

# THUNDER MAX 50

EFI Made Simple. (E.O. D-644)

## Part # 309-370,73 for Big Twin Models

**Thank you for purchasing a ThunderMax 50 ECM!** Please read through the following instructions before beginning the installation procedure. Following these instructions will ensure that the ECM is installed and setup properly for optimal results. If you have any problems or questions, please refer to the SmartLink Tuning .pdf Manual, included on the CD (Help Menu) with this package. **Installation Note:** ThunderMax 50 installation requires an exhaust system modified for or equipped with oxygen sensor bungs.

**Step 1 (309-370, 309-373 Modules have labels pre-attached before shipping, this step not required)**

**Affix the Executive Order Label.** Enclosed in this package are labels with the approved Air Research Board Executive Order identification number. This label must be affixed to the module in the machined pocket found on the face of the ThunderMax 50 ECM (see photo). **You must attach the correct label for your bike's model year:**



**# 309-370 (2001-2005 88" Models) – E.O. # D-644**

**# 309-373 (2006\* 88" Models) – E.O. # D-644**

**\*Except 2006 FXD models**

**Step 2** Insert the SmartLink CD into your computer. SmartLink will automatically open the InstallShield Wizard when the computer finds the CD-Rom. Follow the instructions and install the software on your computer. If you do not have a serial port on your computer for the communication cable, you will need to use a USB to Serial converter (an inexpensive converter is available from Zipper's, #372-000). Install the included driver disc at this time; follow the instructions given by the manufacturer of the converter for installation.

## Installation / Setup Guide

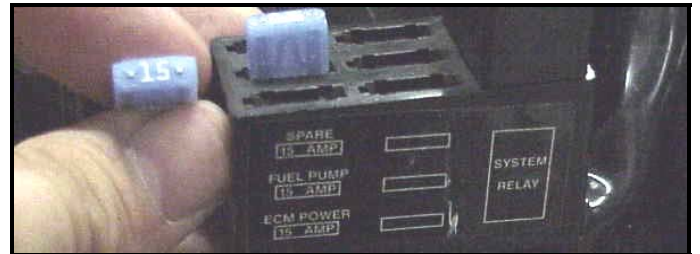
**Please Note: This product is Legal in California (EO # D644) for use on:**

**# 309-370** 2001-2005 Softail® Model H-D  
2002-2005 Touring Model H-D  
2004-2005 Dyna® Model H-D

**# 309-373** 2006 Touring & Softail Model H-Ds

**Step 3** Install the ThunderMax 50 module. **Special Note:** Module location on some model motorcycles (notably all Dyna® and Softail® Rocker® models) makes it difficult to insert the communication cable once the module is installed. An 8" 'pigtail' harness is available (# 309-324) that can be permanently connected to the bike's ECM harness plug, allowing a remote port for the communication cable if desired.

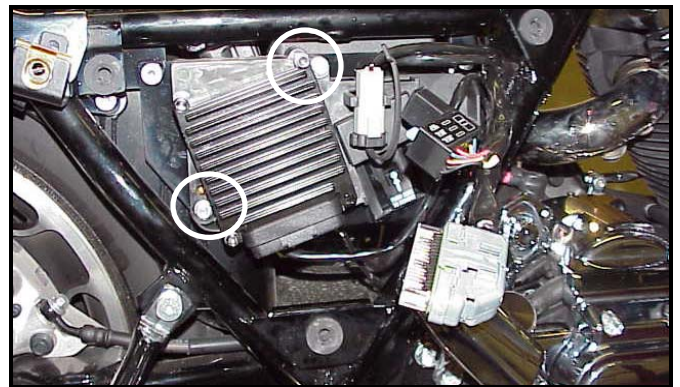
**All Models** - Locate the fuse box that contains the ECM fuse, remove fuse labeled "ECM POWER".



### Touring Models

**FL-A.** Unplug the ECM wiring harness from the factory ECM.

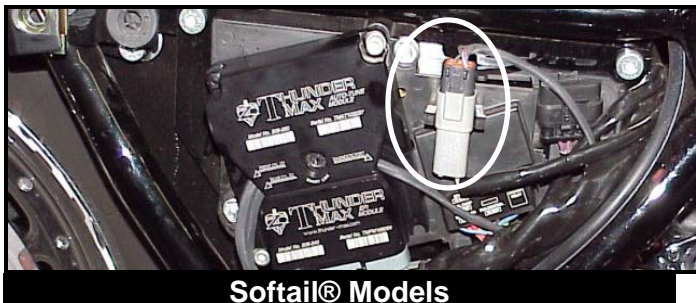
**FL-B:** Remove the factory ECM from the motorcycle, the ECM is held to the electrical caddy by socket head cap screws. The screws have a locking agent on them and can be difficult to remove. Work the screws back and forth slowly to break them loose.



**FL-C:** Install the ECM wiring harness to the ThunderMax 50 ECM. *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.*

**FL-D:** Route the AutoTune harnesses through the frame opening before positioning the ECM for installation. **Re-install the ECM fuse** and secure the fuse box back into position on the electrical caddy.

**FL-E:** Mount the ThunderMax 50 ECM onto the electrical caddy using the two factory socket head cap screws. **Plug the AutoTune harness into the data port (shown).**



**ST-A:** Remove the seat, locate and remove the ECM fuse. Remove the stock ECM from the motorcycle and the wiring harness plug from the ECM. Lift the battery up from the oil tank and remove the battery cables (negative first). Remove the battery.



**ST-B:** 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.



**ST-C:** Connect the ThunderMax 50 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.



**ST-D:** 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). Ensure that the rear O<sub>2</sub> harness plug is positioned closer to the swingarm pivot bolt so it will not be crushed between the upper swingarm and the oil tank at full stroke (suspension bottomed).



**ST-E:** 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.

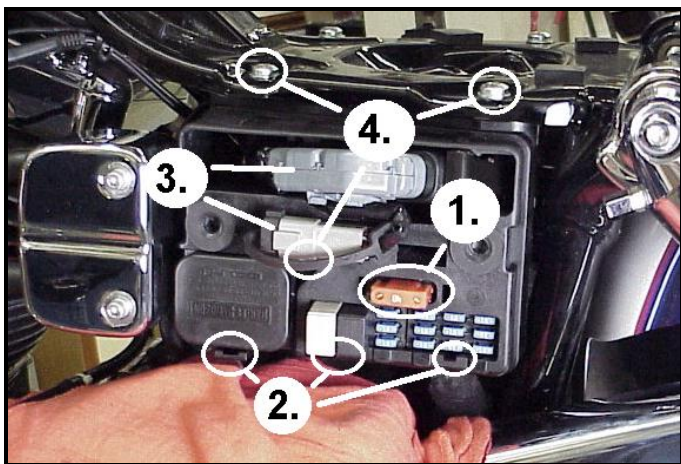
**ST-F:** Re-install the fuse block bracket bolts and attach the ThunderMax 50 ECM to the ECM tray. Re-install the battery (positive cable first) and **install the ECM fuse**. **Plug the AutoTune module into the data port plug on the motorcycle.**



## FXD (Dyna®) Models

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

caddy for removal (4). Unplug the plug wires and harness from the coil and remove the caddy.



**FXD-B:** Remove the stock ECM from the electrical caddy. The caddy must be slightly modified for additional main harness connector clearance.



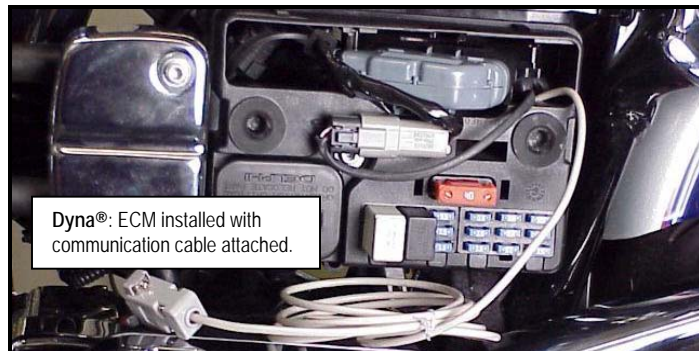
Use a Dremel or Roto-Zip tool to provide additional clearance for the harness plug catch; also remove approximately 3/8" from the partition support as shown.

**FXD-C:** 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 50, or the optional 'pigtail' harness mentioned in step 2 used. If using the communication cable, feed it and the AutoTune power harness through the ECM plug port of the caddy and mount the ECM to the caddy as shown. The oxygen sensor harnesses should exit towards the opposite side of the caddy.



**FXD-D:** 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 and main fuse. Plug the AutoTune module plug 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 an open data port if desired. After programming and setup, the communication cable can be coiled up and kept under the caddy cover if not using the 'pigtail' harness.



Dyna®: ECM installed with communication cable attached.

### Oxygen Sensor Installation

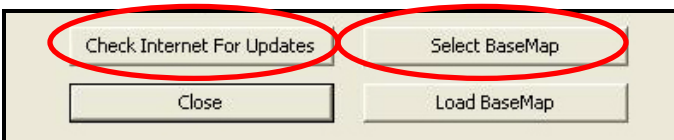
Install supplied wide band oxygen sensors in the front and rear exhaust pipes. Proper installation of the sensor bungs into factory headpipes presents no clearance problems, however, some aftermarket pipes equipped with bungs may require exhaust pipe modification or sensor bung relocation for interference-free installation as the supplied sensors are longer than the factory models some pipe manufacturers use for reference. The sensors must mount freely without contacting surrounding components. **If this is not possible, do not attempt to bend or modify the sensor in any way as it is a sensitive electronic component and will be damaged if you do.** Modify the pipe if required for clearance. Weld-in bungs are available for exhausts systems not equipped with bungs or if current bungs present clearance issues. Bungs should be located no more than 3-4" from the head/pipe connection (for ideal location, refer to the factory location on 2007-up models). Weld-in bungs are available from Zipper's (#272-200, straight; #272-202, angled). After installation, route the sensor harness away from the engine and along the frame when possible, above the lowest frame point to avoid the possibility of dragging ground during operation. Avoid routing harnesses where engine movement or moving parts can contact and damage the harnesses or connector plugs.

Connect the sensors to the closed loop module. The AutoTune harness for the rear cylinder sensor is shorter and can be easily identified by black tracers on all of its wires; both plugs are clearly marked for front and rear use. It is very important to install these correctly or the engine will perform poorly! Tie the harnesses to the frame or existing component harnesses, taking care to avoid contact with any vibrating component that may chaff the sheathing or wires. Some disassembly of bike components may be required for best harness routing.

**FXD Tips:** The rear harness mounts easily, just coil the excess wires and locate them above the transmission. To install the front harness, remove the rear gas tank mounting bolts and loosen the front mounting bolt. Lift the gas tank from the rear, pivoting it on the front bolt. Prop the tank up with a block of wood, exposing the frame backbone. The front harness should travel from the AutoTune module, along the left side of the frame backbone with the oxygen sensor connector plug positioned just above the top engine mount. After installing and tightening the sensor, route the sensor lead up along the left front downtube to the frame backbone and complete the connection to the AutoTune harness. View the connector position with the gas tank in place and tie the wires to the frame; once you have verified gas tank/motor mount clearance, re-tighten tank.



**Step 4** Load a Base Map to your SmartLink software. Selecting a base map for your ThunderMax is easy thanks to the filtering system in the SmartLink software. Open SmartLink; from the toolbar choose **[EFI Maps]** **[EFI Map Listings / Definitions]**. You should first update the Map Definitions file to ensure you have the latest available maps. Close the **[Base Map Definitions]** window, then click the **[Check Internet For Updates]** button (requires internet connection; follow prompts). After updating, select **[Select BaseMap]**.



Available base maps will be shown (if the **[Clear Filters]** button at the lower left of the screen is highlighted, click it to clear filtered maps so all maps will be shown).

Item	Manufacturer	Engine Type	Family	Throttle	Exhaust	Muffler
1	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Head Pipe	Stock HD Muffler
2	HarleyDavidson	88ci	TwinCam A&B	Stock HD TC 06-07 all, 08 FX (25° Inj)	Stock HD FL Head Pipe	Stock HD Muffler
3	HarleyDavidson	88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Head Pipe	HD SE Touring Mu
4	HarleyDavidson	96ci	TwinCam A&B	Stock HD TC 06-07 all, 08 FX (25° Inj)	Stock HD FXST Head Pipe	Stock HD Muffler

Filter the maps to locate a base map that best matches your application by placing your cursor **first** over any 'Engine Type' that matches your engine and right-click it. All maps that do not match your selection will be filtered from the screen.

Item	Manufacturer	Engine Type	Family
1	HarleyDavidson	88ci	TwinCam A&B
2	HarleyDavidson	88ci	TwinCam A&B
3	HarleyDavidson	88ci	TwinCam A&B
4	HarleyDavidson	96ci	TwinCam A&B

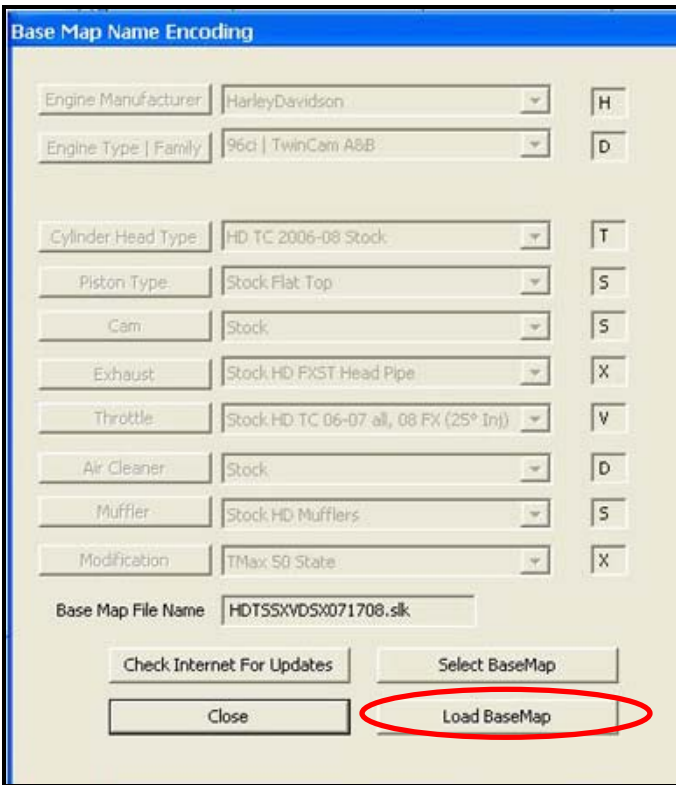
**Second**, place your cursor over the 'Throttle' column and right click your match.

Engine Type	Family	Throttle	Exhaust
88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Head Pipe
88ci	TwinCam A&B	Stock HD TC 06-07 all, 08 FX (25° Inj)	Stock HD FL Head Pipe
88ci	TwinCam A&B	Stock HD 01-05 (Stock 4.22 Inj)	Stock HD FL Head Pipe
96ci	TwinCam A&B	Stock HD TC 06-07 all, 08 FX (25° Inj)	Stock HD FXST Head Pipe

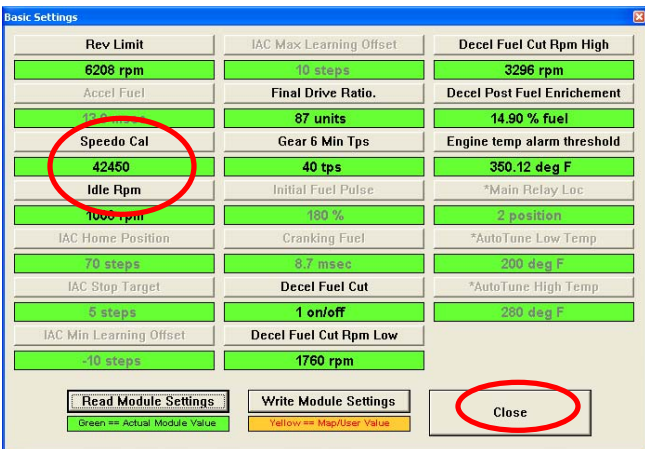
**Third**, right-click the 'Exhaust' type that closest matches your application.

Throttle	Exhaust	Muffler
Stock HD 01-05	Rinehart FL True Duals	N/A
50mm Zipper	Rinehart FL True Duals	N/A
Stock HD TC 06-07 25° Inj	Rinehart FL True Duals	N/A
Stock HD TC 06-07 25° Inj	Rinehart FL True Duals	N/A

**Fourth**, right click the 'Muffler' column if further definition of the exhaust system is required (depends on exhaust application). Keep right-clicking the application columns until you have located the best map match (in the case of identical maps, choose the latest date). Highlight the map you've chosen (left-click; blue bar indicates selected map) and click **[Close]** button. This brings you to the 'Base Map Name Encoding' page, from which you can review the map parameters. Click the **[Load BaseMap]** button to load the map into the software.



**Step 5** From this page you can load the base map into the software by clicking the **[Load Base Map]** button. **[Close]** this page to view the open map page. From the 'Tuning Maps' Tree, click the + sign next to **[Module Configuration]**, then double-click **'Basic Settings'**. The basic settings page opens. Check to see if the

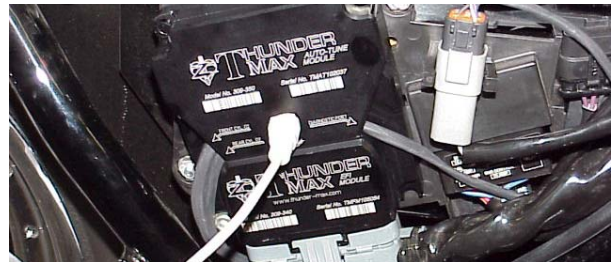


**[Speedo Cal]** calibration setting matches your year and model; if not, click the button, enter the correct value as shown, then click **[Close]**.

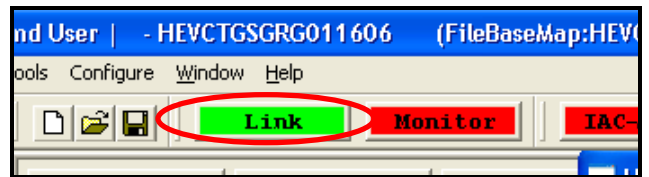
### Speedometer Calibration Settings

Dyna®	2004-2005 FXD	40960
Softail®	2001-2003	4352
	2004-2006	40960
Touring	2002	4352
	2003	20480
	2004-2006	40960

**Step 6** Now you are ready to 'Link' and 'Write' the map to the ECM. Attach the communication cable from your computer to the ThunderMax module, making certain that the cable is routed away from any part of the motorcycle that generates heat.

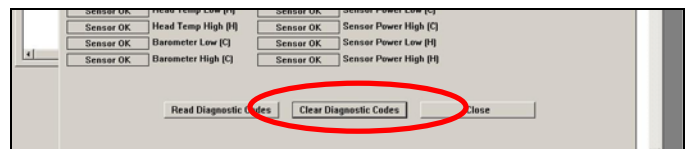


**Step 7** To link to the module, turn the key switch to the "Ignition" position, making certain the "RUN / OFF" rocker switch (Kill Switch) on the handlebar controls is in the "RUN" position. Select the "Link" Button in the SmartLink software. The button turns green to indicate a successful link. Answer **[No]** to the "Do you wish to READ the module map now" question at this time.



From the toolbar, click **[File] [Write Module Maps and Settings]**, answer OK to the message that informs you that you are about to overwrite the current map in the module; the transfer bar appears during the map load.

**Step 8** Verify Module Settings. Before performing this step, clear any active Diagnostic Code readings. While linked, from the Tuning Tree select **[Module Configuration] [Diagnostic Codes]**.



When the Diagnostic Codes window appears, select [Clear Diagnostic Codes]. After completing this step, select Basic Settings from the Module Configuration menu and verify that the speedometer calibration is correct. After verifying these settings, click [Write Basic Settings].

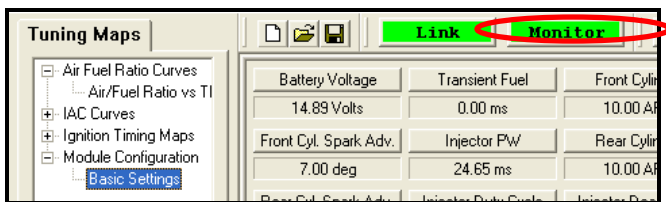
**IMPORTANT STEP BEFORE STARTING**

Next, 'Initialize' the ThunderMax ECM. Initializing establishes 'home' positions for the TPS and IAC, and is a required step any time battery power has been interrupted or established to the ThunderMax ECM. With the handlebar switch in the 'ON' position, cycle the key switch on and off 3 times, leaving the ignition on, and off for 30 seconds each cycle. DO NOT start the engine or move the throttle during this process. After 3 on/off cycles, make certain that the motorcycle is in neutral and start the bike 2 times, letting it settle at idle for 10 seconds; the idle should be smooth and steady. Some engines may require several on/off engine starts to initialize properly. After initialization, shut off the engine, but stay linked for step 9.

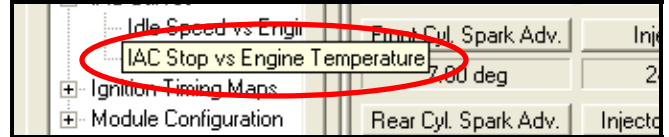


**Step 9** Before restarting the engine, from toolbar click [Monitoring] [Show Gauges]. The "Engine Speed", "Engine Head Temp", "IAC Position", "AFR Front", AFR Rear" and "AFR Target" gauges are automatically formatted and are shown on the screen. Additional gauges can be created if desired (see SmartLink Tuning Manual under Help menu), but the above gauges are most helpful during initial set up. You may select any gauges that you deem important; if too many are chosen your screen may appear cluttered.

**Step 10** Select the "Monitor" button to active the gauges. It is located beside the "Link" button and will turn green when the monitor gauge functions are live. The gauges will be displayed if they were not already on the screen.



**Step 11** Now select the IAC Stops vs. Engine Temperature page from "IAC Curves" menu within the tuning tree. Strike the



spacebar to show the actual values of the tuning block (use left/right arrow keys to move the block marker). Make certain that the motorcycle is in neutral and the engine is cold, and then start the engine. Once the engine idle is stable after 15- 20 seconds, select the "IAC-Auto" button (Idle Air Control Auto Adjustment). Allow the "IAC-Auto" function to run at idle until the engine head temperature reaches 275 degrees. After reaching temperature of 275 degrees, the "IAC-Auto" function automatically shuts off. You can terminate this function at any time, and re-run it at a later time if you wish.

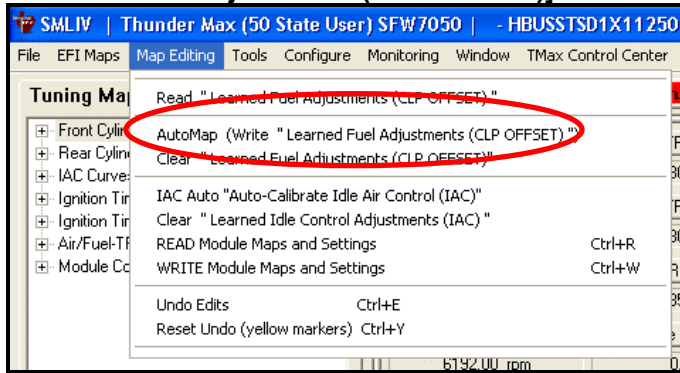
**Step 12** Unlink the SmartLink software from the ECM, turn off the ignition switch and remove the communication cable from the ThunderMax ECM. The motorcycle is now ready to be ridden. Several riding sessions that allow the engine to reach normal operating temperature should be completed. During this process, the IAC virtual stops will automatically be adjusted to the IAC target values set within the map's basic settings. This feature automatically adjusts how the engine comes back to the specified idle speed. If the IAC stops are set too low, the engine will dip below the specified idle speed during certain transient conditions. If the IAC stops are above the IAC position, the engine will idle above the idle rpm specified in the idle speed vs. engine temperature page.

**Step 13** After riding the motorcycle, re-link and "write" the AutoTuned map points to the base map within the module. The AutoMap (Map Editing) function resets the Base Map points to the learned offset point values. This "reset" allows the AutoTune systems to use its maximum range to make future adjustments. Some examples of conditions the AutoMap functions will correct for are:

- Different Exhaust Pipes
- Injector Flow Rates, Spray Angles
- Throttle Body Tolerances
- Fuel Pressure Variances
- Large Changes in Ambient Conditions
- Normal Engine Wear.
- Fuel Quality (ethanol, octane ratings etc.)

To perform the AutoMap function, first ride the motorcycle for 100+ miles, stopping several times to cycle the ignition switch off and on. Vary the RPM and load as much as possible for the ECM to "see" as much RPM variances and throttle positions as possible for it to auto-adjust the fuel points. Once this is done, link and "read" the module [File] [Read Module Maps and

Settings], then select [Map Editing] [AutoMap (Write "Learned Fuel Adjustments (CLP OFFSET)].



The following window will appear; choose [Read Module, Perform AutoMap, Write Module].



The adjusted fuel points will be automatically smoothed and the base map re-written with the new, optimized fuel points. Save the modified map to your hard drive before unlinking, and go ride!

## TIPS AND GENERAL INFORMATION

- **ThunderMax 50** requires an exhaust system modified for or equipped with oxygen sensor bungs.
- **Several support features** are located under the [Help] menu; some require an internet connection.
- **A comprehensive Operation Manual** in PDF format is included within the SmartLink program under the [Help] menu for viewing and printing from your desktop.
- **When the SmartLink program is opened**, it will automatically retrieve and open the last map that was open.
- **2003 FLT/FLHT models:** H-D® used 2 different speedometer calibrations during the extended 2003 model production. Check the part number on the back of your factory ECM. Calibration **20480** is used if the part number ends in -03, while **4352** is used if the ECM p/n ends in -02. If your turn signals don't cancel on a 2003 model, try the alternate setting.
- **Oxygen Sensor Care:** Items that can damage or shorten the life of your sensors:
  - Leaded fuel – Race fuel
  - Oil deposits from oil consumption problems
  - Excessive moisture exposure
  - Excessive (extreme) heat