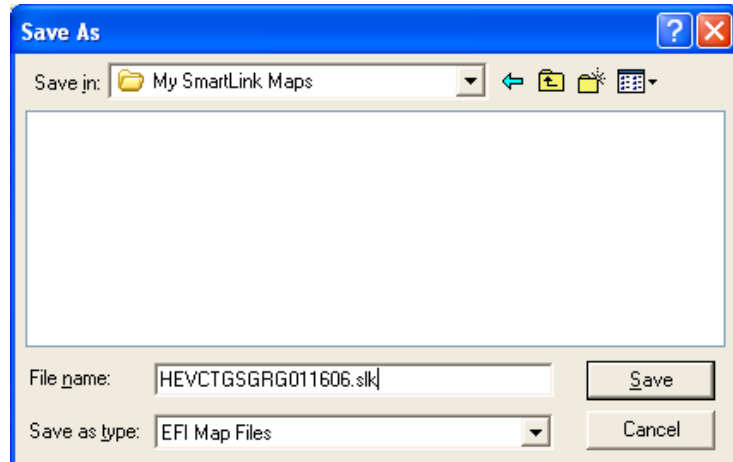


SmartLink IV

The folder that is opened by default is called “BaseMaps.” The easiest way to store and manage the new modified maps is by creating a new folder titled “My SmartLink Maps” in this “BaseMaps” directory. To do this, select the “New Folder” button as shown below, circled in red. A new folder will appear, simply type “My SmartLink Maps” and hit the Enter button on the keyboard.



Select the new folder that was created and type the base map file name that you have loaded. For example: if “HEVCTGSGRG011606.slk” is loaded into SmartLink IV, enter the Base map file name into the “**File Name:**” box select the “Save” button.



A duplicate base map file will be created in this location. As you make changes to the tuning blocks and test the outcomes, save the tested base map files in this same location. **The last six digits of the file name should be changed to the date that the map file was modified.** This will allow you to make multiple changes to the base map file’s tune-up, while retaining your previous tune-ups. By maintaining the original 10 digits of the base map file name, SmartLink IV can still decode the name to reveal the engine combination that the base map file was originally intended for.

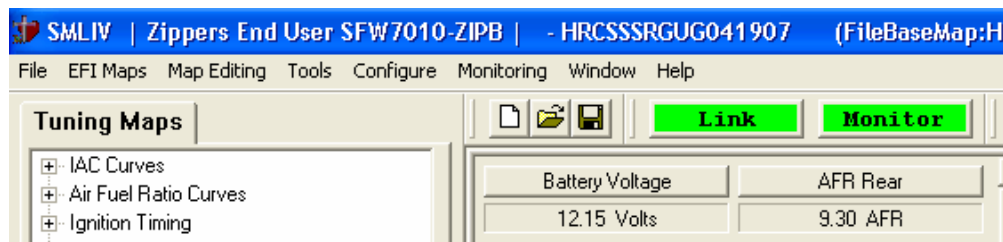
ENGINE MONITOR VALUES & GAUGES

The “Engine Monitor” function is a helpful tool to use while performing live tuning, to keep a watchful eye on the vital engine data while amending maps. In addition, it is very helpful to diagnose problems or to make adjustments with sensors or components. This will allow you to view all of the important sensor values on the same screen as the map page while the engine is running and being tuned.

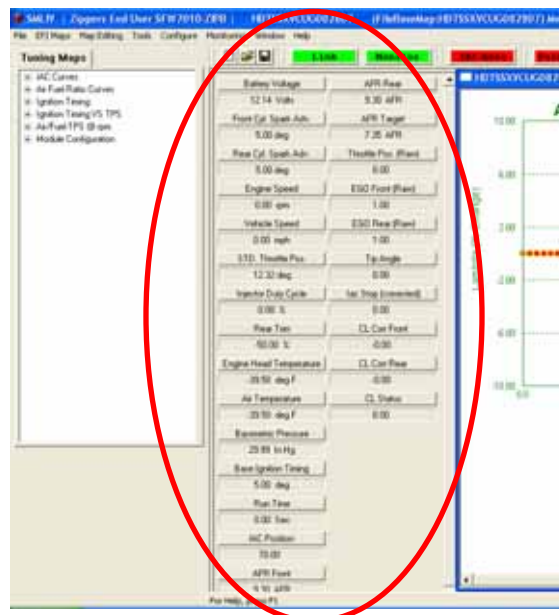


NOTE: The **Engine Monitor Values** will only be **Live** when the ECM is powered up, linked to the computer, and the “Monitor” button selected.

To display the monitor data from the ECM, click the **Monitor** button, which is next to the **Link** button on the toolbar. The “Monitor” button will turn green when active, exactly like the “Link” button does.

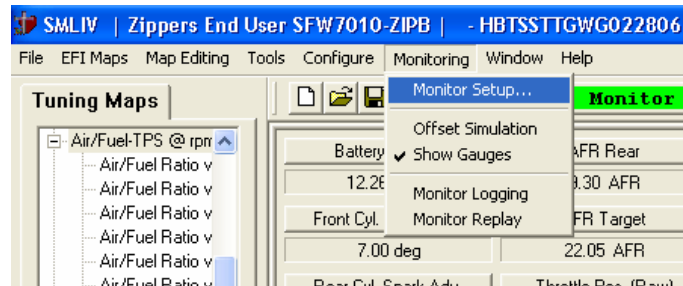


The engine monitor buttons and values are always to the right of the “Tuning Maps” tree. The monitor values will always be in this location. **If any map page windows are maximized, these values will be hidden behind the window.**

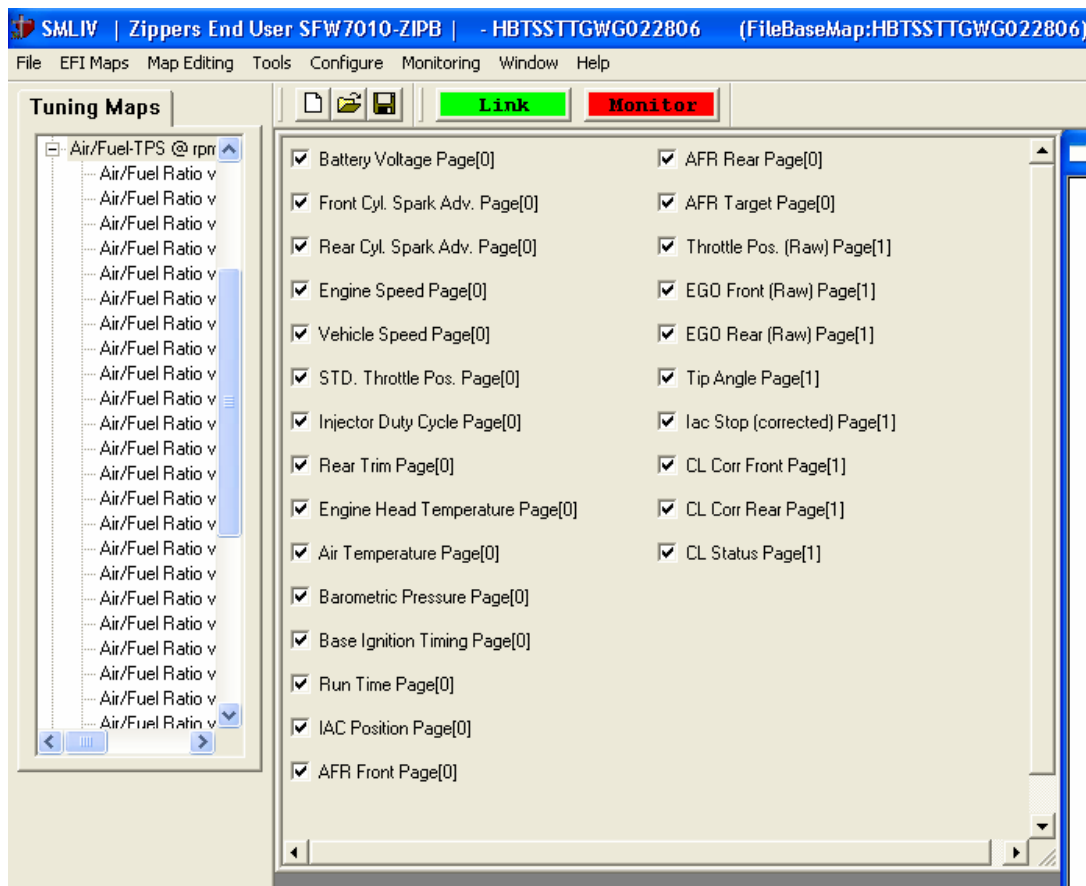


SmartLink IV

To select the values that you wish to monitor in the “Monitor View” portion of the SmartLink IV layout, select **Monitoring > Monitor Setup...** as shown below.



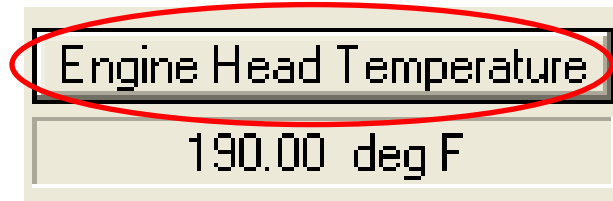
The following screen will appear, with check boxes beside each Monitored Value. Each engine monitor with a check mark will be displayed on the “Monitor Views” section of the SmartLink IV layout. To return to the Monitor Gauge view window; select Monitoring > Monitor Setup... to return to the Monitor Gauges. This “Monitor Setup...” button will toggle between the Monitor Gauge / Setup windows.



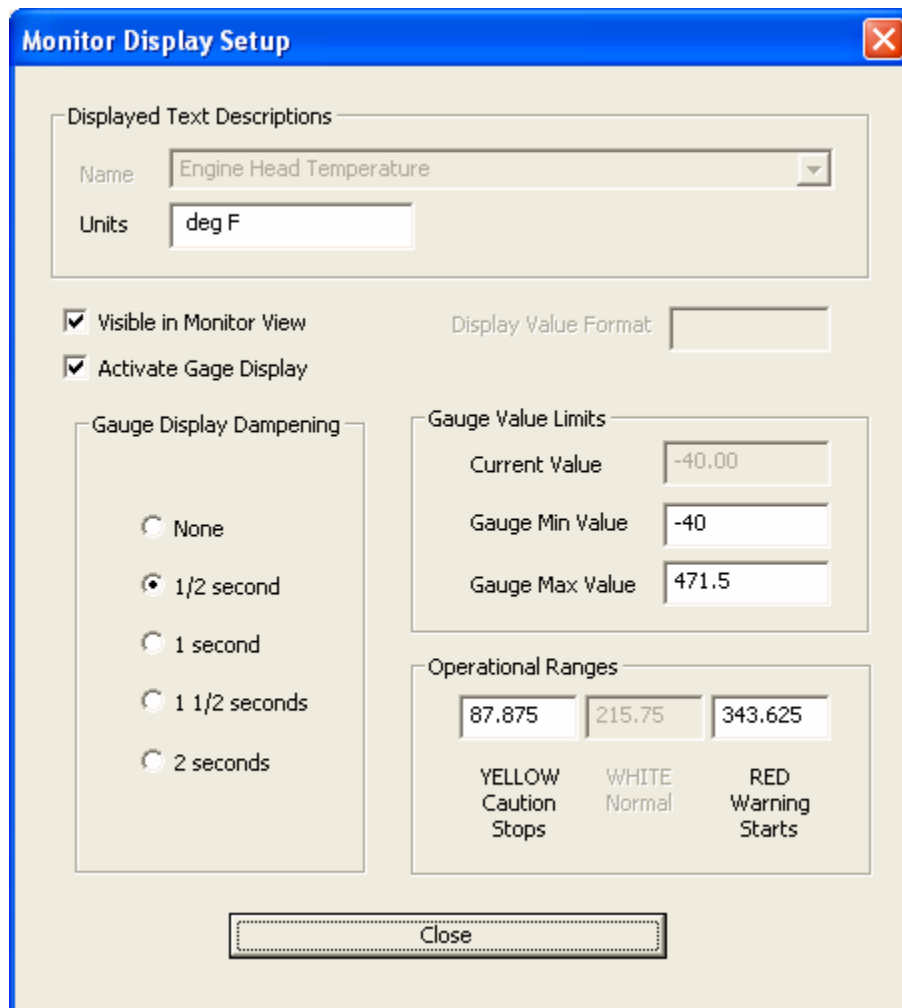
Please note that when the “**Monitor Setup...**” is selected, SmartLink IV automatically terminates the current Monitor session. Selecting “**Monitor Setup...**” should be performed prior to starting a live tuning session. Zipper’s recommends that you keep all of the values selected for the Monitor View section; this will allow you to set up the

Monitor Gauges without toggling back and forth between the Monitor View section and the “**Monitor Setup...**”

The engine monitoring values can be customized into individual gauges to highlight the parameters that you wish to monitor during the run session. To create and customize the gauges, select the name of the gauge (individually) that you wish to monitor.



More than one gauge can be open at once; however each parameter must be selected individually. For example, if the “Engine Head Temp” button is selected, the following window will appear.



Monitor Display Setup

Displayed Text Descriptions

Name: Engine Head Temperature

Units: deg F

Visible in Monitor View

Activate Gage Display

Display Value Format:

Gauge Display Dampening

None

1/2 second

1 second

1 1/2 seconds

2 seconds

Gauge Value Limits

Current Value: -40.00

Gauge Min Value: -40

Gauge Max Value: 471.5

Operational Ranges

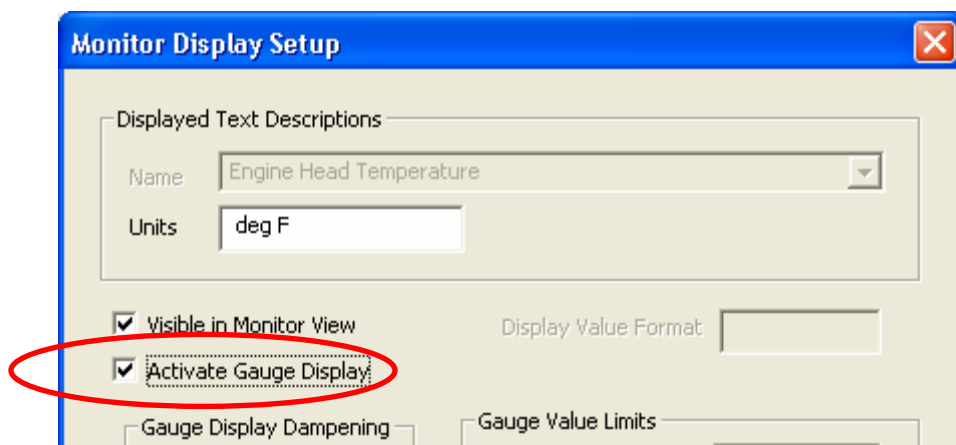
87.875 215.75 343.625

YELLOW WHITE RED
Caution Normal Warning
Stops Starts

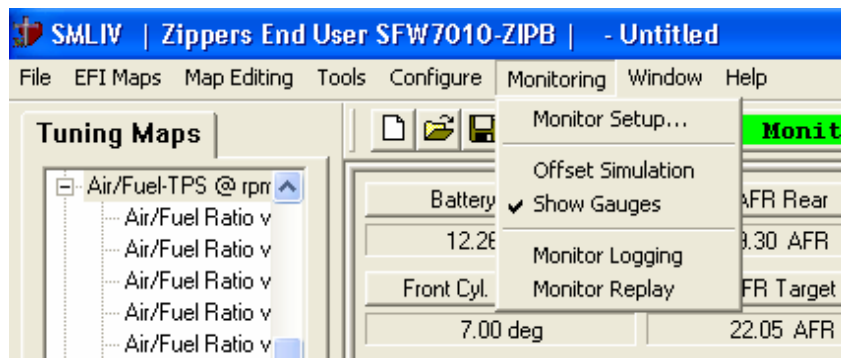
Close

SmartLink IV

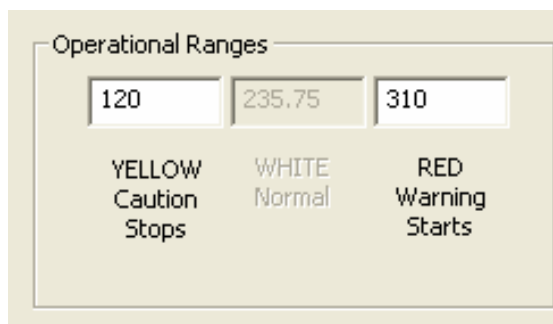
In this dialog, select the box next to the “**Activate Gauge Display**” gauge option. Checking this option tells SmartLink IV that you want the gauge values shown for easy viewing during the tuning process.



This will tell the gauge to appear whenever monitoring is in effect OR whenever gauges are toggled from the menu bar, as shown below. To toggle the visibility of the gauges while Linked to the ThunderMax ECM and monitoring, select **Monitoring > Show Gauges**.

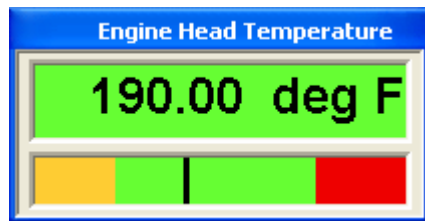


Also within the Monitor Display Setup dialog you can custom design gauges to represent low, normal and high ranges as desired, and set each range of the individual gauges you want to monitor. Colors will read on your computer monitor (yellow, green and red respectively) as set by your parameters.

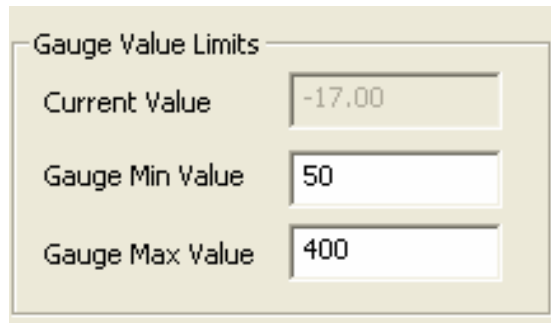


The “Operational Ranges” parameters are entered as values based on the “normal” units of the selected monitor. In this case “degrees F” are the units and the low range (yellow) is from 0 to 120 degrees F and the high range (red) will be anything above 310 degrees F. That leaves the green range (which is listed as white) as 120-310 degrees F. If you enter invalid entries, the software will make corrections and let you verify the changes. This occurs when you OK the dialog box.

The following monitor gauge represents what you have just created. When the temperature rises above the 310° limit, the gauge turns from Green to Red and begins flashing, to immediately bring your attention to the temperature of the cylinder head. Although SmartLink cannot prevent an engine from overheating, if used properly, the Monitor Gauge function will alert you well in advance that the temperature is too high to continue operation.



The next portion of the Monitor Display Setup is the Gauge Value Limits section. From here you will set the minimum and maximum ranges the gauge will represent.

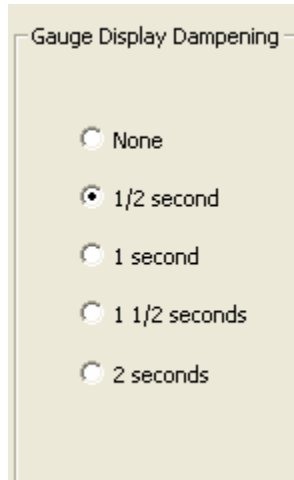


In this case the gauge limits are from 50 – 400 degrees F.

More appropriate limits and ranges may be desired. Experiment with these values to see how they affect the gauges. All Gauge Value Limits, gauge visibility and the gauge location are saved upon exit of the SmartLink IV program.

SmartLink IV

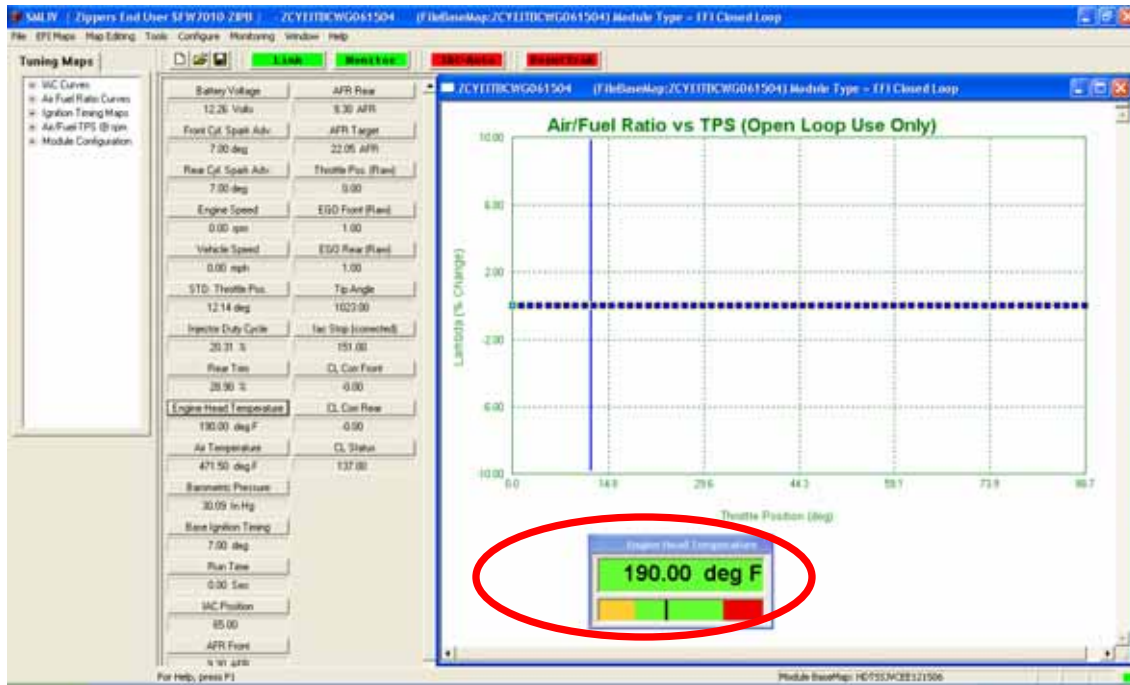
The final section of the Monitor Display Setup is called “**Gauge Display Dampening**”. You will notice after using SmartLink IV for the first time that some of the gauges are constantly changing or varying between a series of values. This is in part due to the sensitivity and sampling rate of the sensors used in the ThunderMax system. ThunderMax samples and records data much faster than the human eye can process the changes. To slow down the data that is being displayed, a timeframe can be imposed on the gauge to limit the refresh rate by up to two seconds. By default the Gauges are set to ½ second dampening. Experiment with these values to find the proper dampening for your application and preference.



The image shows a screenshot of a software interface titled "Gauge Display Dampening". It features five radio button options for selecting a dampening time interval:

- None
- 1/2 second
- 1 second
- 1 1/2 seconds
- 2 seconds

Once the option of “Activate Gauge Display” is selected and the gauge limits are set, one of two things will now happen. The “Engine Head Temp” box will appear on your screen as shown in the following picture, if the “**Link**” and “**Monitor**” buttons have been activated (green background).



If the monitor gauge does not appear, select **Monitoring > Show Gauges** as previously described. Drag the gauges around your screen to customize the output to your preferences. To drag a Monitor Gauge, move your mouse arrow over the blue bar of the Monitor Gauge, then hold down the left mouse button to drag the monitor to a convenient location.

SmartLink IV

Select the most important gauges and move the boxes around to customize the look of the display. This is a valuable feature in Smartlink for several reasons. You can determine the most important parameters for your application and make changes to the gauges when changing from the Air / Fuel Ratio vs. TPS page to the Ignition Timing Maps page. A quick example of how to setup the gauges is shown below.



MONITOR LOGGING / REPLAY

The Monitor Logging is created so you can record data during tuning and riding sessions. This feature is extremely useful to review the stability of your AFRs or when troubleshooting a tuning issue, an electrical problem (faulty sensor), or a mechanical problem like a clogged fuel filter. The Monitor Logging feature will record all of the vital engine operation data, and allow you to save and replay the operating session.

If requested, this data file can also be emailed to Zipper's Technical Support for analysis and recommendations on the tuning issue. In a Closed Loop application, with the AutoTune module installed, you can replay both the front and rear cylinder AFR's as well as the corresponding throttle positions. This information is extremely valuable when modifying the AFR vs. TPS target map pages.

For Open Loop only user, it is not worthwhile to record a run session for Zipper's review, since no AFR's are recorded, there is little value to the Monitor Logging function.

How to Save a Monitor Log:

1. Establish a Link to the ThunderMax ECM through SmartLink IV.
 - a. Install the communications cable between the ThunderMax ECM and your computer.

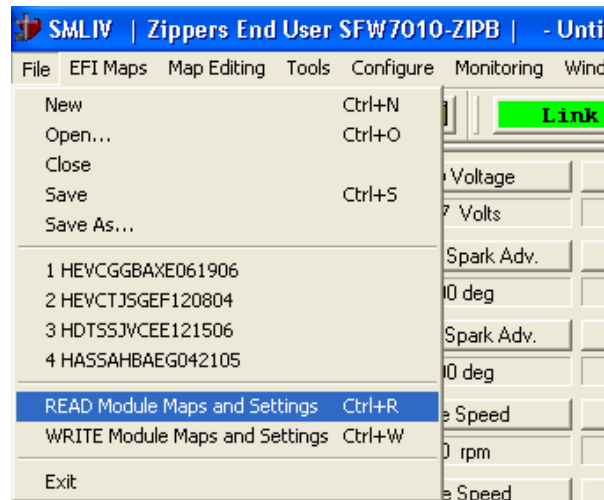
- b. Turn the Ignition **ON**, and move the handlebar switch to the **RUN** position.



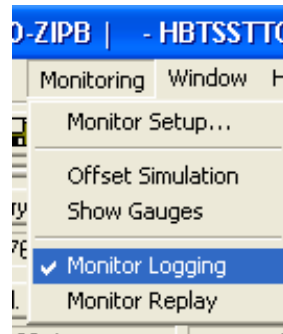
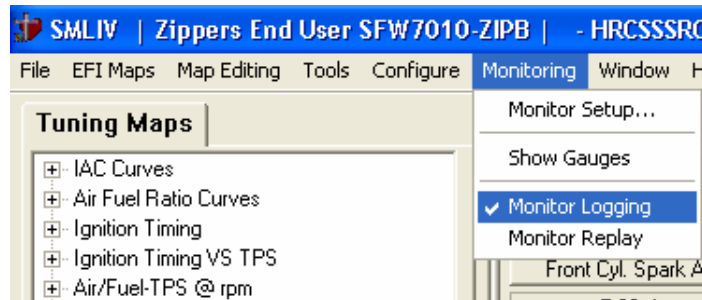
- c. Open SmartLink IV and select the **"Link"** button.

Link

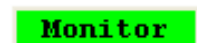
2. To synchronize the ThunderMax ECM to the SmartLink IV software, select **File > READ Module Maps and Settings**, as shown below.



3. Now select **Monitoring > Monitor Logging**, as shown below. A check mark will appear next to Monitor Logging to confirm that the function is activated.



4. Select the **Monitor** button, which will turn from red to green. At this time the Monitor Logging session will begin, with or without the engine running.



5. If your pre-selected Monitor Gauges did not appear, select **Monitoring > Show Gauges**, as shown below. If you have not setup your Monitor Gauges yet, please refer to the section called “**Engine Monitor Values & Gauges**” on page 47.



6. Start the engine and allow the head temperature to rise to a normal operating temperature (260-285° F), and observe the gauge activity. All data is being logged during engine operation. Proceed with Monitor Logging as long as necessary to record any activity for evaluation.

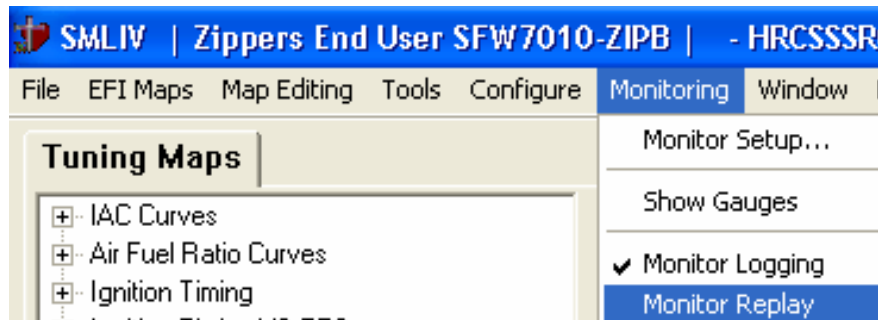


This may require a loaded road test or dyno pull to reveal the tuning problem. Road testing may not be practical unless you own a laptop and have adequate means of attaching and protecting the computer while the motorcycle is in operation. Please use caution and good sense when determining if a road test can be safely performed.

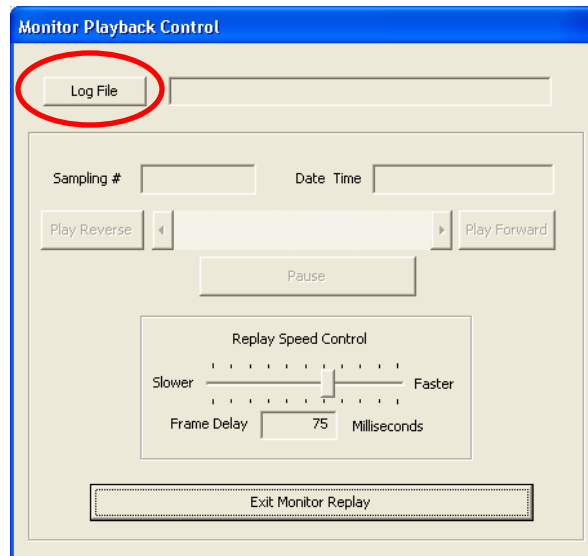
7. Once you are complete with your Monitor Logging session, select the **Monitor** button again to close the monitor session.

How to Replay a Monitor Log:

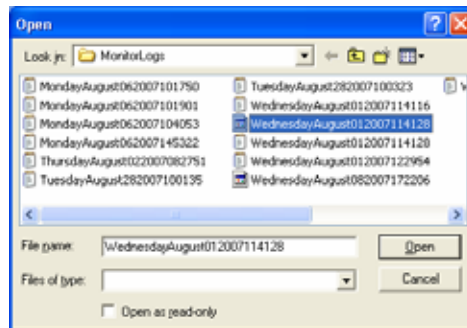
1.) Now that SmartLink IV has created a Monitor Log file, you may open it for viewing by selecting **Monitoring > Monitor Replay**, as shown below.



2.) The following window entitled “**Monitor Playback Control**” will appear.

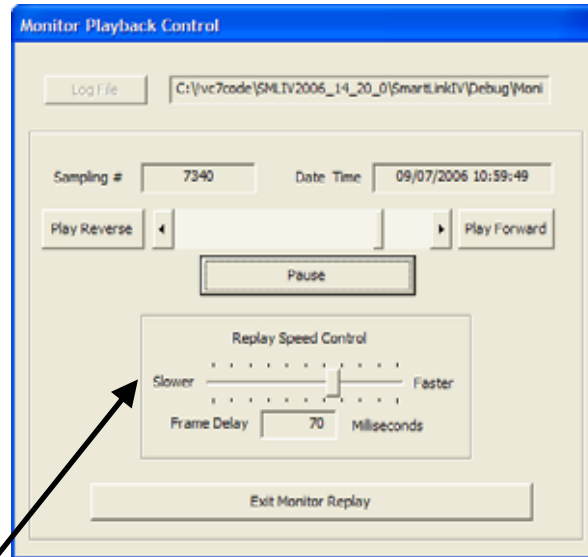


3.) Select the “**Log File**” button, which is circled in red above, and select the appropriate monitor log file. By default the Monitor Logs are saved by the date and time that the log started; which ensures that none of your previous monitor logs are accidentally overwritten. The following window will appear:



Select the appropriate Log File and select the “**Open**” button.

4.) Select the **“Play Forward”** Button, as shown below, and the monitor replay will begin in the background. Drag the **“Monitor Playback Control”** window out of the way of the map window and the monitor gauges.



New for 2008.0.2 :
Replay Speed Control

Since SmartLink IV is replaying the monitor log like a video, you may fast forward or rewind the monitor session by dragging the slider or using the arrow buttons. A **“Replay Speed Control”** slider has been added to the Monitor Playback Control window for SMLIV Version 2008.0.2.

Where are my Monitor Logs saved?

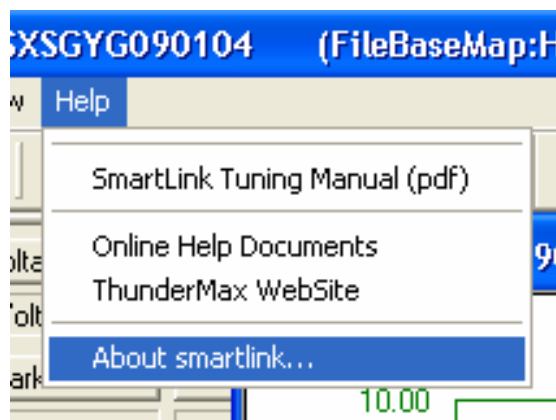
The monitor logs are stored in the “Shared User” folder. A folder titled “ThunderHeart” has been created in this directory. In this instance, SmartLink IV saved the Monitor Log titled “**WednesdayAugust012007114128.txt**” in the following location on my computer, C:\Documents and Settings\All Users\Documents\ThunderHeart\SmartLinkIVZippers\MonitorLogs\WednesdayAugust012007114128.bin. A .bin file is also created in the same location during monitor log replaying.

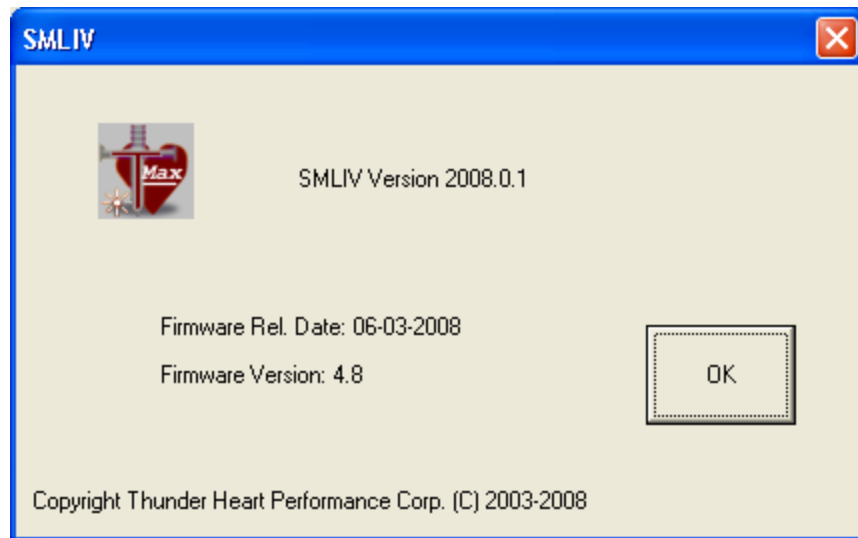
How do I send a Monitor Log to Zipper’s for review?

The location of the monitor log is important if you need to submit your Monitor Log to Zipper’s Technical Support for review. Please contact ProductSupport@ZippersPerformance.com with your problem before emailing the monitor log file. When submitting a monitor log for review, please include the following items:

- 1.) The **Monitor Log File, only the .txt file is needed.**
- 2.) The **Module Map File installed in your ThunderMax ECM.** You must save the map from your ThunderMax ECM, and email the .SLK map file with the Monitor Log File. The AutoTune offsets and learned data that are stored in the map file must accompany the .txt file for proper monitor log reviewing.
- 3.) The **Version Number** of the **SmartLink IV** software that you are using.
- 4.) Completed **Fax-In Technical Support Form**, located at the end of this manual.

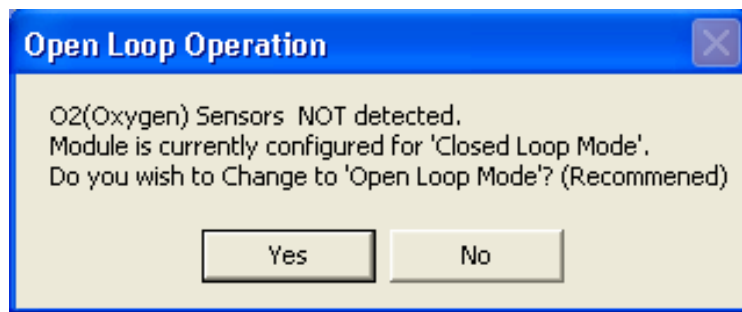
To find the SmartLink IV version, select **Help > About SmartLink...**, as shown below.





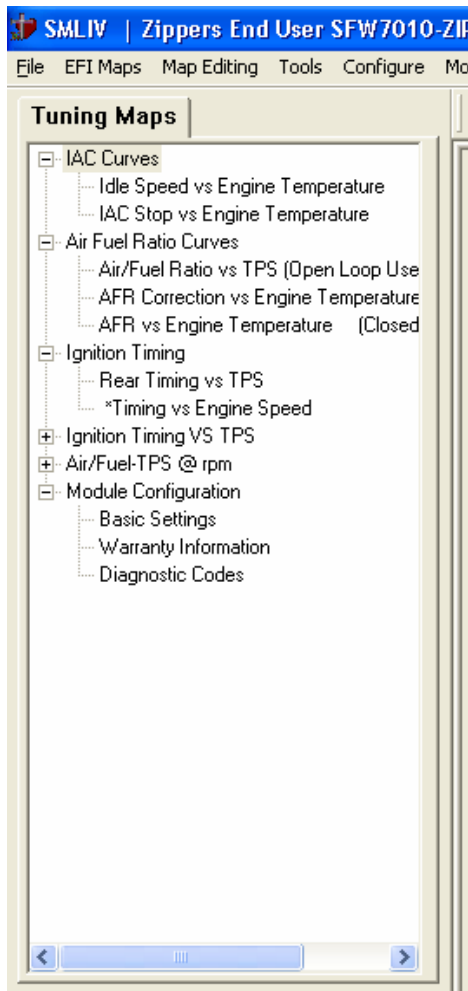
Monitor Logging / Replay Troubleshooting:

For Open Loop setups (No Auto-Tune), the following warning will appear:



This warning is normal, it has detected that no oxygen sensors are available; click the "Yes" button and proceed.

TUNING MAPS TREE



The Tuning Maps Tree is located on the far left of the SmartLink IV layout, and is used to access different tuning and configuration pages of the software. Clicking on each of these tree titles opens a window to allow editing of a particular function:

IAC Curves

- 1.) The **Idle Speed vs. Engine Temperature map** page is primarily used to control the Idle Speed during a cold start warm-up period.
- 2.) The **IAC Stop vs. Engine Temperature map** page is used to control the amount of air allowed into the engine at idle by the IAC Plunger.

Air Fuel Ratio Curves

- 1.) The **Air/Fuel Ratio vs. TPS map** page is only used on Open Loop ThunderMax applications (NO Auto-Tune). This allows the user to alter the AFR at varying throttle position.
- 2.) The **AFR Correction vs. Engine Temperature map** page allows the adjustment of the AFR correction at specific operating temperatures.
- 3.) The **AFR vs. Engine Temperature map** page is only for Closed Loop (Auto-Tune)

applications. This gives the Auto-Tune module AFR targets for specific operating temperatures.

Ignition Timing Maps

There are now 34 map pages for complete spark curve manipulation. The first 32 map pages are called "Timing vs. TPS @ RPM" map pages. These pages show the complete spark curves for every 256 RPM, and every throttle position.

In addition to the complete spark curve map pages, two separate map pages have been created called "Rear Timing vs. TPS" and "Timing vs. Engine Speed." The "Rear Timing vs. TPS" map page allows you to modify the timing in the rear cylinder only, to combat issues of spark knock that occurs only on the rear cylinder. The "Timing vs. Engine Speed" map page is a composite map page similar to the previous SmartLink versions. This table allows you to make quick changes to the master spark curve maps at specific RPMs. This map page is very effective in dealing with spark knock problems in particular areas. See page 88, in the "Tuning the ThunderMax ECM with Smartlink IV" section, for a complete discussion on how to tune the Ignition Timing Maps.

Air/Fuel-TPS @ RPM

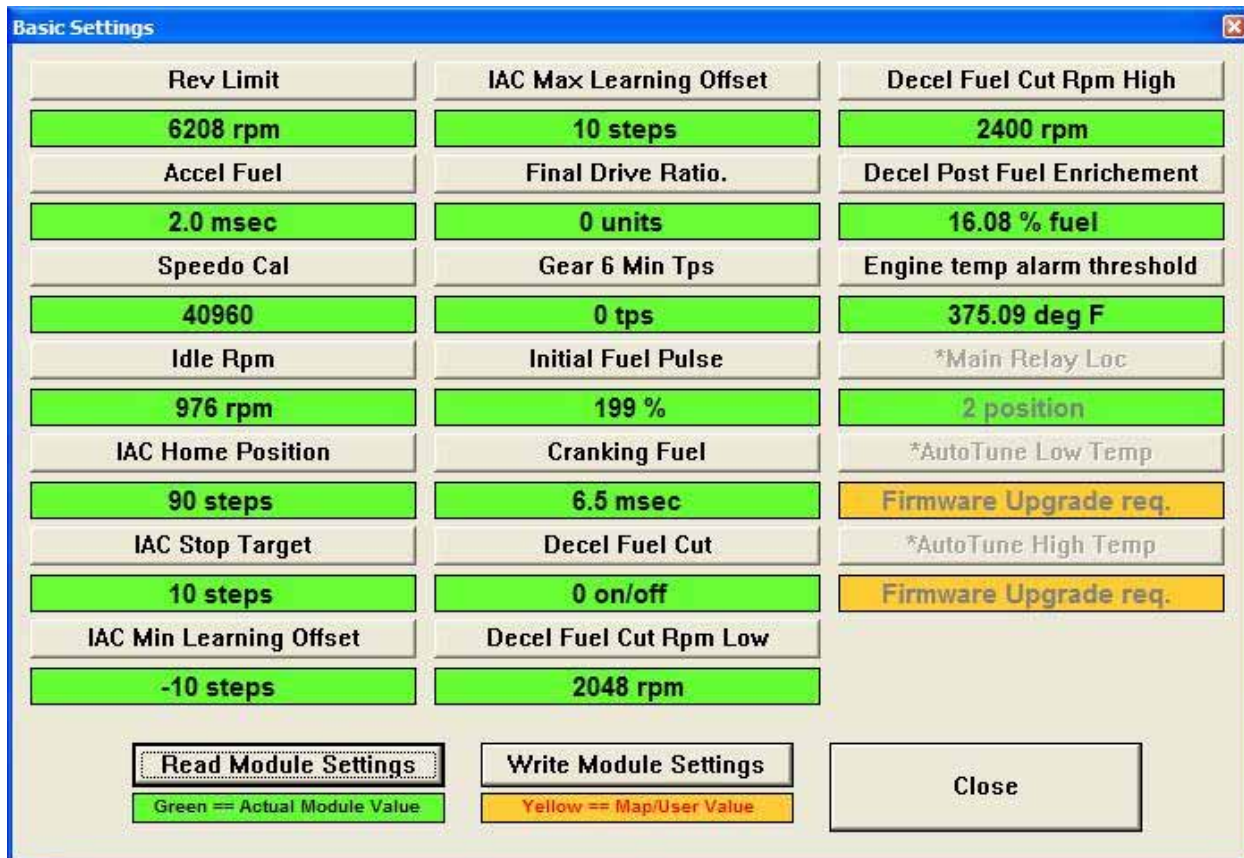
The **Air/Fuel Ratio vs. TPS map pages** allow you to set the AFR targets for the Closed Loop Operation (Auto-Tune). These 32 map pages allow you to adjust the AFR for every 256 RPMs of operation, with 32 throttle positions per RPM map page. This totals 1024 points of adjustment for the AFR. This gives you the option to refine the AFR from idle all the way up to wide open throttle (WOT) individually. These map pages will allow you to set specific areas for fuel economy (standard cruising RPM and TPS), but set the higher RPM pages for maximum power. This is a giant leap beyond the carbureted era, no longer do you have to sacrifice fuel economy across the board to improve or maintain peak output at wide open throttle.

Module Configuration

- 1.) **Basic Settings** – The Basic Settings page is used for editing the Idle Speed, RPM limit, Speedometer Calibration, Accel Fuel (accelerator pump simulation), Initial fuel pulse IAC stops targets, limits to offsets and IAC Home Position.
- 2.) **Warranty Information** – The ThunderMax ECM is constantly data logging while you ride and tune the motorcycle. The purpose of this page is to log the time that you spend at certain RPM ranges, as well as head temperatures, cycle time per riding session, and even how many times the Rev Limiter has been hit. This may sound intimidating, but the information is extremely valuable to you. These functions will aide any technician in determining why a certain failure occurred. The more data that you can provide to Technical Support the easier (and quicker!) it will be for them to help you.
- 3.) **Diagnostic Trouble Codes** – The ThunderMax ECM can quickly tell you if any of the 38 sensor functions are operating properly or not. If a sensor has failed, you will immediately see what the problem is on this page.

MODULE CONFIGURATION BASIC SETTINGS OVERVIEW

As described in the previous section, select the Module Configuration pages in the Tuning Maps Tree. Select the “**Basic Settings**” page under the “**Module Configuration**” heading. Double click “**Basic Settings**” to open. The following window will appear.



Notice that the selections on the right-hand portion of the “Basic Settings” window are grey and non-selectable. The features are only available for modules that are using Firmware version 4.8. Please upgrade your firmware by the instructions given on page 131, and the new features will be accessible.



ALWAYS read your map before making any changes to your Basic Settings. **After making a change to any of the Basic Settings, ALWAYS WRITE Module Maps and Settings to your ThunderMax ECM before ending the Linked session.**

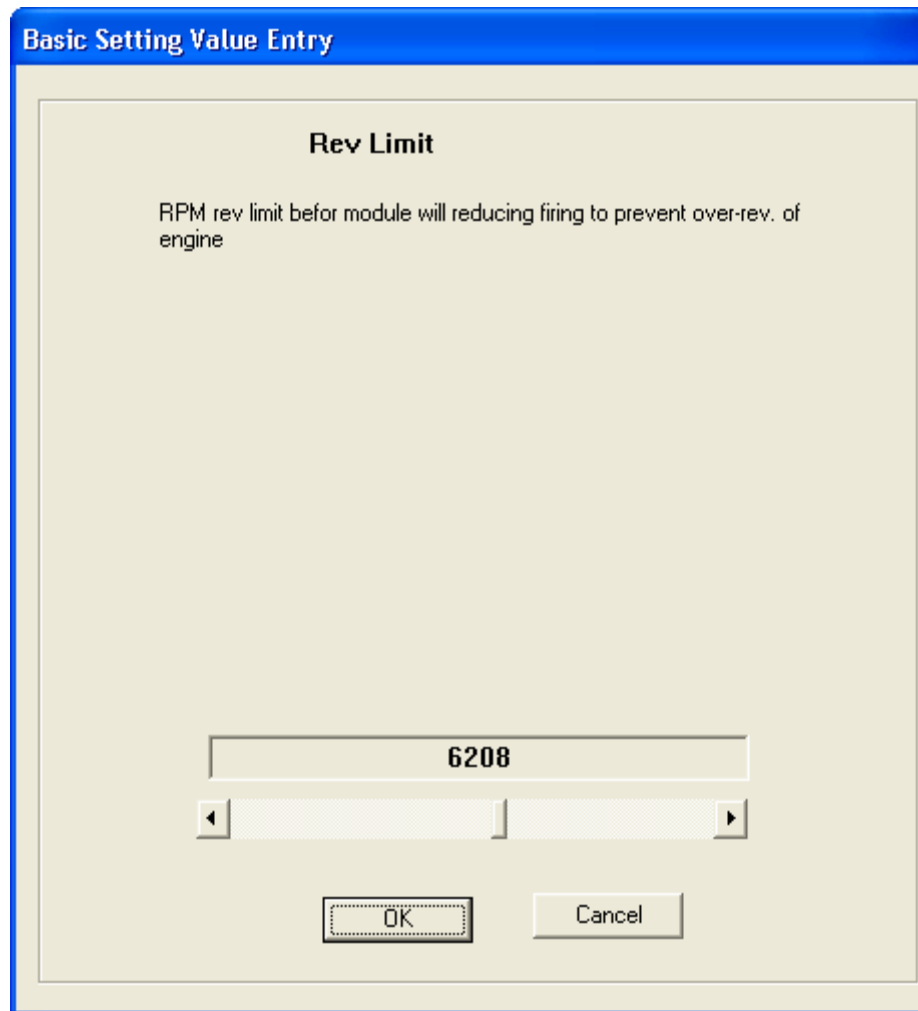
The following window will appear once the Firmware is upgraded to version 4.8:

Basic Settings		
Rev Limit	IAC Max Learning Offset	Decel Fuel Cut Rpm High
6496 rpm	25 steps	2560 rpm
Accel Fuel	Final Drive Ratio.	Decel Post Fuel Enrichment
13.0 msec	87 units	6.27 % fuel
Speedo Cal	Gear 6 Min Tps	Engine temp alarm threshold
40600	40 tps	334.63 deg F
Idle Rpm	Initial Fuel Pulse	*Main Relay Loc
944 rpm	100 %	2 position
IAC Home Position	Cranking Fuel	*AutoTune Low Temp
100 steps	7.8 msec	200 deg F
IAC Stop Target	Decel Fuel Cut	*AutoTune High Temp
10 steps	1 on/off	350 deg F
IAC Min Learning Offset	Decel Fuel Cut Rpm Low	
-25 steps	2048 rpm	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">Read Module Settings</div> <div style="border: 1px solid black; padding: 2px;">Write Module Settings</div> <div style="border: 1px solid black; padding: 2px;">Close</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="background-color: #90EE90; padding: 2px; font-size: 8px;">Green == Actual Module Value</div> <div style="background-color: #FFD700; padding: 2px; font-size: 8px;">Yellow == Map/User Value</div> </div>		

New “Basic Settings” Features for SmartLink IV 2008.0.2 with Firmware 4.8:

- 1.) **Auto Tune Low Temp** – The low head temperature threshold that the Auto Tune module begins tuning at.
- 2.) **Auto Tune High Temp** – The high head temperature threshold that the Auto Tune module stops tuning at.
- 3.) **Main Relay Loc** – This value tells the ECM if the model is a Big Twin® or Sportster® based motorcycle. It is now non-adjustable by an End User, the value is embedded in the Base Map. If you select a Sportster® Base Map, it will automatically change the Main Relay Loc value for you.

To change the values of the Basic Settings, simply click on the name of the function that needs to be changed. For example, if “Rev Limit” is selected, the “**Basic Setting Value Entry**” box will appear with a slider to adjust the value, as shown below.



It is recommended that at this time you setup the basic settings for the ECM/ motorcycle you are working with. The next section is titled “**Configuring the Basic Settings.**” This section will teach you how to adjust each of the functions in the “Basic Settings” window, along with a tutorial on what each of these functions performs. Remember, if you do not understand some of the terminology that is being presented to you in the manual; refer to the **Glossary of Terms** at the end of the **SmartLink IV Tuning Manual** for assistance.

CONFIGURING THE BASIC SETTINGS



ALWAYS read your map before making any changes to your Basic Settings. **After making a change to any of the Basic Settings, ALWAYS WRITE Module Maps and Settings to your ThunderMax ECM before ending the Linked session.**

Rev Limit:

At the Rev Limit RPM setting, the module will begin to cut spark to one or both cylinders as required to bring engine speed back down below this RPM.



Rev Limit Tip: Know the peak RPM that the engine configuration is designed for. Most V-Twin engines are not designed to run much over 6,200 RPM. Use caution with this setting, as a limit that is too high may allow mechanical damage to occur to the engine.

Accel Fuel:

This function is similar to an accelerator pump in a carburetor. As the number increases, more fuel is delivered to the engine during rapid throttle changes. This setting is pre-set to optimum specifications during the creation of the base map; yet differences in injector flow rates, changing closed loop targets, or other variables may require some adjustment to optimize throttle response. Zipper's recommends a base setting for Accel fuel to be a value between 8-14. The Accel Fuel function is meant to be used to optimize the off-idle throttle response.



Accel Fuel Tuning Tip - If you experience a pop or misfire in the intake tract while blipping the throttle at lower RPM's, lower Accel fuel value until the situation improves. Use for Open Loop operation or closed loop when a richer than desired idle mixture is present.

Speedo Cal:

This setting is a calibration value, which differs in relation to certain years and/or models of motorcycles. Note that an incorrect speedometer calibration can also affect other electronic accessory functions. Check the Speedo Cal for your year and model motorcycle.



This step must be performed before attempting to ride the motorcycle for the first time. Zippers cannot be held responsible for an inaccurate speedometer calibration if this step is not followed or neglected. Traffic violations may result if your speedometer does not match your local traffic authority's radar gun.

SmartLink IV

The entry can be from 1 to 99,999. At this time, the known base numbers are as follows:

Dyna®	2004-2005	40960
	2006-2008	45900
	CVO 2008	42450
Softail®	2001-2003	4352
	2004-2006	40960
	2007 - 2008	42450
Touring	2002	4352
	2003	20480
	2004-2006	40960
	2007 (16")	42450
	2007 (17")	42000
XL 883	2007 - 2008	48400
XL 1200	2007 - 2008	46000

On 2004 or later models, you may vary from these algorithms to offset different tire sizes and gear ratios on given models as long as the turn signals continue to cancel properly. On 2003 and earlier motorcycles, if the turn signal canceling function from the TSSM fails to work, you will need to reset the algorithm back to the original number for proper TSSM operation. For extreme gear ratio changes or accessory six-speed transmissions, an accessory speedometer recalibration device is recommended.

One common problem deals with the turn signal canceling function. You must confirm the production year of your motorcycle by checking the date stamp on the original factory ECM. The 2003 model year motorcycles were produced for an 18 month period and the algorithms must be chosen for production date (2002 or 2003), not simply the 2003 Anniversary model year date. All 03 motorcycles with an ECM with -01A or -02 part # will use the 4352 (2002) algorithm.

Speedometer Calibration through the Factory Equipped Speedometer (No ECM Link required)

Firmware version 4.5 and higher supports user programming of the Speedo cal setting thru the factory equipped speedometer display. The following instructions will guide you through the calibration process without linking to the ThunderMax ECM. Currently there are 8 values programmed in the ThunderMax ECM.

Programmed Location	Speedo Value	Chart Value	Model Breakdown
1	10 mph	40960	Dyna [®] 2004-2005, Softail [®] & Touring 2004-2006
2	20 mph	45900	Dyna [®] 2006-2008
3	30 mph	4352	Softail [®] 2001-2003, Touring 2002
4	40 mph	42450	Softail [®] 2007, Touring (16"wheel) 2007, 2008 CVO Dyna [®]
5	50 mph	20480	Touring 2003
6	60 mph	42000	Touring (17" wheel) 2007
7	70 mph	48400	XL883 2007
8	80 mph	46000	XL1200 2007

For example, if you have a 2004 Dyna[®] model motorcycle, your programmed Speedo Cal is in location 1. Multiply "Location 1" by 10 mph to obtain the speedometer value of 10 mph. For a 2007 XL883, select location 7, this equals 70 mph on the speedometer.



- Determine your Speedometer Value (mph) from the chart above.
- Enter the Speedo Calibration Programming Mode on the Speedometer by turning the ignition power on, while holding the throttle wide open. **DO NOT START THE MOTORCYCLE with the throttle fully opened.**
- The Speedometer value will begin to climb if the Programming Mode is properly activated. The speedometer value (mph) will begin to rise in increments of 10 mph. Release the throttle when your Speedometer Value from Step 1 is reached. The Speedometer will freeze on this calibration value when released.
- To program the new value in the ThunderMax ECM's memory, simply activate the hazard flashers. After a second or two, the speedometer value will drop back to zero. You are now finished and can de-activate the hazard flashers.

Note: If a value has already been entered into the speedometer, the speedometer will immediately jump to the value previously entered. If you continue to hold the throttle open, the value will continue to climb by increments of 10 mph. If this situation occurs, turn the ignition off, then back on to restart the procedure.

Idle RPM:

This setting reflects the idle speed at normal operating temperature. This is used to adjust idle speed once the engine reaches full operating temperature.

IAC Home Position:

The IAC Home Position setting will determine how much air is required to pass by the IAC motor for the engine to start without assistance of moving the throttle plate. This value indicates the position (in “counts”) of the Idle Air Control (IAC) with the key in “RUN”, without the engine running. This setting affects the amount of air the engine receives while cranking thru the IAC port. The IAC Home Position range is from 0 (fully closed) to 255 (fully open) counts.



IAC Home Position Tip: For 2001-2005 models, this value generally is between **90 and 115 counts**. On 2006 models with a factory throttle body, **58-70 counts** is a standard value. A value that is too low won't allow the engine to start properly. A value that is too high may require the engine to crank excessively to start. If either situation exists, adjust the values by +/-

5 points at a time to test the starting improvement.

IAC Stops Target:

This function provides a spread target that the IAC stops will learn to adjust below the IAC position. 2001-2005 (7-8) is recommended. 2006 & later (8-10) is the recommended values.

IAC Learning Offsets (Min and Max):

The ThunderMax ECM employs a constant learning function in determining the IAC Offsets. If setup properly, the IAC Learning function should not require a large window of offset learning.

Final Drive Ratio:

A setting for “Final Drive Ratio” is only needed on 2007 motorcycles with a 6th Gear Indicator light. **The default value that should be used for a 2007 motorcycle is 87.** Please note that this value is merely a compensation factor for the calibration needed to activate the light, not the actual Final Drive Ratio of the motorcycle. Please disregard this function if you do not have a 6th gear indicator lamp.

Dyna[®] Model motorcycles, use a value of 84 for this setting to illuminate the light.

Gear 6 MIN TPS:

The smallest value of throttle position that will allow 6th gear display. This function is only used on motorcycles equipped with OEM 6 speed transmissions and a 6th gear indicator light on the instrument cluster. If your application does not have a 6th gear indicator light, set the value to 0.

The default value bikes equipped with this feature is 40. For any reason, if your 6th gear indicator light is inoperable, please confirm that you have firmware version 4.3 or later. Also confirm that the value in the 6th gear min TPS is 40. If not, enter this value and write it to the module.

Initial Fuel Pulse:

This setting will affect the way that the motorcycle starts when the engine is cold. When the ignition is turned on, the ThunderMax ECM tells the injector to spray a defined amount of fuel to prime the cylinders. The default setting is 199 for most maps. We suggest small changes to find the ideal setting for quick starting. Typically when properly tuned to the application, the engine will fire “immediately” and eliminate the strain on your battery from excessive cranking.

The Initial Fuel Pulse will only pulse the injector once during each key cycle event. If you lower the setting too much, the function will provide less of an aide in cold starting the engine.

Cranking Fuel:

This allows you the option to richen or lean the fuel mixture during cranking conditions only. The Cranking Fuel option helps the engine start easier by delivering a rich fuel mixture to the engine, to promote a quicker initial combustion.

Decel Fuel Cut:

The “Decel Fuel Cut” option is the ON / OFF switch for the Decel Fuel Features.

Using a value of (0) turns the feature off, and a value of (1) turns on this option. For example, if your motorcycle does not currently pop on deceleration, it is not recommended to activate this feature. **If you are experiencing deceleration popping, set this value to (1) and proceed forward to setting the Decel Fuel options.**

Decel Fuel Cut Rpm Low:

The “Decel Fuel Cut RPM Low” setting should reflect the lowest RPM where the deceleration popping is occurring. This feature is set at 2048 RPM by default, however the setting is adjustable from 1280 to 3040 RPM. Simply take note of the RPM where the popping stops and use this for the “Decel Fuel Cut Rpm Low” value. This is where the fuel cut process is terminated. Fuel delivery is returned to normal below this RPM.

Decel Fuel Cut Rpm High:

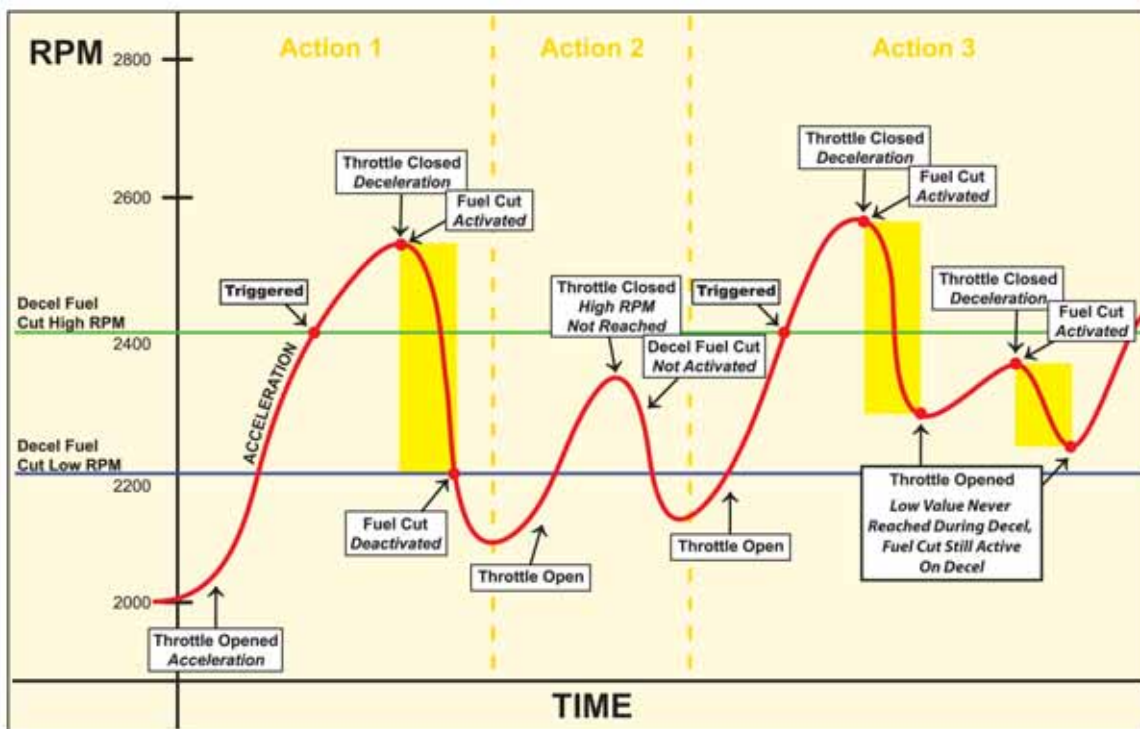
The “Decel Fuel Cut RPM High” setting should reflect the highest RPM where the deceleration popping occurs. This feature is set at 2400 RPM by default; however the High setting is adjustable from 2048 to 4064 RPM. Simply take note of the RPM where the popping begins and set this value at that RPM. Your setting will be the rpm at which the Decel Fuel Cut is triggered during acceleration.

The following picture depicts three scenarios to aide in your understanding of the Decel Fuel Cut function.

“Action 1” represents a situation where both the Low and High Fuel Cut RPMs are achieved, the Decel Fuel Cut is triggered, activated, and deactivated.

“Action 2” shows a situation where the High RPM was never achieved, and the Decel Fuel Cut is neither triggered nor activated.

“Action 3” shows how once the Decel Fuel function is triggered, it will not deactivate until after the engine RPM falls below the Decel Fuel Cut Low RPM.



Decel Post Fuel Enrichment:

The Decel Post Fuel Enrichment feature is similar to an accelerator pump on a carburetor. **This enrichment feature smoothes the transition from an OFF to ON throttle condition and makes it as seamless as possible.** This seamless transition is achieved by not allowing the manifold to enter a “dry” condition that can occur on long periods of deceleration, which may cause a pause, or a lag, in throttle response once the blade is opened. The Decel Post Fuel Enrichment has a range from 0 to 100, with the default setting of 16.08.

Engine Temp Alarm Threshold:

An adjustable Engine temperature alarm threshold is a new feature that allows you to set the cylinder head temperature when the “Check Engine” light turns on, to warn that the cylinder head temperature is starting to overheat.

All of the individual models of motorcycles produce different amounts of heat, as well as dissipate the heat differently. If you are riding a motorcycle that shrouds the airflow from the cylinder heads, the engine will maintain a higher operational temperature over the models that do not obstruct the air from the engine. These are air-cooled engines, if the air is not flowing past the engine, the engine cannot dissipate the heat.

Now you can select at what temperature you want to be warned, either raising the value for motorcycles that are constantly tripping the “Check Engine” light, or lowering the value if you want an early warning of a heat build up situation. Previously, the “Check Engine” head temperature warning value was set at 325 degrees. This setting created some alarm for those not familiar with the feature, so the value has been raised to 350 degrees in firmware 4.6 and higher.

Main Relay LOC:

This setting is no longer adjustable by End Users. The Main Relay Loc value distinguishes between a Big Twin and a Sportster model motorcycle. **This value is embedded in the Base Map file and no longer needs to be altered.** Sportster model motorcycles will be in the “2 position”, and Big Twin models will be in the “1 position.”

Auto Tune Low and High Temp Settings

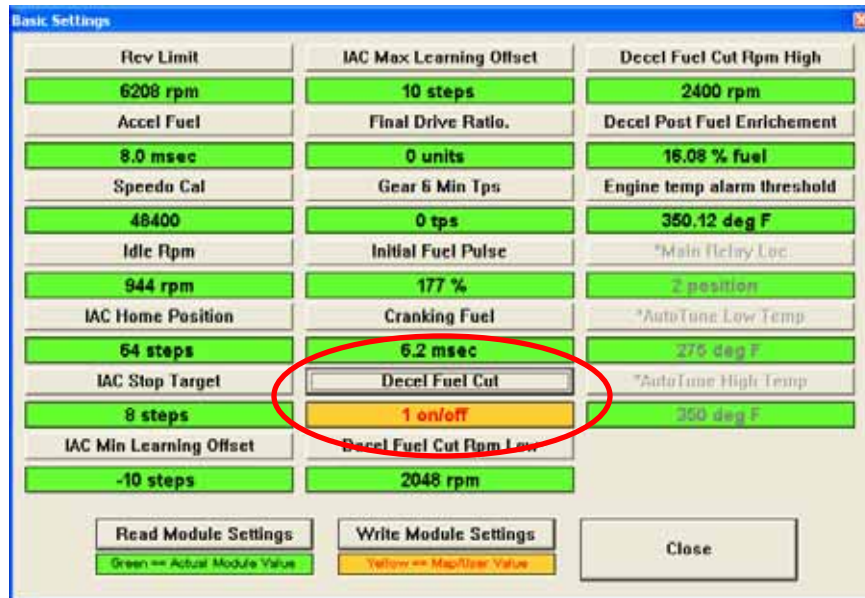
This setting is non-adjustable by End Users, and the value is tied to the Base Map. A Sportster model motorcycle requires a higher head temperature tuning range than a Big Twin motorcycle, and the values are set accordingly.

If your application requires a special temperature threshold, please contact Zipper’s support.

Read/Write Basic Settings:

The buttons at the bottom of the Module Configuration window allow you to immediately save the changes made to the ECM. This is also useful when attempting to read the current Module Configuration settings in a module that has already been in operation.

Any changes made when you're not linked to your ThunderMax ECM will result in a value with a yellow background. This simply means that the value is on your computer, but not updated to your ECM. In the following example the Decel Fuel Cut option was turned on, but not while linked to the ECM.



MODULE CONFIGURATION WARRANTY INFORMATION

The Warranty Information window displays the amount of time that you've spent at particular RPM ranges, as well as the head temperatures that your engine has seen. This is extremely useful information when tuning the motorcycle. You will now be able to see what RPM ranges are most frequently used by your riding style. This will allow you to focus your tuning effort to the most frequently used ranges.

The following window will appear when the "Warranty Information" option is selected. Select the "Read Module Logs" button to update the logged data into SmartLink IV.

Hrs:Mins:Secs		Rev Limit Hits	
500 Rpm	00:00:55	2000 Rpm	00:14:33
600 Rpm	00:05:39	2100 Rpm	00:11:51
700 Rpm	00:05:51	2200 Rpm	00:12:33
800 Rpm	00:05:37	2300 Rpm	00:12:44
900 Rpm	03:12:51	2400 Rpm	00:10:13
1000 Rpm	04:37:27	2500 Rpm	00:09:25
1100 Rpm	00:44:55	2600 Rpm	00:07:40
1200 Rpm	00:32:23	2700 Rpm	00:06:49
1300 Rpm	00:17:55	2800 Rpm	00:07:41
1400 Rpm	00:10:18	2900 Rpm	00:04:56
1500 Rpm	00:13:43	3000 Rpm	00:04:59
1600 Rpm	00:13:21	3100 Rpm	00:03:57
1700 Rpm	00:17:08	3200 Rpm	00:05:56
1800 Rpm	00:13:57	3300 Rpm	00:04:25
1900 Rpm	00:09:58	3400 Rpm	00:02:37
3500 Rpm	00:03:11	4900 Rpm	00:01:25
3600 Rpm	00:02:37		
3700 Rpm	00:01:36		
3800 Rpm	00:02:05		
3900 Rpm	00:01:38		
4000 Rpm	00:02:11		
4100 Rpm	00:01:16		
4200 Rpm	00:01:00		
4300 Rpm	00:00:58		
4400 Rpm	00:01:27		
4500 Rpm	00:01:08		
4600 Rpm	00:01:18		
4700 Rpm	00:00:56		
4800 Rpm	00:01:15		
5000 Rpm	00:01:12		
5100 Rpm	00:00:45		
5200 Rpm	00:00:38		
5300 Rpm	00:00:36		
5400 Rpm	00:00:34		
5500 Rpm	00:00:23		
5600 Rpm	00:00:43		
5700 Rpm	00:00:35		
5800 Rpm	00:00:40		
5900 Rpm	00:00:34		
6000 Rpm	00:00:19		
6100 Rpm	00:00:18		
6200 Rpm	00:00:00		
6300 Rpm	00:00:00		
6400 Rpm	00:00:00		

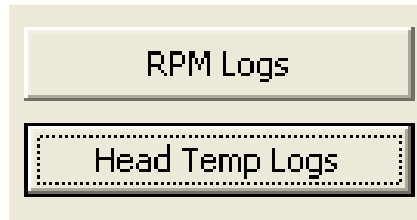
Buttons at the bottom: Read Module Logs (circled in red), Save to File, RPM Logs, Close, Clear Module Logs, Load from File, Head Temp Logs.



If you are experiencing problems viewing the Warranty Information, please verify that the DPI Setting (**D**ots **P**er **I**nch) on your computer is set at "Normal Size", which is 96 DPI. Any value other than 96 DPI may not allow this window to open properly. Generally a higher DPI value will eliminate all of the buttons found at the bottom of the window. If you don't see the "Read Module Logs" button, double check the DPI setting.

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The warranty information function is viewed as two separate logs, one based on RPM and one based on Head Temperature. To toggle between the logs, simply select which log you wish to view from the two separate Log buttons, as shown below.



If the “Head Temp Logs” button is selected, the following window will appear.

Service Settings

Edit VIN/SRN

Total Hrs.

Engine Starts Rev Limit Holds

Rev Limit Hits

Run Sessions

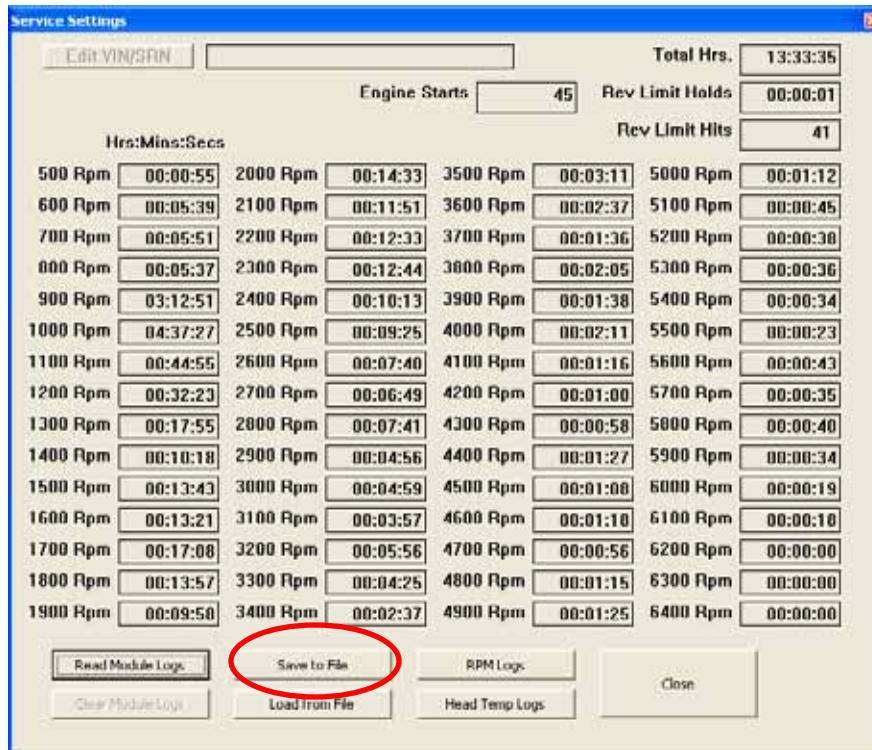
184 Deg	<input type="text" value="94"/>	304 Deg	<input type="text" value="1"/>	424 Deg	<input type="text" value="0"/>
192 Deg	<input type="text" value="2"/>	312 Deg	<input type="text" value="1"/>	432 Deg	<input type="text" value="0"/>
200 Deg	<input type="text" value="2"/>	320 Deg	<input type="text" value="1"/>		
208 Deg	<input type="text" value="2"/>	328 Deg	<input type="text" value="1"/>		
216 Deg	<input type="text" value="3"/>	336 Deg	<input type="text" value="0"/>		
224 Deg	<input type="text" value="2"/>	344 Deg	<input type="text" value="0"/>		
232 Deg	<input type="text" value="1"/>	352 Deg	<input type="text" value="0"/>		
240 Deg	<input type="text" value="1"/>	360 Deg	<input type="text" value="0"/>		
248 Deg	<input type="text" value="0"/>	368 Deg	<input type="text" value="0"/>		
256 Deg	<input type="text" value="5"/>	376 Deg	<input type="text" value="0"/>		
264 Deg	<input type="text" value="5"/>	384 Deg	<input type="text" value="0"/>		
272 Deg	<input type="text" value="9"/>	392 Deg	<input type="text" value="0"/>		
280 Deg	<input type="text" value="6"/>	400 Deg	<input type="text" value="0"/>		
288 Deg	<input type="text" value="3"/>	408 Deg	<input type="text" value="0"/>		
296 Deg	<input type="text" value="4"/>	416 Deg	<input type="text" value="0"/>		

Read Module Logs Save to File RPM Logs Close

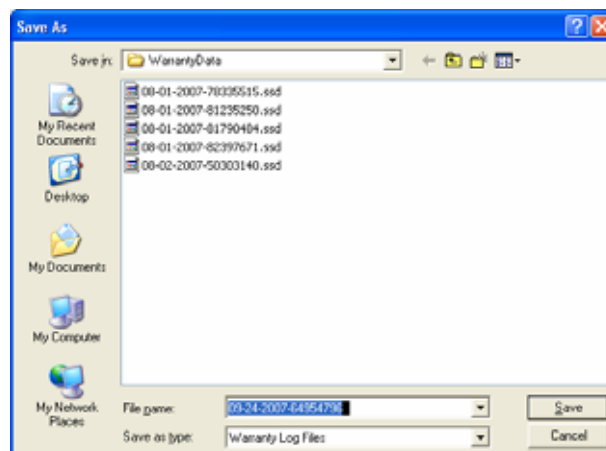
Clear Module Logs Load from File Head Temp Logs

Saving the Warranty Information Data:

To save the Warranty Information data that is stored in the ThunderMax ECM, first select the “Save to File” button at the bottom of the “Service Settings” window, as shown below.



Once the “Save to File” button is selected, a window will appear titled “Save As.”



Select “Open” and an Excel spreadsheet will be created in the directory “C:\Documents and Settings\All Users\Documents\Thunder Heart\SmartLinkIVZippers\WarrantyData.”

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Two files will be created when a Warranty Data Log is saved. The first file is an Excel Spreadsheet that contains ALL of the data displayed on the “Service Settings” window, including both Head Temperature and RPM logs. This Excel spreadsheet can be printed out for your reference.

The second file that is created is an .SSD file which can be opened through SmartLink IV. If you select the “Load from File” button, as shown below, SmartLink will reopen the saved warranty log data for viewing.

The screenshot shows the 'Service Settings' window with the following data:

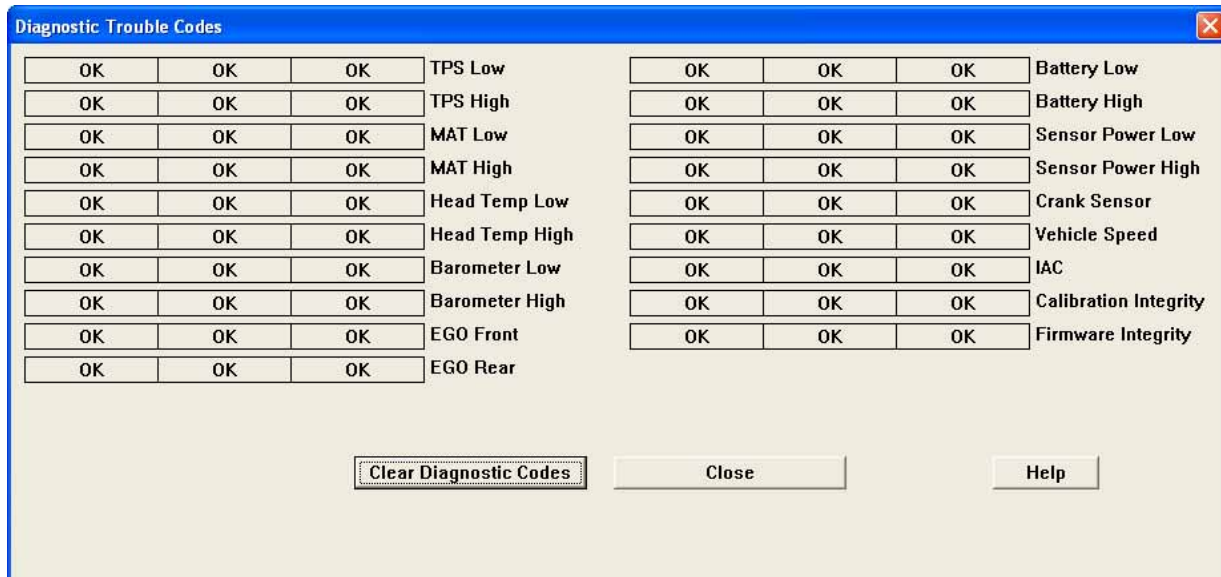
Hrs:Min:Secs	
500 Rpm	00:00:55
600 Rpm	00:05:39
700 Rpm	00:05:51
800 Rpm	00:05:37
900 Rpm	03:12:51
1000 Rpm	04:37:27
1100 Rpm	00:44:55
1200 Rpm	00:32:23
1300 Rpm	00:17:55
1400 Rpm	00:10:18
1500 Rpm	00:13:43
1600 Rpm	00:13:21
1700 Rpm	00:17:08
1800 Rpm	00:13:57
1900 Rpm	00:09:50
2000 Rpm	00:14:33
2100 Rpm	00:11:51
2200 Rpm	00:12:33
2300 Rpm	00:12:44
2400 Rpm	00:10:13
2500 Rpm	00:09:25
2600 Rpm	00:07:40
2700 Rpm	00:06:49
2800 Rpm	00:07:41
2900 Rpm	00:04:56
3000 Rpm	00:04:59
3100 Rpm	00:03:57
3200 Rpm	00:05:56
3300 Rpm	00:04:25
3400 Rpm	00:02:37
3500 Rpm	00:03:11
3600 Rpm	00:02:37
3700 Rpm	00:01:36
3800 Rpm	00:02:05
3900 Rpm	00:01:38
4000 Rpm	00:02:11
4100 Rpm	00:01:16
4200 Rpm	00:01:00
4300 Rpm	00:00:58
4400 Rpm	00:01:27
4500 Rpm	00:01:08
4600 Rpm	00:01:10
4700 Rpm	00:00:56
4800 Rpm	00:01:15
4900 Rpm	00:01:25
5000 Rpm	00:01:12
5100 Rpm	00:00:45
5200 Rpm	00:00:38
5300 Rpm	00:00:36
5400 Rpm	00:00:34
5500 Rpm	00:00:23
5600 Rpm	00:00:43
5700 Rpm	00:00:35
5800 Rpm	00:00:40
5900 Rpm	00:00:34
6000 Rpm	00:00:19
6100 Rpm	00:00:10
6200 Rpm	00:00:00
6300 Rpm	00:00:00
6400 Rpm	00:00:00

Additional window details:

- Engine Starts: 45
- Total Hrs: 13:33:35
- Rev Limit Holds: 00:00:01
- Rev Limit Hits: 41
- Buttons: Read Module Logs, Save to File, RPM Logs, Close, Clear Module Logs, Load from File (circled in red), Head Temp Logs.

MODULE CONFIGURATION DIAGNOSTIC TROUBLE CODES

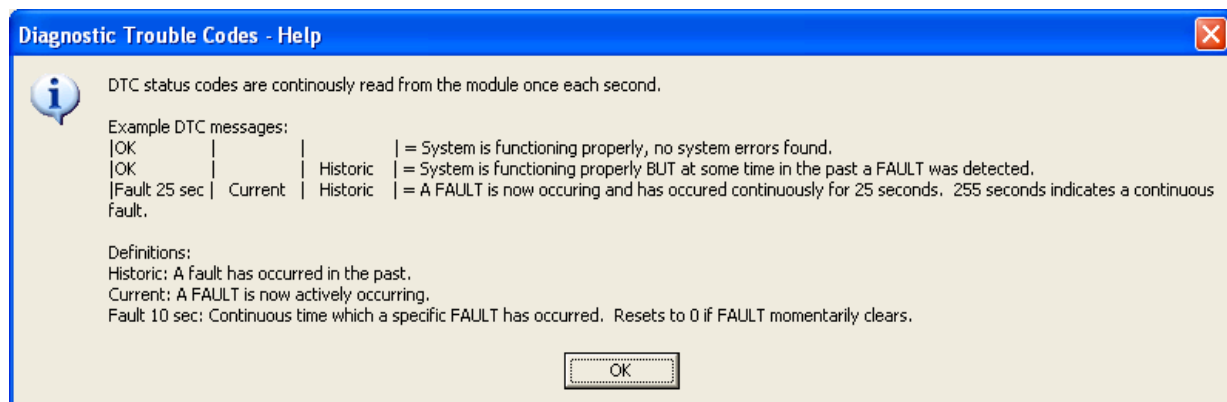
When the Diagnostic Codes option is selected from the Tuning Tree, the following window will appear:



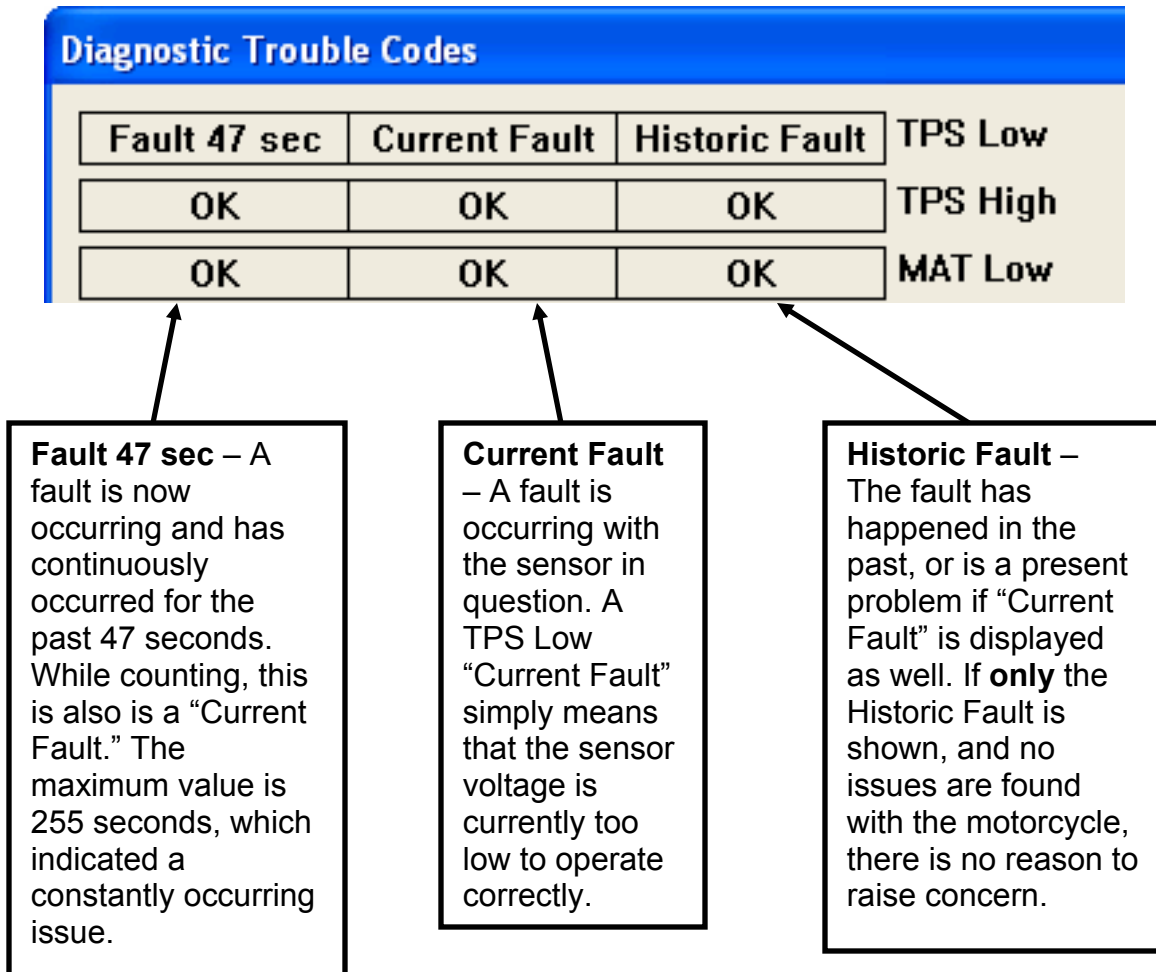
Select “Read Diagnostic Codes” when linked to your ThunderMax ECM to download the Diagnostic Trouble Codes.

The Diagnostic Trouble Codes window displays the current and historical errors for all of the sensors and devices that are necessary for the proper operation of your motorcycle. This window eliminates the need for the factory scan tool for reading trouble codes. Instead of outputting a trouble code, this window will display the status of the electronics without any confusing codes.

If you select the “Help” button, the following window will appear:



The “Diagnostic Trouble Codes – Help” window explains the setup of the Diagnostic Trouble Code (DTC) window. Three types of messages are given in the DTC window, Current errors, Historic Errors, and a message if and when a Fault has occurred, but is no longer present.



The Diagnostic Trouble Codes are very useful when troubleshooting issues that may or may not be directly related to the ThunderMax. If an error is occurring with a sensor, but you only see a Historic Code, use the “Clear Diagnostic Codes” button to clear the historic codes. If the problem happens again, it will reappear in the Historic Fault column.

The DTC uses abbreviations for the sensor names, and it will show if the sensor voltage is too high, or too low for the normal operating range.

TPS Low / High = Throttle Position Sensor

MAT Low / High = Mass Air Temperature

Head Temp Low / High = Cylinder Head Temperature

Barometer Low / High = Barometer pressure sensor in the ECM

EGO Front / Rear = Oxygen Sensor Front / Rear Status – The engine must be operating for this function to correctly diagnose the oxygen sensors.

Battery Low / High = Main 12v Battery Voltage

Sensor Power Low / High = Voltage across the low power sensor circuit (Factory equipped 5 volt sensor circuitry)

Crank Sensor = Crank Position Sensor (CPS)

Vehicle Speed = Vehicle Speed Sensor (VSS)

IAC = Idle Air Control System

Calibration Integrity = Reserved for future upgrades, currently non-functional

Firmware Integrity = Reserved for future upgrades, currently non-functional

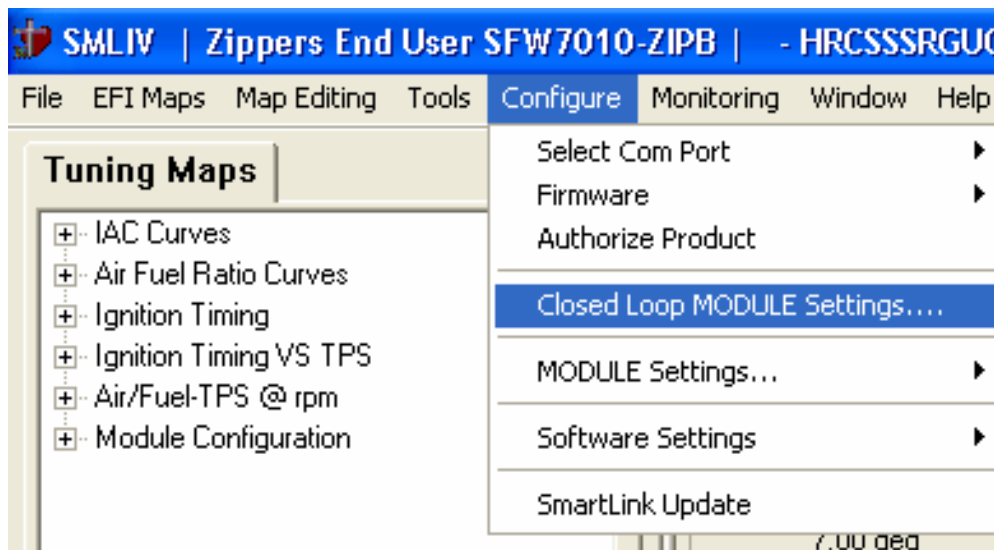
CLOSED LOOP MODULE SETTINGS (Optional Settings for Auto-Tune Closed Loop)

The Closed Loop Module Settings are only used when an Auto-Tune module is used in conjunction with the ThunderMax ECM. If the ThunderMax ECM is configured for Closed Loop operation, it searches for the oxygen sensors when the ignition is turn on.

If the oxygen sensors are not found, the software will alert you that the oxygen sensors are not detected, and SmartLink will convert the ThunderMax ECM back to Open Loop Settings and solely operate off of the Base Map File. If the oxygen sensors are found, the module will directly operate off of the settings in the “Closed Loop Module Settings” window.

The ThunderMax ECM processes feedback from the wideband oxygen sensors to adjust the fuel volume at all points, by creating learned “Offset” points from the installed ‘Base Map’ fuel points. These ‘learned offset points’ are stored within the ThunderMax ECM and are used in conjunction with the base map. The base map is dynamically used by the ThunderMax ECM and the Auto-Tune’s active (closed loop) feedback system. The ‘base map’ fuel points are not being adjusted by either the AutoTune or ThunderMax ECM.

To view the Closed Loop Module Settings window, select **Configure > Closed Loop MODULE Settings...** as shown below.



Closed Loop Configuration Layout:

The Closed Loop Configuration window is broken into two distinct columns, one for the Module settings, and one for the Map settings.

The screenshot shows the 'Closed Loop Configuration' window with two columns: '(Module) Closed Loop Settings' and '(Map) File Closed Loop Settings'. Both columns have checkboxes for 'Close Loop Processing' and 'AutoTune', which are checked. Below these are sections for 'Air Fuel Ratio Override' and 'Idle Air Control Override', each with an 'Enabled' checkbox (unchecked) and input fields for 'AFR' and 'IAC'. The 'Max CLP Offset' section has input fields for 'Session' (5%) and 'Maximum' (25%), and a 'Link/Read' button. The 'Maximum CLP Offsets' section has similar input fields and a 'Write (Map) Settings To (Module)' button. A 'CLOSE' button is at the bottom.

**Left Side
(Module Side)**

**Closed Loop
Settings saved
in your
ThunderMax
ECM.**

**Changes made to
the Module side
are only saved if
Linked to an
ECM.**

**Right Side
(Map Side)**

**Closed Loop
Settings saved to
the Map file on
your computer.**

**Any changes
made to the Map
side must be
written to the
ECM before the
changes are
implemented by
the ThunderMax
ECM.**

Enabling Closed Loop Operation:

- 1.) Establish a communications Link to the ThunderMax ECM.
- 2.) Select Configure > Closed Loop Module Settings...
- 3.) **Check the "Close Loop Processing (Map)" options on both sides of the window, as shown below.**

This screenshot shows the 'Closed Loop Configuration' window with the 'Close Loop Processing' checkboxes checked for both the Module and Map sides. The 'AutoTune' checkboxes are also checked. The rest of the window content is partially obscured.

- 4.) Select the “Write (Map) Settings To (Module)” button at the bottom of the Closed Loop Configuration window.

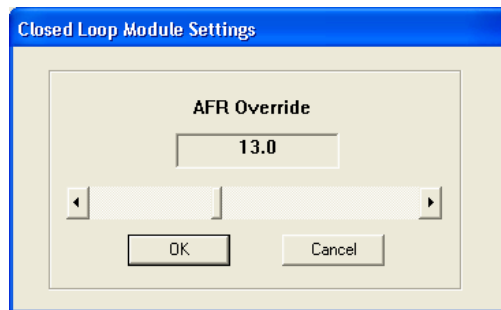


Write (Map) Settings To (Module)

If you do not have an Auto-Tune module installed, an error message will appear to alert you that the oxygen sensors have not been found. If this occurs the ThunderMax will default back to an Open Loop environment.

Air Fuel Ratio Override: Race mode

The Air Fuel Ratio Override function overrides **ALL** ‘Air/Fuel Ratio vs. TPS’ pages at **ALL** RPM’s. When you select the AFR (Map) button, the following box will appear to allow you to change your Target AFR. Once adjusted, select the “Write (Map) Settings To (Module)” button again to update the ThunderMax ECM.



To target *specific* Air/Fuel Ratio RPM ranges and throttle positions, leave this box unchecked and edit the individual ‘Air/Fuel-TPS @ rpm’ map pages located under the ‘Tuning Maps’ tree, see page 110 for detailed instructions.

Idle Air Control Override:

During Normal Operation, always keep the Idle Air Control Override unchecked. This setting should not be enabled except for diagnosing a particular type of supported problem or during tuning on a load cell dyno. **Enabling the IAC Override during normal operating conditions will create starting and running problems.**



Only enable the IAC Override for troubleshooting purposes, when advised by Zipper's.

Maximum CLP Offsets:

The Maximum CLP Offsets allows you to adjust the amount of Closed Loop learning corrections. This simply means that you can alter the range that the Auto-Tune unit can tune away from the Base Map file, with a limit on allowed tuning per session, as well as an overall limit regardless of time.

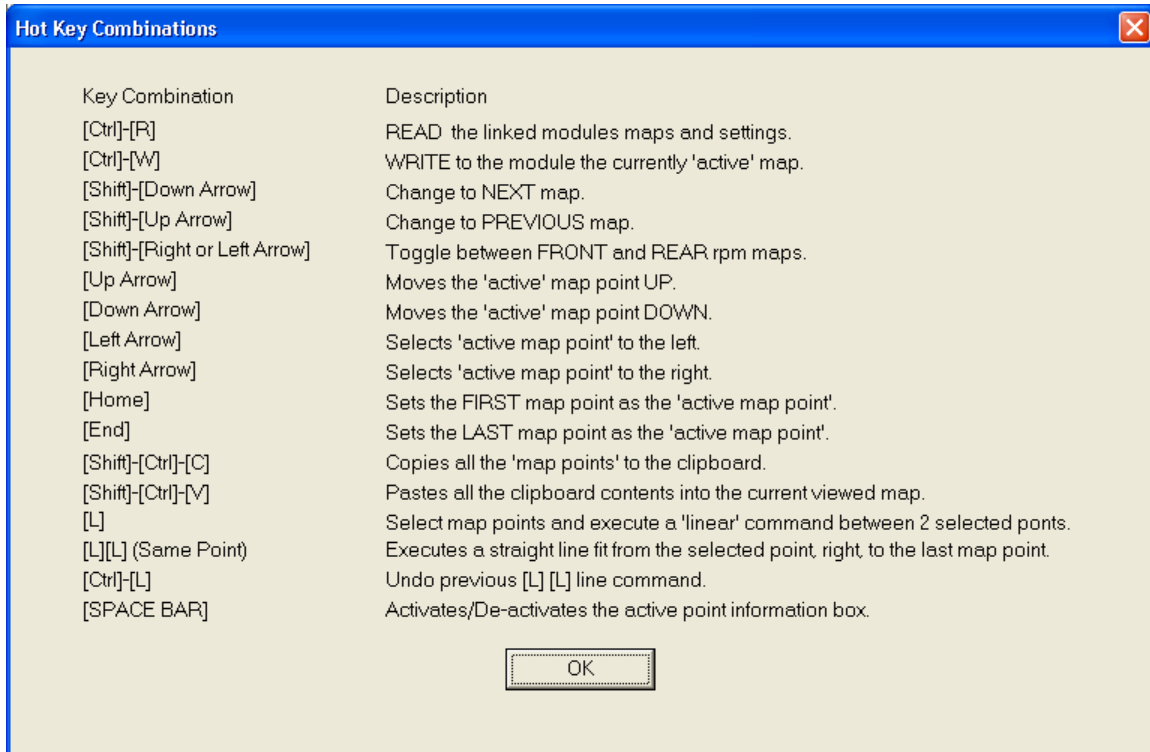
The “**Session (Map)**” button sets the AFR *maximum learning correction* from the Base Map’s fuel setting, *per session*; by percentage (range is 0-50%). A ‘session’ is defined as the period of time from engine on to engine off (per cycle).

The “**Maximum (Map)**” button sets the *total* AFR maximum learning correction from the base map’s fuel setting by percentage (regardless of number of sessions; range is 0-50%).

Unless your application is a considerable mismatch to the installed base map, the default settings of 5% per session and 20% maximum are sufficient for most AFR corrections. If the Base Map selection is a poor match to the application, the amount of learning needed will be significant. If the closest Base Map match is significantly different from your combination, increase the CLP Offsets to broaden the learning range per session. This will reduce the amount of time the ThunderMax needs to learn the appropriate fuel points. Once the tune up is close, adjust these settings back to 5% and 20%.

SMARTLINK IV HOT KEY COMBINATIONS

At any point when SmartLink IV is open, if you select the “F2” button, the following display will appear, titled “Hot Key Combinations”.



Key Combination	Description
[Ctrl]-[R]	READ the linked modules maps and settings.
[Ctrl]-[W]	WRITE to the module the currently 'active' map.
[Shift]-[Down Arrow]	Change to NEXT map.
[Shift]-[Up Arrow]	Change to PREVIOUS map.
[Shift]-[Right or Left Arrow]	Toggle between FRONT and REAR rpm maps.
[Up Arrow]	Moves the 'active' map point UP.
[Down Arrow]	Moves the 'active' map point DOWN.
[Left Arrow]	Selects 'active map point' to the left.
[Right Arrow]	Selects 'active map point' to the right.
[Home]	Sets the FIRST map point as the 'active map point'.
[End]	Sets the LAST map point as the 'active map point'.
[Shift]-[Ctrl]-[C]	Copies all the 'map points' to the clipboard.
[Shift]-[Ctrl]-[V]	Pastes all the clipboard contents into the current viewed map.
[L]	Select map points and execute a 'linear' command between 2 selected points.
[L][L] (Same Point)	Executes a straight line fit from the selected point, right, to the last map point.
[Ctrl]-[L]	Undo previous [L] [L] line command.
[SPACE BAR]	Activates/De-activates the active point information box.

OK

The SmartLink IV Hot Keys are meant for users who are comfortable with the layout and features of the software, but are looking for a quicker means of navigating the software.

Essential SmartLink IV Hot Keys

[Home] – The Home key will select the FIRST tuning block map point on the displayed map file page. (Leftmost map point)

[End] – The End key will select the LAST tuning block map point on the displayed map file page. (Rightmost map point)

[Spacebar] – The spacebar will toggle the “Tuning Block Details” box, which displays the live data associated with each tuning block.

[◀▶] – The left and right arrow keys, ◀▶, allow you to move between highlighted, or active, tuning blocks.

[▲▼] – The up and down arrow keys, ▲▼, allow you to move a highlighted tuning block either up or down. Quite simply it's the arrow keys that allow you to navigate through the Base Map File map pages and make adjustments to the tuning blocks.

Tuning Related SmartLink IV Hot Keys

[L] - To create a linear line between two points, tap the L key on the first point, then move to the second point and tap the L key.

[L][L] – To create a horizontal line from a selected tuning block to the end of the map page (right-hand side), tap the L key twice in a row.

[CTRL] [L] – If you decide to undo an [L][L] command, holding down the Control [CTRL] key and selecting the L key again will undo the last linear line command.

Section 4:

**Tuning
The ThunderMax ECM
With SmartLink IV**

TUNING OVERVIEW

Open Loop

There are several ways to approach tuning, if it is required for your application. The method of tuning in open loop is on a load control dynamometer with 2 wide band O₂ sensors measuring each cylinder's AFR value. Another option is to use a portable wide band AFR meter to generate the data needed to adjust your map. With this equipment, and the SmartLink IV tuning software, you can monitor and adjust specific AFRs under varying loads. However, this work is quite laborious and therefore expensive.

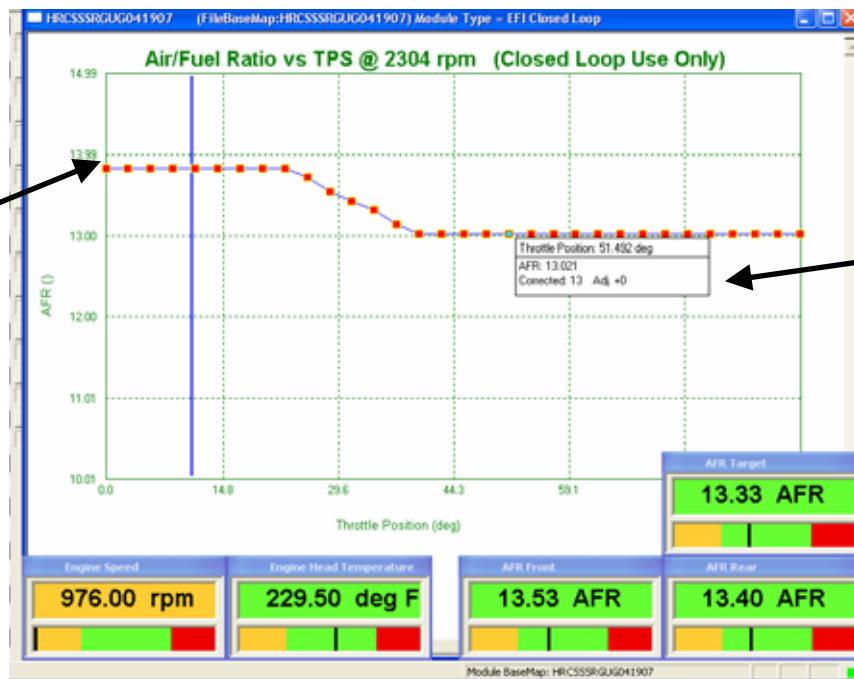
Understandably, if you don't have this type of equipment you should strongly consider adding the ThunderMax with an AutoTune system. This system requires 2 bungs to be added in the head pipes for oxygen sensors (2006 & earlier Delphi Based Factory EFI motorcycles) to upgrade to a ThunderMax wide band closed loop system. The AutoTune module receives power from the factory Diagnostics Port, for an easy plug-in installation. This "All in one" package can save significant time in properly tuning your motorcycle.

IMPORTANT NOTE

Any work on a chassis dynamometer, power sampling or live tuning, must be performed after the engine has reached full operating temperature. The map is designed to be stable and make optimum power at full operating temperature; anything below that may result in sampling of an engine that is still in warm-up mode (running in a richer AFR TARGET fuel map). **Changing a fuel map while the engine is in warm-up mode will proportionally affect the main (operating temperature) map, with possibly adverse results.** Always make adjustments at normal operating temperature.

The "Tuning Blocks" can be moved either up, or down by using the Arrow Keys (▲▼) on your keyboard.

The left or right Arrow Keys (◀▶) change the selected Tuning Block.

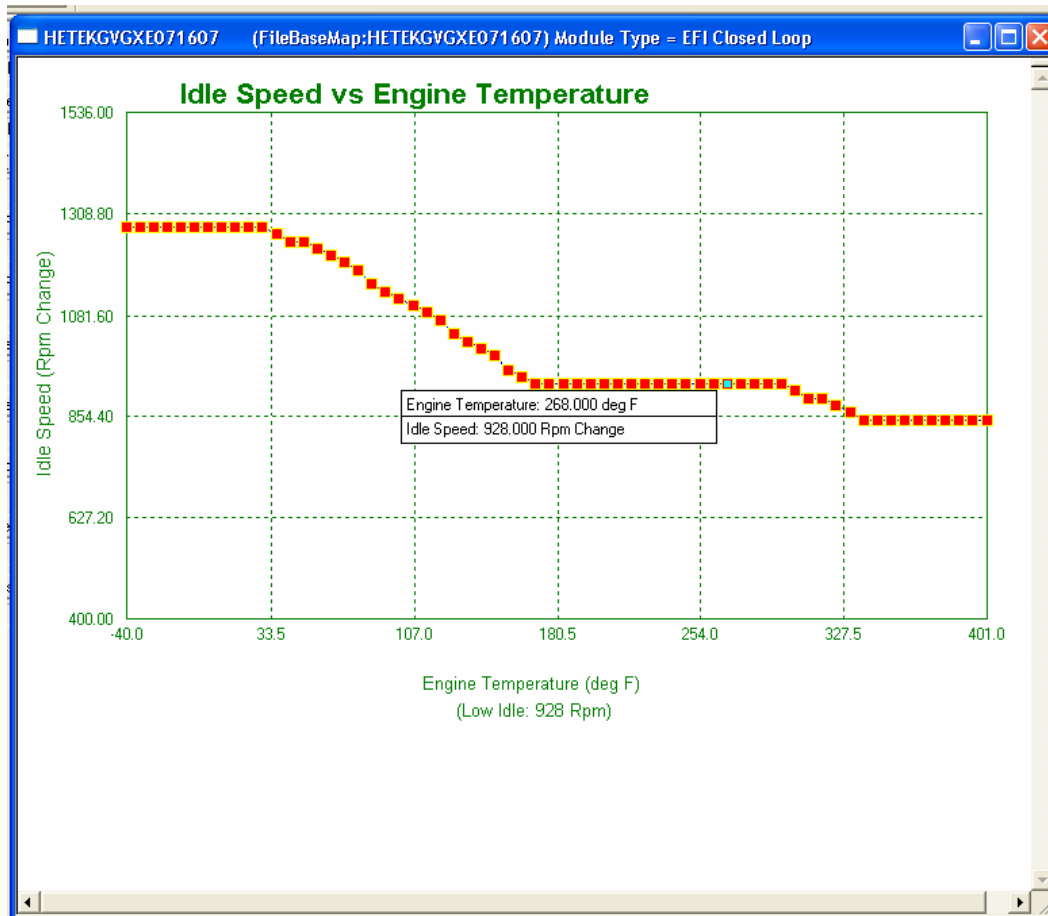


Select the Map page with your mouse to Draw Focus to the window.

Tap the SPACEBAR on your keyboard to enable / disable the "Tuning Block Details" window.

Active Monitor Gauge Display

IDLE SPEED VS ENGINE TEMPERATURE



The Idle Speed vs. Engine Temperature map page is a graph comparing the engine temperature to a designated RPM. Generally speaking as the engine temperature rises, the idle RPM will decrease.

The ThunderMax ECM uses this page to dictate the idle RPM of your motorcycle. **The Idle Speed vs. Engine Temperature map page is changed by the Idle RPM value in the Basic Settings window.** Changes to the “Basic Settings” Idle Rpm will change this Idle Speed vs. Engine Temperature map page for you in the normal operating temperature range. Please read the appropriate section that follows; either Open Loop or Closed Loop depending on your configuration.

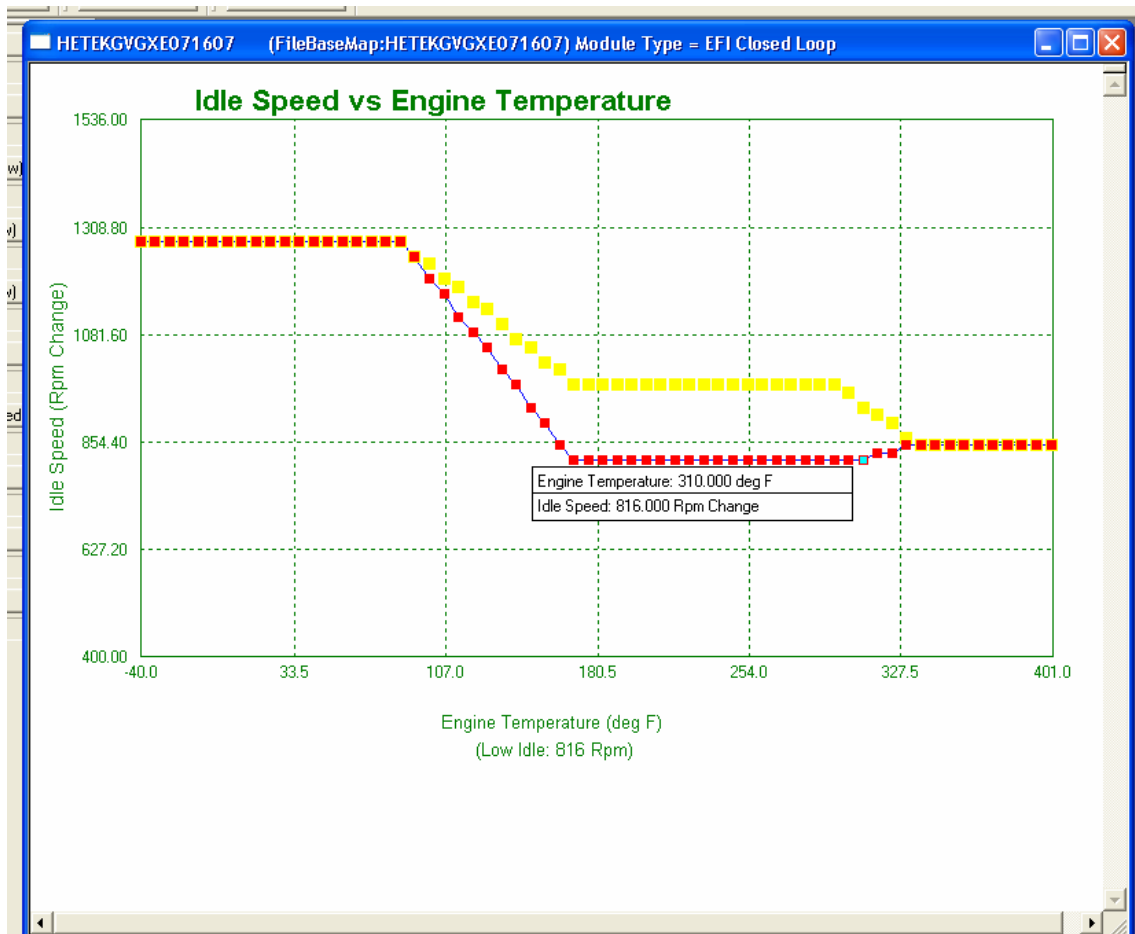
Open Loop: The Base Map has been calibrated to the default idle RPM. To *significantly* alter the idle rpm, a variety of map pages will be affected, so it is not recommended to perform this in open loop. If you desire to significantly lower or raise the idle from the default setting, it is recommended that you convert your open loop system to closed loop with the Auto-Tune module. The only way to significantly change the idle in open loop is to make changes to several of the lower RPM map pages. To achieve this properly, a load-cell dynamometer and oxygen sensing equipment will be required. If

you do not have this type of equipment, it will be less expensive to convert your ThunderMax to Closed Loop.

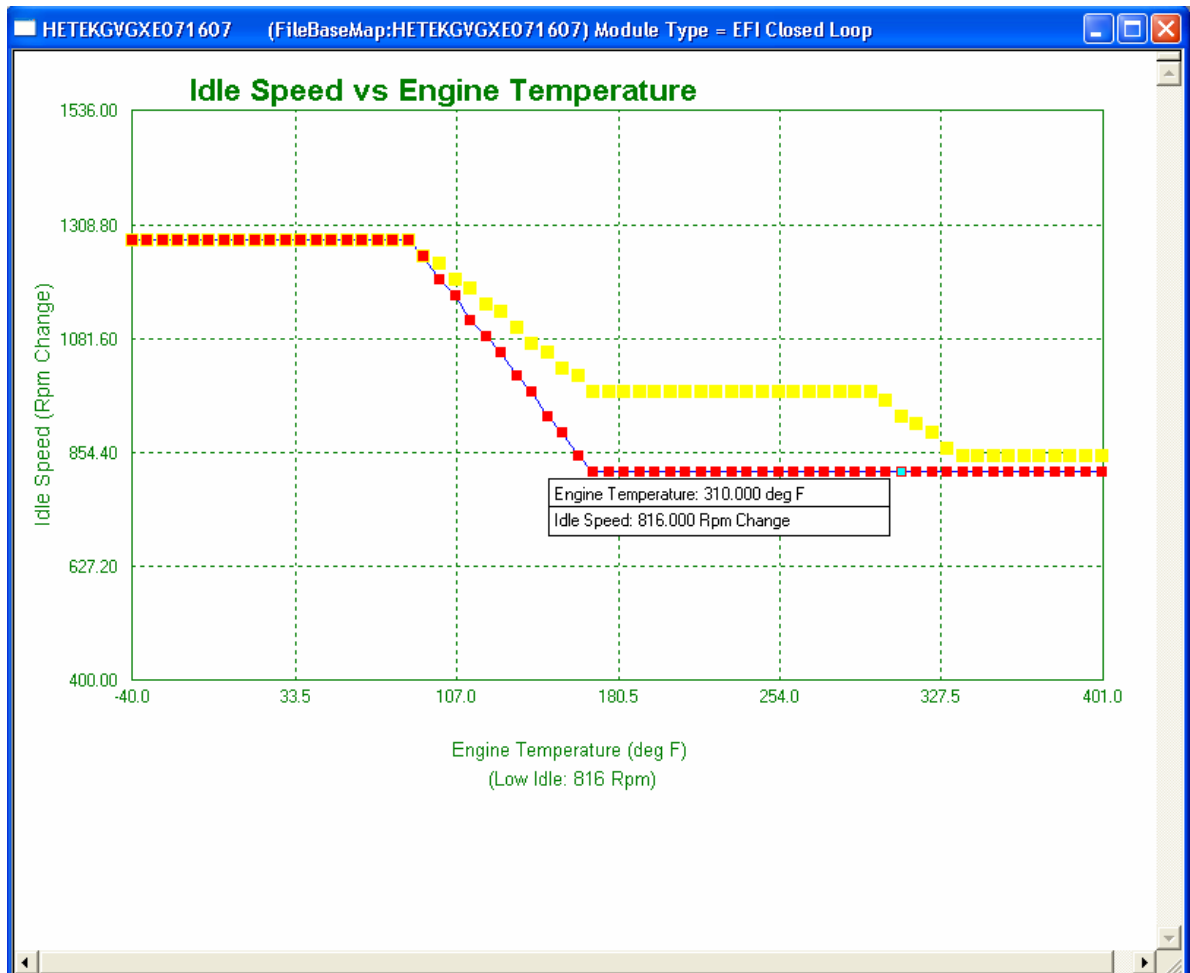
Small changes can be acceptable in open loop; Zipper's recommends only going +/- 50 rpm from the default idle setting to maintain a stable AFR.

Closed Loop: (Auto-Tune Module) - Most of the base maps in the ThunderMax data base are calibrated to idle between 960-1008 RPM. To reduce the idle speed, the low speed map pages must be recalibrated. This is done by lowering the idle speed in increments of no more than 100 RPMs and running the engine to allow learning of the map pages. Once the AFR becomes stable, you can further lower the idle speed until the desired RPM is reached.

If you decide to change the Idle RPM of your motorcycle, please note that changes are automatically made to the "Idle Speed vs. Engine Temperature" map page. Changing the Idle RPM in the "Basic Settings" Window only changes the Idle Speed vs. Engine Temperature map page in normal operating conditions. Make any further adjustments manually, if necessary, after you have reached your desired Idle RPM. Please examine the following map page shown; this is an example of what happens when you alter the Idle RPM from 976 to 816.

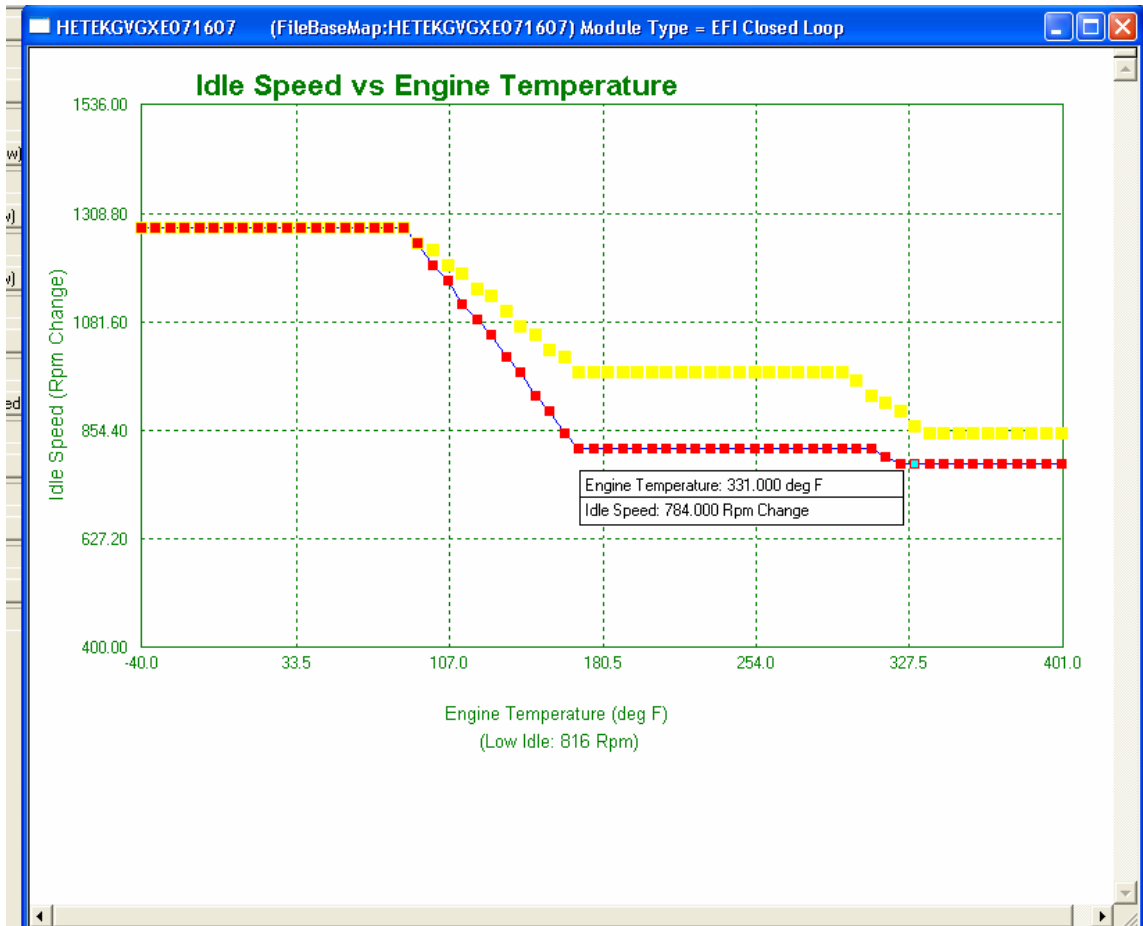


The Idle Speed vs. Engine Temperature map page now shows the current and previous positions of the tuning blocks. At 317 degrees, the map begins to climb back up to the default Idle RPM. It is recommended to blend the end of the curve to match the normal operating temperature Idle RPM. Select the 310 degree map point, then select the “L” button twice to activate the SmartLink IV Hot Key [L][L] Straight Line fit function. The curve should now follow the normal operating temperature Idle to the right side of the map page, as shown below.

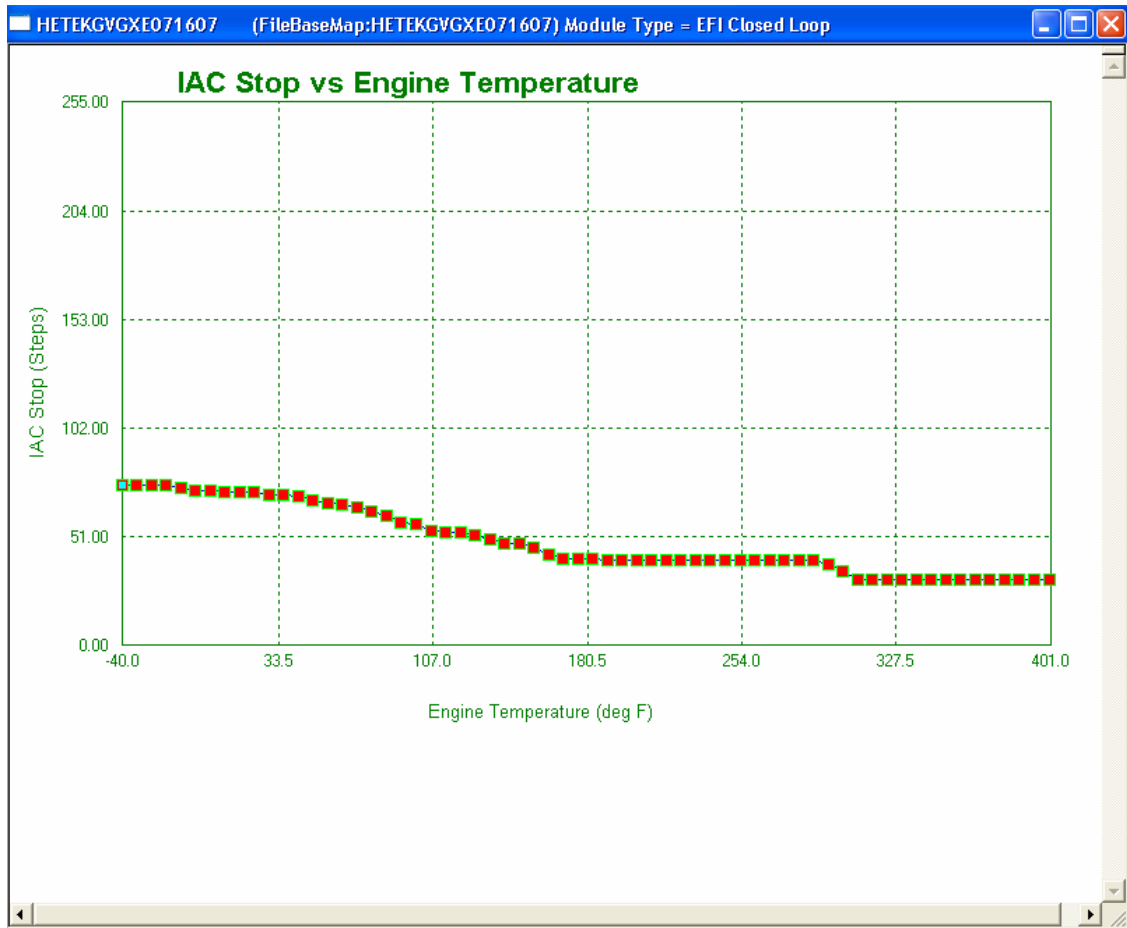


The reason for reducing the Idle RPM in a high heat situation is quite simple. A lower Idle RPM produces less heat. This will slow down the build up of heat, which reduces engine power, prematurely wears key engine parts, and ultimately can cause a catastrophic failure. If your Idle RPM is set at 864 RPM, you do not want the idle to increase when it hits 317 degrees.

The following picture shows an Idle Speed vs. Engine Temperature map page that has been modified to include a lower idle at higher head temperatures with the default Idle RPM. At 317 degrees, the Idle RPM begins to lower as the head temperature increases, by 338 degrees, the Idle RPM is 864. Each motorcycle is slightly different, experiment with lower Idle RPMs to find the lowest stable Idle RPM. Too low of an Idle RPM and the motorcycle will begin to vibrate excessively, as well as reducing the oil pressure and charging capability. Use Caution when altering the Idle RPM significantly.



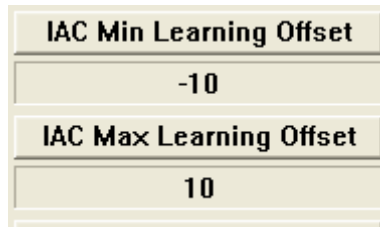
IAC STOP VS ENGINE TEMPERATURE



The purpose of adjusting the IAC Stops is to help bring the engine speed back to the proper idle speed during the variety of conditions that occur when the throttle is closed. The IAC function compensates for the manufacturing variables associated with the fuel injectors, the fuel pressure regulator, and the throttle blade fit in the throttle body. The variables of the Air Fuel Ratio are caused by different engine combinations and the variance in the airflow of the throttle body, either caused by calibration of the adjusting screw as per the factory settings or by wide manufacturing tolerances associated with the production of the stock throttle body in the 2001-2005 models.

IAC Min/Max Learning Offsets:

In the “Basic Settings” window, you will find two options related to the IAC learning function, IAC MIN Learning Offset, and IAC MAX Learning Offset. The IAC Learning function can learn up 1 step per session, and down 10 steps.



These offsets define a range of values that the ThunderMax ECM is allowed to learn within. By default the IAC is allowed to learn 10 steps above, and 10 steps below the original Base Map file.

IAC Curve Problem Solving:

IAC Position Value is too low: The system hasn't been properly initialized. Reinitialize the module by cycling the power on & off, this establishes the proper position for the IAC motor. See page 11 for the complete ThunderMax ECM Initialization procedure.

Rough Idle, Engine Does Not Start, or Does Not Stay Running:

The wrong map may be selected for the application, or the AFR is so far off that the engine will not stay running. If you are operating in Open Loop (no Auto-Tune), Double check the definitions of the map that you are using, then install a probe in the tail pipe to determine the AFR.

Excessively High Idle:

If the ECM has previously been mounted on another motorcycle, or older firmware has recently been updated, the IAC stops will have learned offsets that need to be cleared. To clear the offsets, select **Map Editing > Clear “Learned Idle Control Adjustments (IAC)”**.

Hardware to Check when IAC Problem Solving:

If you are using a S.E. throttle body and are experiencing unusual engine operation (Idle Instability), immediately check the Intake Flange seals. These flanges are prone to cracking during installation & operation due to the material selection of the flanges. Air leaks have become very common on these throttle bodies due to the flanges cracking at the U shaped slot for the flange bolt. If you find that the flanges are cracked, do not attempt to replace with another set of the exact same flanges, as the inferior material used will continue cracking. Billet flanges are available from Zipper's to solve this common problem, (Zipper's PN: 117-059).

The second item to check on the S.E. throttle bodies is the **throttle blade calibration**. These throttle bodies are not calibrated from the manufacturer, and provide no method to easily calibrate the throttle blade opening. **The symptoms to look for are poor idle, erratic behavior during warm up, or starts then stalls.** If this engine runs great once it's warm and off idle, the throttle body calibration is more than likely the culprit.

The following is a basic procedure to roughly calibrate a throttle body:

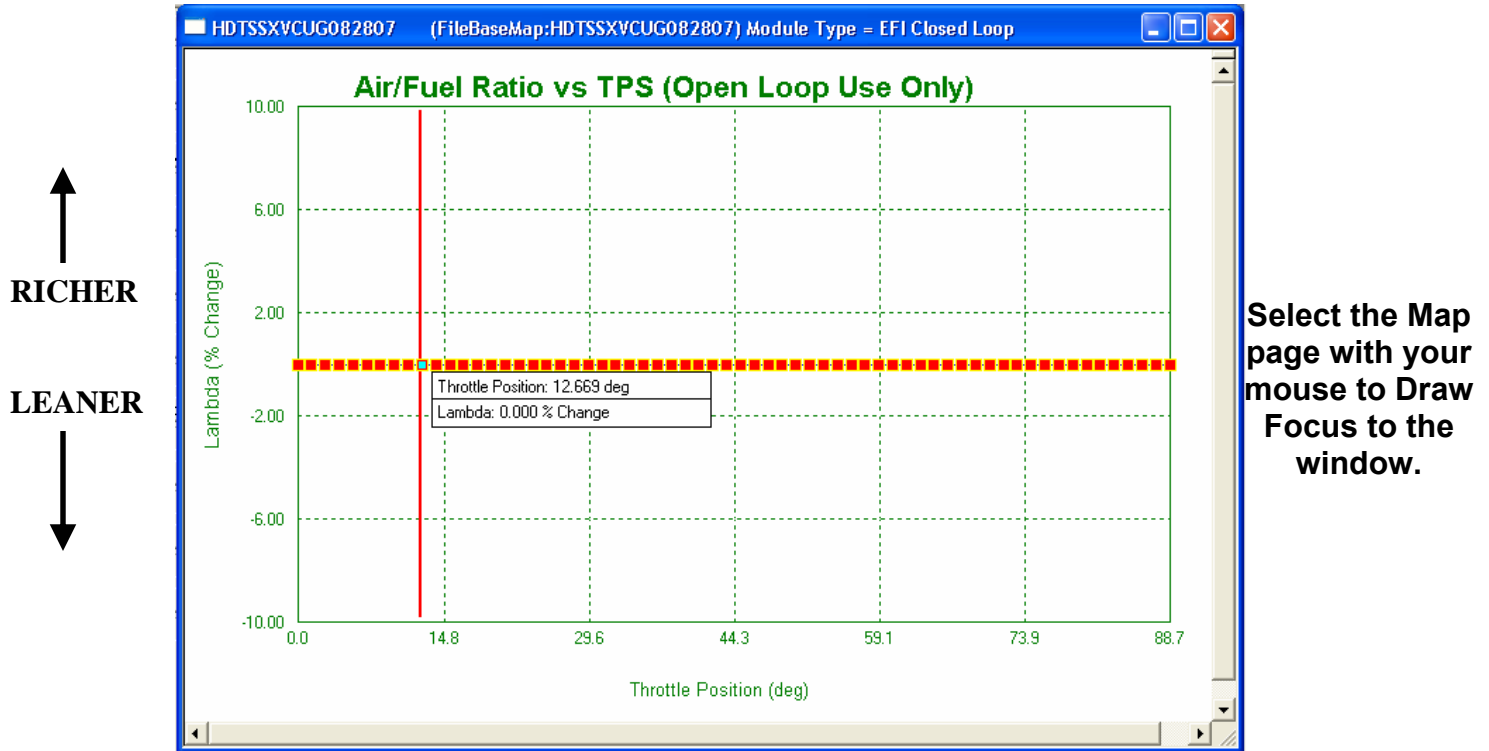
1.) You must acquire a special tool in order to move the set screw on the S.E. throttle body. Snap-On tool # TTXR15TPE will help you perform this task. If the throttle stop screw does not touch the crank, adjust until there is slight contact.

2.) Install the throttle body assembly and properly adjust the cables. Open the throttle blade and place a long blade feeler gauge, 0.003" thick, below the bottom of the throttle plate. Then gently close the throttle onto the stop. Ideally you want some resistance as you pull the feeler gauge from underneath the throttle blade.

If resistance is not present, adjust the set screw until you have achieved this. Once complete, make certain that the adjustment screw is secured in the throttle body casting, or use Loctite to secure your setting.

3.) After the proper map is selected and loaded, re-initialize the ThunderMax ECM.

AIR/FUEL RATIO VS TPS (Open Loop Only)



The Air / Fuel Ratio vs. TPS map page can be used to make quick and easy adjustments to the air/fuel ratio at different throttle positions. If you want to make changes, it is best to base the change on the following:

- (1) **Desired improvement in fuel economy at a specific throttle position range (Leaner)**
- (2) **More H.P. which may require additional fuel (Richer)**
- (3) **Accurate O₂ data which will suggest what areas should be adjusted**
- (4) **Drivability issues or problems at certain throttle positions**

Information gathered from a commercially available oxygen sensor, that can display and record the engine's A/F ratio under a variety of conditions, is very informative. These systems require a wide band oxygen sensor to be installed in the head pipes, or a tail pipe probe for each cylinder, for accurate AFR measuring. Without these systems, Open Loop tuning will be a difficult task.

If you are using a tailpipe probe on a chassis dynamometer we suggest that you have the probe installed throughout the length of the pipe less 4-6 inches so you can get a stable reading in the heat zone of the pipe. Wide band readers will not produce predictable data in low heat areas of the pipe, and are susceptible to exhaust reversion

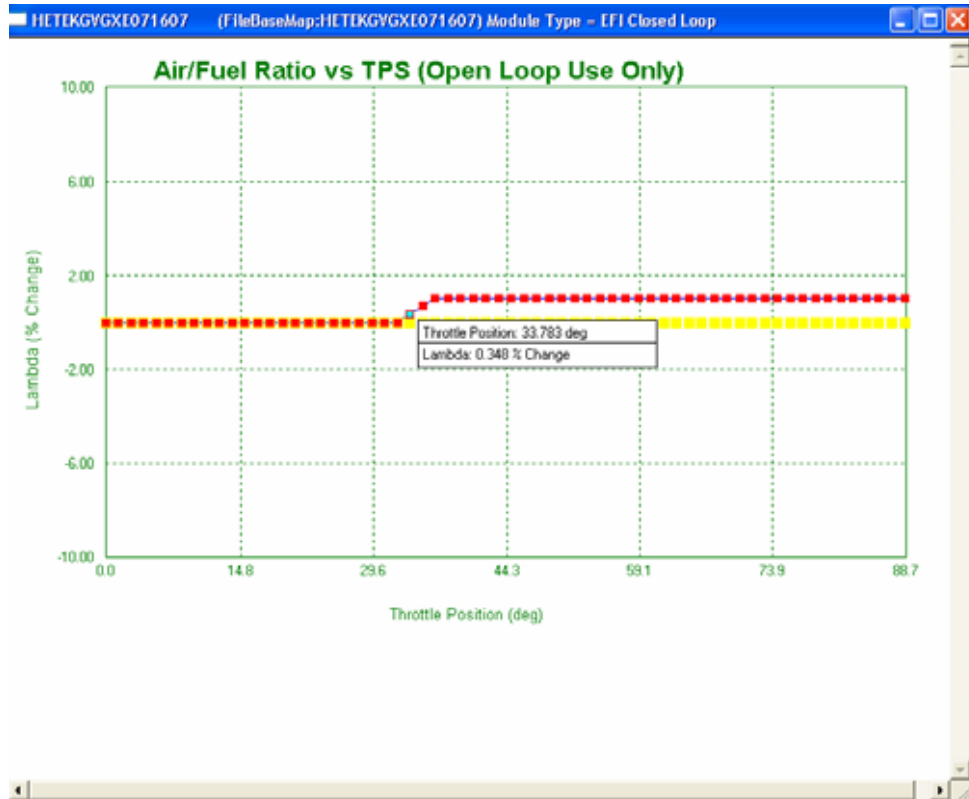
that can skew the data. If you have the proper instruments for AFR recording and load control, contact Zipper's and ask about the Advanced Tuner Software.

Each block in the Air/Fuel Ratio settings box allows you to adjust the fuel for a particular throttle position. Engine load is displayed as throttle position points in 1.6-degree increments from 0 to 88.7 degrees (wide-open throttle). This is a similar adjustment to changing the jets in a carburetor. The range represents an increasing load from 0 to full throttle. Each block can be adjusted from the original setting plus 10% to minus 10% of fuel from the installed base map.

Modifying an Air/Fuel Ratio Map (OPEN LOOP ONLY):

1. Establish a module link as described in the *Linking to the ECM* section.
2. **Read Module Map & Settings** – Now that you're linked to the ThunderMax ECM, select File > Read Module Map & Settings to synchronize the ECM to the SmartLink IV software.
3. Go to the **Tuning Maps Tree** and select the Air/Fuel Ratio vs. TPS (Open Loop Only) map to adjust the module settings at the throttle position(s) and RPM range where tuning is required. Select a point of adjustment using the left/right arrow keys; to view throttle position and percentage of change at the point of adjustment, strike the space bar and a window will appear showing the throttle position at that point and the amount of fuel that will be added or subtracted by moving the point with the up and down arrow keys.

The following map page shows where fuel has been added to the amount supplied in the base map. Each block can be raised (Richened) or lowered (Leaned) from the base map's centerline, or starting point. The text box shows the fuel percentage change and the throttle blade position each block represents. These changes can be performed live, with the engine running or not. During a live session, a vertical cursor line moves with the throttle position when the monitoring function is activated. Blend these fuel blocks smoothly into and out of the range that has been identified as a problem. See the picture on the following page to see the vertical cursor line and the information provided when the spacebar is struck during a live tuning session.

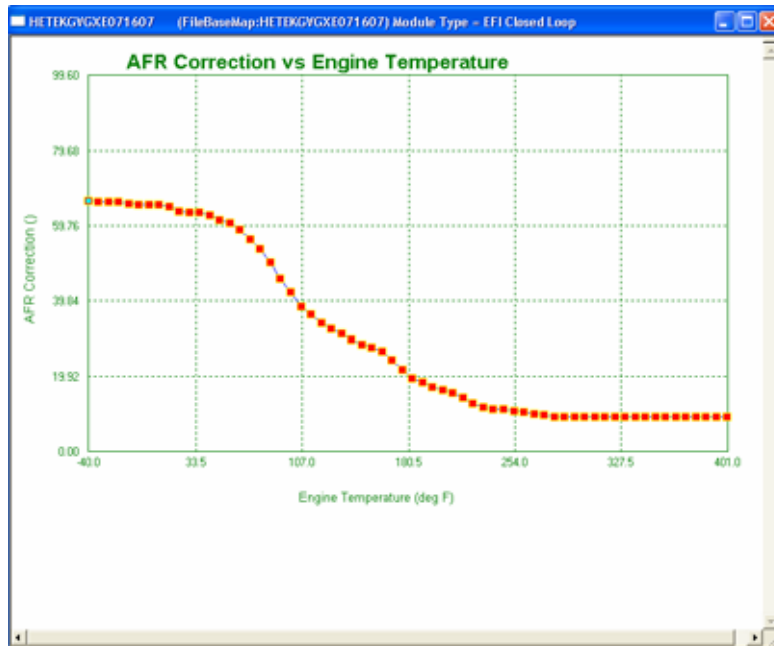


Select the Map page with your mouse to Draw Focus to the window.

If you are attempting to tune without the benefit of a load control dynamometer, two options should be considered if you're having problems:

- 1.) Seek Professional Tuning Help: If you are at the end of your tuning ability and the bike isn't performing as you feel it should, it may save a lot of time if you seek professional tuning help. The combination of a load-cell dynamometer, oxygen sensing equipment, and a skilled tuner may ultimately be the solution if your engine combination is drastically different from the Base Map Database scenarios. Email ProductSupport@ZippersPerformance.com if you need help selecting a Base Map for your combination.
- 2.) Consider purchasing the ThunderMax Auto-Tune Closed Loop Module. A ThunderMax Auto-Tune Closed Loop module will automatically correct changes required to your map, and literally tune while you ride your motorcycle. This option is best for individuals that do not have a skilled local tuner or anyone locally that can tune an Open Loop EFI engine. The Auto-Tune module is similar to having a skilled tuner riding along with you making adjustments as needed, however much faster than any human being could react. The benefit to the AutoTune module is tremendous, you can achieve a more stable AFR at all throttle positions, as well as improved fuel economy.

AFR CORRECTION VS ENGINE TEMPERATURE



Select the Map page with your mouse to Draw Focus to the window.

The AFR Correction vs. Engine Temperature map page should not be used as a “tuning map” page; rather it should be used as path to make corrections to remedy problems relating to AFR stability at specific warm up engine operation temperatures.

Example- If your engine starts and runs as desired in the warm weather months yet as you approach the cold weather season, you observe an unstable operation only at specific temperatures. For example, between 37-51 degrees an unstable AFR exists, but once the engine exceeds 51 degrees engine idle operation is stable. Therefore you would not want to make alterations to Base Map Target pages that would affect the AFR at normal operating temperature, only make an alteration on this page.

AFR Correction vs. Engine Temperature page allows you to make changes at specific temperatures where the problem may exist, without changing AFR's at normal operating engine temperature.

Closed Loop:

If you are operating in closed loop, you will likely never need to adjust this page. The Auto-Tune module has enough adjustment to correct any potential Idle Speed issues, regardless of the Idle Rpm set in the “Basic Settings” window. If you are experiencing unstable Idle, please double check that you've loaded the closest Base Map to your application, and that your module has been properly initialized.

If you attempt to make adjustments on this page always monitor the front & rear AFR's in the software to measure result of your changes.

Open Loop:

This page should not be adjusted without wide band oxygen sensors in the tail pipe. You must measure any lean or rich conditions, as well as corresponding head temperature, to accurately tune the motorcycle.

The purpose of the page is to correct a confirmed temperature related anomaly in the Base Map. You need to be certain what's causing the temperature related problem before adjusting this page, or more problems will be created.

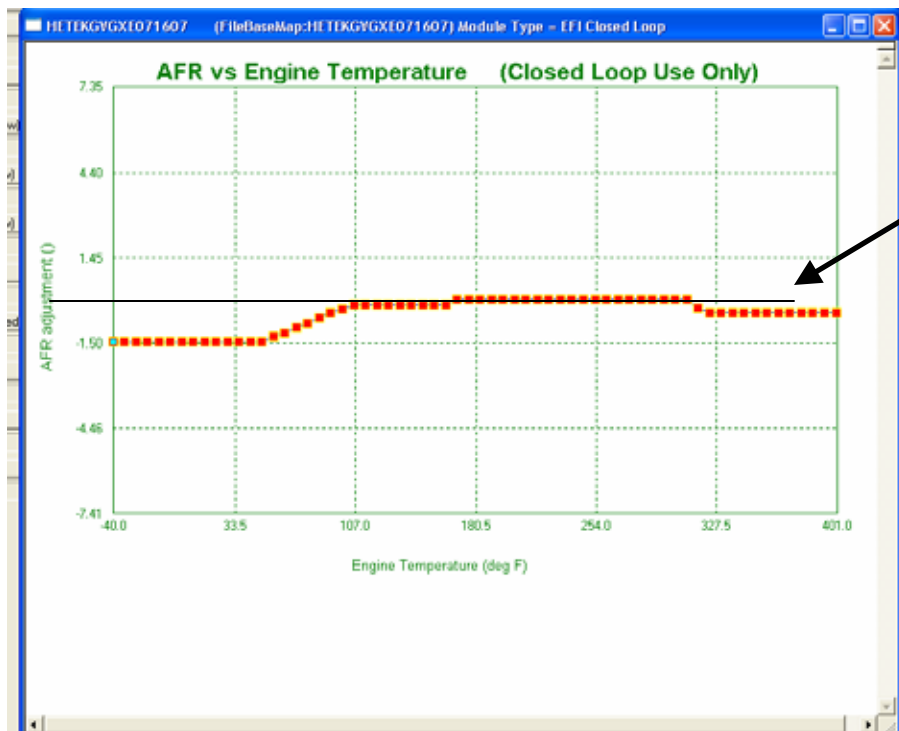
Never adjust the entire map structure at all temperatures, for it will affect all engine operating temperatures, which will likely skew the normal operating conditions.

Before considering adjusting this page, first allow the IAC Stops Curve to stabilize the IAC operation. This may take several complete operating sessions to stabilize. If the problem persists at all temperatures, you can add fuel thru the AFR Vs TPS page (open loop) map page.

AFR VS ENGINE TEMPERATURE

(Closed Loop Only)

↑
LEANER
↓
RICHER



“0%” AFR Adjustment = Base Map Setting

The AFR vs. Engine Temperature map page is only used in Closed Loop (Auto-Tune) applications. The AFR vs. Engine Temperature Map Page works in conjunction with the AFR Target pages, adding correction to the AFR's at specific engine temperatures.

For example, if you observe the AFR in both cylinders, in conjunction with the AFR target window on the monitor page, you will notice the target AFR leans out as the engine approaches normal operating temperature. This phenomenon is the AFR vs. Engine Temperature at work.

To observe the correction applied at a particular engine temperature, select the appropriate tuning block and press the space bar to read values. Lowering the blocks richens the measured AFR, and raising the blocks leans the AFR. If the measured AFR is too rich or too lean during lower temperature operation, adjust the blocks accordingly on this page to achieve the AFR set on the AFR Target page.

It is not recommend that changes be made to this map page unless instructed by Zipper's Technical Support.

IGNITION TIMING MAPS

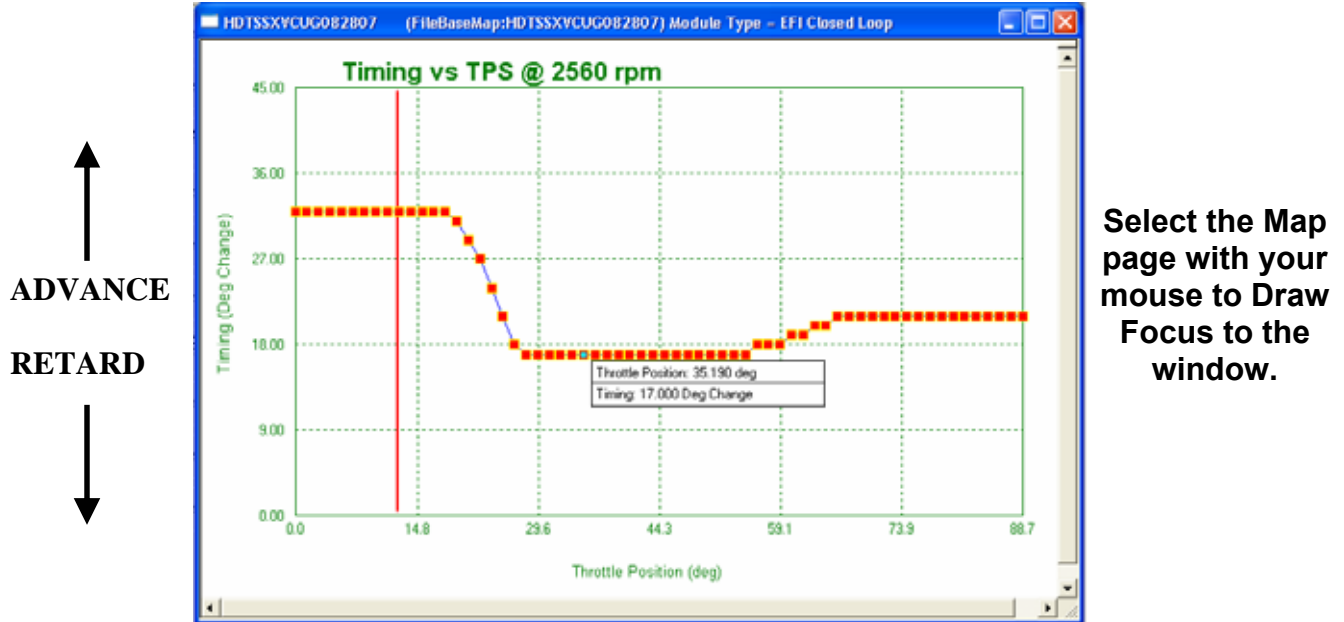
The Ignition Timing Maps feature has changed drastically from the previous versions of SmartLink IV. Three new main features have been added to ease the timing adjustment process. These new features will aid experienced tuners, as well as beginning to intermediate tuners, in properly adjusting the timing on the ThunderMax ECM.

Previous versions of SmartLink IV only had one page which allowed the user to make simple adjustments to the timing set by Zipper's. Now 34 map pages are available for complete timing control.

Timing Features:

- 1.) **Full "Timing Curve" Map Pages** are now accessible for everyone. A map page is available for every 256 RPM, showing the full ignition curve for each RPM, 32 pages total. These shapes were created on a load-cell dynamometer with the specific parts listed in the Base Map definitions. Different camshafts or higher compression combinations will require adjustments to these pages.
- 2.) **Rear Cylinder Adjustment** – A page titled "Rear Timing vs. TPS" is now available, this page allows you to make fine adjustments on the Rear cylinder only to offset any situations where the rear cylinder requires a different timing. **Most cases will not require Rear cylinder adjustment**, only make changes to this page if you've validated that your rear cylinder requires a timing adjustment on a dynamometer. **No data = no adjustment.**
- 3.) **Timing vs. Engine Speed** – This page is carried over from the previous SmartLink IV software, however instead of displaying a straight line to alter the "hidden" timing curve pages; it now shows a generalized curve across the RPM range. This allows for a quick view of the overall timing scheme, and eases adjustment with an easier to understand map page. This page shows the wide open throttle curve, adjustments to this page move all 64 points on each particular RPM curve map page.

Timing vs TPS @ RPM; Full Timing Curve Map Pages:



The 32 Map pages that display the Timing vs. TPS @ RPM are now available to all users of SmartLink IV. These pages contain the complete timing curves used by the ThunderMax ECM. Remember that each page is a static RPM page, relating the Timing in degrees to the Throttle Position.



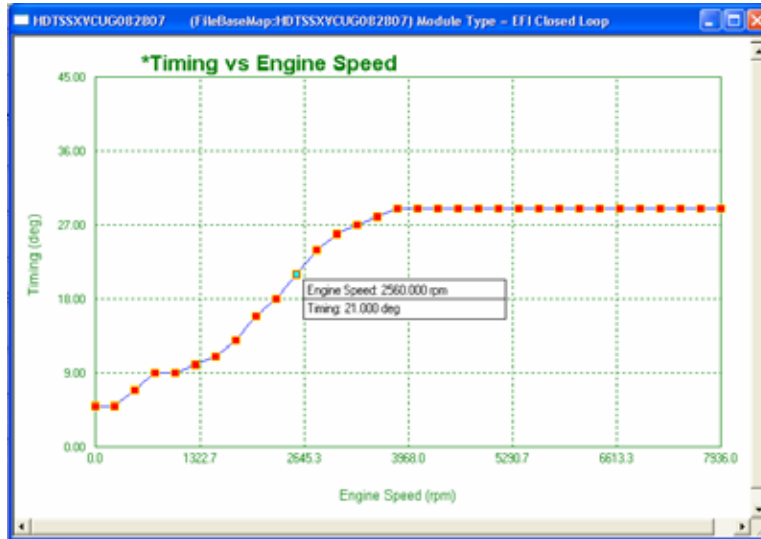
You can cause serious engine damage if the timing is set too aggressively. If timing changes are being tested on a road environment, great care must be taken in watching your surroundings and staying safe.

Since the Timing vs. TPS @ RPM map pages were developed at Zipper's on dynamometers using sophisticated equipment, it is impossible for Zipper's to help you customize each individual map page for your combination. If you only need a slight timing adjustment at a specific RPM, consider using the Timing vs. Engine Speed Map page, as described in the next section.

Timing Vs Engine Speed Map Page:

This map page is for making quick adjustments to the ignition timing map. It allows ignition timing adjustments in one-degree increments at every 256 RPM from the base setting of the installed map.

↑
ADVANCE
RETARD
↓



Wide Open Throttle Timing

Each point change moves all 64 points on the corresponding Timing vs TPS @ Rpm Map Page.

Each point in the **Timing vs. Engine Speed** map page allows the tuner to adjust the spark timing for a particular RPM range. Moving a tuning block on this page will move every point on the corresponding RPM map page. For example, if you adjust the 2560 RPM tuning block up one degree, ALL throttle position points on the 2560 RPM page will move up one block.

If the knock is slight at a particular RPM, you may be able to remedy the situation by removing 1-2 degrees of timing at the Timing vs. Engine Speed page at the specific RPM it occurs. If the knock is more pronounced you may need to remove additional timing at specific throttle positions on the Timing Vs TPS pages at the specific RPM value you want to adjust then road test to review the changes.

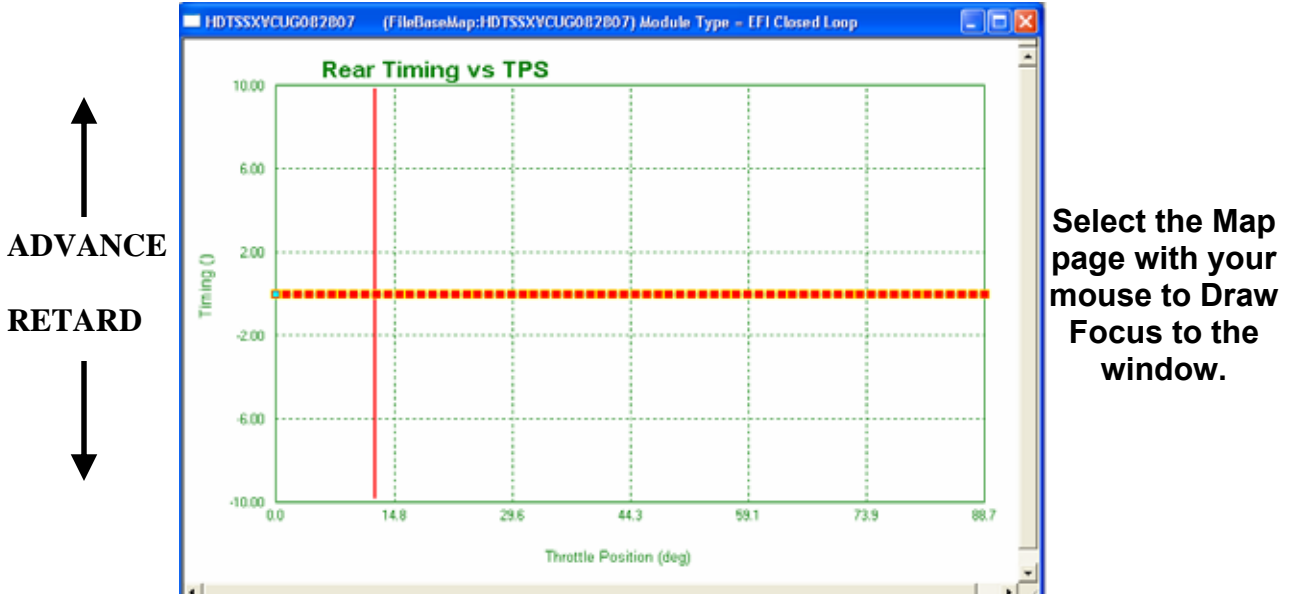
Attempt to adjust the timing on this composite page before altering the curves on the Timing vs. TPS @ RPM map pages.

NOTE: Higher values of spark advance can improve response, efficiency, and power until you reach the point of detonation, which reduces power and can damage the engine.



WARNING! BEWARE OF DETONATION! Severe pre-ignition or detonation can cause severe engine damage. If spark knock is heard or detonation is found by reading your spark plugs, immediately stop testing and retard the ignition timing at that RPM to remedy the situation.

Rear Timing vs. TPS (Rear Cylinder Timing Correction):



The Rear Timing vs. TPS page was added to eliminate any oddities between the front and rear cylinder operation. The ThunderMax AutoTune system individually monitors and alters the fuel setting for each cylinder for optimum operation. Now you have the ability to individually adjust the rear cylinder's timing in comparison to the front cylinder as well. Due to the differences associated with the operation of the two cylinders, the rear cylinder adjustment allows you to modify the spark for optimum operating conditions.

Modifying the Rear Timing vs. TPS page does not alter the Timing vs. TPS @ RPM map pages. This page only offsets the output of the main spark curves, but does not affect the front cylinder timing at all.

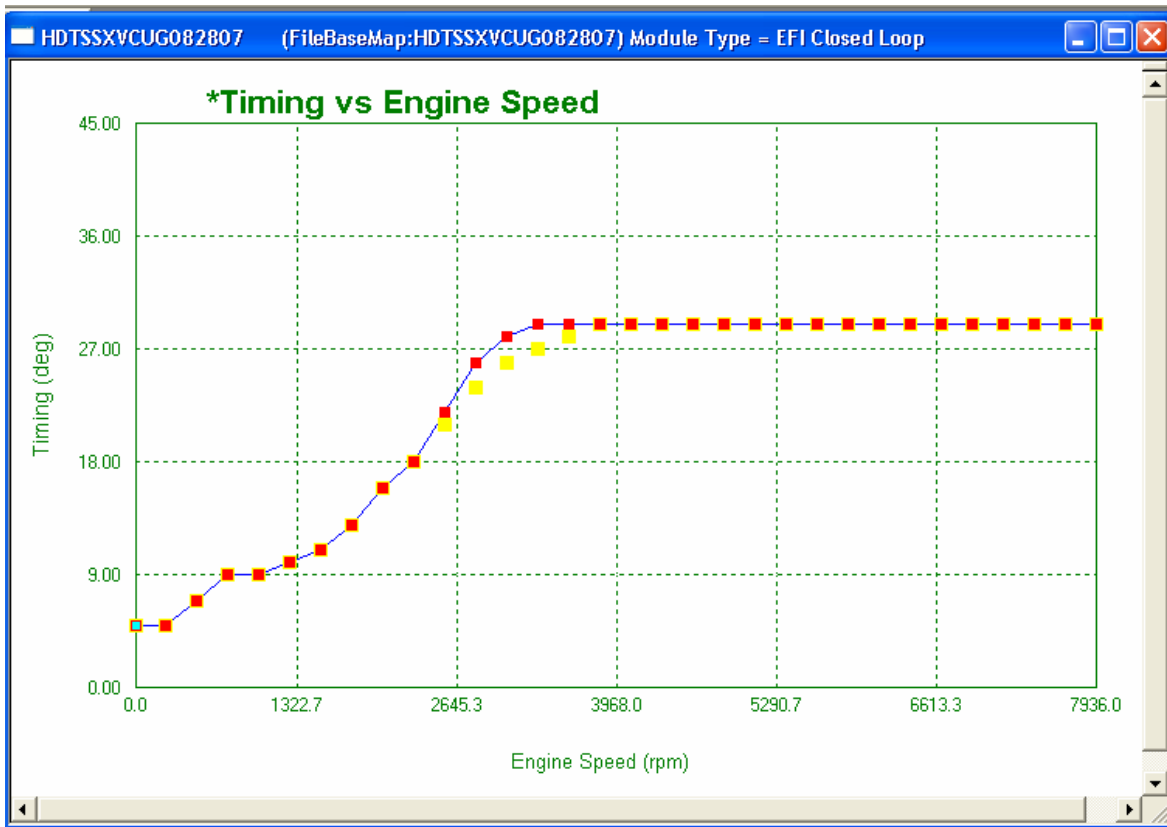
This page will always start as a straight line at 0% Timing Adjustment. Any adjustments made to this page are recorded as % Timing Adjustment by Throttle position.



Most cases will not require Rear cylinder adjustment, only make changes to this page if you've validated that your rear cylinder requires a timing adjustment on a dynamometer. No data = no adjustment.

Smoothing the Blocks:

It is important to “smooth” the surrounding blocks to avoid abrupt changes in timing settings. The following figure shows a smooth spark curve adjustment change. Since the Timing vs. Engine Speed page has changed from a straight line showing the percentage of change to the generalized spark advance curve, it should be easier to smooth the blocks and see the changes that are being made to the Base Map timing curves. Remember you can always check each individual timing curves (Timing vs. TPS) map pages to see the effect that has occurred. If in doubt, test the new setup, record your findings, and make changes as needed.



How to find Throttle Position of Detonation (Spark Knock or Pinging):

If you are attempting to tune without the benefit of a load control dynamometer, you may find the following suggestion helpful. Link to the module without starting the engine with the monitoring function enabled, open the Air/Fuel vs. TPS window and observe the red vertical bar indicating active throttle position. Twisting the throttle through its range will move this vertical bar. Using masking tape; wrap tape around the throttle grip, at the edge closest to the switch housing. Apply another piece of tape to the switch housing (base) alongside of the grip tape. Make a mark across both pieces of tape indicating the throttle position at idle. See the pictures on the next page for clarification.

Using the vertical bar as a guide, make marks on the grip tape even with the base idle mark at $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and full throttle. When you can identify the location of the throttle position RPM during a drivability issue, you will find it very easy to pinpoint and make adjustments to the areas that need it. The following pictures show an example of how to use tape to tell an approximate TPS while using a non-load control chassis dynamometer.



WARNING: ANY TUNING OPERATION INVOLVING ACTUAL OPERATION OF THE MOTORCYCLE ON PUBLIC STREETS OR HIGHWAYS IS DANGEROUS! FULL ATTENTION TO TRAFFIC CONDITIONS SHOULD ALWAYS BE YOUR FIRST FOCUS ANYTIME YOU ARE OPERATING A MOTORCYCLE ON PUBLIC ROADS. INATTENTION TO CONDITIONS CAN LEAD TO ACCIDENTS AND PERSONAL INJURY INCLUDING DEATH.



Closed Throttle – Marked “0”



$\frac{3}{4}$ Throttle – Marked “3”

Timing Troubleshooting:

Here are a few common scenarios that have been seen several times by Product Support. The first thing you need to do before you adjust the base map is to verify you have selected the correct map. Selecting a map with incorrect parameters is usually the source for spark knock problems. Take the time to verify the best possible base map has been selected for your application.

- 1.) If you have not experienced any spark knock or detonation problems, **but pinging develops after your last fuel stop**, do you need to adjust your timing? As long as spark knock has not been experienced before, continue operation of the motorcycle, and purchase fuel from a different source before making any changes to your map.

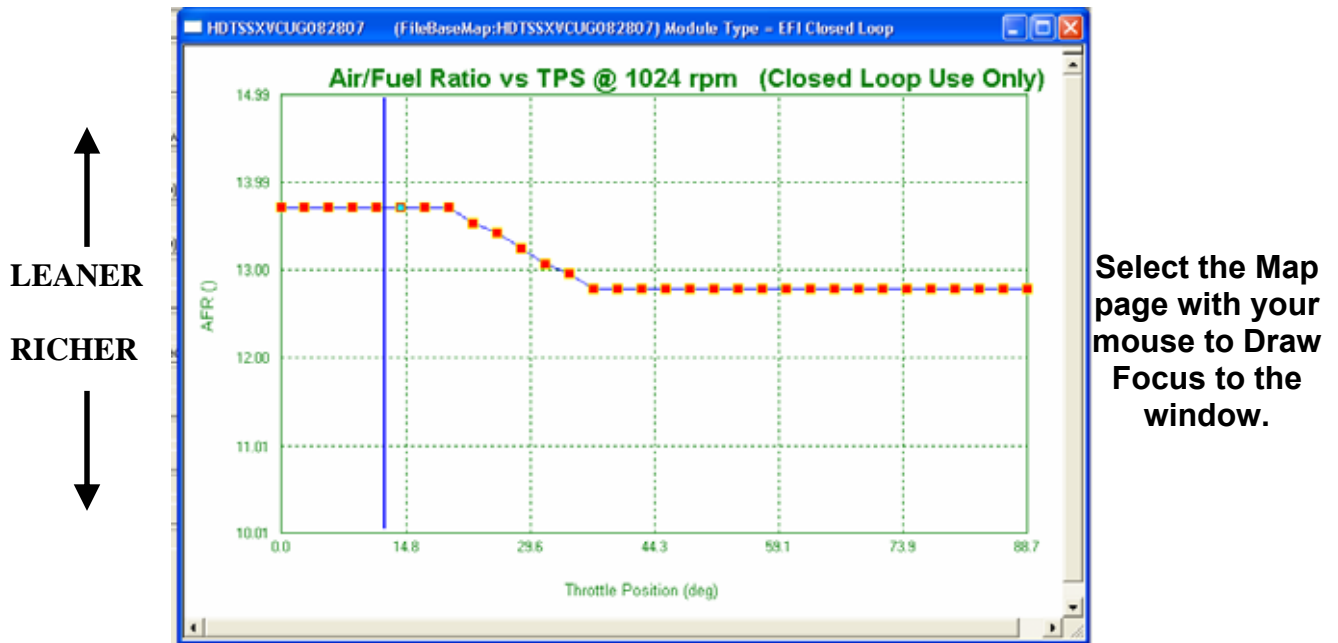
It is common for gasoline to be blended differently in different regions of the country. Touring riders will experience this much more so than riders that stay in one region of the country.

- 2.) If the gasoline has not made a difference in the operation of the motorcycle, check that your intake & exhaust seals are not leaking, your AutoTune module is turned on, as well as reading the spark plugs. If excessive oil is found on the plugs, you may have a head gasket leak. A head gasket leak can cause detonation by depleting the octane rating of the fuel, allowing a build up of gasoline in the combustion chamber, and igniting the rich mixture when the temperature reaches a high enough level to pre-ignite.

AIR FUEL RATIO VS TPS @ RPM PAGES

“AFR TARGET PAGES”

Closed Loop Only



The “AFR Target” pages are the **most important pages in the software** for managing a highly efficient, well tuned engine. It’s the AFR Target pages that allow you to make maximum power and maximum fuel economy at the same time. Since the throttle positions are drastically different between a maximum power scenario and a best MPG scenario, you can dial in each section independently, and achieve both.

Simply put, these are the “AFR Target Pages” that the AutoTune module is working to achieve during Closed Loop Tuning. To explain the strategy, there are 32 target points of adjustments (throttle position) per map page, with a map page for every 256 RPM’s. Each base map has default values which you can change to improve fuel economy at cruising speeds or richen up for more power at the race track. The AutoTune module works to maintain these targets as all of the ambient conditions involved change.

There are two options for setting the AFR’s in your ThunderMax ECM.

- 1.) The first technique, which is the preferred method, takes more time to setup, yet allows you to vary the AFR targets for different RPM and Throttle Positions. This allows you to fine tune the AFR for economy at light loads (leaner AFR during lower throttle positions) at the same time as tuning for peak power in high throttle positions (richer AFR during heavy load or acceleration). The pay off is worth the effort, for increased throttle response, maximum power, and excellent fuel economy can all be

achieved simultaneously. The end result will be a perfect balance of power and economy even as conditions change.

2.) Another technique in setting up the AFR Targets, which is recommended for racing or other special applications, can be achieved very simply in the “Closed Loop Module Settings” window. The option of “AFR Override” allows you to set (1) specific AFR for the ThunderMax ECM to target at all points and conditions. This is discussed in the Closed Loop Module Settings section on page 82. This choice is most popular with racers or dynamometer tuning for Base Map recalibration or generation or just simply tuning for maximum measured power output. **Choosing this option will affect the warm-up AFR as well, which may adversely effect the operation of the motorcycle.**

Note: It will require several sessions for these targets to be achieved; provided you operate the engine at these specific RPM's and throttle positions at operating temperature.

AFR Target Tuning Aides:

To simplify tuning the 32 Air/Fuel Ratio vs. TPS @ RPM map pages, “copy” and “paste” functions have been added to SmartLink IV. For example, if you modify your normal cruising RPM map page and are pleased with the results, you can now copy this curve and paste it into other RPM map pages. Select “Shift-Control-C” to copy the map page. Now scroll to the next map page and select “Shift-Control-V” to paste the copied RPM map page onto the new RPM map page. Select “F2” at any point to view the SmartLink IV Hot Keys. For example, start by modifying the 768 RPM Map Page, then paste that curve on all of the map pages up to the 3584 rpm page.

Section 5:

Diagnostics and Troubleshooting

BASIC DIAGNOSTIC TIPS

The bulk of all ECM returns to Zipper's are not faulty ECMs; rather the wrong map was selected, learned offsets were not cleared, a factory sensor has failed, or simply the AutoTune module is turned off. Every ThunderMax ECM is quality tested before the final packaging, which includes linking to the module and starting an actual engine. If you just installed the ECM and your engine won't start, something is likely wrong with the installation (hardware or software) or something may be wrong with your motorcycle, reinstall your factory ECM to validate that the problem is on the motorcycle, not the ThunderMax ECM. The following is a quick guide on what to check when a problem occurs.

There are a few basic steps that should be taken when attempting to troubleshoot problems encountered when using the ThunderMax EFI system. Before altering the base map in the ECM, inspect all of the components that were installed, altered or otherwise handled during the module installation. Loose connections and damaged wires, worn or melted covering, can cause significant problems and are difficult to diagnose. A simple check of the wiring can save you enormous amounts of time troubleshooting if the culprit is wiring related.

Confirm the Serial Number of the map installed in your ECM. Make sure you are using the latest module firmware and software. Zipper's receives support calls about performance problems regularly, only to find out that the correct map was not loaded or the default test map was still installed in the module. **Make certain that you've written the selected map to the ECM, simply loading it in SmartLink IV does not write the map to the ECM.** Also if you are using the ThunderMax Auto-Tune Module, make sure you've enabled the Auto-Tune function under the Closed Loop Configuration window, page 82.

If you installed a ThunderMax ECM to solve an operational problem on your motorcycle, and the problem still exists after installing the ThunderMax ECM, it is likely that there is a problem with your motorcycle, not your ECM. **If your motorcycle didn't start or idle properly before installing the ThunderMax ECM, and the problem still exists, please state this upfront with Zipper's Customer Support, being upfront will save you time.** If the problem was pre-existing and the issues are stated clearly to customer support, the chances of solving the issue quickly are dramatically increased.

When adjusting any EFI equipped engine with any level of certainty you need to be able to read & or record air fuel ratios. Other wise your efforts will be extremely time consuming with a hit or miss approach to obtaining a result. If you have no way of reading the AFRs (Open Loop Tuning without O₂ sensing equipment), a better alternative will be to add ThunderMax Auto-Tune wide band closed loop module. This system will create offsets from your base map to maintain proper AFRs. In addition, with the Auto-Tune system functioning, you can record a riding session in a monitor log, and replay the session on your computer. This will allow you to watch

Diagnosics and Troubleshooting

the AFR's under normal riding operation. This can help reveal issues like a clogged fuel filter or an intake manifold seal leak.

We strongly suggest you bring the engine to normal operating temperature, review and log the values using the “Engine Monitors” & “Monitor Logging” functions of the software. These values are vital in troubleshooting a problem that may be keeping the engine from operating properly. With the new Monitor Logging feature, you can log an operating session and email the data to Zipper's Technical Support for review.

If either AFR's are not reading correctly in the monitor windows or (or at all), there may be a problem with the following:

- (1) The Data Port is not plugged in (Power for the Auto-Tune module)
- (2) Damaged wiring on the closed loop module
- (3) Damaged Wiring or connector of the oxygen sensor
- (4) An oxygen sensor is unplugged
- (5) An oxygen sensor is damaged or dirty

To test that the oxygen sensors are active and properly working, turn the ignition on, yet do not start the engine. Link to the module & monitor the AFR of the Front and Rear cylinders using the Monitor Gauges. Read the AFR Values for the Front & Rear cylinders, without starting the engine. After approx. 10 seconds, the sensors should be calibrated. Once calibrated to the ambient air, the oxygen sensors should warm up to a value of 19.36 for each sensor in the monitor window.

If you cannot replicate the value of 19.36, your oxygen sensors are not calibrating correctly. This will cause corrupt data to influence the effectiveness of the ThunderMax Auto-Tune module to properly follow the targets on the tuning pages.

If steps 1-4 are found to be in good order, remove the sensors and inspect for soot build up. You can clean the sensors with a product like CRC brand "QD electronic cleaner" then reinstall sensors and re-perform tests.

If the sensors work now correctly, or you have to replace them, you should trouble shoot to determine if the wrong map has been selected or the map pages need to be adjusted. Excessively rich AFR's during the warm up procedure, or at normal operating temperatures, will ultimately coat the sensors in soot (carbon). Once the sensors are dirty, they may not operate correctly, which can cause corrupt data to influence the Auto-Tune ECM's tuning.

If your motorcycle is operating properly, and the tune up begins degrading, it is highly likely that a mechanical issue is influencing the Auto-Tune module. This is actually a great warning system; for example, let's assume that your intake seals start leaking. In an open-loop EFI system, the mixture begins getting leaner, and leaner, creating excessive heat and multiple other issues. If you are using the

Closed Loop Auto-Tune system, the ECM will continue richening the mixture to maintain the AFR targets. Eventually you will notice a loss in power, lower fuel economy, and a loss in idle stability.

Since the Auto-Tune module is adding additional fuel for the additional air provided by the leak, the engine never gets a chance to over-heat or cause significant engine damage. Since this is a learning system, if you feel that the tune up is deteriorating, more than likely the system is over-correcting a mechanical problem that must be fixed.

Another issue that has become problematic is corrosion on the ECM connections or on the ECM & fuel pump fuses. Both can create conditions that are difficult to replicate or reproduce when troubleshooting. Both of these seals are factory equipped and unrelated to the ThunderMax ECM.

When cleaning your motorcycle, you should never directly wash the ECM compartment with water! Excessive water can create a host of bizarre technical problems. The ECM is designed to keep water out; however, with pressurized water it is possible to soak the factory wiring harness connector to ECM connection.

If a problem occurs after filling up your motorcycle with gas, make certain that the gas isn't the culprit before you change anything in the ThunderMax ECM. It is not uncommon for fuel blending to vary in different regions of the country.

Another common scenario is related to old gas, if you start your bike at the beginning of the riding season, with last season's gas still in the tank, the first thing you need to do is drain the old gas and replace it with fresh gasoline. Due to the increasing amounts of alcohol in the gasoline that's being refined and blended today, the shelf life has gone down on common gasoline. The alcohol separates from the gasoline and changes the properties of the gasoline. If you think you may be experiencing a problem related to old gas, change the gasoline before putting any additional time into it. Low octane fuels are not recommended for these engines, and will cause tuning issues if used.

In addition you may need the Harley-Davidson® **Electrical Diagnostic Manual**. These manuals are model-specific and contain valuable information in troubleshooting issues with EFI equipped motorcycles. The troubleshooting charts that follow are set up to aid the technician in solving issues that you may be experiencing on a motorcycle equipped with the ThunderMax EFI system. If the problem is not related to the ThunderMax ECM, you will need to refer to the service and diagnostic manuals for the specific model in question.

If the troubleshooting chart does not help you identify the problem that you are facing, please refer to the section in this manual titled "Tech Questions and Support," then follow the instructions on how to contact Zipper's Performance Products with the problem at hand. **If you do not follow these instructions and**

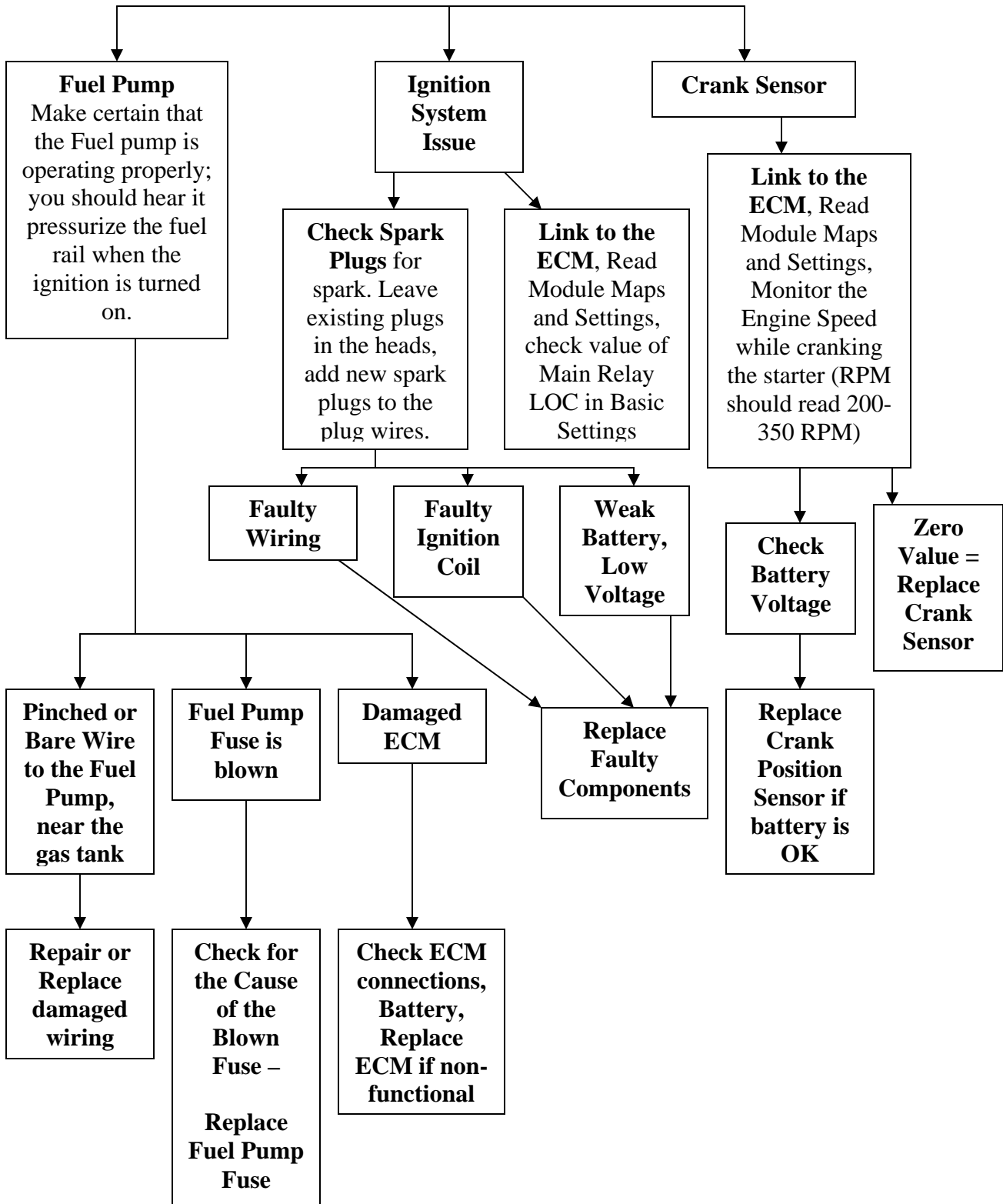
call for help without any specific information that is requested, your technical support call will not be productive. Zipper's wants you to get the most out of our technical support crew and adjustments are easy to make; however without all of the information at hand we will not be able to accurately help solve your problems.

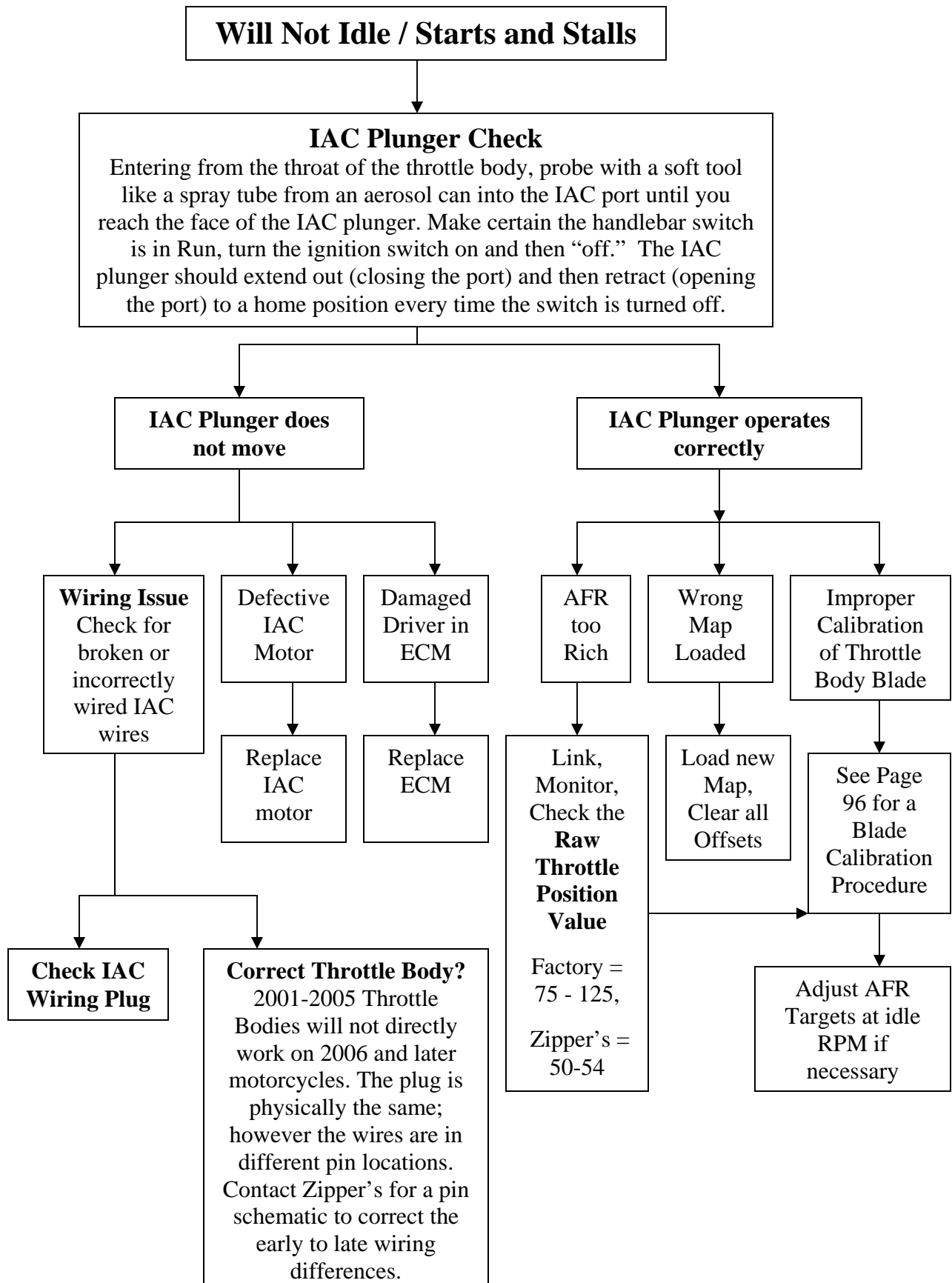
The preceding pages were developed from technical support questions raised directly by the users of the ThunderMax ECM. Use this as a reference for troubleshooting before calling the Product Support line, as many discussions in the next section are regularly explained on the tech line. **Using the manual will reduce the amount of time needed to identify and correct any issues at hand.**

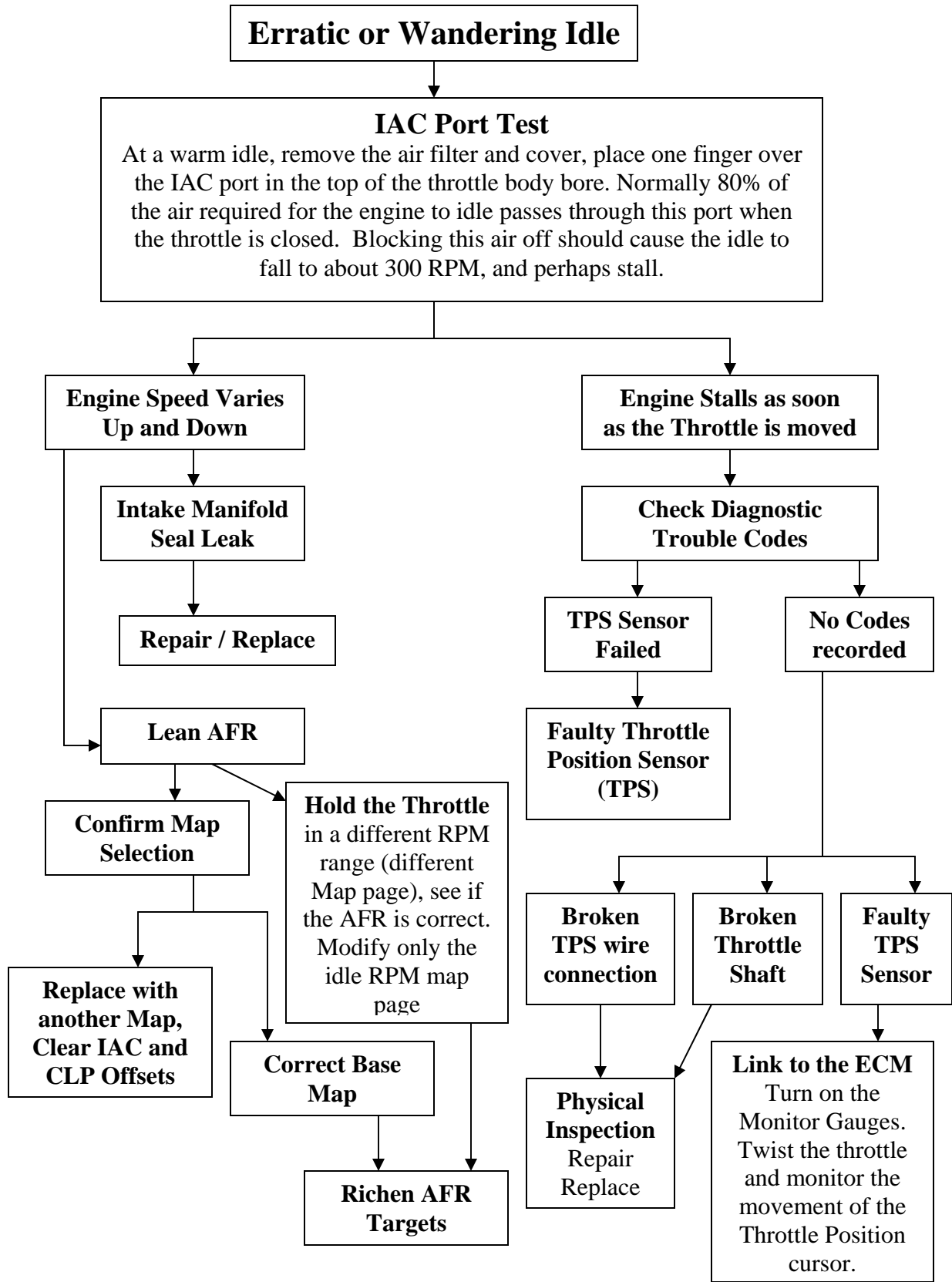
Some of the descriptions may be brief in the following diagnostic flow charts; however any topic can be easily cross-referenced by using the Glossary, Index, Table of Contents, or the Visual Index in the Appendix.

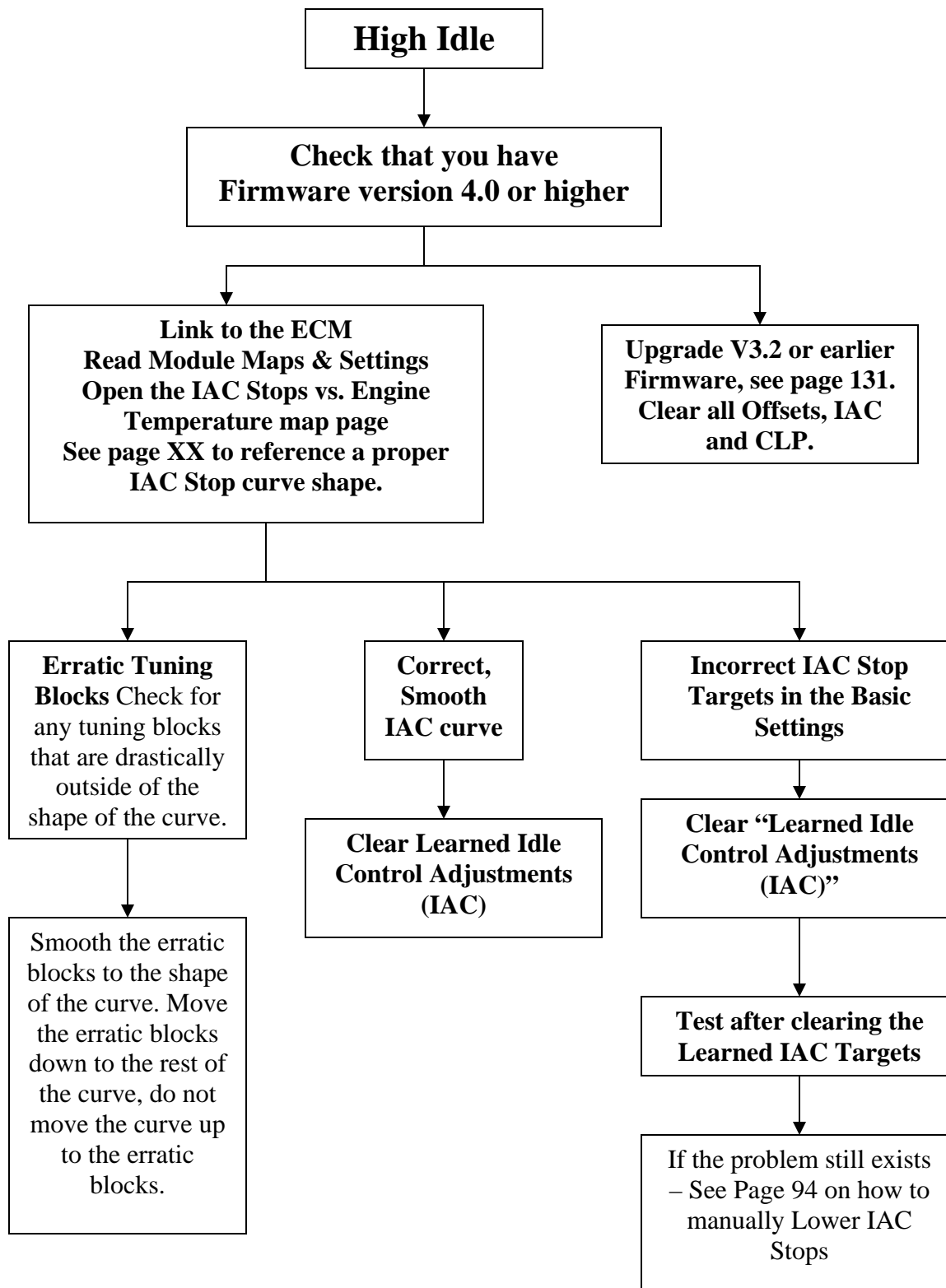
Important note- If you need to change a faulty or damaged TSSM on the motorcycle you will likely not be able to start the engine with the replacement TSSM. This will require you to remove the ThunderMax module and install the O.E. ECM so you can properly access and activate the new TSSM module thru digital tech. For further information refer to the electronic diagnostic manual for your motorcycle.

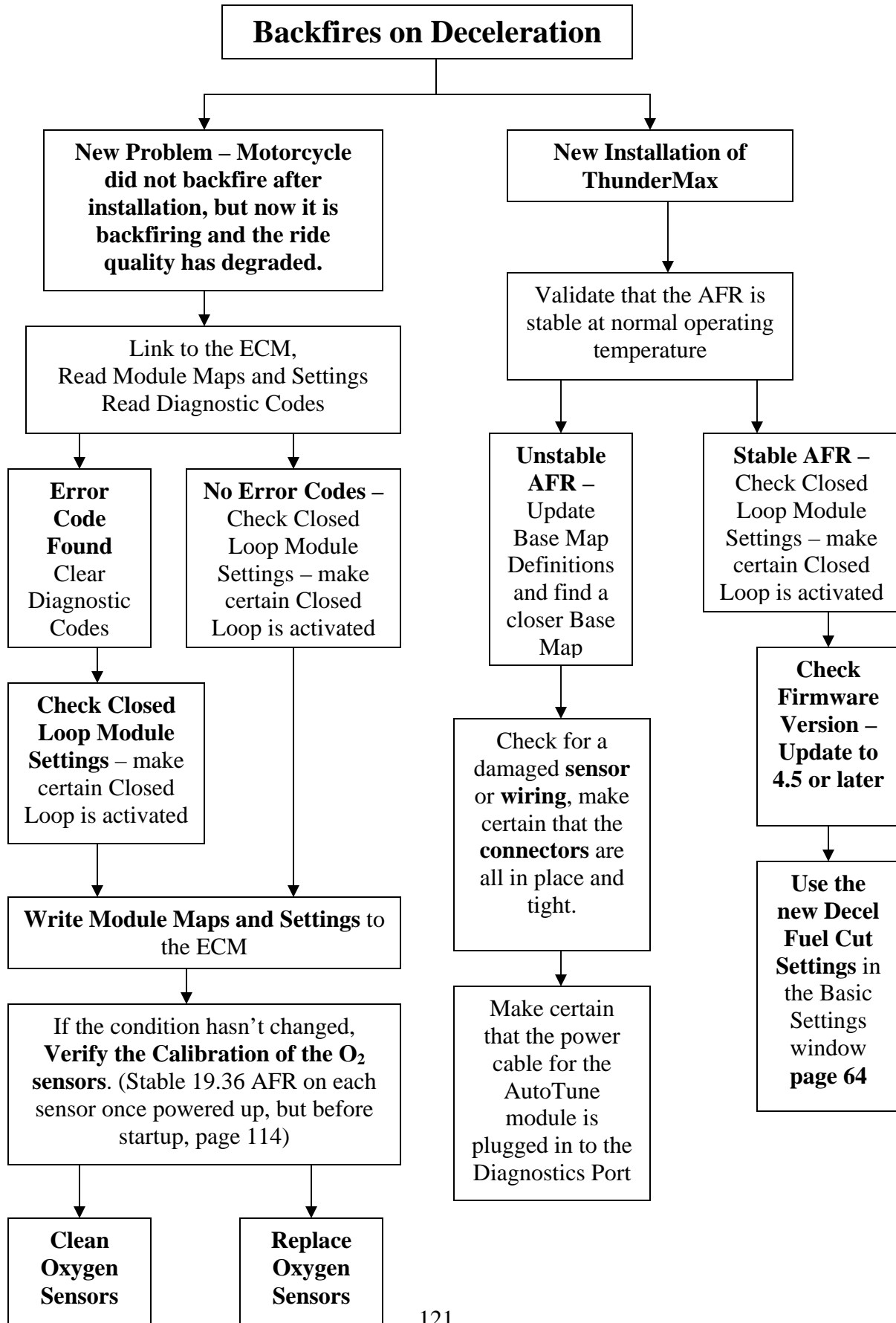
Starter Cranks, Engine Will Not Start

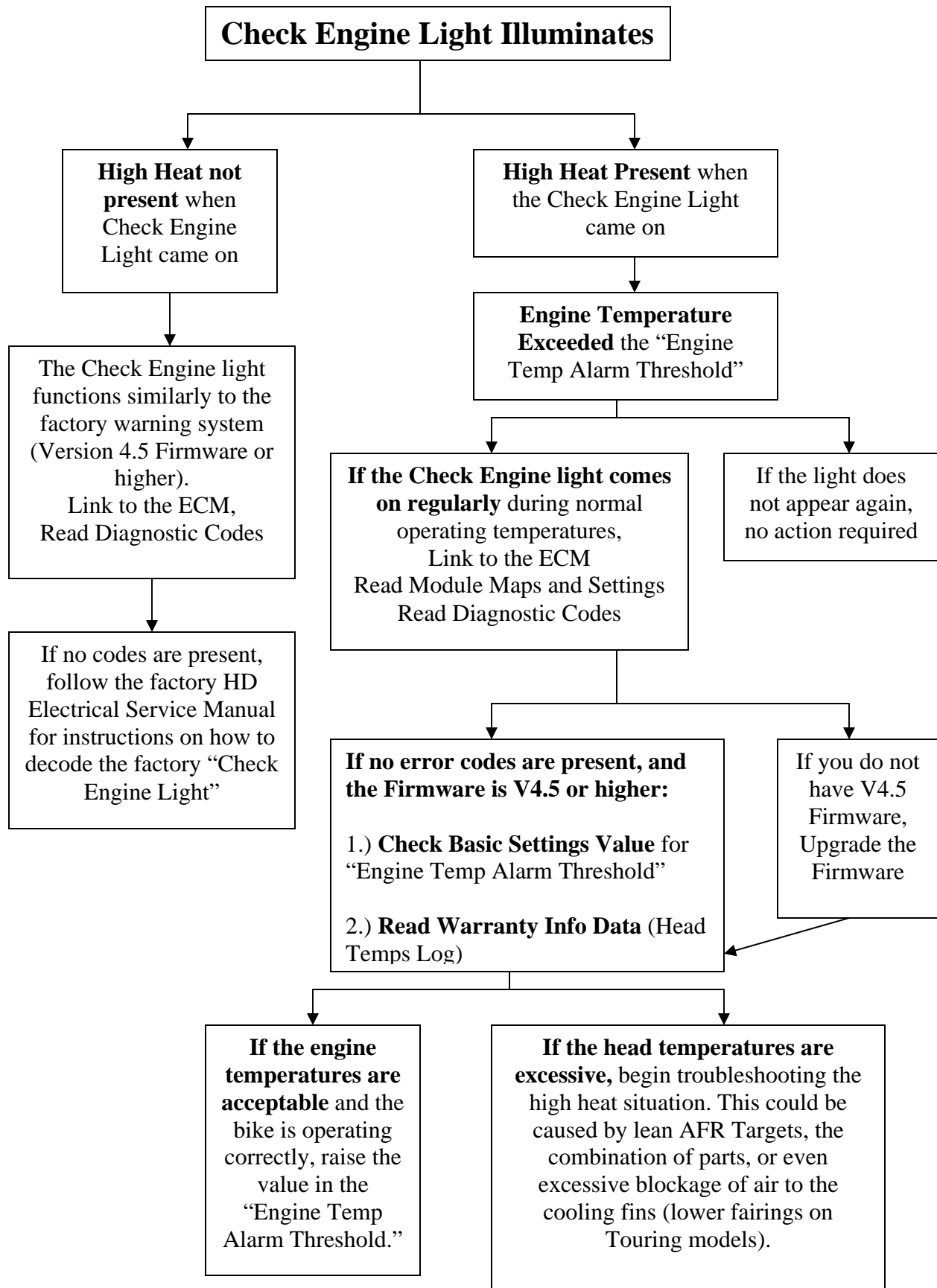












GENERAL PERFORMANCE PROBLEMS

EFI equipped engines need the same basic elements to function properly as carbureted engines. If you are experiencing a performance problem, first review all installation instructions and verify all steps were followed, then:

- **Electrical Issues** - Check for loose battery cables or other loose electrical connections. Then check for a failed sensor. View the Diagnostic Troubleshooting Codes.
- **Spark** - Check the spark plugs for proper color or soot inspect the air cleaner for dirt. If the motorcycle has an operational issue before installing the ThunderMax ECM, it is probable that there's another problem on the motorcycle that you need to solve before you proceed with tuning.
- **Air / Fuel Quality** - Ensure the engine is receiving clean air and good fuel. If the fuel is from last season or has been varnishing for several months, drain, flush and start over with fresh fuel.
- **Mechanical Issues** - Check for a mechanical issues such as loose hardware on the throttle body, improper throttle blade setting, leaking intake manifold seals, fuel delivery problems (in-tank fuel filter and fuel line), injector problems, wiring, wet sumping, or poor ring seal.

GENERAL INSTALLATION NOTES

Lights on the Console / Speedometer: On certain models, the turn signals or other lights in the gauges / gauge cluster may flash when the ignition switch is initially turned on. **No action is required** if the lights work properly during normal operation.

Engine Light: If the engine light illuminates at high temperature during operation of the motorcycle, the ThunderMax ECM is warning you that the cylinder head temperature has reached the danger zone of 325 degrees. Firmware 4.6 or higher will allow you to adjust the setting for the temperature that the warning light illuminates, with a default value of 350 degrees. **Continued operation (without a cool down period) could cause severe engine damage!** See page 73 for more detail on this feature.

Engine Light / Battery Light at Startup: The ThunderMax ECM operates differently from the factory ECU. When starting, the ThunderMax ECM goes through a sequence of events testing and illuminating each individual light at startup. Although this sequence is different than the factory ECU, the sequence is normal for the ThunderMax ECM.

Low Fuel Light (Up to 2007 models)- The low fuel light will operate exactly the same whether you are using the ThunderMax ECM or the factory ECM. Our in house testing has found that the low fuel light does not activate at the same time on

Diagnosics and Troubleshooting

every tank. What this means is that the volume of fuel left in the tank when the low fuel light comes on, varies almost every time it is activated. This inconsistency is not related to the ThunderMax ECM or any other aftermarket ECM on the market.

Battery Light Function: If the light comes on during idle speed at operating temperature, this light is indicating low voltage of your charging system. Voltage can be viewed at the monitor window. Charging systems are not a function of the ECM. Before you take any action, verify voltage at idle which could be low due to conducting the initializing and other diagnostic work with the ignition switch on. Recharge the battery, verify that the charging system is working properly and review the light function. If the problem persists, contact Zipper's.

Removing, Changing or Charging the Battery: When installing the ECM for the first time, remove the fuse for the ECM before disconnecting or reconnecting the battery. Hot-swapping components could promote a premature failure, which could result in damage to the controller.



Always pull the ECM fuse before disconnecting or reconnecting the battery! At any point if the ECM Fuse has been pulled, including battery replacement, the ThunderMax ECM must be re-initialized. Failure to do so may require linking to the module to fix the IAC Stops location. See the initialization procedure on page 11.

ABOUT THUNDERMAX

The ThunderMax EFI is a complete, stand alone ECM for all Delphi based motorcycles. This high-resolution Alpha/N-based system is the most advanced engine management system available. The ThunderMax ECM is not a post-fuel devise, or a “signal modifier”, it is a complete factory ECM replacement. The same technology is also available for all Magnetti-Marelli based H-D 1997-2001 motorcycles.

The ThunderMax EFI system is a joint development and distribution project between two industry leaders, Zipper's Performance Products and Thunder Heart Performance Corp. Zipper's Performance Products is a leading developer and producer of engine kits and performance components for the H-D aftermarket industry. Thunder Heart Performance Corporation engineers, designs and manufactures high technology systems and components for the motorcycle industry.

Our companies are committed to developing and improving the best engine management and fuel injection products in the industry. Our staff is dedicated to customer support.

The ThunderMax comes with a 3 year limited warranty.

For additional information including ThunderMax Cams by Red Shift as well as software and instruction updates, please visit the ThunderMax website, www.Thunder-Max.com .

Section 6:

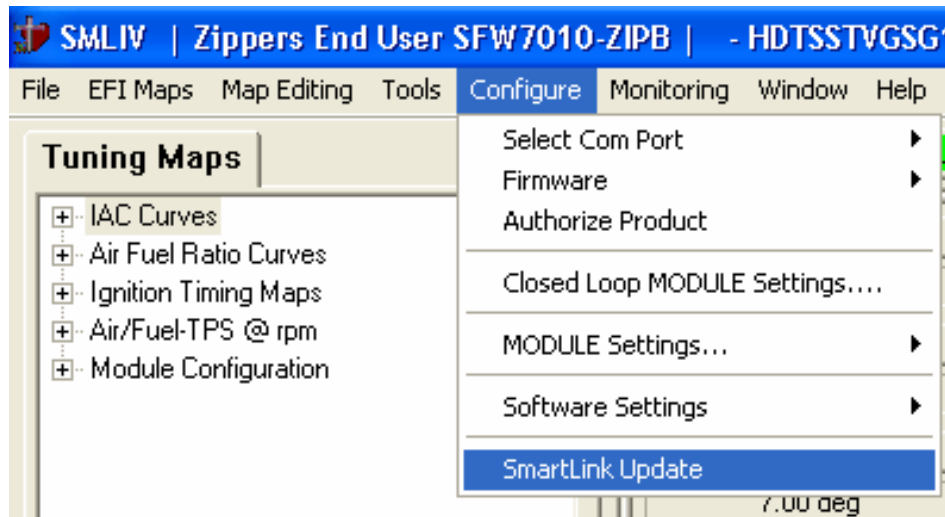
Updates

An Internet Connection is required for all updates.

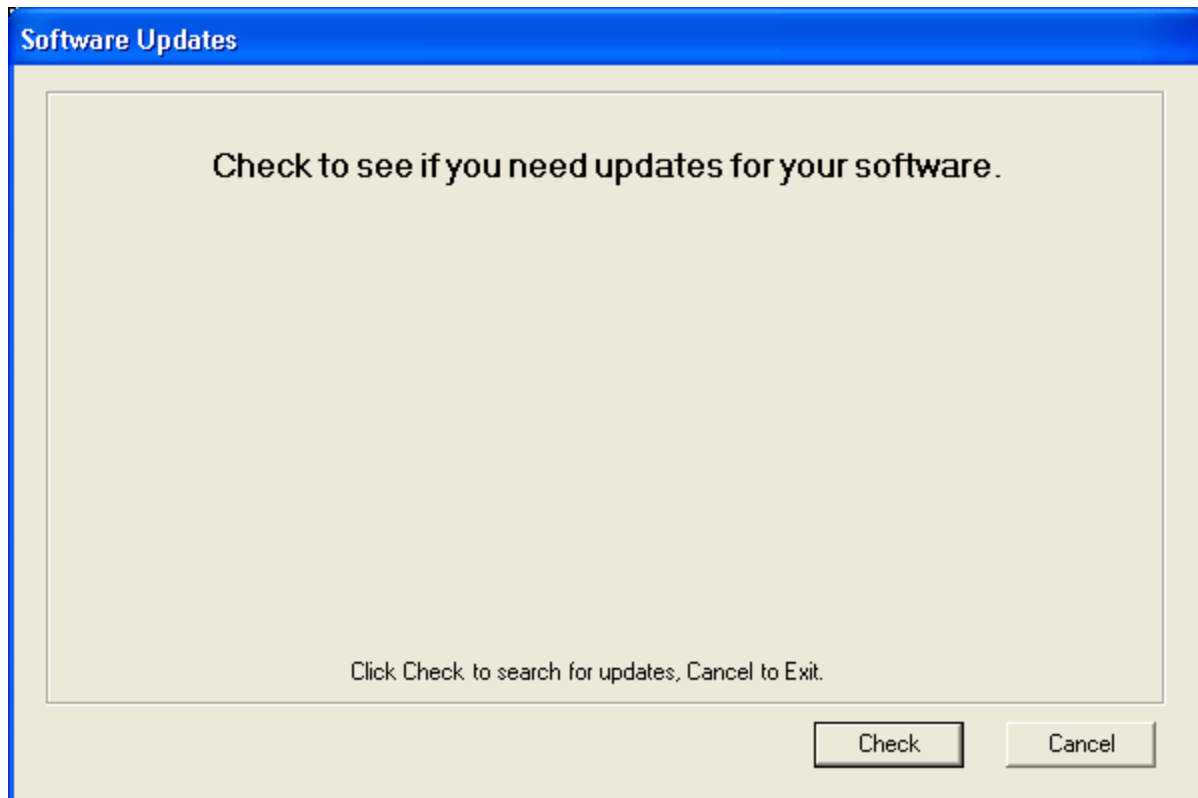
UPDATING THE SMARTLINK SOFTWARE

To maintain the most current version of SmartLink IV, use the update function in the software. **An Internet Connection is required for all updates.**

Select **Configure > SmartLink Update** to begin the update process, as shown below.



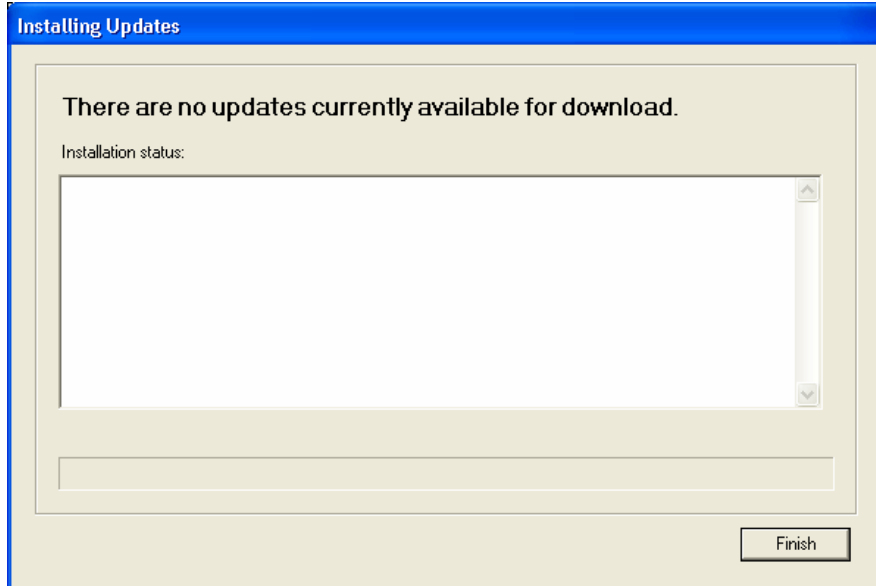
The following window will appear:



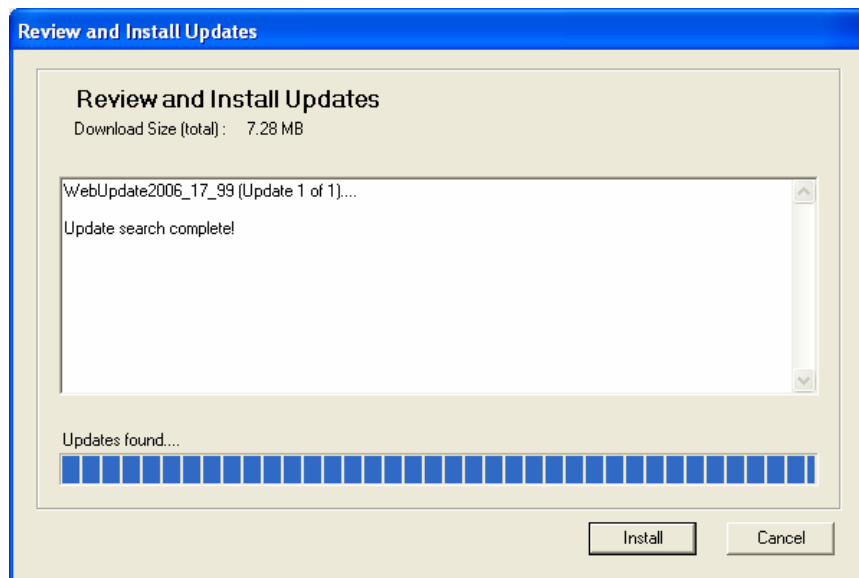
Updates

One of two choices will appear:

Software is up to date!
No action required.

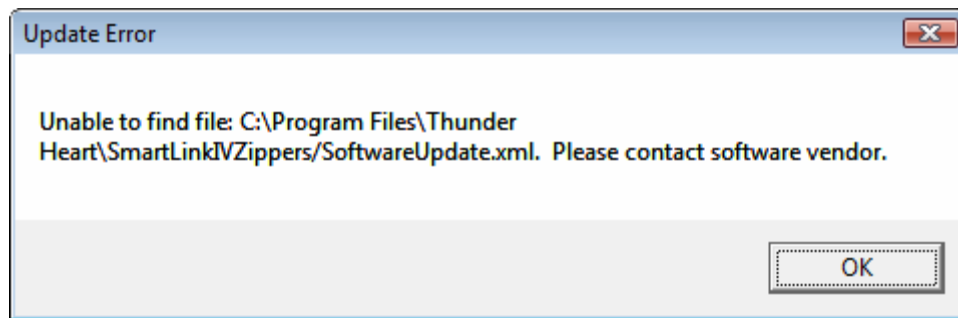
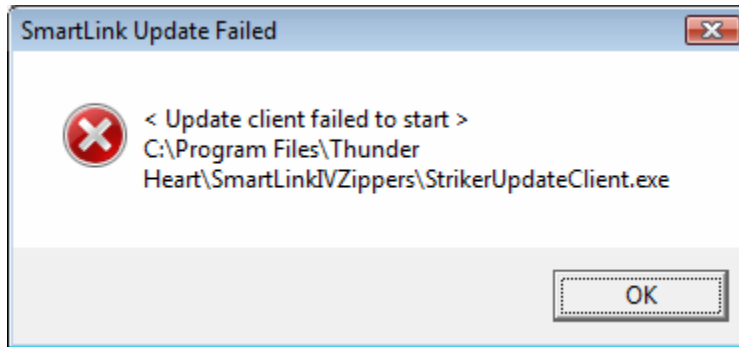


New Software Available!
Proceed Forward with the Update Process



Follow the instructions provided by the SmartLink IV update windows to update your version of SmartLink IV. When complete, open SmartLink IV and select **Help > About SmartLink...** to check the version number that is currently installed on your computer.

With the Vista Operating system, if you receive either of these two errors, you will need to reinstall SmartLink IV before you can proceed with any updates.

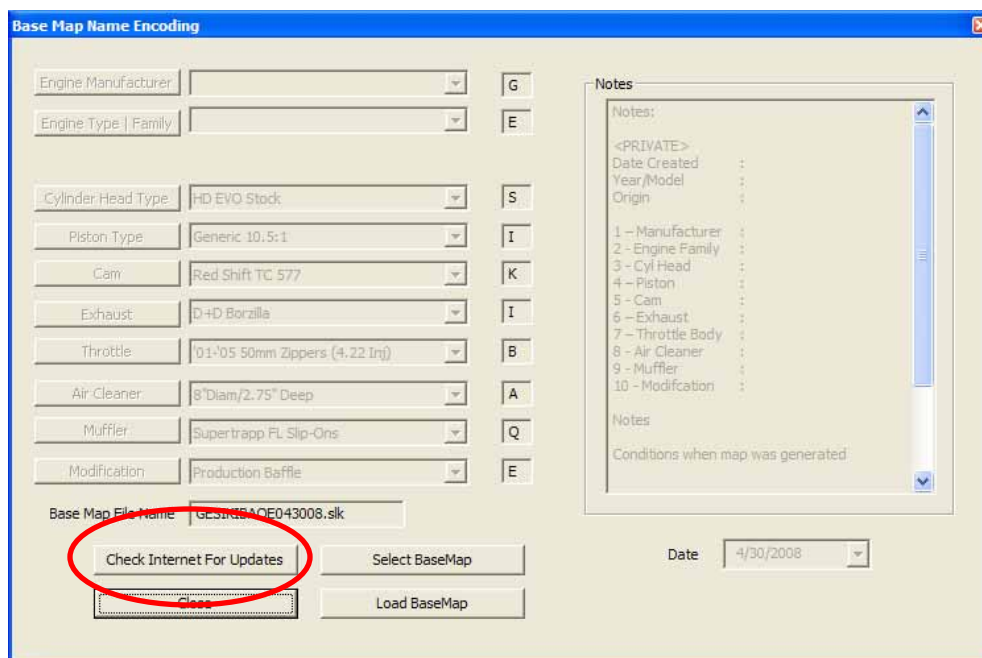


Both of these errors occur when an earlier version of SmartLink IV was loaded, but without the special instructions for the Vista operating system. Current versions of SmartLink IV (2007 & newer) do not require special installation instructions for Vista.

Uninstall SmartLink IV from your computer (Control Panel > Program Manager). Now install SmartLink IV 2008.0.2 onto your computer, and follow the instructions given on screen during the installation. Any additional updates or upgrades can now be utilized without special instructions.

UPDATING THE BASE MAP DEFINITIONS

To ensure that you have the complete and up to date Base Map Library, select the “Update Definition File” button on the “Base Map Name Encoding” window, as shown below.



You must be connected to the internet to update the Base Map Definitions as well as retrieving any available new Base Maps. The SmartLink IV Installation CD does contain the base map library; however it is only as current as the CD itself. Versions 2008 and later will automatically download any new base map files when the definition file is updated. Previous versions will only download a list of available base map choices. **Again, an internet connection is a requirement for updating the SmartLink IV software.**

It is simply good practice to update the definition file when searching for a new Base Map file. Not only are new maps constantly being created, but the older Base Maps are updated occasionally as well. Once updated, you may proceed with selecting an appropriate Base Map for the current engine combination you are working with.

If you are satisfied with the operation of your current Base Map, chances are a new Base Map will not make a significant difference to the operation of the motorcycle. Updated maps could contain spark curve or fuel management changes, or even different fuel economy strategies.

UPDATING THE FIRMWARE IN YOUR THUNDERMAX ECM

For any modules with a Firmware version of 3.2 or higher, you can update the firmware, if an update is available, through the SmartLink software. You must be linked to the ThunderMax ECM to update the firmware in the module. **An Internet connection is required to download the Firmware.** Once the firmware file is downloaded, you do not have to be connected to the internet to upload the new Firmware to the ThunderMax ECM. There are two stages in updating the Firmware in the ThunderMax ECM.

First Download

Stage 1: Check for an update, and download the latest Firmware onto your computer.

Stage 2: Link to the ThunderMax ECM and upload the newly downloaded Firmware to the module.

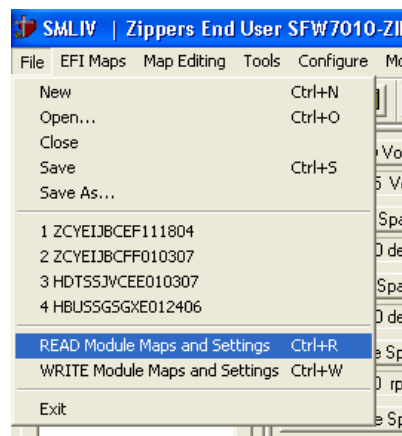
Both stages are fully covered in the following pages. Both require that you are linked to the ThunderMax ECM, and have read the module map and settings.

To begin the Firmware update procedure:

- 1.) **Link** to your ThunderMax ECM

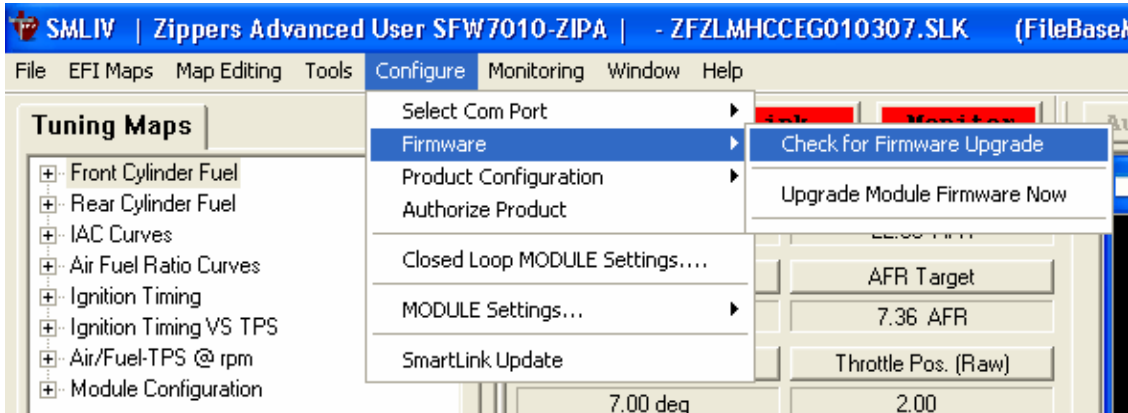
Link

- 2.) Select **File > Read Module Maps and Settings**

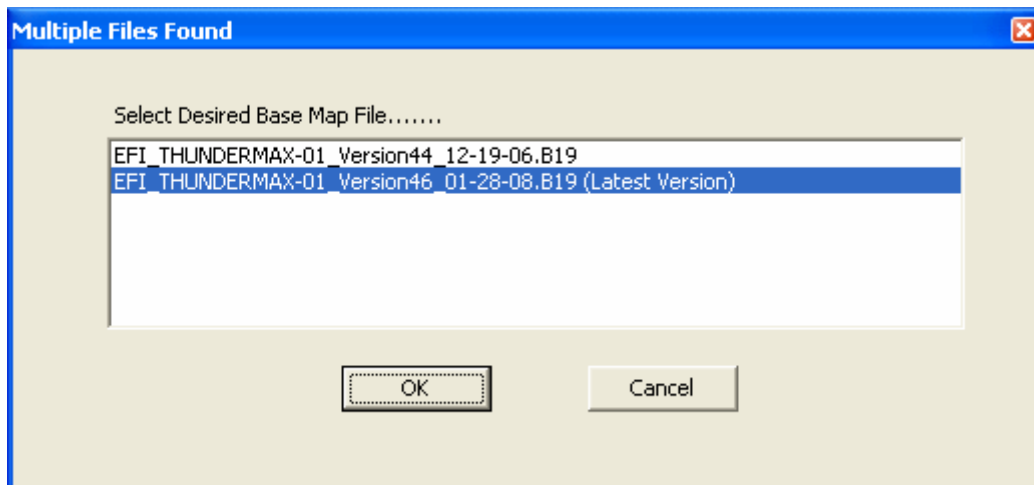


Stage 1: Downloading an Updated Firmware

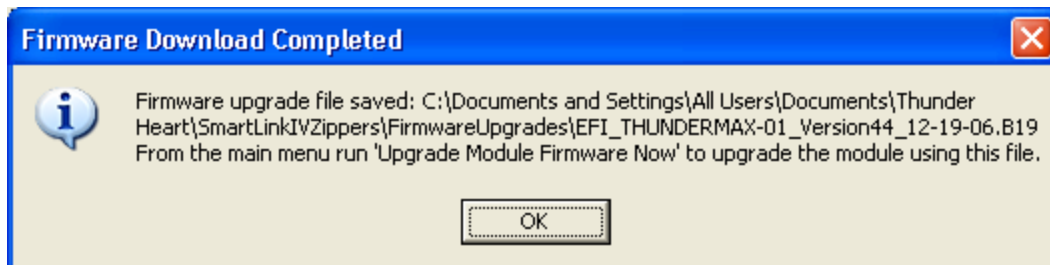
Select Configure > Firmware > Check for Firmware Upgrade to see if there is an updated Firmware available for your ThunderMax ECM.



If an updated firmware is available for your ThunderMax ECM, the following window will appear:



If you select the “OK” button, the firmware download will begin. Once completed, the following window will appear.

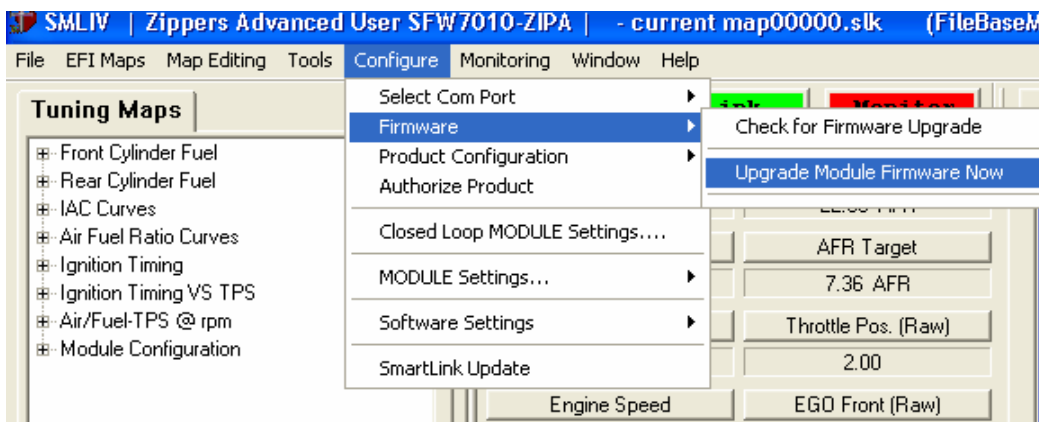


Stage 2: Uploading a New Firmware Version into the ThunderMax ECM

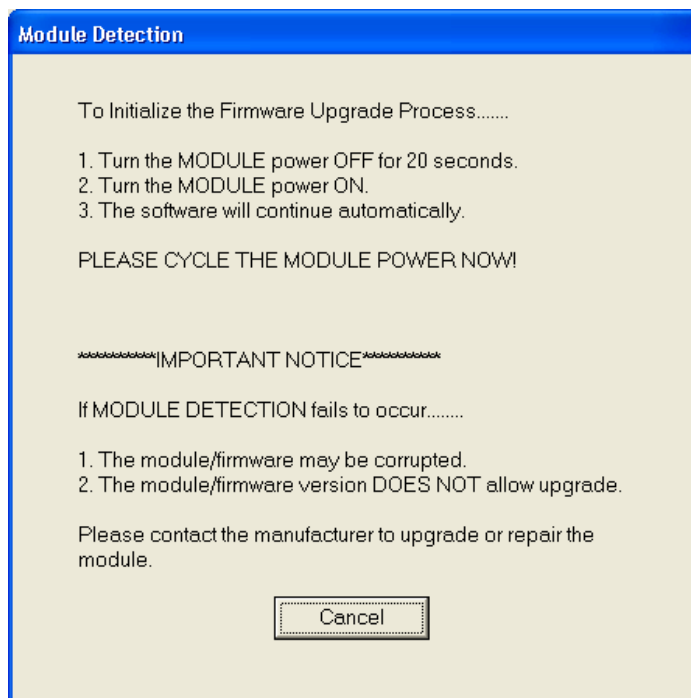
Link

Link to the ThunderMax ECM, and Read Module Maps and Settings. SmartLink 2008.0.2 and newer will automatically read the map from your ECM before any firmware upgrade can begin.

To upload the new Firmware to the ThunderMax ECM, select Configure > Firmware > Upgrade Module Now, as shown below. **You must be linked to the ThunderMax ECM to perform any Firmware upgrades.**



Once selected, the following window titled “Module Detection” will appear:

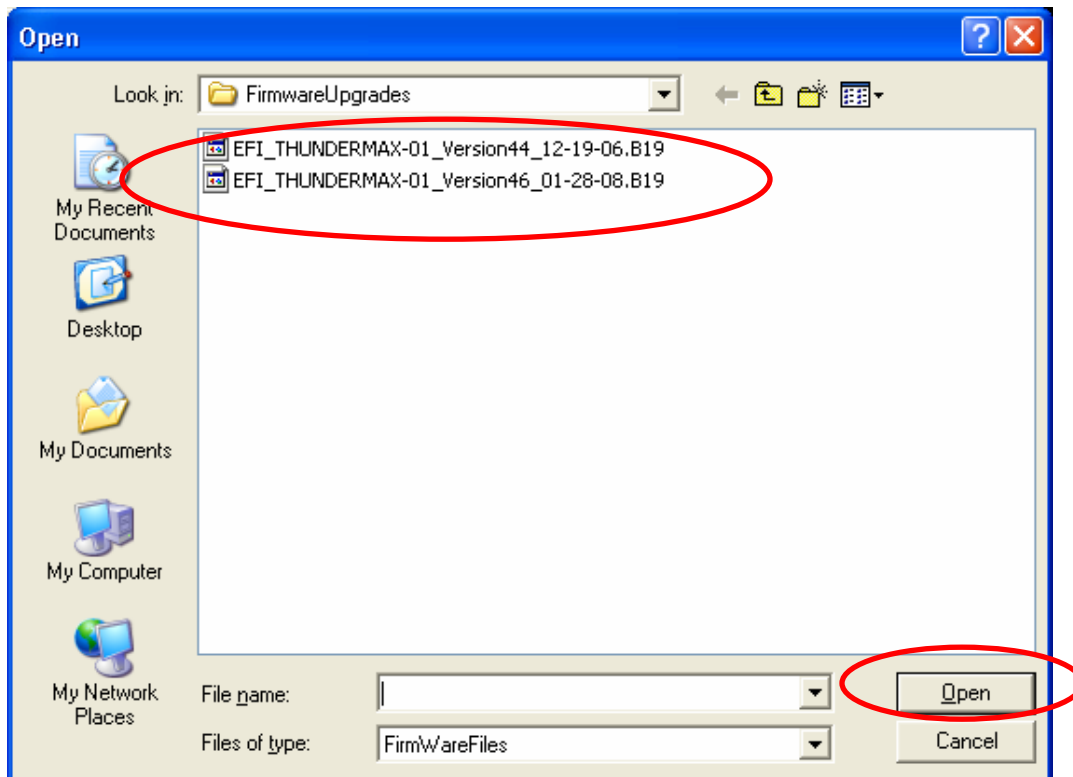


Updates

Follow the instructions on the “Module Detection” window:

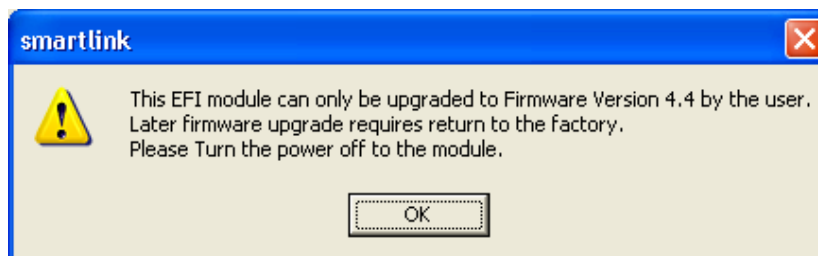
- 1.) Turn off the Ignition Switch for 20 seconds.
- 2.) Turn on the Ignition Switch

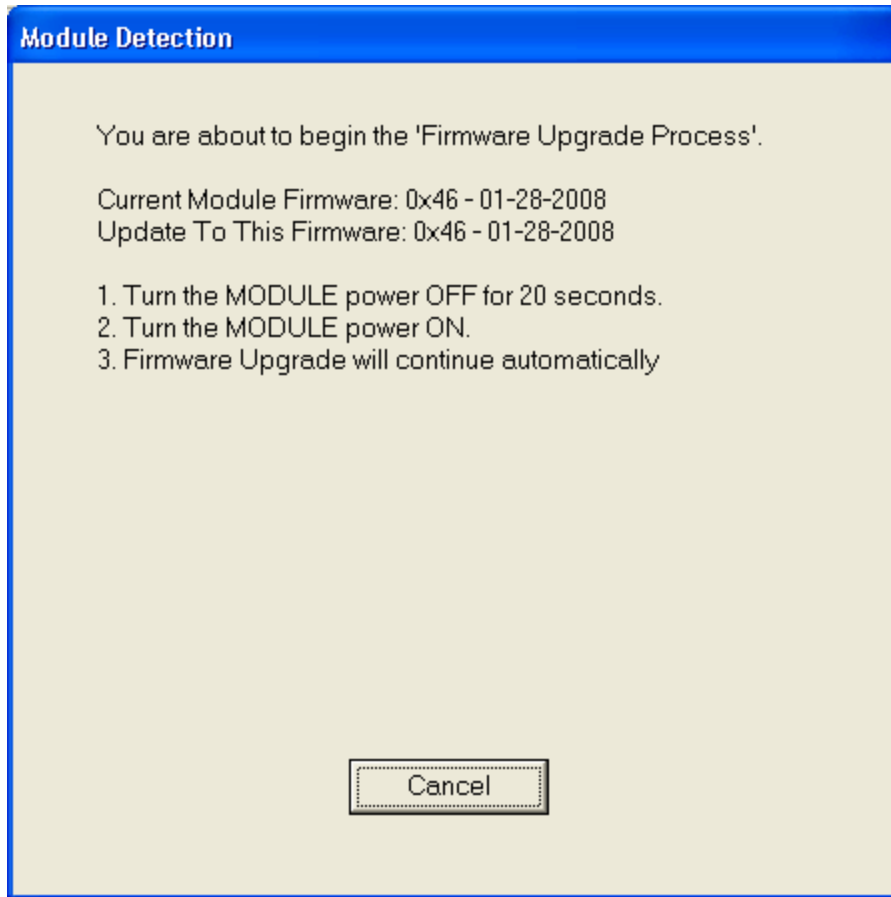
The update process will now automatically begin. The following window will appear, allowing you to select the most recent version of the Firmware that you’ve downloaded onto your computer. Select the most recent version of the firmware, and select the “Open” button, as circled below.



Once the file has been opened, the following window will appear titled “Module Detection.” Follow these instructions and your firmware update will be update on your ThunderMax ECM.

Some Gen 1 modules cannot accept Firmware version 4.5 or higher. SmartLink will tell you if it is incompatible with your module version, as shown below. Always select the newest firmware date that SmartLink will allow you to load.

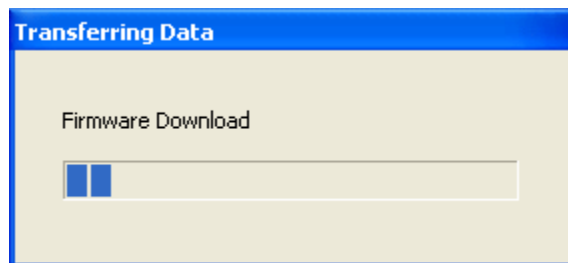




Follow the instructions on the “Module Detection” window:

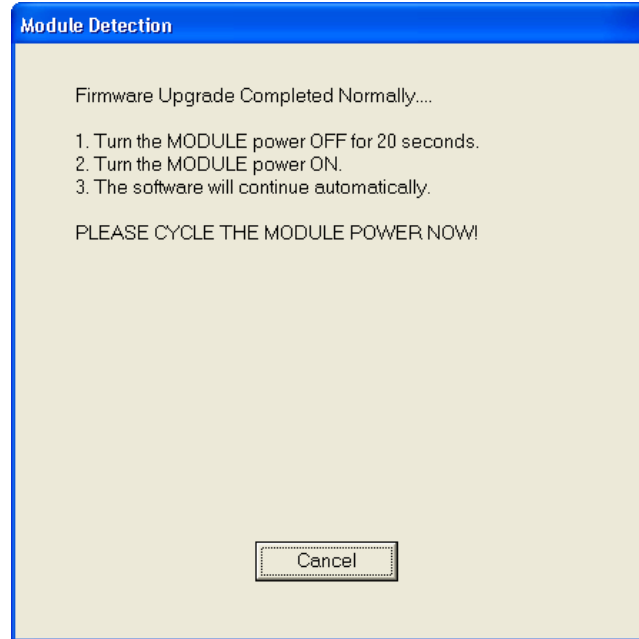
- 1.) Turn off the Ignition Switch for 20 seconds.
- 2.) Turn on the Ignition Switch

If the Firmware upgrade process is successful, you will see the following status window appear, titled “Transferring Data.”



Updates

Once the transfer completes, the “Module Detection” window will appear again.



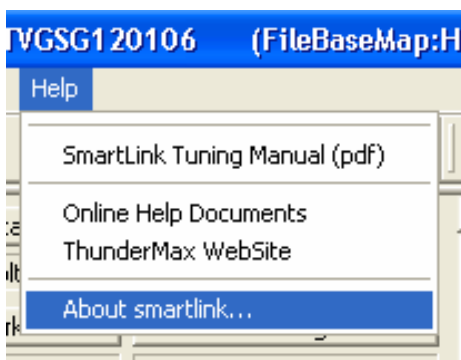
Follow the instructions on the “Module Detection” window:

- 1.) Turn off the Ignition Switch for 20 seconds.
- 2.) Turn on the Ignition Switch



Lastly, “WRITE Module Maps and Settings” to complete the Firmware Upgrade process. If you neglect to write the map back to the ECM, errors will arise that will keep the motorcycle from operating correctly.

The Firmware is now upgraded in your ThunderMax ECM. To check the firmware version on your ThunderMax ECM, simply open SmartLink IV, Link to the ECM, and select **Help > About SmartLink...**, as shown below. The “SMLIV” window that pops up will display the current software and firmware versions.



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GLOSSARY OF TERMS USED

Accel Fuel – Factor of fuel enrichment during rapid throttle movement.

AFR (Air Fuel Ratio) – Percentage of air and fuel as measured from a single engine cycle. Example an AFR of 14: 1 = 14 parts of air per 1 part of fuel by weight.

AFR Correction – Percentage of additional or reduced fuel to the base map at a specific operating condition.

AFR Override – Allows a single AFR variance from the map target AFR settings on each closed loop map page.

Auto-Tune – A Plug and Play add on for the ThunderMax ECM, allowing the use of closed loop feed back to make lasting adjustments to the base fuel map. These adjustments may be needed due to degradation of fuel components, manufacturing tolerances in the throttle body, IAC motor, TPS, injectors, or any other component variations.

Barometric Pressure – The measured atmospheric pressure at the ECM, this is a variable factor relative to absolute atmospheric pressure, and ultimately effects the AFR in your engine.

Base Ignition Timing – This displays the calculated ignition timing from the base map before corrections are applied.

Base Map – A set of curves that determine the amount of fuel and ignition timing required for each operating condition, for one engine configuration.

Base Map Definitions – The Base Map Definitions are the strings of data that display the parts used in each Base Map File. This is updateable with a high speed internet connection. The update will reveal any new Base Maps added to the Base Map Library by Zipper's.

Basic Settings - A window used to observe / change the basic module settings such as Idle RPM, Speedometer Calibration and IAC learning offsets, etc.

CL (Closed Loop) – Meaning the use of feedback or reference of set point value to adjust Offsets to adjust the fueling output.

CL Corr Front – Front cylinder percentage Adjustment Pre & Post Auto Tune

CL Corr Rear – Rear cylinder percentage Adjustment Pre & Post Auto Tune

CL Status – A value which can be helpful with tech support to diagnose a problem related to the closed loop feedback system.

Closed Loop Processing – The use of a feedback sensor (oxygen sensor) to correct fuel delivery based on past air/fuel ratio readings.

CLP Offset – The deviation of fueling values from the base map as a result of Auto tune corrections.

Cranking Fuelflow – % of fuel supplied during engine startup mode.

Crank Position Sensor – Determines the precise location and speed of the crank shaft.

DTC Warnings – Diagnostic Troubleshooting Code Warnings

ECM – Electronic Control Module (or Engine Control Module or Electronic Control Unit (ECU) –

EFI – Electronic Fuel Injection

EGO –Exhaust Gas Oxygen (the oxygen content of exhaust gases)

EGO Front – Front cylinder real time reading

EGO Rear – Rear cylinder real time reading

EGO Target – The desired target as per map settings

Engine Monitor Gauge – A display window selected from the monitor page

Final Drive Ratio – The option of “Final Drive Ratio” is only used on 2007 motorcycles with a 6th Gear Indicator light. The default value that should be used for a 2007 motorcycle is 87.

Firmware – The internal program which directs the functions of the ECM for fuel control, spark control etc. The Firmware is updateable with a high speed internet connection.

Normal Operating Temperature – Cylinder head temperature between 240-285 degrees Fahrenheit.

Gear 6 Min Tps – Smallest value of throttle position that will allow 6th gear display, this setting is only used on 2007 and newer motorcycles. The default value for 2007 motorcycles is 40.

IAC (Idle Air Control) –A stepper motor which controls by- pass air function in the throttle body. The IAC’s main purpose is to control airflow requirements at idle.

IAC Home Position – A value which is used to increase or decrease the amount of by-pass air for the IAC port, used during the starting function only.

IAC Max Learning Offset – The Maximum offset that the IAC stop can learn to.

IAC Min Learning Offset – The Minimum offset that the IAC stop can learn to.

IAC Override – Allows the user to freeze the IAC position at a desired value. This may be useful for diagnostic purposes, but should not be used during normal operation.

IAC Plunger – Tapered tip of the Idle Air Control motor which controls the by-pass air flow at Idle.

IAC Stop – A virtual lower limit for the IAC position.

IAC Stop Target – A numerical value indicating the target for the IAC stop setting.

Idle Speed – The target in the software for desired engine speed at idle when at normal operating temperature.

Ignition Timing – A variable point at which ignition spark occurs, measured by degrees of advance or retard relative to top dead center position of the piston.

Initial Fuel Pulse – An adjustable setting that primes the cylinders for optimum starting time. This only occurs one time per ignition start cycle.

Initialization (Module) –The process which calibrates the IAC position and TPS value to the module.

Injector Duty Cycle – Percentage of time the injector is powered by the ECM per combustion stroke.

Injector Size Compensation- Used to apply a fueling compensation to ALL fueling maps based on the ratio of the “Map Injector Size” versus the “New Injector Size”.

Link –A term referring to the communication between the software and the module.

Load Control Dynamometer – A modern Load Control “dyno” has an electronically controlled brake or loading device added to allow tuning at specific RPM targets. This is the ideal setup for tuning EFI engines.

Main Relay Loc – The routing of power in the ECM –Value of (2) for all Big Twins (1) for XL models.

Module Fueling Offsets – Offsets that have been learned by the ECM to correct the AFR at particular RPM and Throttle Positions.

NADS Nitrous – Nitrous Assist Dry System – An electronic “Dry” nitrous system that uses the ThunderMax ECM to add fuel like a Wet system. This is a plug and play add-on to the ThunderMax ECM.

Narrow-Band Oxygen Sensor – An oxygen sensor used to measure the amount of unburned oxygen in the exhaust stream of an operating engine. The term narrow band refers to the small range of AFRs that the sensor can report to the ECM. A factory sensor is a narrow band, typically a 1, 3 or 4 wire oxygen sensor.

Open Loop – No feedback “loop”; manual changes to the base map required to alter or adjust the AFR. The ECM operates solely off of the Base Map File regardless of the engine’s operation.

Oxygen Sensor – An electronic sensor that measures the proportion of (O₂) in gas being analyzed.

PointTrak – The specific location of the vertical cursor to the point being adjusted.

Rear Trim – Rear Trim is the percentage of fuel being trimmed from the rear cylinder injector’s pulse width to match the front and rear cylinder AFRs.

Rev Limit – A “Basic Settings” value which limits the engine rpm. Please consult the manufacturer of your engine to find the maximum RPM recommended. This is meant to be a safeguard against potential damage caused by over-revving the engine beyond its mechanical capabilities.

Session (Tuning) – Also known as a “Key Cycle Event”. Every time the ignition switch is powered off, then powered on again, a new tuning session begins.

SmartLink Map Database – The SmartLink Map Database is a database of pre-made, professionally tuned Base Maps that span from an 88” stock engine to a giant Zipper’s 124” engine.

SmartLink Update – Allows user to check for updates, and when available update the SmartLink IV software through a high speed connection.

Speedometer Calibration – The Speedo Calibration is a number that is used by the ECM to determine the vehicle’s speed. This value is a function of the vehicle transmission, rear pulley, tire diameter, etc.

Stoichiometric Air-Fuel Ratio (Stoichiometry) – This is the Ideal balance of reactants and products for the chemical equation associated with the operation of

combustion. For gasoline applications, a stoichiometric mixture is found to have an air-fuel ratio (AFR) of 14.7:1, or 6.8% Fuel.

TPS (Raw) - An unfiltered voltage signal which can assist with adjusting throttle blade settings.

Tip Angle – Also known as Bank Angle, refers to a sensor which detects if the bike is tipped or banked to one side more than 45 degrees for longer than one second. Power is interrupted to Turn Signals, Starter Motor, Ignition Controller, Fuel Pump and Coil when this sensor is tripped.

TPS (Throttle Position Sensor) – A potentiometer attached to the throttle shaft which communicates throttle position to the ECM using a voltage signal.

Tuning Map Tree – The Tuning Map Tree is the leftmost part of the SmartLink IV Layout. This is where all of the individual tuning maps and module configuration options are located.

Wide-Band Oxygen Sensor – A type of sensor which is capable of precisely measuring exact air/fuel ratios.

APPENDIX

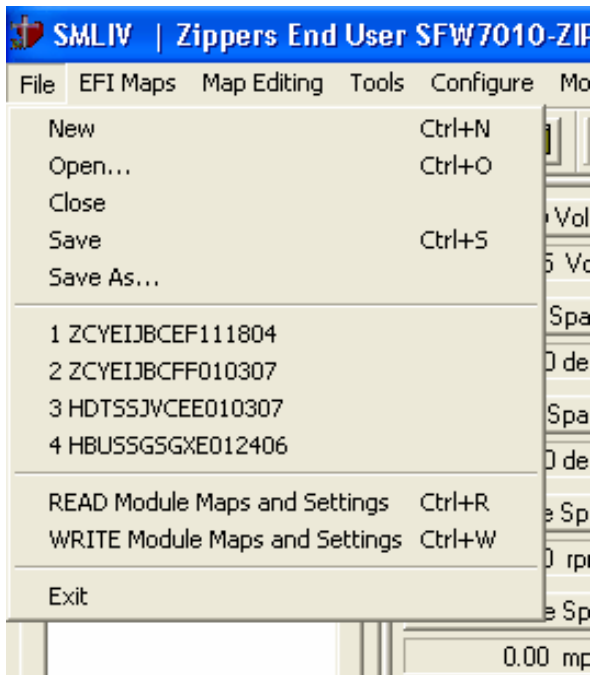
Drop Down Menus

The following section is to be used as a quick reference when using SmartLink IV. All of the menus are dissected and a quick explanation of each option is given. Each explanation is accompanied by a page number, which references the section in this manual that fully covers the topic.

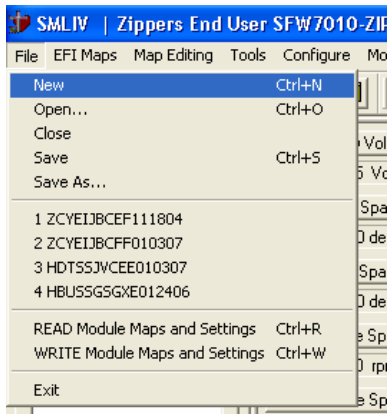
Appendix Index:

- A1: File**
- A2: EFI Maps**
- A3: Map Editing Tools**
- A4: Tools**
- A5: Configure**
- A6: Monitoring**
- A7: Window**
- A8: Help**

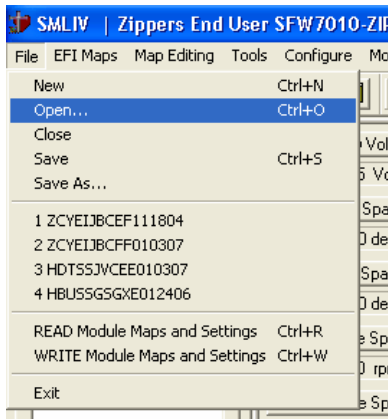
Appendix A1: File



The “File” Menu contains the standard menu options of New, Open, Save & Exit. In addition to the standard options, communication to the ECM can be performed through this menu with the Read / Write functions.

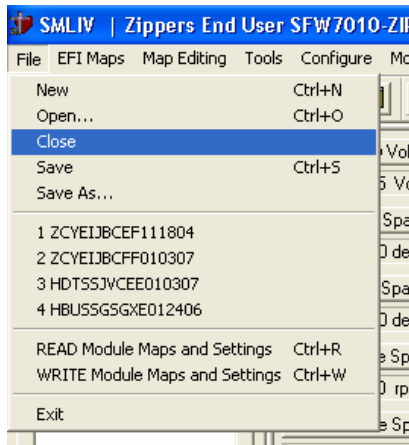


The “New” option will allow you to open an “Untitled” Base Map File. Although you cannot create a new Base Map with the software, the “Untitled” Base Map is necessary when linking to a ThunderMax ECM with an unknown Base Map File loaded onto it.

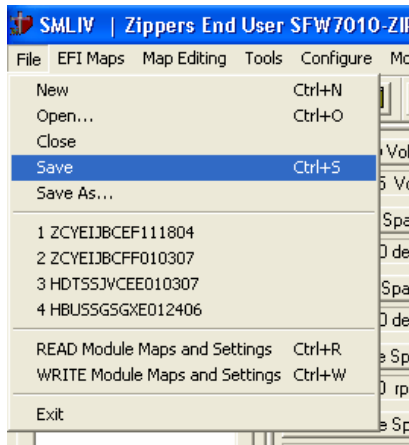


The “Open” option allows you to open a Base Map File, if you already know the name of the file that you need. When selected, the Base Map folder on your computer will be displayed, with all of the current Base Maps listed. If you do not know which Base Map file you need, please see the EFI Maps section in Appendix A2.

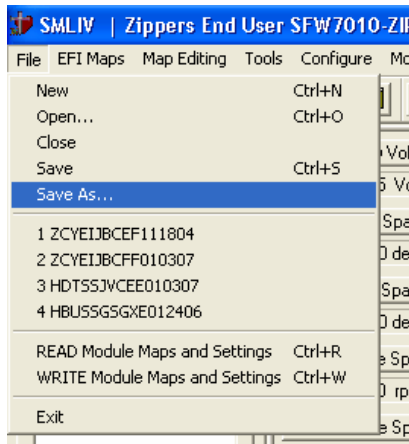
Appendix



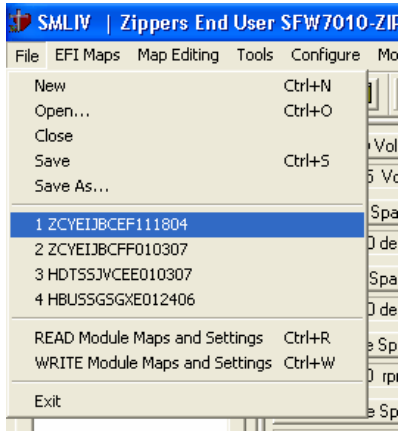
The “Close” option will close the Base Map file that is currently opened in SmartLink IV. By default, if changes have been made, SmartLink will ask if you want to save your changes.



The “Save” option operates exactly like the “Save As...” option. When selected, the Base Map File Folder will be opened for file naming. This saves the map that is currently displayed in SmartLink IV, along with changes made to the Base Map File.

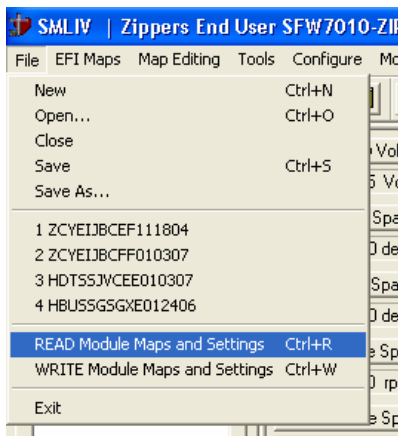


The “Save As...” option allows you to save your tuning work to your computer. The ThunderMax ECM records any changes made, but it is a good idea to save your modified Base Map File under a new name to prevent it from being overwritten.

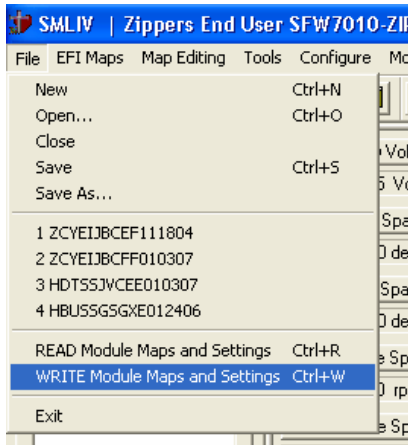


The “History” function of SmartLink IV will always be displayed between the “Save As...” option and the “READ Module Maps and Settings” option.

This section will display the names of the last four Base Map Files that have been used on this particular installation of SmartLink IV.

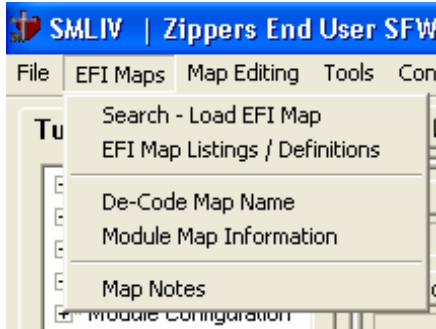


The “READ Module Maps and Settings” option is used for synchronizing SmartLink IV to the ThunderMax ECM’s Base Map File. This particular function will read the ECM’s Base Map and display it in SmartLink IV.

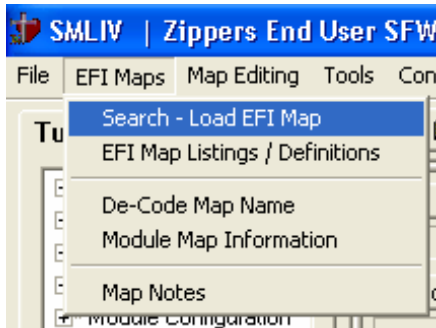


The “WRITE Module Maps and Settings” option is also used for synchronizing SmartLink with the ThunderMax ECM. However, this option will write the map displayed in SmartLink IV to the ThunderMax ECM.

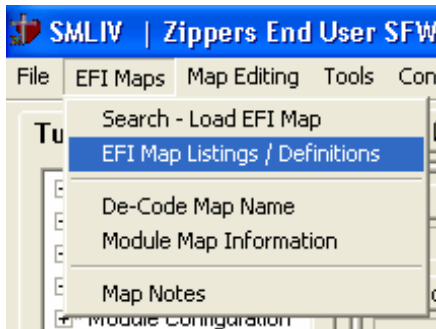
Appendix A2: EFI Maps



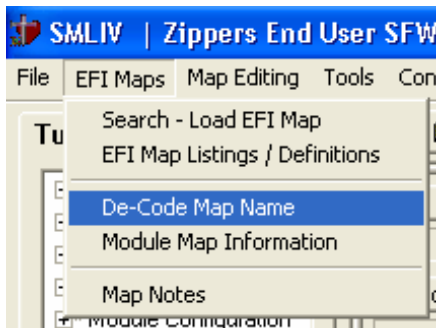
The “EFI Maps” Menu contains all of the functions that you need to find a Base Map File for your application.



The “Search – Load EFI Map” option open the “Base Map Search” window, which allows you to do a quick search for a known Base Map File. This option allows you to search the Base Map Files on your computer, as well as the SmartLink IV Database Library via the internet.

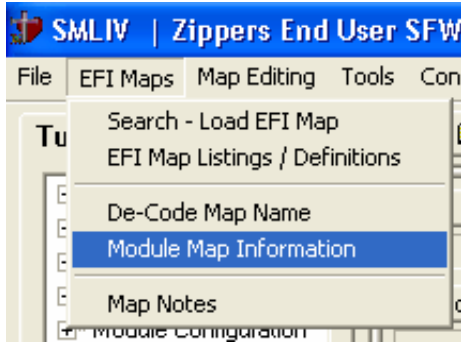


The “EFI Map Listings / Definitions” option opens the Base Map Name Encoding window. This provides you with full access to browsing the Base Map File Database, loading a chosen Base Map into SmartLink IV, as well as an option to update your current Base Map File Definitions.

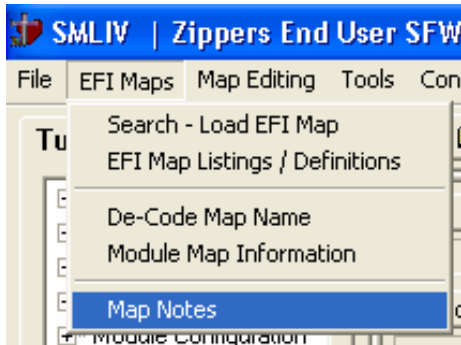


The “De-Code Map Name” option opens the “Base Map Name DeCoding” window.

This window allows you to take a Base Map File name, and dissect it to find out the combination of parts that the Base Map was created for.

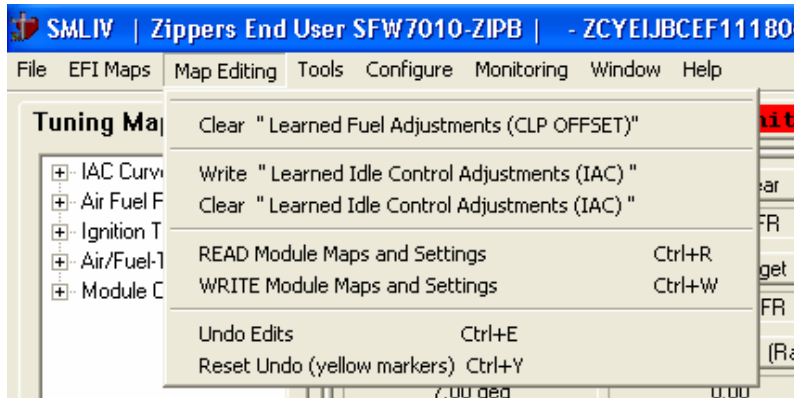


The “Module Map Information” opens the Base Map Name Encoding window. This will also quickly tell you the engine configuration that was used when the Base Map File was constructed.

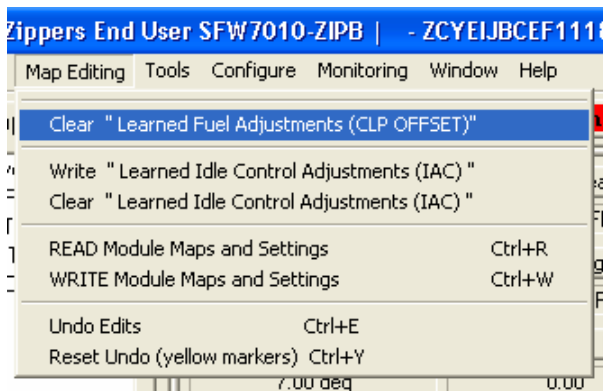


The “Map Notes” option will display a window called Map Notes. If you haven’t used this feature before, it will load as a blank window. Please use this window to save any notes on the changes that have been made from the Base Map File.

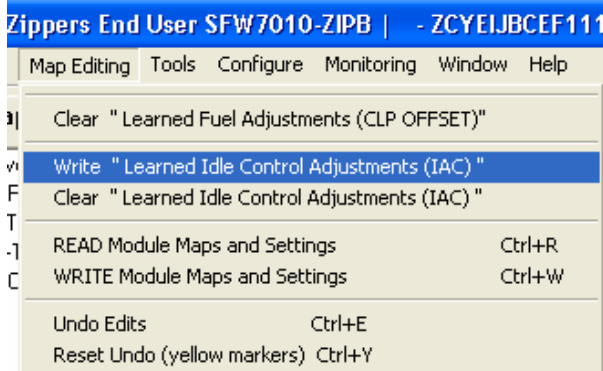
Appendix A3: Map Editing



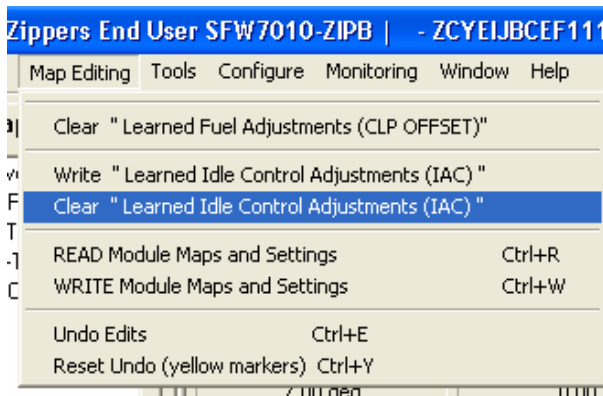
The “Map Editing” menu allows you to manipulate the learning functions of the ThunderMax ECM.



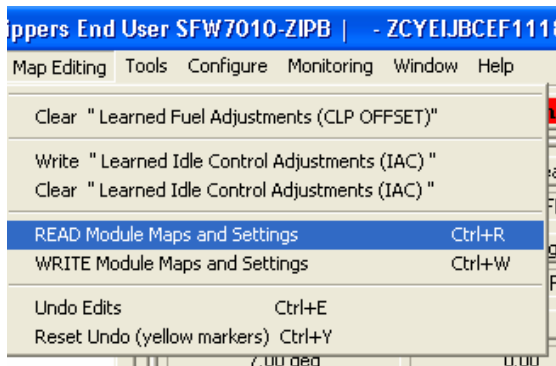
The “Clear “Learned Fuel Adjustments (CLP OFFSET)”” option is used only with the AutoTune Closed Loop System. This feature will erase any learned offsets that the AutoTune system has created.



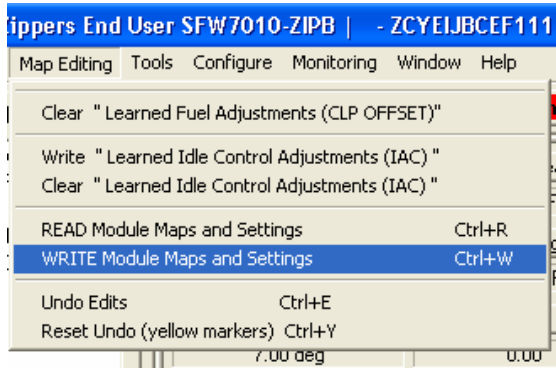
The “Write Learned Idle Control Adjustments (IAC)” option allows you to set the previously learned IAC points as the Module Map File. This will update your Module Map and allow you to tighten up your learning ranges.



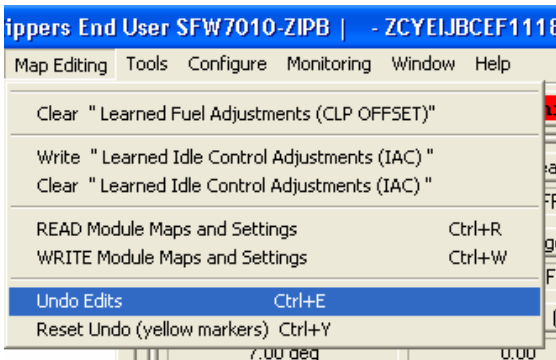
The “Clear Learned Idle Control Adjustments” option will remove ALL offsets that ThunderMax has created for controlling the IAC function. This is necessary when significant changes to the engine combination are made.



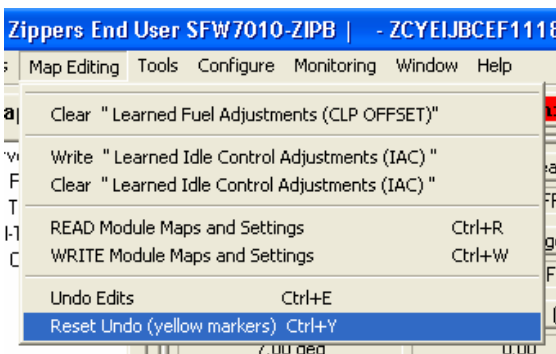
The “READ Module Maps and Settings” option is used for synchronizing SmartLink IV to the ThunderMax ECM’s Base Map File. This particular function will read the ECM’s Base Map and display it in SmartLink IV.



The “WRITE Module Maps and Settings” option is also used for synchronizing SmartLink with the ThunderMax ECM. However, this option will write the map displayed in SmartLink IV to the ThunderMax ECM.

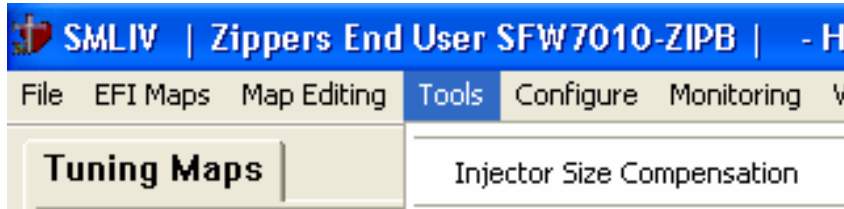


The “Undo Edits” option returns any learned map points back to the original map point, as shown by yellow tracers. Simply put, the tuning blocks will return to the yellow tracers.

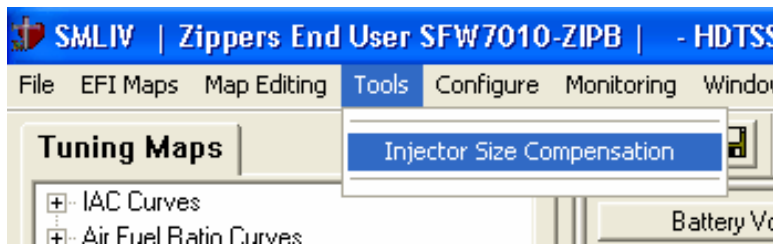


The “Reset Undo (yellow markers)” option is used for altering the Base Map file in the ThunderMax ECM. This option lets you set the learned and adjusted map tuning blocks as the Module Map File points. Simply put the yellow tracers are reset to reflect the ECM’s adjustments.

Appendix A4: Tools



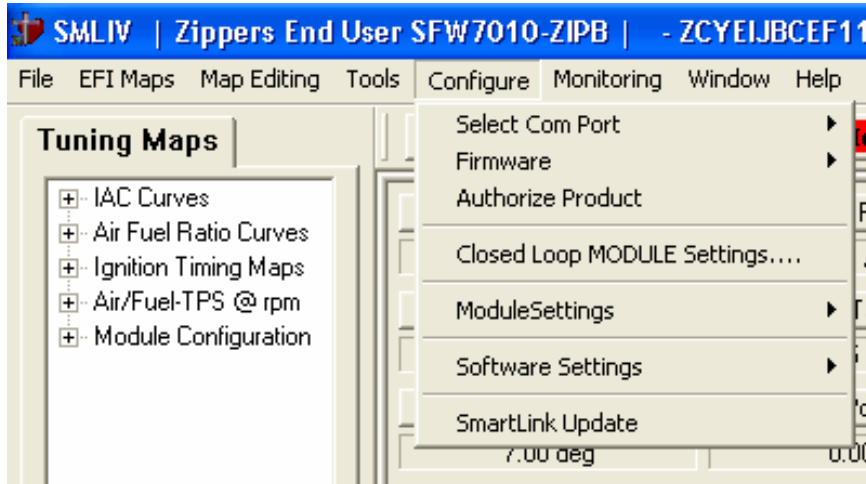
The “Tools” menu is primarily used when a change occurs to the engine combination that the ThunderMax ECM has already been used with.



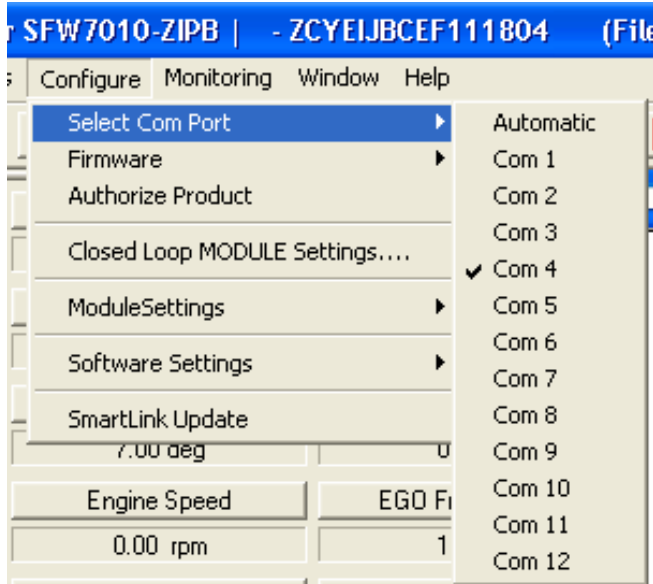
The “Injector Size Compensation” option opens up a window that will ask for the size of the existing injector and the new injector. This feature will determine the percentage fuel change

between the two injectors, and adjust ALL of the map points by this factor.

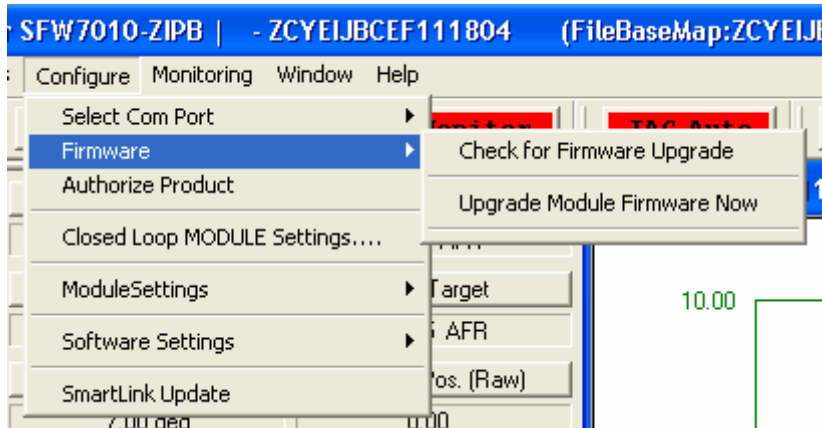
Appendix A5: Configure



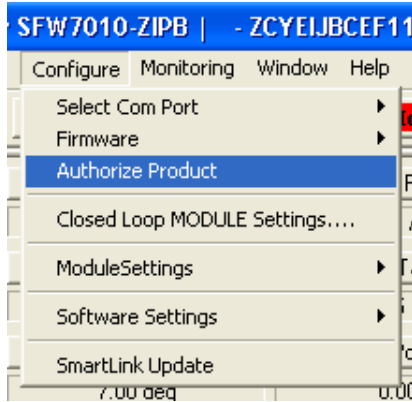
The “Configure” Menu contains options pertaining to the settings of the ThunderMax ECM as well as SmartLink IV.



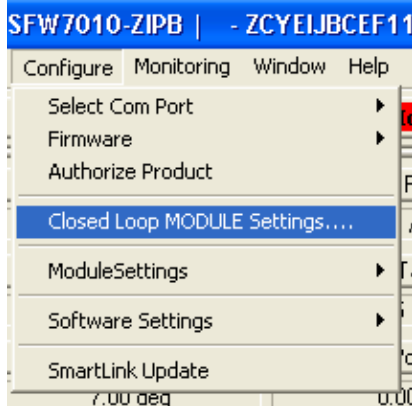
The “Select Com Port” option should never need to be used, however if a problem occurs during the Linking process, this option allows you to specify which Com Port you are attempting to communicate through. SmartLink IV automatically finds the proper Com Port and rarely needs to be told which Port to use. This option is only for those rare instances.



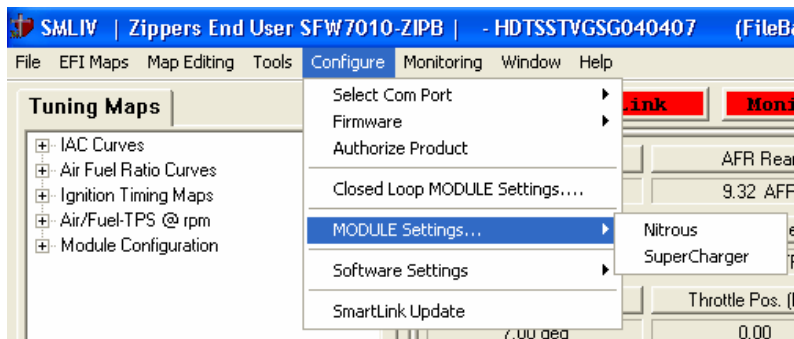
The “Firmware” option allows you to check and upgrade the firmware that is used in the ThunderMax ECM.



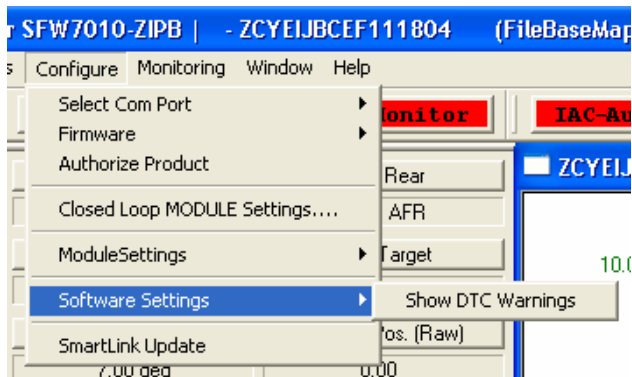
The “Authorize Product” option is only used when upgrading from End User software to Advanced User. This will only be used by tuners who have successfully been approved by Zipper’s to use the Advanced User software. The Advanced User Software is used in the creation of new Base Maps, specific equipment is required to properly create a Base Map.



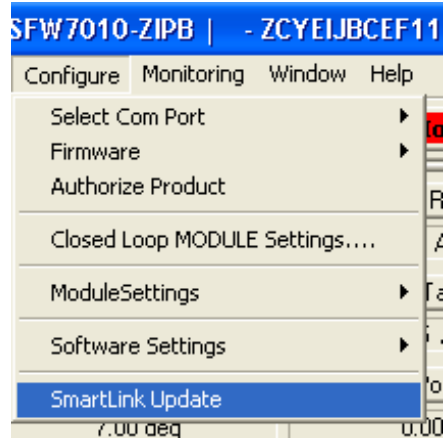
The “Closed Loop MODULE Settings...” option is only used with the Auto-Tune Closed Loop system. This will open a window that gives you several options on how to use the Closed Loop system on your application.



The “Module Settings” option allows you to activate and control the NADS nitrous system and any supercharger system. These settings allow you to make changes to account for these power adders.



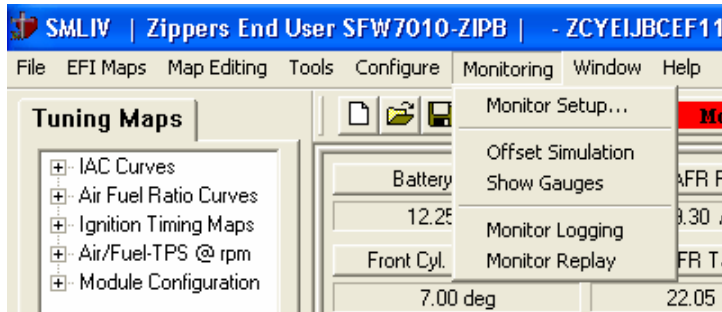
The “Software Settings” option allows you enable or disable the Diagnostic Trouble Code data from being displayed when a link is made to the ThunderMax ECM.



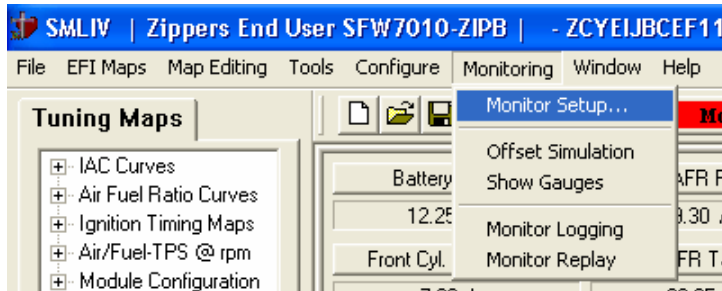
The “SmartLink Update” option allows you to check and see if a newer version of SmartLink is available. You will need an internet connection to check for updates.

The SmartLink software package is constantly being refined and upgraded, no matter what version you may have purchased, a free upgrade is always available as the software improves.

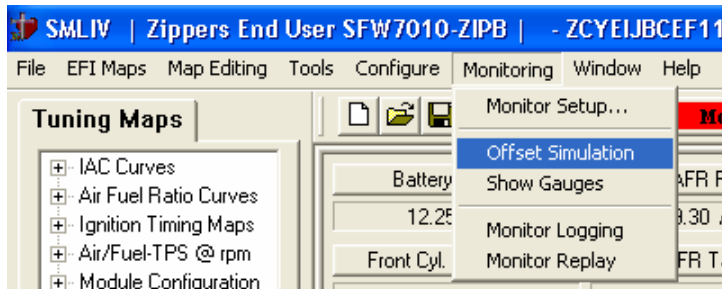
Appendix A6: Monitoring



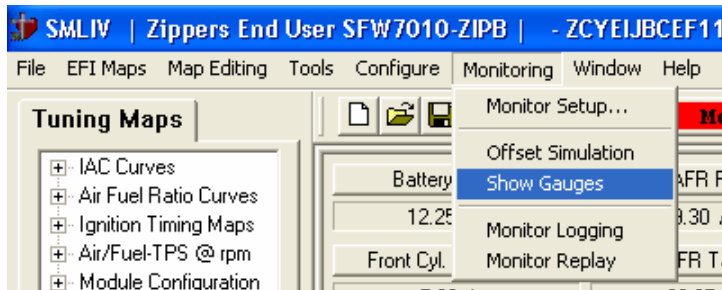
SmartLink IV Monitoring is used while performing live tuning, to keep a watchful eye on the vital engine data. Also the monitoring function allows you to customize your gauge layout, and record an operating session.



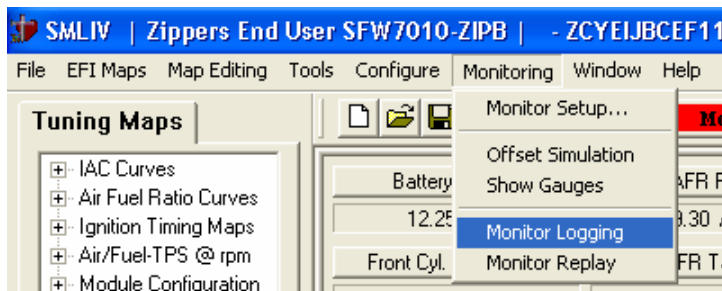
The “Monitor Setup...” option allows you to choose which monitored values you want displayed on the main Monitor View page.



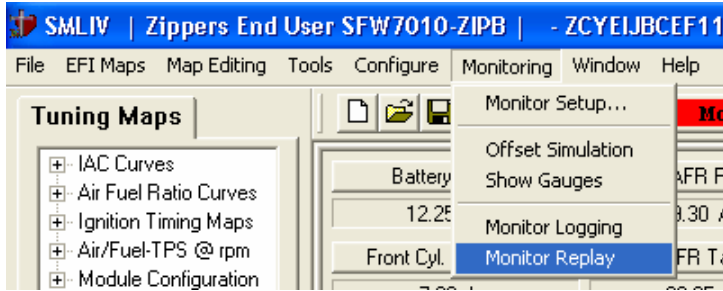
The “Offset Simulation” option is solely used in Technical Support situations. This allows the Zipper’s Technical Support to see the offsets created in your module.



The “Show Gauges” options allows you to toggle the visibility of the customized Monitor Gauges.

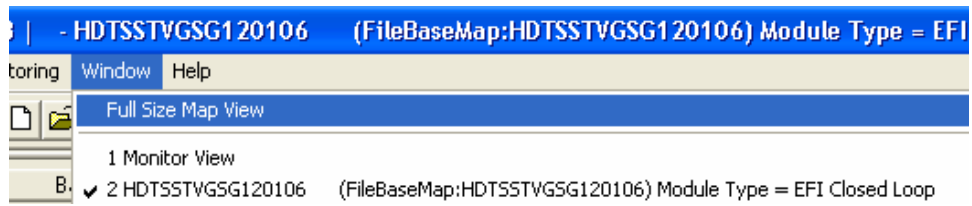


The “Monitor Logging” option allows SmartLink IV to record a tuning or operating session for later review or replaying. Very useful when a tuning issue arises.



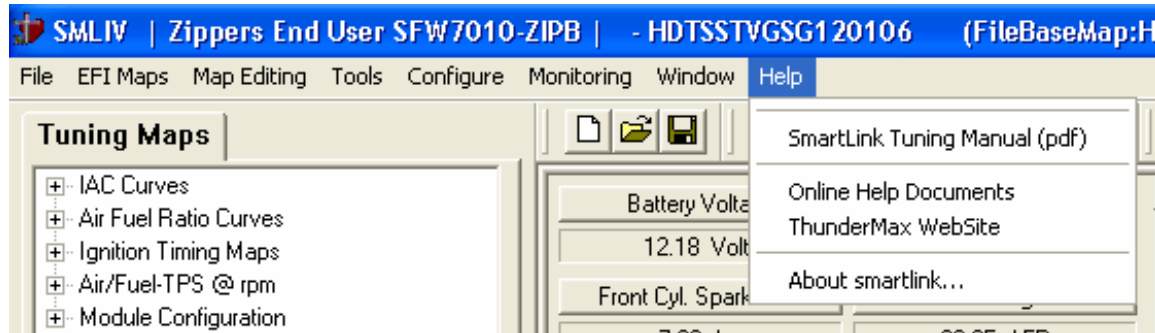
The “Monitor Replay” option allows you to open recorded Monitor Logs for review. This is a great tuning aid when troubleshooting operating issues.

Appendix A7: Window

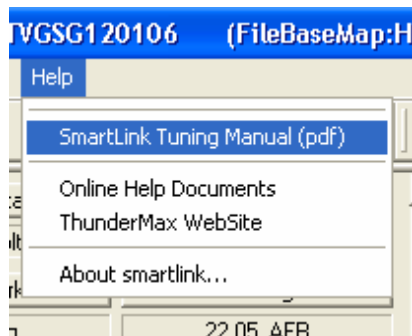


The Window menu allows you to maximize the Tuning Map window.

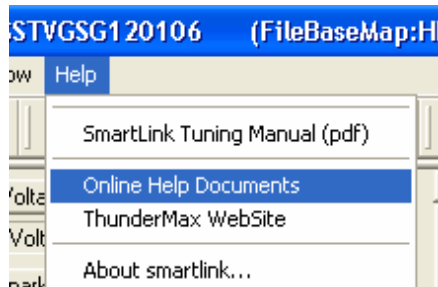
APPENDIX A8: Help



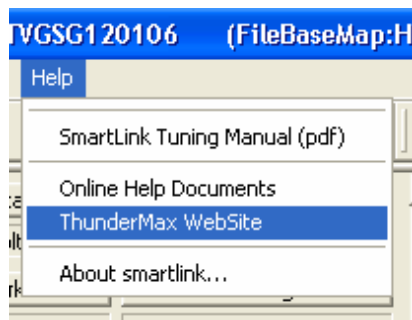
The Help menu has four options which all relate to technical support for the ThunderMax ECM and SmartLink IV.



The SmartLink IV Tuning Manual (pdf) is now easier to find, simply select this option and the latest Full Tuning Manual will open in Adobe Reader.

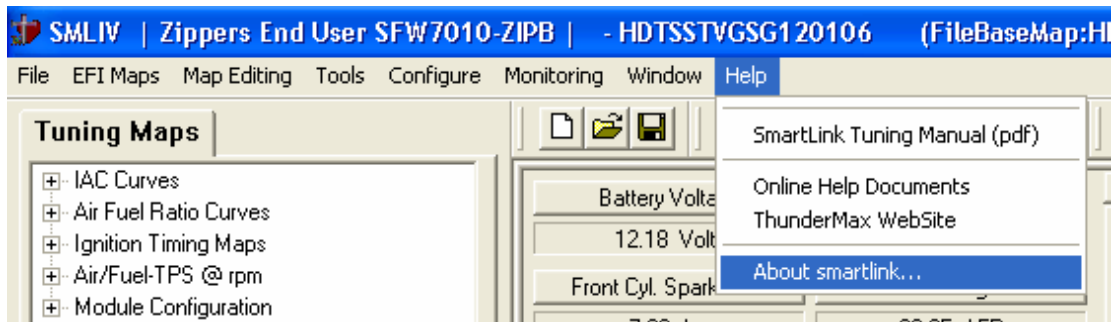


The “Online Help Documents” is a link that takes you directly to the Instructions section of the ThunderMax website. Any additional support documents can be downloaded from this site.



Simply select “ThunderMax Website” and now your default web browser will open directly to the ThunderMax site. The website contains all of the supporting documents, as well as information about additional ThunderMax products, larger throttle bodies, ThunderMax Cams by Red Shift, etc.

Appendix



The “About SmartLink...” option will display the current SmartLink IV version number, as well as the current ThunderMax ECM Firmware version if linked to a module.

ThunderMax EFI Technical Support Information

FAX IN SUPPORT FORM - FAX TO 410-579-2835

Contact Information:

Name			
Company			
Address			
Phone			
Fax			
Email			
1	Motorcycle	Year	
		Model	
		Engine Size	
			(Verify the year by the serial number on the stock ECM)
2	Throttle Body	Manufacturer	
		Size	
3	Air Cleaner	Manufacturer	
4	Exhaust System	Manufacturer	
		Model	
5	Camshaft	Manufacturer	
		Grind Number	
6	Cylinder Heads	Manufacturer	
		Estimated Compression Ratio	
7	Map Number (16 Digit)		
	Is the map modified?		
8	Open Loop		
	AFR at idle or WOT		
9	Closed Loop (AutoTune)		
	CLP enabled on Map & ECM?		
	AFR override checked?		
	Session map %		
	Maximum %		
10	Describe the problem that you are having, along with any symptoms experienced.	Please include your firmware and software version numbers	

Did you email your map or monitor log file to ProductSupport@ZippersPerformance.com for review?