Harley-Davidson®



Electronic Fuel Injection Race Tuner User's Manual

MODEL YEAR 2005 SOFTWARE UPDATES

- 'Copy and Paste' has been implemented in this version. Single cells, multiple cells, and whole tables can now be copied from one calibration and pasted onto another. 'Ctrl-C' and 'Ctrl-V' short cuts work the same as other Windows programs.
- The 'Edit' menu now includes a 'View and Edit Item Tuning Comments . . . ' selection. This is a place to put notes about the table you are presently working on. Each table can have its own set of notes and these notes are saved with the calibration file.
- Hot Keys" are still available.
 - "Ctrl-L" opens the Load file dialog box
 - "Ctrl-S" opens the Save dialog box
 - "Ctrl-P" opens the Program dialog box
 - "Ctrl-X" opens the Exit dialog box

The "-" key will decrement the values in a highlighted cell or group of cells

The "+ " or"=" key will increment values in a highlighted cell or group of cells

- To re-size screens, simply drag the corner.
- In "Basic Mode" when you change a value and save, changes remain visible, rather than defaulting.

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INTRODUCTION

The Screamin' Eagle EFI Race Tuner Kit will provide the experienced race tuner with tools and data similar to what Screamin' Eagle uses to create its EFI calibrations for Stage Kit configurations. The system is designed for Harley-Davidson Electronic Sequential Port Fuel Injection, (ESPFI) systems offered on 2001 and later Softail and 2002 and later Touring model motorcycles, (from here on referred to as the "current ESPFI" system.

KIT CONTENTS

- 1-CD containing:
 - Tuning Mode program including Basic and Advanced sections
 - Data Mode program
 - Screamin' Eagle EFI calibrations up to the time of this printing for 2001 and Later EFI-equipped Softail models, 2002 and Later EFI-equipped Touring models, 2004 and Later Dyna models, and 2002 and Later V-Rod models.
 - User's manual
- Computer Interface Module
- Specialized Cable to connect Computer Interface to Data connector on vehicle
- 9-pin male-to-female Serial Port to connect Computer Interface to your computer

This product is designed for Race Use Only



DISCLAIMER & WARNINGS

Do not install the EFI Race Tuner on any model other than those specified in this User's Manual. Doing so may result in poor engine performance, electrical-system damage, and/or engine damage.

This Screamin' Eagle EFI Race Tuner system is intended for high-performance applications only. This engine-related performance part is not legal for use on pollution-controlled motor vehicles. Use of this Screamin' Eagle EFI Race Tuner system may reduce or void the Limited Warranty Coverage.

This Screamin' Eagle EFI Race Tuner system allows the engine to reach optimum RPM. It is extremely important that the rider use the tachometer to avoid harmful RPM's and possible engine damage. Engine-related Performance Parts are intended for the experienced rider only.

Do not exceed 6200 RPM on all Twin Cam 88 engines that use stock valve springs. Exceeding 6200 RPM on these vehicles may cause engine damage.

Do not exceed 6200 RPM on balanced Twin Cam B 88 engines, regardless of additional engine modifications. Exceeding 6200 RPM on these vehicles may cause engine damage.

HOW TO USE THIS MANUAL

First – Read the Introduction to Harley-Davidson EFI Systems

While it may be tempting to bypass instructions in favor of immediately using the Screamin' Eagle EFI Race Tuner, it is likely that some, or all of the information in the next chapter; Introduction to Harley-Davidson EFI Systems will be critical to your successful use of this product. Read this chapter to gain a foundation of knowledge in how the EFI system functions.

Second – Glance Thru the User's Manual

Take a few minutes to glance through all pages of this User's Manual to get familiar with its content.

Third – Get Comfortable With the Tuning & Data Mode Programs

Open and view the Basic, Advanced and Data Mode sections of the Tuning Mode and Data Mode Programs to get comfortable with their many terms and functions. Click on every box to view the drop down lists and other command windows. When you encounter a term or function that you want more information about, use the Index or Glossary in this Manual or click on the Find Icon in the Adobe[™] Toolbar, (looks like a pair of binoculars) in the menu bar at the top of the Adobe screen. This will locate the page or pages where the word exists.

Note that much of the User's Manual has information organized in colored text boxes:

Explanations, descriptions and functions are provided in blue-colored text boxes

Step by step commands are provided in yellow-colored text boxes

Tips, notes and warnings are provided in gray-colored text boxes with orange trim

Fourth – Use this Manual as a Reference Tool

The Screamin' Eagle EFI Race Tuner Kit offers so many tools for tuning and can be used in so many ways that it will likely take the user some time to fully comprehend the depth of all they can do. For that reason, the User's Manual is designed primarily for reference.

Note: There is also a <u>Contents</u> section located in the <u>Help</u> selection of both the Tuning Mode & Data Mode software programs. Additional information can be found there that supports the use of this product.

HARLEY-DAVIDSON EFI SYSTEMS

How It Works

Before discussing how the Screamin' Eagle EFI Race Tuner kit works it is important to understand how the Electronic Fuel Injection system functions on 2001 and Later EFI-equipped Softail models, 2002 and Later EFI-equipped Touring models, 2004 and Later Dyna models, and 2002 and Later V-Rod models. That said, it is assumed that the user of this product has a thorough understanding of internal combustion engine operation.

Harley-Davidson Electronic Sequential Port Fuel Injection System, (ESPFI)

This completely new engine management system was released starting with select 2001 model year Softail motorcycles. This system is a speed/density, open loop, sequential port fuel injection design that also controls spark timing and spark intensity.

Speed/Density System – When the ECM monitors manifold air pressure, air temperature, throttle position and engine rpm to manage fuel delivery.

Open Loop Control – When the ECM monitors sensors positioned on the intake side of the engine and does not monitor the end result of internal combustion at the exhaust.

Sequential Port Fuel Injection – When the injector nozzle is positioned in the manifold near the intake valve and is precisely timed to deliver fuel to each cylinder.

This ESPFI system is the exclusive design used on select 2001 and Later EFI-equipped Softail models, 2002 and Later EFI-equipped Touring models, 2004 and Later Dyna models, and 2002 and Later V-Rod models.

Current ESPFI Components

The following is a list of the major components of Harley-Davidson's current ESPFI system. It is important to have an understanding of what these components do before learning how the ESPFI system functions. Refer to the appropriate Harley-Davidson Service Manual for the vehicle you are working on for additional information on component design and function and for the physical location and testing procedures for each individual component.

ECM – Electronic Control Module – this is the brain of the system that collects input signals from multiple sensors, makes decisions and sends output signals to deliver fuel and spark to the engine.

CKP – Crank Position Sensor – this sensor provides input signals to the ECM that indicate engine rpm, (how fast the engine is running in **R**evolutions **Per M**inute.) The ECM also uses these inputs to determine what stroke the engine is in so it can deliver the fuel and spark at the desired time.

HARLEY-DAVIDSON EFI SYSTEMS - CONT'D

MAP – Manifold Absolute Pressure – This sensor provides input signals to the ECM and reacts to intake manifold pressure and ambient barometric pressure. Intake manifold pressure reflects changes in engine speed and load. Ambient barometric pressure reflects changes in atmospheric pressure caused by weather conditions or changes in altitude. The ECM uses the inputs from this sensor to help calculate how much air is entering the engine.

IAT – Intake Air Temperature – This sensor provides input signals to the ECM as it reacts to the temperature of the air entering the engine. For example, hot air has less oxygen in it than cool air. The ECM uses the inputs from this sensor to help calculate how much oxygen exists in a quantity of air.

ET – Engine Temperature – This sensor provides input signals to the ECM as it reacts to the engine temperature of the front cylinder head. The ECM uses the signals from this sensor to determine if the engine is at operating temperature, or warming up.

TP – Throttle Position – This sensor provides input signals to the ECM as it reacts to throttle shaft rotation, telling the ECM throttle position, if the throttle is opening or closing, and how fast it's opening or closing.

VSS – Vehicle Speed – This sensor provides input signals to the ECM to indicate if the bike is moving or sitting still. It is used mostly to assist the control of idle speed.

BAS – Bank Angle Sensor – This sensor is located in the turn signal module and it sends a signal to the ECM if the bike leans over more than 45° from vertical. If the ECM gets this signal for more than one second it assumes the bike fell over and it shuts down both the fuel management and ignition circuits.

Ion Sensing System – This system uses ion-sensing technology to detect detonation or engine misfire in either the front or rear cylinder by monitoring the electrical energy at the spark plug following every timed spark. If an abnormal level of energy is detected across 2 or 3 spark firings the ECM responds by retarding spark timing in the problem cylinder as needed to eliminate it.

Fuel Injectors – The fuel injectors are electric valves that open and close to deliver a high-pressure spray of fuel directly at the intake valve. They are controlled by output signals from the ECM to deliver fuel at a precise moment. If more fuel is needed, the ECM will signal the injector to remain open for a longer period of time. The period of time is known as the injector "pulse width" and is measured in milliseconds. One method of rating fuel injectors is by their flow rate – such as in gm/sec, or grams per second.

Electric Fuel Pump – A 12-volt high-pressure fuel pump, (located in the fuel tank) supplies fuel under pressure to the fuel injectors.

Fuel Pressure Regulator – A mechanical device that controls fuel pressure to 55-62 PSI by returning excess fuel from the fuel pump back to the fuel tank.

HARLEY-DAVIDSON EFI SYSTEMS - CONT'D

IAC – Idle Air Control – An electric valve that's threaded, (each rotation is a "step") and controlled by output signals from the ECM to open and close as needed to allow enough air into the engine for starting and idle operation. The greater the number of IAC steps, the greater the amount of air enters the engine through the IAC passages.

As mentioned, the ECM is the brain of the ESPFI system. And, like our own brain, it has memories and it makes decisions. The ECM memories are located in Look-up tables, (see example Air Fuel Ratio table to right.) The ECM uses several different Look-up tables to make decisions on fuel and spark management. The Look-up tables that are in constant use by the ECM are the VE, (Volumetric Efficiency,) AFR, (Air Fuel Ratio) and Spark Advance tables.



One type of Look-up table the ECM always uses is for VE, which is a percentage rating of how much air is flowing through the engine while running as compared to its theoretical capacity. For example, an engine with a displacement of 88-cubic inches running at 5600 rpm at full throttle has a theoretical airflow capacity of 100% when it flows about 143-cubic feet of air per minute, (cfm). If the same engine flows 107cfm at 5600 rpm it would have a VE of about 75%. And, if the engine flows about 157cfm at 5600 rpm it would have a VE of about 110%. That's right, the VE can exceed 100%, especially in high performance engines that have improved airflow through the engine. VE reacts to engine speed and to anything that increases or decreases airflow through the engine. The VE Look-up tables in the Screamin' Eagle calibrations are calculated from data they gather while testing live engines on engine and chassis dynamometers, and with data acquisition equipment in conjunction with track testing.

Overview of How the Harley-Davidson ESPFI Functions

The front and rear cylinder VE Look-up tables, which are programmed into the ECM, tell the ECM how much air, (volume) is flowing into the engine at different engine rpm and throttle positions.

The ECM also monitors the intake air temperature and manifold absolute pressure, which provide it with an indication of air density, or the amount of oxygen contained in a volume of air.

The AFR, (Air Fuel Ratio) table, which is programmed into the ECM, tells the ECM what AFR the engine should require under specific engine loads, (engine load is determined by monitoring manifold absolute pressure and engine rpm) to produce the performance that's desired.

The front and rear Spark Advance tables, which are programmed into the ECM, tell the ECM the spark advance desired for specific engine loads to produce the performance that's desired.

When the engine is running the series of events typically follows the process below:

- The ECM monitors the CKP, TP, IAT & MAP sensors telling it engine rpm, throttle position, intake air temperature and manifold absolute pressure.
- The ECM looks at throttle position and engine rpm when it refers to the VE Look-up tables. From this information the ECM knows the volume of air that should be entering each cylinder at this moment, under these present conditions.
- At the same time the ECM looks at intake air temperature and manifold absolute pressure to calculate the density of the air entering the engine. Air density tells the ECM how much oxygen is in the air entering the engine.
- Now the ECM knows exactly how much oxygen is entering each cylinder and it refers to the AFR Look-up table for the AFR that's desired. It then sends the appropriate output signals to the fuel injectors to achieve the AFR it has been programmed to deliver for the current engine rpm and engine load.
- The ECM also refers to the Spark Advance Look-up tables for the desired spark advance for each cylinder according to the current engine rpm and engine load. The ECM then sends output signals to the front and rear ignition coils to deliver the desired timing of the spark for each cylinder.

ESPFI System Operation



HARLEY-DAVIDSON EFI SYSTEMS - CONT'D

- When the engine is experiencing a temporary condition such as when the bike is being started on a cold morning, it uses additional Look-up tables that are also programmed into the ECM. For example, a cold engine that's being cranked to start rotates at a very low rpm and needs additional fuel. The ECM reads the ET and CKP sensors, which tell it the engine is cold, and that it's rotating at cranking speed. The ECM then refers to a Cranking Fuel look-up table and directs the fuel injectors to remain open longer, (increasing their pulse width) which delivers a richer air/fuel mixture for starting. It also directs the IAC to open to its programmed number of steps to allow enough air into the engine for starting and idling.
- When the engine starts to run the ECM sees the higher rpm and then refers to a Warmup Enrichment look-up table that it uses to add the additional fuel needed while the engine is still cold. The table is designed to diminish its affect, (referred to as "decay value") to zero as the engine comes up to operating temperature.

ECM Refers to:	When:	Other Factor:	Purpose:	
Cranking Fuel Table	Engine is being started	Engine Temperature	To increase fuel injector pulse width and deliver more fuel for starting	
Warm-up Enrichment Table	Engine is colder than operating temperature		To richen AFR for cold engine and diminish effect as engine warms up	
Idle RPM Table	Throttle is closed	Engine Temperature	To keep idle rpm at desired speed as engine warms up	
Intake Air Control Table	Throttle is closed	Engine Temperature	To allow enough air into the engine for cold engine idle	

HARLEY-DAVIDSON EFI SYSTEMS - CONT'D

Heat Management System

The ESPFI systems on 2002 Touring and Softail series bikes also incorporate a sophisticated heat management system that operates in three-phases to keep things cool in extreme conditions.

Phase I: If the ECM detects engine temperature above approximately 300° F while moving or stationary it reduces the idle speed. A lower idle speed produces fewer combustion events per minute and that reduces engine heat.

Phase II: If the ECM detects an engine temperature that's still drifting higher while moving or stationary it richens the AFR. An increased amount of fuel in the air/fuel mixture has a cooling effect on the engine.

Phase III: If the ECM detects an engine temperature that's still drifting higher while moving or stationary it directs the fuel injectors to skip, (only when the bike is stationary) and not deliver fuel on every intake stroke. This limits the number of combustion events taking place, which produces less heat.

The 3-Phases just described function seamlessly, and the rider may not notice the transition from one phase to the next.

INSTALLING SOFTWARE

Equipment Needed

The Screamin' Eagle EFI Race Tuner software requires Windows NT4 w/SP4 or above, or Windows 2000. It is recommended that the operating system have current Windows updates installed.

Minimum system hardware requirements:

- Pentium-class PC at 133 MHz or above
- Display Resolution 800 x 600 or above, 1024 x 768 recommended
- One available serial RS-232 Communication port

Memory:

- Win NT 4.0 64 MB
- Win 2000/ME/XP 128M
- Hard Drive Space Required: 10 MB

Note: The requirement for a RS-232 serial port. Use of a USB serial port converter is not supported and is not guaranteed to work due to communication timing requirements.

Installation of Screamin' Eagle EFI Race Tuner Software

Data Mode software is supplied bundled with Tuning Mode software on a CD-ROM disk. To install the software, use this procedure:

- 1. Insert the CD into the CD-ROM of the computer.
 - Within a few seconds, the install screen should appear. Click on the Install Products button to bring-up the installation options.
 - Click on the Install Data Mode button to begin the installation process.
- 2. Follow the on-screen instructions during the install process. It is recommended that you use the default installation settings during installation.

Note: On some early Windows 95 machines, the CD auto start may not operate. In this case, use Windows Explorer and navigate to the <CD-ROM>/DM_INSTALL/ directory and double-click on the Setup.exe program

INSTALLING SOFTWARE - CONT'D

Getting Started

The EFI Race Tuner programs are invoked from Windows by double clicking on the appropriate **icon** on the desktop, or by selection from the Start-Programs – **Screamin' Eagle Tools menu**. This will bring up the main display.

Note: The first time the Screamin' Eagle EFI Race Tuner is run, the position and sizing of the forms are set to their default values and are located in the upper left of the display screen. The forms may be re-sized and moved to the positions that best suit your needs and monitor size. The Screamin' Eagle EFI Race Tuner will remember the last position of all forms and return to them the next time the program is started.

OVERVIEW OF SOFTWARE PROGRAMS

Tuning Mode Programs

Basic Tuning Section

The Basic Tuning program is the easiest to use for simple tuning tasks and the program that's recommended for those users who do not have prior experience with EFI Race Tuning. There are 2-basic tuning tables provided:

- Main Fuel Table use this tuning table to adjust the ECM's AFR target for both front and rear cylinders at the same time
- Main Spark Table use this tuning table to adjust the spark advance for both front and rear cylinders at the same time

Additionally, the user can adjust the ECM Tuning Constants, such as engine displacement and fuel injector rate and they can toggle the knock sensor ON/OFF and set engine rpm limit.

Advanced Tuning Mode

This program provides the user with tuning flexibility that's very similar to what Screamin' Eagle uses to create their EFI calibrations. There are a total of 9-Tuning Tables.

- Air-Fuel Ratio Use this to adjust the ECM AFR target value for both the front and rear cylinders at the same time
- VE Front Cyl. Use this to adjust just the Front VE value which will change the ECM calculation for fuel delivery. (VE value tells the ECM how air should be entering the engine in the conditions monitored
- VE Rear Cyl. Same as VE Front Cyl.
- Spark Advance Front Use to adjust just the Front Spark Advance timing
- Spark Advance Rear Same as Spark Advance Front
- Warmup Enrichment Use to adjust the extra fuel the ECM delivers to the engine while it's warming up
- Cranking Fuel Use to adjust fuel enrichment delivered for starting engine
- Idle RPM Use to set idle rpm with engine warming up or at operating temperature
- IAC Warmup Steps Use to adjust IAC Steps to assist idle control in engine as it's warming up

Additionally, the user can adjust the ECM Tuning Constants, such as engine displacement and fuel injector rate and they can toggle the knock sensor ON/OFF and set engine rpm limit.

In either the Basic or Advanced Tuning Modes the user makes edits to the tables desired, saves the new file they created and then programs the ECM with the new calibration.

OVERVIEW OF SOFTWARE PROGRAMS - CONT'D

Data Mode Program

The Harley-Davidson Screamin' Eagle Data Mode Program is a data acquisition program that can be used to record over 20-different types of engine and vehicle data from the vehicle's ECM. The user can record data periods up to 30-minutes for tuning or troubleshooting purposes while testing the bike on a closed-course track or chassis dynamometer. Three mini-programs within the Data Mode program provide the tuner with methods to assess and compare vehicle performance.

Please refer to Section 6.0 for more information.

OPENING TUNING PROGRAM & SELECTING FILE



TIP: Create a LOG that lists the Tuning files you have modified and for what purpose they were modified.

Example: 3283401A.MT2: 2001 & Later Softail 1550 Stage II

"File modified for Screamin' Eagle Pro 2-into-1 exhaust - 64796-00A"

TUNING MODES & LIMITS

Tuning Mode Commands

To select Basic or Advanced Tuning Modes:

- Click on Setup
- 2. Click on Basic or Advanced Tuning Mode in drop down list

🧱 Tuning Mod	le Desić M	ode Acte	Maria			ang katalan			
Elo Edit	Setup In	ble Solad	tion Teb	CONG.	anson 🖁 🖁	la la			
C/Prognet	Setup Dis	play Col	0F8	58.00 /5	de la	ning Hode Fi	e Louded	TwittOAH	677
Store Graph	Setup Sci Options	men Size			THEFT	11 164 17 2005	C 504 C 1004	a C 20 Uwa As C 100 Uwa	
Terrere terrere t	Sanic ox	i Advene	ed Mede 🔃	r Des	ic Node			i	
IFFM	20	30	100.00	C. May	enced Me	de 👘	80	90	1
758.000	1	0.0	0.0	0.0	0.0	0.5	0.0	0.0	184
Concentration (1990)	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	
1250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	124
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	121
1750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	181
2000	0.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0	76 h



Tuning Limits Explanation

The range of adjustment in the Look-up tables will provide the race tuner with a broad range of tuning flexibility. Limits have been set in the software to help the race tuner prevent mistakes that might be damaging to the engine. The colored cells in the example above indicate that the upper or lower limits have been met in those specific cells. Example:

- Green colored cells indicate setting cannot be decremented lower.
- Red colored cells indicate setting cannot be incremented higher.

MENU BAR FUNCTIONS

Menu Bar

Explanation The Menu Bar has File, Edit, Setup, Table Selection and Help command boxes. When you click on each a drop down list can be viewed that provides additional commands.

SEE TABLE BELOW



Menu Bar Functions						
File	File					
Load Tuning File*	Loads File into the Tuning Program					
Save Tuning File*	Save File being viewed					
Print Table*	Print Table currently being viewed					
Program ECM*	Program the ECM with the file currently being viewed					
File Names	Recently Viewed Files					
Exit	Close Program					
Edit						
Edit File Comments*	Edit Comments for file being viewed					
View & Edit Item	Notes Specific to each Table					
Tuning Comments						
Edit Part Number*	Edit Part Number for file being viewed					
Сору						
Paste						
Setup						
Setup Display Colors*	Change Colors for high & low limits, etc.					
Options	Show or not show list of files on program startup					
Basic & Advanced	Select Basic or Advanced Tuning Modes Window					
Mode						
Table Selection						
Main Fuel Table*	View and edit Main Fuel Table					
Main Spark Table*	View and edit Main Spark Table					
ECM Tuning	View and edit engine statistics, fuel injector size, RPM					
Constants*	limits, Knock control, etc.					
Help						
Contents	View Information about Tuning Mode Program					
About	View Information: software, revisions, licensing, etc.					

Indicates this item is covered in greater detail in this User's Manual

LOAD & SAVE TUNING FILES



Tip: Create a new file name for any files you have modified and Keep a LOG of the file names with a description of what the modification was for, such as for a specific exhaust system or camshaft.

TIP: Create additional Folders to group your files by motorcycle model or performance configuration.

Warning: Some early versions of Windows 95™ will not allow long file names.

PRINTING TUNING TABLES



Print Tuning Files Table of Options				
File Select Font	Choose from a large assortment of True Type® font types and sizes to customize the look of the printed table			
Page Setup	Change paper size and orientation, margins and print commands			
Print Setup	Change commands for printer output			
Print	Send table in view window to default Print window and select how many copies you want. Or, select Print to File and window will open to select what folder to send the table to.			
Exit	Close Print window and return to Tuning Mode			
Options Show Cell Colors	Toggle limit colors on and off for printing			

PROGRAMMING ECM

Programming ECM Commands

- 1. Click on File in Menu Bar
- 2. Click on Program ECM See command options and information below



ECM Programming Commands		
Command:	Select to:	
File		
Exit	Close ECM Programming window	
Com Port No Selection Com1 Com2 Com3 Com4 Com5 Com6 Com7 Com8	 Choose Communications Port desired to connect your computer to the Screamin' Eagle Interface. Select Com 1 for most applications Consult with computer manufacturer for additional information 	
Options	None available in this application	

ECM Programming Functions				
Com Status:	Indicates Com Port selected			
ECM Information Box:				
VIN	Vehicle VIN – (2001 models may not show VIN)			
ECM PN	Base ECM Part Number			
CAL. ID	Calibration File in ECM now			
Get ECM Info Buton	Collects ECM Identification Info			
File Information Box:	File Information Box:			
ECM PN	ECM PN – (Must match Read ECM PN) in "File Info" Box			
CAL. ID	New Calibration File to be programmed into ECM			
Programming Status:	Indicates Status of ECM Programming Operation			
Program ECM Cal Button	Loads Current Tuning File into ECM			

PROGRAMMING ECM - CONT'D



Note: The EFI Tuner Interface Module is a "single unit" design that permanently links to the ECM the first time communication is established. The Interface Module can then be used an infinite number of times with that ECM, but the Interface Module will not communicate with any other ECM's.

Owner must Store Interface Module in a Secure Place for future tuning or data recording. If the Interface Module is lost or broken a new Screamin' Eagle EFI Tuner kit must be purchased to obtain a new Interface Module that can communicate with the ECM.

Continued from previous page:

- 6. Turn vehicle ignition ON but Do Not Start Engine
- 7. Wait 10 seconds for the ECM programming lockout time to elapse
- Click Get ECM Info to establish ECM communication link and gather ECM info such as:
 - VIN
 - Read ECM PN
 - File ECM PN
 - Read File CAL ID
 - File CAL ID
- 9. If error message indicates "Unable to Read ECM Data" then...
 - Check ignition is ON
 - Check cable connections
 - Check Com Port selection, (4.6)

Continued below

Com Status Com 1 o	pes	Com Status Explanation When you click on Get ECM Info you should see information similar to this example. • VIN – Vehicle ID Number, (2002 & later ECM's)
VIN +++++ Read ECM PN: 32772-0 File ECM PN: 32772-0 Read CAL ID 32107-0 File CAL ID 32107-0	01 01 01-000 01-007	 Read ECM PN – the OE hardware PN of the ECM in vehicle. (Must match File ECM PN to program ECM) File ECM PN – the OE hardware PN of the tuning file to be programmed into the ECM Read CAL ID – the software calibration PN of the ECM in the vehicle File CAL ID – the software calibration PN of the ECM in the vehicle
Programing Status Finished Reading 10 Info 005 Program ECM	GetECM Info	 tuning file you are going to program into the ECM Note: This example shows us That the Read ECM PN and File ECM PN are a match – this is correct That the Read CAL PN is 32107-01-000 in the ECM and we are going to program the ECM with our File CAL PN which is 32107-01-007, (the 007 is our part number extension that identifies the unique tuning file we have created)

10. Click on "Program ECM" box to start the programming operation

11. The programming operation will take approximately 1 minute to complete

After Programming Operation is Finished:

- 1. Turn vehicle ignition OFF
- 2. Disconnect cables and Interface Module

WARNING:

DO NOT INTERRUPT THE PROGRAMMING OPERATION or the ECM may be programmed with corrupted data!

×

*

EDIT FILE COMMENTS & PART NUMBER

Entering Comments for Tuning File or Specific Tables

An important part of tuning is being able to keep track of any edits you made to the tuning file or any of the tables and for what purpose those edits were made. This is easily accomplished by using the Enter Comments for this Tuning File Window or View and Edit ItemTuning Comments Window.

Enter Comments Commands

- 1. Click on Edit in the Menu Bar
- Click on Edit File Comments in the drop down list
- Type information you want to save in the Comments Window
- Click on Save Changes or your comments will be erased when you close window
- 5. Click on Exit to close

Editing File Part Number

Use this function to add a 3-digit number to the end of the calibration number so that the H-D technician can track file changes.



Enter Comments for this Tuning File

This calibration was developed using the following components:

SE Air Cleaner and Breather Kit P/N 29440-99A SE 1550 Big Bore Cylinders P/N 16546-99 or 18549-99 SE 1550 Flat Top Pistons P/N 22851-99A SE 203 Cems P/N 25937-99B

"File modified for Screamin" Eagle Pro 2-into-1 exhaust-64796-00A"

Tip : Type comments about:

Save Changes

 What special or unique equipment caused the need for special tuning

Exit

 Place notes in specific table that edits were made: Idle, WOT, Midrange, AFR, Spark, etc.

Edit Part Number Commands

Use this window to add a 3-digit suffix that identifies your unique ECM tuning file.

- 1. Click on Edit in Menu Bar
- 2. Click on Edit Part Number
- Type a 3-digit number into the right window such as 001, 002, etc.
- 4. Click on OK to save change
- Click on Exit to close window and return to Tuning Mode
- Keep a Log of these numbers, 001, 002, etc. and any information that's pertinent to the tuning file that you may need later

SELECT DISPLAY COLORS

Select Display Colors Commands

Change display colors to reflect personal preference. (Default colors shown at right)

- 1. Click on Setup in Menu Bar
- 2. Click on Setup Display Colors
- 3. Double click on a color to open Color Palette
- 4. Click on Color desired
- 5. Click OK to save apply color
- 6. Click OK to save changes



MAIN FUEL TABLE

Main Fuel Table Commands

- 1. Click on Setup in Tuning Mode Menu Bar
- Click on Basic and Advanced Mode then click on Basic Mode
- 3. Click on Table Selection then click on Main Fuel Table

Main Fuel Table Explanation

Make edits to air fuel ratio that affect BOTH front & rear cylinders

Select

- · Set Baseline: Resets highlighted cells to last "saved" file version
- · Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- · Decrement to reduce value in highlighted cells by Unit amount selected
- · Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

In the Example Below we edited 3-cells telling the ECM to Make the Target AFR Richer, (Increase Fuel Delivered) by 3.3% AFR at 90 kPa MAP and 2500-3000 rpm.

C.Vhogram Files/TTS\\3283401A.MT2			31-Dec	31-Dec-01 3.58.08 PM			uning Mode File Loaded		
how Graph	Set Baseline	SetFielerence	Decre	Inem	Increment	C 1 Unit C 2 Units	C 10 Units	C 20 Units C 100 Units	
OPH					MAP (kPa)				
nr e	20	30	40	000 5 0	min print bU print	70	80	90 S S	
750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1000	00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.00	
2750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33	
3000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33	
3500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
4500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
6600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

(More Fuel)

MAIN FUEL TABLE - CONT'D

Main Fuel Table Commands

- Determine the area of the Main Fuel Table that you want to increase or decrease the fuel being delivered to the engine, (See Tuning Tips Section)
- Use cursor and click on single cell or sweep across multiple cells to Highlight Cells for editing
- Click on Unit Denomination desired, (1,2,5, etc.) and then click on Increment or Decrement
- 4. Increment Cells to make FRONT & REAR cylinder ECM Target AFR RICHER-
- Decrement Cells to make FRONT & REAR cylinder ECM Target AFR LEANER-(Less Fuel)
 - Higher MAP values = Higher engine loads
 - Edits will appear as numbers indicating the percentage increase or decrease of the ECM Target AFR.
 - Example Edit shows an increase of 3.3% <u>Richer</u> ECM Target AFR in 3 cells at 90kPa and 2500-3000 rpm. This Increases the Fuel Delivered to the Front & Rear Cylinders in those 3-Cells

C.\Program)	Files/1151_1328	3401A.MT2	31-Dec-I	01 3:58:08	IPM 1	luning Mode File	Loaded	TWIN	ICAN
ow Graph	Set Baseline	Set Reference	Decier	nent	Increment	C 1 Unit C 2 Units	C 5Units C 10 Units	C 201	Units I Uni
DOM					AP (kPa)				
NF	20	30	40	50	60	70	80	90	1933
750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
1750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2250	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	-
2500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33	
2750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33	T
3000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.	T
3500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	R
4000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	N
4500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
EEOO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

MAIN SPARK TABLE

Main Spark Table Commands

- 1. Click on Setup in Tuning Mode Menu Bar
- Click on Basic and Advanced Mode then click on Basic Mode
- 3. Click on Table Selection then click on Main Spark Table

Main Spark Table Explanation

Make edits to Spark Timing that affect BOTH front & rear cylinders

Select

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- · Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

In the Example Below we edited 3-cells telling the ECM to Increase Front & Rear Cylinder Spark Advance timing by 2.25-degrees at 90kPa MAP and 2750-3500 rpm.

C:VPiogram	Elever 1153 AROR	SUNTA MT2	31-Dec	01.358-08	PM	uning Mode File	Loaded	TWB	14 A.
ow Graph	Set Baceline	Set Relevenc	Dece	ment	Increment	C 1 Unit C 2 Units	C 10 Units	C 20 C 10	Units 0 Uni
RPM				N	AP (kPa)				
	20	30	40	50		70	80	90	1000
750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2250	0.00	0.00	0000000	0.00	0.00	0.00	0.00	0.00	1
2500	0.00	0.00	0.00	0.00	0.00	0.00	0.00		-
2750	0.00	0.00	0.00	0.09	0.00	0.00	0.00	2.25	T
3000	0.00	0.00	0.00	0.03	0.60	0.00	0.00	2.25	
3500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	
4000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	and a literature	1
4500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
6600	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1

MAIN SPARK TABLE - CONT'D

Main Spark Table Commands

- Determine the area of the Main Spark Table that you want to increase or decrease the spark timing advance for the front & rear cylinders, (See Tuning Tips Section)
- Use cursor and click on single cell or sweep across multiple cells to Highlight Cells for editing
- Click on Unit Denomination desired, (1,2,5, etc.) and then click on Increment or Decrement to increase or decrease spark advance for the front & rear cylinders
- 4. Increment Cells to Increase Spark Advance for FRONT & REAR cylinders
- 5. Decrement Cells to Decrease Spark Advance for FRONT & REAR cylinders
 - Higher MAP values = Higher engine loads
 - Edits will appear as numbers indicating the Degrees of Spark Advance increase or decrease for front & rear cylinders
 - Example Edit shows an increase of 2.25-degrees Spark advance in 3-cells at 90kPa and 2500-3000 rpm. This Increases the Spark Advance of both the Front & Rear Cylinders in those 3-Cells

C:\Program Files\TTS_ \3283401A.MT2			31-Dec	31-Dec-01 3:58:08 PM			Tuning Mode File Loaded		
ow Graph	Set Baseline	Set Releven	Decre	ment	Increment	C 1 Unit C 2 Units	C 10 Units	C 201	Unit) Uni
DOM				M	IAP (kPa)				
	20	30	40	50	60	70	80	90	
750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
1750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2250	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2500	0.00	0.00	0.00	0.00	0.00	0.00	0.00 🖉	0.00	5
2750	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	T
3000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	225	1
3500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.25	T.
4000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
4500	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	N
5000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
- EEnno	0.00	0.00	0.00	0.00	0.00	0.00	0.00	n pn	

3-D GRAPH



	3-D Graph Commands
Start	Click on Show Graph Box to open 3-D Graph Window
File Print 3D Graph	 Select preferred Text Font & Text Size Change Page Setup for margin control, etc. Change Printer Setup for print commands Print to default printer to send 3-D graph to printer Exit and return to 3-D Graph window Toggle Cell Colors on/off for printing
Options	Toggle Graph Image to be on top or behind other items on screen
Tools Contour Levels	Adjust Graph Contours to 8-, 16- or 32-levels for more or less definition
Projection	Set Projection of Ceiling to be zoned, contoured or both for a different way of viewing table

TIP: 3-D graph can be rotated for a different perspective by clicking on a graph corner and holding both the left and right mouse buttons down while moving cursor


ECM TUNING CONSTANTS WINDOW

ECM Tuning Constants Explanation

The calibration parameters in the ECM scale the fuel calculation to the Engine Displacement and Fuel Injector Rate listed in the ECM Tuning Constants.

Use to:

- · Edit engine displacement if you have changed bore or stroke
- Edit injector flow rate if you have changed or modified injectors
- · Set engine rev limit
- Toggle Knock control on/off



ECM Tuning Constants Commands

Start: Click on Table Selecti	on in main menu bar – then click on ECM Tuning Constants
Engine Displacement	Click on & Edit with Increment – Decrement boxes. Affects ECM fuel calculation.
Injector Size, (Flow Rate)	Click on & Edit with Increment – Decrement boxes. Affects ECM fuel calculation.
Engine RPM Limit	Click on Scroll Bar Arrow & Drag to see full rpm range Click on Desired Engine Rev Limit CAUTION: Do NOT set engine rev limit higher than 6200 rpm for Softail Twin Cam B engines or damage from over rev may result Do NOT set engine rev limit higher than 6200 rpm for Twin Cam engines with cast pistons, stock valve springs or stroker flywheel kits or damage from over rev may result
Knock Control	Enabled = ON - Disabled = OFF
Select:	

Set Baseline: Resets highlighted cells to last "saved" file version

- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected

OPENING TUNING PROGRAM

Opening Tuning Program Commands

- Double click Tuning Mode Icon on your computer Desktop window to launch program
- 2. Read CAUTION Statement
- Click on "I Accept" to open program or "I Decline" which will close program.

Select File Commands

 Double click on the Tuning Mode File you want to load into the Tuning Mode program --or: Highlight Tuning Mode File you want to load and click on Open





TIP: Create a LOG of the Tuning Mode files you've created with information about their specific purpose.

Example:

3283401A.MT2: 2001 & Later Softail 1550 Stage II

File modified for Screamin' Eagle Pro 2-into-1 exhaust – 64796-00A

TUNING MODE & LIMITS

Tuning Mode Selection

To select Advanced Tuning Mode:

- 1. Click on Setup in Menu Bar
- Click on Advanced Mode to open program

C-Propar ShowSnaph	Setup Dia Setup Sc Options	splay Col reen Size	ors	425410 , mert	incesed	Lungh G 1 C 2	tota FilmLoad Unite C Unite C	5 Units 10 Units	C 20 LW
	Besic an	d Advanc	ed Wode	🖉 🛩 Bas	ic Mode				
RPM	20	30	40	Adv	unced Ma	-	80	50	100
758	0.0	0.0	0.0	0.0	0.3	0.0	10	100	44
1000	0.0	0.0	0.0	0.0	0.3	0.0		15	1.84
1250	0.0	25	0.0	0.0	0.3	0.0	0.0	10.00	
1588	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
1750	0.0	0.6	0.0	0.0	0.3	0.0	0.0	0.0	0.0
2000	0.0	1.81.17	0.0	0.0	0.3	0.0	0.0	0.0	0.0
1258	0.0	1.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
2500	0.0	0.1			0.3	0.0	0.0		0.0
2750	0.0	P.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0
2000	0.0	62	4.0	0.0	0.3	0.0	0.0	6.0	0.0
2500	0.0	21	40	0.0	0.3	0.0	0.0	0.0	0.0
4000	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
4580	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
5888	0.0	0.0	8.0	0.0	0.3	0.0	0.0	0.0	0.0
5580	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0

Tuning Limits Explanation

This screen shows the Air-Fuel Ratio Table for the file 3283401A.MT2. Note:

- Green Colored Cells indicate they are at the lowest point of their range of adjustment
- Red colored cells indicate they are at the highest point of their range of adjustment

CPropul	Awy JIN. UN	DIGITAMT2	-11 A	Dec-01158-0	EPH .	Juring Ho	or File Londos	Contract In	- THINGAN
Show Graph	SetBaseire	SerRela	ence D	eceneri	Incented	C 20		UHAs BCDWs	C 20 Della
					HAP DP-I				
nr.	28	30.00	40	58	60	70	10.88.0 8	-	nonenatione
750	136	1117 -	120	138	135	12.0	324	1.10.0	t the
1000	13.6	117	13.8	141	0.138.0	1.138.01	11724	119	310
1250	13.7	145	14.2	141	14.1	13.8	12.7	110	PLD
1500	12.7	REFERENCE	14.2	141	- 14.1	12.8	110	11.8	11.4
1750	137	145	143	141	0.541	138	1115	12.5	12.3
2000	137	3.14103	144	142	142	13.8	182	12.5	12.5
2250	11.7	CONS.	14.4	142	14.2	14.1	31.2	12.6	12.6
2500	13.7	1005	5.143	143	543	1111	182	126	128
2750	120	10148	14.3	143	34.3	14.3	11.2	12.6	12.6
3000	110	0.048	200315-0	14.3	14.3	M.3	112	126	12.6
3500	12.9	0.000000	1000	143	14.2	14.2		128	126
6000	12.3	145	14.2	141	13.8	13.3	112	12.5	125
4500	12.0	12.9	12.9	129	0.125	12.8	01128	- 125	115
5000	12.3	TeV.	1210	129	12.8	12.8	12.8	12.5	12.6
5500	12.3	125	12.5	125	12.4	52.4	12.2	12.2	12.2

MENU BAR

Menu Bar Explanation	Edia France Decih	Service In the service of the servic	ntelle Arie atin Salar 340 APR2 SetRele a	an Stan Tu Stan Stan Stan	et e Cump Ji 1540e H ment 🔤 🔄	annen E N Di	jalp nmallices sk 17.11kv 17.20ks	Loaded C. Staats C. Staats	C 101	CPH Detr
The Menu Bar has File,	ans.	10000			M	1 (KI 16)		aga,		
Edit, Setup, Table	1000	70.	1.10	44		A	2.0.20.000	0.2		
Coloction and Lipin	/50	18			1.8	00	7.8		00	
Selection and help	1000	A 8	6.5	DL		00	- 18			
command hoves When	20.0									- 51
command boxes, when							19			
you click on each a drop	100	1.0		0.0	2.5	00	18	0.3	0.0	
you click on bacin a drop	Out-					+	<u>\</u>			
down list can be viewed	122.0	16		0.0	6.6	00	7.8	0.2	- LU	1
	25.01	10	100	0.0		0.0	16	- 60		
that provides additional	000	12	i i i	DE		00	16	83	c.0	
a a manada	1000	11			5.5	1111	18	11.1	1 11	
commanos.	010	11	0	0.0	8.8	0.0	11	0.0	00	
	52.0	18	10	0.0	8.8	0.0	1.5	6.0	C.O.	- 11
	010	1.5	1 10	0.0	5.5	0.0	18	0.0	CG	- 33
SEE TARI E BELOW	1.00	1.	1.1.1			1	1.8			1
SEE INDEE DELOT										<u> </u>
			Kein	fael Table I	Parcent Ch	orveol - Calit I	Crobied			

<u>M</u>	enu Bar Functions
File	
Load Tuning File*	Loads File into the Tuning Program
Save Tuning File*	Save File being viewed
Print Table*	Print Table currently being viewed
Program ECM*	Program the ECM with the file currently being viewed
File Names	Recently Viewed Files
Exit	Close Program
Edit	
Edit File Comments*	Edit Comments for file being viewed
View & Edit Item Tuning Comments	Notes Specific to each Table
Edit Part Number*	Edit Part Number for file being viewed
Сору	
Paste	
Setup	
Setup Display Colors*	Change Colors for high & low limits, etc.
Options	Show or not show list of files on program startup
Basic & Advanced Mode	Select Basic or Advanced Tuning Modes Window
Table Selection	
Main Fuel Table*	View and edit Main Fuel Table
Main Spark Table*	View and edit Main Spark Table
ECM Tuning	View and edit engine statistics, fuel injector
Constants*	size, RPM limits, Knock control, etc.
Help	
Contents	View Information about Tuning Mode Program
About	View Information : software, revisions, licensing, etc.

* Indicates this item is covered in greater detail in this User's Manual

					*******		and the same of		Selection .
then bear	Sectories'	Sai New			(Marine)	174	1933		- Carlot
and the second second					1007-007-0				
1000-000	1		1.00		40	1.11	1.00.00	1. 1 1. 1	100
2012 BR 201	10.00	101	1000	- 100 C	1000	1941	1.118	200 Biologica	10046
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	Menu Bar Functions
Table Selection Air-Fuel Ratio Table*	View and Edit ECM AFR Target that affects front and rear cylinders
VE Front Cyl.*	View and Edit Front Cylinder VE
VE Rear Cyl.*	View and Edit Rear Cylinder VE
Spark Advance Front Cyl.*	View and Edit Front Cylinder Spark Advance
Spark Advance Rear Cyl.*	View and Edit Rear Cylinder Spark Advance
Warmup Enrichment*	View and Edit Warmup Enrichment Table that affects front and rear cylinders
Cranking Fuel*	Set Cranking Fuel Enrichment in relation to engine temperature
Idle RPM*	Set Idle RPM in relation to engine temperature
IAC Warmup Steps*	Set IAC Warmup Steps in relation to engine temperature
ECM Tuning Constants*	View and Edit engine displacement, fuel injector size, RPM limits & Knock control
Table Comparison Working Calibration*	View and Edit Tuning Tables
Baseline Calibration*	View ONLY, (no Edits allowed) Baseline Cell Values (Baseline Values are the last values saved in the file that were not Reference values)
Reference Calibration*	View ONLY, (no Edits allowed) Reference Cell Values, (Reference Values are the original Screamin' Eagle values for that file)
Compare Edits to Baseline*	View ONLY, (no Edits allowed) the Numerical Difference of edits to Baseline cell values
Compare Edits to Reference*	View ONLY, (no Edits allowed) the Numerical Difference of edits to Reference cell values
Help Contents	View Information about Tuning Mode Program
About	View Info about software, revisions, licensing, etc.

LOAD & SAVE TUNING FILES



- 1. Click on File in Menu Bar
- Click on Recently Used File Names or...
- Click on Load Tuning File Double click on Desired File or... Highlight and click on Open to load file into the Tuning program.



Save Tuning File Commands

- 1. Click on File in Menu Bar
- 2. Click on Save Tuning File
- Type New File Name if edits were made.

Example:

3283401-01

(the "-01" indicates that this file has edits to it)

 Click on Save to save changes

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1111100-000		2 129060A.HT.1					10.0
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4508 5808	123	12.9 12.5	12.9	28 128	126	12.6	13.6

TIP: Create Additional Folders to group files by motorcycle model or performance configuration. Grouping files makes it easier to locate them later. Example:

Create Touring and Softail Folders.

TIP: Create New File Names for any files you have modified and Keep a LOG of the file names and tuning particulars for future use.

Note: Some older versions of Windows 95 only allow short file names with 8-characters

PRINTING TABLES

Print Table Commands

- 1. Click on File in Menu Bar
- Click on Print Table to print Tuning Table currently in view

See list of Print Table Functions below

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	in Name -		200040	ANNESS ANNESS		14					
	arrent Cast	asset.	Working the second	g Carero	alter i						
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	122	Kin .	12.7	134	24.3	12.4	33.4	1.2.4	66.638	N 15.516	
	20.	12.2	12011	54.7	14.1	114.1	11.8	52.2	100		
le l	10.1	100	Sec.	100	100.0	124.2	10.0	1000	10.0	1111-11	
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2	255	10.0	6666	14.2	24.3	14.1	14.1	23.2	15,2,8	12.4	
	- T	830	161.88	Sec.	24.2	14.1	14.1	23.2	2.1.8	1128	
1	401	1000		10000	236.3	111	14.2	1000	1011	1.1.1	
- E	101	100	10000	111	1111	1111	12.1	100	10.14	-	
E	(1)) (1))	12.2	10.0	100	1.2.5	112.0	12.0	111.6	101.5	1124	
	100	82.3	12.8	121	125	10.1	12.1	192.2	111	100.0	
1	104	12.2	20.4	1124	1524	12.4	1.1.4	12.2	15.1.2	12.2	
	10	SIL	21.4	12.8	121	12.1	12.4	1.1.1	17.1.1	1022	
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	 COULTING 	na 1949 P		AL CONTRACT	1000.00						

	Print Table Functions
File Select Font	Choose from a large assortment of True Type® Fonts and Sizes to customize printed table
Page Setup	Change Paper Size & Orientation, margins and print commands
Print Setup	Change commands for Printer Output
Print	Send Table Currently in View to Default Print Window and select how many copies. Or, select Print to File and window will open to select what folder to send the table to.
Exit	Close Print window and return to Tuning Mode
Options Show Cell Colors	Toggle Cell Colors on and off for printing

PROGRAM ECM

Programming ECM Commands

- Click on File in Menu Bar
 Click on Program ECM See command options and information below

Rie GerPat, Connent	
PROGRAMMING INSTRUCTIONS	COM 2 Open
 Turn OFF the vehicle ignition switch. Make contain the interface is connected to the PC serial port. Connect the interface cable to the vehicle. Turn OH the vehicle ignition switch. Press the "Program EChd" sutton to initiate the programming process. 	FCM Information MIN KMNS EGM PNA KEGM PNB CALID: KEGM CALIDS Get ECM Info I
The programming operation well commence and well been approximately 3 minute to complete After programming has completed, you must: 1. Turn OFF the vehicle ignition sentch.	Frie Information ECM PN 12498-05.12514-05 CALID: 1271HM005-000
2. Disconnect the interface. 3. West 10 seconds before starting the vehicle. WARNING: NO NOT INTERPRIPT THE PROGRAMMING PROCESS OR THE ECM MAY BE PROGRAMMED WITH CORRUPTED DATA	Programing Status (Programming Status Message) U% Program FCM Cal
	Exit

ECM	Programming Commands
Command:	Select to:
File	
Exit	Close ECM Programming window
Com Port No Selection Com1 Com2 Com3 Com4 Com5 Com6 Com7 Com8	 Choose Communications Port desired to connect your computer to the Screamin' Eagle Interface. Select Com 1 for most applications Consult with computer manufacturer for additional information
Options	None available in this application

ECM Pr	ogramming Functions
Com Status:	Indicates Com Port selected
ECM Information Box:	
VIN	Vehicle VIN – (2001 models may not show VIN)
ECM PN	Base ECM Part Number
CAL. ID	Calibration File in ECM now
Get ECM Info Buton	Collects ECM Identification Info
File Information Box:	
ECM PN	ECM PN – (Must match Read ECM PN) in "File Info" Box
CAL. ID	New Calibration File to be programmed into ECM
Programming Status:	Indicates Status of ECM Programming Operation
Program ECM Cal Button	Loads Current Tuning File into ECM



Note: The EFI Tuner Interface Module is a "single unit" design that permanently links to the ECM the first time communication is established. The Interface Module can then be used an infinite number of times with that ECM, but the Interface Module will not communicate with any other ECM's.

Owner must Store Interface Module in a Secure Place for future tuning or data recording. If the Interface Module is lost or broken a new Screamin' Eagle EFI Tuner kit must be purchased to obtain a new Interface Module that can communicate with the ECM.

Continued from previous page:

- 6. Turn vehicle ignition ON but Do Not Start Engine
- 7. Wait 10 seconds for the ECM programming lockout time to elapse
- Click Get ECM Info to establish ECM communication link and gather ECM info such as:
 - VIN
 - Read ECM PN
 - File ECM PN
 - Read File CAL ID
 - File CAL ID
- 9. If error message indicates "Unable to Read ECM Data" then...
 - Check ignition is ON
 - Check cable connections
 - Check Com Port selection, (4.6)

Continued below

Com Status Com 1 open	Explanation: When you click on Get ECM Info you should see information similar to this example. • VIN – Vehicle ID Number, (2002 & later ECM's) • Read ECM PN – the OE hardware PN of the ECM in
VIN:	 vehicle, (Must match File ECM PN to program ECM) File ECM PN – the OE hardware PN of the tuning file to be programmed into the ECM Read CAL ID – the software calibration PN of the ECM in the vehicle File CAL ID – the software calibration PN of the tuning file you are going to program into the ECM
Programing Status Finished Reading ID Information 100% Program ECM Evit	 That the Read ECM PN and File ECM PN are a match – this is correct That the Read CAL PN is 32107-01-000 in the ECM and we are going to program the ECM with our File CAL PN which is 32107-01-007, (the 007 is our part number extension that identifies the unique tuning file we have created)

- 10. Click on "Program ECM" box to start the programming operation
- 11. The programming operation will take approximately 1 minute to complete

After Programming Operation is Finished:

- 1. Turn vehicle ignition OFF
- 2. Disconnect cables and Interface Module

WARNING:

DO NOT INTERRUPT THE PROGRAMMING OPERATION or the ECM may be programmed with corrupted data!

EDIT FILE COMMENTS & PART NUMBERS

Edit File Comments

- 1. Click on Edit in Menu Bar
- 2. Click on Edit File Comments
- Type Information about modifications, component part numbers, Specific tuning info. etc.
- Click on Save Changes box to save your typed comments or comments will be automatically erased when the program is closed
- 5. Click on Exit to close



Tip: Type comments about:

- What special or unique equipment caused the need for special tuning edits
- General area of the tuning file that edits were made: Idle, WOT, Midrange, AFR, Spark, etc.

Editing File Part Number

Use this function to add a 3-digit number to the end of the calibration number so that the H-D technician can track file changes.

Edit Part Number Commands

Use this window to add a 3-digit suffix that identifies your unique ECM tuning file.

- 1. Click on Edit in Menu Bar
- 2. Click on Edit Part Number
- Type a 3-digit number into the right window such as 001, 002, etc.
- 4. Click on OK to save change
- Click on Exit to close window and return to Tuning Mode
- Keep a Log of these numbers, 001, 002, etc. and any information that's pertinent to the tuning file that you may need later



SELECT DISPLAY COLORS & SIZE





AIR-FUEL RATIO TABLE

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Air-Fuel Ratio Table Adjustment

- This table affects the <u>ECM Air-Fuel Ratio Target</u> for BOTH Front & <u>Rear</u> cylinders Increments make Front & Rear cyl. AIR-FUEL RATIO TARGET LEANER – (LEANER = less
- Decrements make Front & Rear cyl. AIR-FUEL RATIO RICHER (RICHER = more fuel)
- MAP Higher values = Higher engine loads
- Edits will appear as numbers indicating ACTUAL AIR-FUEL RATIO TARGET that ECM uses in its calculations to determine fuel delivery.

Start: To Open Air-Fuel Ratio Table from Advanced Mode click on Table Selection -Then Click on Air-Fuel Ratio

CVProgram	Flend TSA, 1009	MOTA MT 2	ing kap	10ec013580	I PM	Juning Me	te File Loaded	ni del de	TWINCAS
how Graph	Set Baseline	Set Relev	evce	Decrement	Increment		ଲି ମୁକ୍ତ ଲାମୀ	Units O Units	C 20 Unit C 100 Uni
DP4					HAP (kPa)				
	20	12 30 3 3	40	50 (50	1000 64 00 31	70	80	1999 80 1993	100
(1) 750 (1)	13.6	137	10138	13.8	13.5	13.0	12.4	110	11.0
1000	13.6	13.7	138	11.14.1	12.0	13.0	12.4	11.0	11.0
1250.000	13.7	145	14.2	0.0014.1	141	13.0	12.7	11.0	0.11.0
1500	13.7	STAR S		s 50 14100	10.141	13.8	130,00	11.5	55.11.4
1750	137	145	14.3	14.1	14.1	13.8	125	125	12.3
2000 (17)	13.7	1.145.00	52.14.4	14.2	11421	1.13.8	13.2	125	11, 12,5
2250	13.7	1.115	14.4	14.2	14.2	14.1	13.2	126	126
2500	137	145	14.3	14.3	143	14.3	10.132.00	111126.00	12.6
2756	13.0	144	14.3	14.3	143	14.3	13.2	12.6	· 12.6
3000	13.0	145.00	Co. 348 -	143.0	14.3	14.3	13.2	126	12.6
3500	123.05	145	345	20143	143	142.00	-0.132	125 -	12.5
4000	12.3	145	14.2	0.0014.135	13.0	13.3	12.2	12.5	12.5
114500 101	123	12.9	12.9	12.9	12.9	12.8	12.8	12.5	12.5
5000	12.3	12.9	129	12.9	128	12.8	7-125	12.5	12.5
SSI00	12.8	12.5	125	125	17.4	12.4	12.2	12.2	12.2

Air-Fuel Ratio Table Commands

Use cursor and click on single cell or

sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

VE FRONT/REAR CYLINDER TABLE

VE Front/Rear Cylinder Table Adjustment

The ECM refers to the VE Tables for the volume of air that should be entering each cylinder as it relates to the current throttle position and engine rpm. Use VE Tuning Tables to edit AFR of each cylinder independent of the other

- Increments will Increase Front/Rear Cyl. VE Value (Telling the ECM there is more air entering the cylinder and the ECM will tell the injector to deliver MORE FUEL)
- Decrements will Decrease Front/Rear Cyl. VE Value (Telling the ECM there is less air entering the cylinder and the ECM will tell the injector to deliver LESS FUEL)
- Throttle Position: 0 = Throttle closed, 100 = Throttle wide open
- Edits will appear as numbers indicating percentage of cylinder fill.

Start: To Open VE Tables from Advanced Mode click on Table Selection -Then Click on VE Front Cyl. or VE Rear Cyl.

C-Uhog	Set Baseline	Set Bette	ence 1	Decorrect	Increment		Unit Pallate	5 Unde	C 20 Units
	Louisianiania					102.3	Write a set	10 Onla St.	1000m
-		i sana ya	9999999	Throttle	Position (P	urcun()		9977999	2223)/2227
nrm.	282.000 a 201 a	2010/02	0.01500	S 202 20 337	10.3000000	2140 (0)	12/10/07/11	210 80 703	100 100
500	70.0	74.0	77.0	82.0	0.58	84.0	85.0	85.0	83.0
750	720	74.0	77.0	82.0	82.0	84.0	85.0	85.0	83.0
					the state of the s				
10 g	vamela: The	aaa bixi	hliabta	d calls w	070	84.0	85,0	85.0	83.0
10 E	xample: The	ese hig	hlighte	d cells w	ere E to bo	84.0 75.0	85.0 77.0	85.0 78.0	83.0
10 E 12 i 15 i	xample: The	ese hig 10-unit	hlighte s causi	d cells w ing the V	ere E to be	84.0 75.0 78.0	85.0 77.0 80.0	85.0 78.0 63.0	83.0 75.0 80.0
10 E 12 i 15 r	xample: The noremented ligher and te	ese hig 10-unit elling th	hlighte s caus e ECM	d cells w ing the V that mor	ere E to be e air is	84.0 75.0 78.0 82.0	85.0 77.0 80.0 85.0	85.0 78.0 63.0 85.0	83.0 75.0 80.0 195.0
10 E 12 i 15 F 17 20	xample: The ncremented ligher and te ntering the f	ese hig 10-unit Illing th front cy	hlighte s causi e ECM flinder.	d cells w ing the V that mor The ECN	ere E to be e air is 1 will	84.0 75.0 78.0 82.0 83.0	85.0 77.0 80.0 85.0 93.0	85.0 78.0 63.0 65.0 55.0	83.0 75.0 00.0 05.0 93.0
10 E 12 i 15 h 17 20 t	xample: The ncremented igher and te ntering the i hen direct th	ese hig 10-unit elling th front cy te injec	hlighte s causi e ECM rlinder. tor to d	d cells w ing the V that mor The ECN seliver mo	ere E to be e air is 1 will bre fuel	84.0 75.0 78.0 82.0 83.0 83.0	85.0 77.0 60.0 85.0 930 110	850 780 630 850 910	83.0 75.0 90.0 95.0 51.0 25.0
10 E 12 i 15 h 20 t 22 a	example: The incremented ligher and te intering the i hen direct th t 2000 to 350	ese hig 10-unit elling th front cy te injec 00 rpm	hlighte s causi e ECM rlinder. tor to d at 60 to	d cells w ing the V that mor The ECN feliver mo o 100% th	ere E to be e air is 1 will pre fuel prottle	84.0 75.0 70.0 02.0 83.0 83.0 83.0	85.0 77,0 60.0 85.0 930 930 930 930	85.0 70.0 63.0 75.0 93.0 93.0 93.0 93.0	83.0 75.0 90.0 91.0 91.0 91.0 91.0
10 E 12 ii 15 h 20 c 22 d 25 d 27 F	example: The incremented ligher and te intering the i hen direct the t 2000 to 350 osition. This	ese hig 10-unit elling th front cy te injec 00 rpm s is an	hlighte s causi e ECM flinder. tor to d at 60 to excelle	d cells w ing the V that mor The ECN feliver mo to 100% th nt metho	ere E to be e air is 1 will pre fuel prottle d of	84.0 75.0 70.0 02.0 83.0 83.0 83.0 83.0 83.0	85.0 77.0 60.0 85.0 93.0 13.0 13.0 13.0 13.0	85.0 78.0 83.0 85.0 93.0 93.0 93.0 93.0 93.0	83.0 75.0 90.0 91.0 95.0 95.0 95.0 95.0
10 E 12 ii 15 h 20 c 22 d 27 f 30 f	example: The incremented ligher and te intering the f hen direct the t 2000 to 350 osition. This hodifying the	ese hig 10-unit front cy te injec 00 rpm s is an e AFR c	hlighte s causi e ECM flinder. tor to d at 60 to excelle of one o	d cells w ing the V that mor The ECN leliver mo o 100% th nt metho cylinder a	ere E to be e air is 1 will ore fuel orottle d of und not	84.0 75.0 70.0 02.0 83.0 83.0 83.0 83.0 83.0 83.0 83.0 83	85.0 77,0 60.0 85.0 93.0 93.0 93.0 93.0 93.0 93.0 91.0 91.0 91.0	85 0 78.0 03.0 15.0 110 51.0 51.0 51.0 51.0 21.0 110 110	83.0 75.0 90.0 91.0 95.0 95.0 95.0 95.0 95.0 95.0 95.0
10 E 12 ii 15 i 17 c 20 t 25 d 27 f 30 f 35 t	example: The incremented ligher and te intering the f hen direct the t 2000 to 350 osition. This nodifying the he other.	ese hig 10-unit front cy te injec 00 rpm s is an e AFR o	hlighte s causi e ECM dinder. tor to d at 60 to excelle of one o	d cells w ing the V that mor The ECN leliver mo o 100% th ot metho cylinder a	ere E to be e air is t will ore fuel irottle d of ind not	84.0 75.0 70.0 83.0 83.0 83.0 83.0 83.0 83.0 83.0 93.0 93.0 95.0	85.0 77,0 00.0 85.0 93.0 93.0 93.0 93.0 93.0 93.0 93.0 93	85 0 78.0 83.0 95.0 95.0 93.0 93.0 93.0 93.0 93.0 93.0 93.0 93	83.0 75.0 90.0 91.0 95.0 91.0 95.0 91.0 95.4 91.0 95.0
10 E 12 i 15 r 20 C 22 t 25 a 27 F 30 r 35 t	example: The incremented ligher and te intering the f hen direct the t 2000 to 350 osition. This nodifying the he other.	ese hig 10-unit elling th front cy te injec 00 rpm s is an e AFR o	hlighte s causi e ECM dinder. tor to d at 60 to excelle of one o	d cells w ing the V that mor The ECN leliver mo o 100% th nt metho cylinder a	ere E to be e air is 1 will ore fuel irottle d of ind not	84.0 75.0 70.0 83.0 83.0 83.0 83.0 83.0 83.0 83.0 93.0 93.0 95.0 90.0	850 77,0 80,0 150 930 110 110 110 110 930 910	85 0 78.0 83.0 93.0 93.0 93.0 93.0 93.0 93.0 93.0 9	83.0 75.0 90.0 91.0 95.0 95.0 91.0 95.0 91.0 95.0 91.0 95.0 95.0 95.0

VE Front & Rear Cylinder Table Commands Use cursor and click on single cell or

sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- · Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- · Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

SPARK ADVANCE – FRONT/REAR CYLINDER TABLE

Front/Rear Spark Advance Table Adjustment

Use the Spark Advance Tables to Edit the Spark Timing of Either Cylinder independent of the other:

- Increments Increase (Advance) Front/Rear CYL. Spark Timing (Example: If cell value of 35 degrees was incremented 5 degrees, spark would fire at 40 degrees before piston reaches TDC)
- Decrements Decrease (Retard) Front/Rear Cyl. Spark Timing (Example: If cell value of 35 degrees was decremented 5 degrees, the spark would fire at 30 degrees before piston reaches TDC)
- Edits will appear as numbers indicating the degrees of crankshaft rotation where spark occurs before the piston reaches TDC.

Start: To Open Spark Advance Tables from Advanced Mode click on Table Selection -Then Click on Spark Advance Front Cyl. or Spark Advance Rear Cyl.

	the second se	1.000	ance De	cremone	Increment	C 20	м С.5 ма С.1	Units 0 Units	C 2010-hi C 10010-hi
RIPM	20	30	40.000	50	10.60100		80		100
1500	35.00	35.00	35.00	35.00	35.00	34.00	28.00	23.00	18.00
1750	40.00	40.00	40.00	38.00	40.00	35.00	29.00	24.00	21.00
2000	- 45.60	6.05	44.00	42.00	= 40.00	36.75	29.00	25.00	24.00
2250	45.00	6.00	- 45.60	44.00	41.00	37.00	32.00	27.25	25.00
2500	45.00	45.00	- 45.00	43.00	42.00	38.00	133.00	23.75	26.00
2750	45.00	45.00	45.00	44.00	43.00	39.00	1. 35.00-1.	31.00	26.50
	45.00	45.00		1500	6000	40.00	38.00	£ 30.00	27.00
3500	45.00	45.00	45.00	0034530000	10050630	42.00	37.00	29.00	27.00
4000	45.00	45.00	-45.00	45.00	6.6506		35.00	30.00	27.00
4580	45.00	45.00	45.00	45.00	43.00 G	39.00	33.00	28.00	28.00
5000	45.00	45.00	45.00	45.00	40.00	37.00	31.00	23.00	28.00
5500	45.00	45.00	45.00	45.00	44.00	36.00	30.00	27.00	28.00
··· 6000	45.00	45.00	45.00	45.00	44.00 m	00.00	29.00	29.00	27.00
257000 Second	45.00	45.00	45.00	3 45 00	44.00	36.00	29.00	29.00	27.00

Front/Rear Spark Advance Table Commands Use cursor and click on single cell or sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected.
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

WARMUP ENRICHMENT TABLE

Warmup Enrichment Table Adjustment

The Warmup Enrichment Table tells the ECM to Deliver Additional Fuel to BOTH front & rear cylinders as the engine is warming up.

- · Cell numbers indicate AFR enrichment for both cyl.
- Increments Increase Fuel Enrichment of both cyl. at the engine temperature indicated (HIGHER NUMBER = MORE FUEL)
- Decrements Reduce Fuel Enrichment at the engine temperature indicated (LOWER NUMBER = LESS FUEL)
- Example: If the air-fuel ratio of the running engine was 12.5 it will be enriched by 3.9 points additional fuel when the engine temperature is -16 C degrees or lower which makes the adjusted AFR 8.6, (12.5 – 3.9 = 8.6 AFR).

Start: To Open Warmup Enrichment Table from Advanced Mode click on Table Selection -Then Click on Warmup Enrichment



Warmup Enrichment Table Commands

Use cursor and click on single cell or

sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected.
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

CRANKING FUEL TABLE

Cranking Fuel Table Adjustment

This table tells the ECM what the front & rear cylinder

- Fuel Injector Pulse Width should be when the Engine is Being Started
- Cell numbers indicate total injector pulse width for starting.
- Increments Increase Front &Rear cyl. injector pulse width of cranking fuel. LONGER PULSE WIDTH = MORE FUEL
- Decrements Reduce Front & Rear cyl. injector pulse width of cranking fuel. SHORTER PULSE WIDTH = LESS FUEL.
- Example: At an engine temperature of 80°C the front and rear injectors will remain open for
 - 11.3 milliseconds to deliver enough fuel for starting the engine at cranking speeds.

Start: To Open Cranking Fuel Table from Advanced Mode click on Table Selection -Then Click on Cranking Fuel



Cranking Fuel Table Commands Use cursor and click on single cell or

sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected.
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

IDLE RPM TABLE

Idle Speed Table Adjustment

Use to adjust Engine Idle Speed at specified engine temperatures

- · Cell numbers indicate engine rpm at engine temperature indicated.
- Increments Increase engine rpm at 0% throttle position.
- Decrements Decrease engine rpm at 0% throttle position.

Example: Note that Idle Speed is higher when the engine is still warming up - 1248 rpm when the engine is at 16° C.

Start: To Open Idle RPM Table from Advanced Mode click on Table Selection -Then Click on Idle RPM



Idle RPM Table Commands

Use cursor and click on single cell or sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

IAC WARMUP STEPS TABLE



IAC Warmup Steps Table Commands Use cursor and click on single cell or

sweep cursor across multiple cells to highlight cells for editing

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected
- Unit Denominations: Set Unit values for editing cells with Decrement Increment commands

ECM TUNING CONSTANTS SCREEN



The calibration parameters in the ECM scale the fuel calculation to the Engine Displacement and Fuel Injector Rate listed in the ECM Tuning Constants. Use to:

- · Edit engine displacement if you have changed bore or stroke
- Edit injector flow rate if you have changed or modified injectors
- Set engine rev limit
- Toggle Knock Control on/off



ECM Start To Open ECM Tuning Then Click on ECM Tun	I Tuning Constants Commands Constants from Advanced Mode click on Table Selection - ling Constants
Engine Displacement	Click on & Edit with Increment – Decrement boxes. Affects ECM fuel calculation.
Injector Size, (Flow Rate)	Click on & Edit with Increment – Decrement boxes. Affects ECM fuel calculation.
Engine RPM Limit	Click on Scroll Bar Arrow & Drag to see full rpm range Click on Desired Engine Rev Limit CAUTION: Do NOT set engine rev limit higher than 6200 rpm for Softail Twin Cam B engines or damage from over rev may result Do NOT set engine rev limit higher than 6200 rpm for Twin Cam engines with cast plstons, stock valve springs or stroker flywheel kits or damage from over rev may result
Knock Control	Enabled = ON - Disabled = OFF
Select:	•••••••••••••••••••••••••••••••••••••••

- Set Baseline: Resets highlighted cells to last "saved" file version
- Set Reference: Resets highlighted cells to original Screamin' Eagle calibration
- Decrement to reduce value in highlighted cells by Unit amount selected
- Increment to increase value in highlighted cells by Unit amount selected

TABLE COMPARISON COMMANDS

Table Comparison Commands

Select:

- Working Calibration to edit table currently being viewed
- Baseline Calibration to view cell values of last "saved" edits to file
- <u>Reference Calibration</u> to view cell values of original Screamin' Eagle calibration for this file
- <u>Compare Edits to Baseline</u> to view the "difference" of working calibration to last "saved" edits
- <u>Compare Edits to Reference</u> to view the "difference" of working calibration to original Screamin' Eagle Calibration cell values

file ::: Edit :: 5	ietep 🗆 Ie	ble Select	on: Te	ble Comp	arison 🗄 🗄	1 4 233333	25 s		
COP open R	eeATTSA. ASS	SINAMI2		Working Cr	alibration.	10560000	4.	ideit (2020)	TWINDH
Show Dright	Set Baseline	Set Releve	•	Baseline C Reference	alibration Calibratic			C SUND C 1010HB	C 20 Units C 100 Units
ври	10	15		Compare E	dits to Re	denenco		100	
500	74.0	77.0	020	12.0	04.0	0.00	- 150	0.03	8
101750		77.0	82.0	82.0	TT (4.0 TT	10.05.0	05.0	0.03	8
Contra 6,666 (C.C.)	TVD 1	77.0	102.0	12.12.1	04.0	05.0	00.0	R10	

C Program P on Graph	Benttsh N2	SMOTA MT2	eree	Working C Baseline C Reference	alibration alibration Calibratio	
лгн	10	15	2	Compare I	dils to Re dils to Re	terence
500	0.00	0.0	0.0	0.0	0.0	0.0
750	0.0	0.0	0.0	0.0	0.0	0.0
1000	00	0.0	0.0	0.0	0.0	0.0
1250(11)	100	0.0	0.0	0.0	0.0	0.0
1500	0.00	0.0	0.0	0.0	0.0	0.0
1750	0.00	0.0	0.0	99	0.0	0.0
2000	10000	0.0	0.00	10	10.00	0.0
2250 200	10.00	0.0	0.0	10	10	
2500	50.00	077.0.0 577	122.0.014	55 10 35	10	0.0
2750	00	0.0	0.0	10	112(10)X()	0.0
3000	00	0.0	0.0			0.0
3500 (1)	00	0.0	0.0	0.0	0.0	0.0
4000 5555	200 EX	ST00753	0.0	0.0	0.0	0.0
4500			0.0	0.0	0.0	0.0
5000	0.000	0.0	0.0	0.0	0.0	0.0

NOTE: CELL VALUES CAN BE EDITED IN WORKING CALIBRATION ONLY

Example: When the Compare Edits to Baseline is selected the current edits made to the 8 cells shown are seen as the difference between the last saved table edits and the current edits

2-D & 3-D GRAPH SCREEN

2-D or 3-D Graph Explanation This function provides the user

with a tool to view tables with:

- 3-parameters in 3-D
- 2-parameters in 2-D

Use the 3-D Graph as a visual reference tool to spot irregularities in a tuning table.



<u>2-D</u>	3-D Graph Commands
Start	Click on Show Graph Box
File Print 3D Graph (Print command for 2-D or 3- D) Program automatically selects 2-D or 3-D graph dependent on table type	Select preferred Text Font & Size Change Page Setup for margin control, etc. Change Printer Setup for print commands Print to default printer to Send Graph to Printer Exit and return to Graph window Toggle Cell Colors on/off for printing
Options	Toggle Graph Screen to be on top or behind other items in printed copy
Tools – (3-parameter tables) Contour Levels	Adjust Graph Contours to 8-, 16- or 32-levels for more or less definition
Projection	Set Projection of Ceiling to be zoned, contoured or both for a different way of viewing file

<u>TIP</u>: 3D Graph can be rotated for a Different perspective by holding both the left and right mouse buttons down while moving cursor position.



INTRODUCTION TO THE SCREAMIN' EAGLE EFI RACE TUNER DATA MODE

Sophisticated On-Board Data Acquisition

The Harley-Davidson Screamin' Eagle Data Mode Program is a complete software application that can be used to record over 20-different types of engine and vehicle data on fuel injected- 2001 and later Softail series vehicles and 2002 and later Touring series vehicles. The data is collected from the vehicle's ECM. The user can record for short periods of time, which is extremely useful when using the Data Mode program in conjunction with a motorcycle chassis dyno. Or, the Data Mode program can record for extended periods of time, (up to 30-minutes) for tuning or troubleshooting purposes on a closed-course track.

Data Organized in Frames

The data is collected and organized as individual records called "Frames". Each frame is like a "snapshot" of the input and output information being handled by the ECM at that moment. Up to 16,000 frames can be recorded at a sample rate of up to 10-frames per second. Sample rate is dependent on how many streams of data are being monitored, the capability of the computer being used and limitations of the cabling and data port.

The data can then be manipulated in a wide variety of manners.

Main Display Table

The Main Display in the Data Mode screen provides a table that lists all of the data that was collected in the type of recording the user selected. Two types of data recordings may be performed – Dyno Data or Engine Data. The Dyno Data selection records 12-types of data, but at a higher sample rate because less data has to be monitored. The Engine Data selection is most commonly used because it collects the most different types of data and that way the user will have collected all of the information they might ever need.

The data can then be viewed frame by frame, in numerical form, in the Main Display table. The user can use the information in this table to diagnose tuning opportunities, or as a tool to identify anomalies that may have occurred during the test that may be contributing to poor performance. This includes the ability to record active and historical DTC's

Graphing Display

The same data in the Main Display table is also displayed in graph form at the bottom of the main screen. Four lines of data, selected by the user from the list of data in the Main Display, can be graphed in overlay fashion in four different colors. The graph can be set for Auto-playback if desired, with the travel speed adjustable. Additionally, the user can select any portion of the graph where they want more detail, and use the Zoom feature to enlarge the selected graph area as desired.

INTRODUCTION TO THE SCREAMIN' EAGLE EFI RACE TUNER DATA MODE - CONT'D

Three Mini-Programs Provide Professional Performance Comparison

To compare the acceleration performance of the vehicle the Data Mode program contains three, (3) different mini-programs:

The **Time to Distance** program estimates the distance traveled between 2 user-selected recorded frames by using the speed it measured and its own high-resolution time data. It then calculates the average forces of acceleration and measures the elapsed time. This can be used to compare roll-on acceleration tests that were performed in the same gear by setting the start and end of the roll-on runs at the same points, such as 25 and 80 mph in 3rd gear. The value of the tuning adjustments that were made can then be easily identified by comparing the acceleration rates and elapsed times of the past and present tests.

The **Quarter Mile Calculator** estimates the 60-foot, 1/8-mile and 1/4-mile distance traveled from a user-selected Beginning point using the speed measured and its own high-resolution time data. It then calculates the elapsed time and the average forces of acceleration. This program was designed to record a drag race from a standing start, but can be used to compare roll-on acceleration tests that were performed in the same gear. The difference is how you use the program is determined by where the user sets the start and end points. In either test, quicker elapsed times and higher rates of acceleration would tell the tuner that the tuning adjustments had paid off.

The **Dyno Horsepower Estimator** graphs horsepower and torque by interpreting the weight of vehicle & rider, the rate of acceleration and the engine rpm of the user-selected range of recorded data. Additionally the Dyno Estimator can factor the effects of wind drag, power loss due to drivetrain friction, and various drive ratios. The data can also be exported to a spreadsheet program such as Microsoft Excel[™].

Manual Format

This manual was designed to be used as a reference tool. The amount of text has been streamlined for easier reading. The information has been divided into 3-types:

Explanations, descriptions and functions are provided in blue-colored text boxes

Step by step commands are provided in yellow-colored text boxes

Tips, notes and warnings are provided in gray-colored text boxes with orange trim

LAUNCHING PROGRAM & OPENING DATA FILES



TIP: Note that many of the Data files in this example have been created to identify:

- The model and year of the vehicle
- · That the vehicle is all stock or has been modified
- The last 6 characters of the VIN
- What Screamin' Eagle Calibration was programmed into the ECM
- Modifications such as "no knock" to indicate Knock Control Disabled

It is suggested that the race tuner use a system that makes sense to them so that they can identify basic features of the Data File without the need to open each file and look at its file Comments.

Note: Some early versions of Windows 95[™] only allow 8-characters in a file name.

DATA MODE BASICS

Data Mode Explanation

The Data Mode Program of Harley-Davidson Screamin' Eagle EFI Tuner can provide the skilled race tuner with an abundance of critical data that can be viewed in a multitude of different ways. The next few pages will provide the user with an overview of the many tools available. Detailed descriptions will follow.

The Example below is a data file created from the closed-course track test of a 2002 Harley-Davidson Softail Heritage Classic, FLSTCI.

Data Mode File File View Set	Playback Ip Help	Active					<u>. 0 x</u>
C.L.FLSTO	0.02 10.016	355.DM2	2 3/31/2002	2.14:12:05	n (begen)	Recs: 1888 / 0	отс ок
Hom	::Value:	Unit	Rom Nom	Yales :	Unit	Status Bit Name	Value
Speed	1044	RPM	Battery Voltage	13.2	Volts	Engine Run Mode	000 N (100
Véhicle Speed	0	MPH	Engine Temp	97	тС	Vehicle Tipped	0.00
Vehicle Speed	0	km/hr	Engine Temp	207	F	VTD Active	0
Throttle Position %	0.0	76	Intake Air Temp	42	°C		1275
Throtile Position V	0.35	Volta	Intake Air Temp	108	F		6.8
MAPLoad	34.7	kPa.	Barometer	97.4	kPa.		
AFR Desired	11.8		IAC Position	35	Steps	Dischart Control C	and Street
VE Front	77.0	36	Desired Idle	1000	RPM	o nor	4
VE Rear	67.5	76	Warm-up Fuel	10	24 rich	0.699	
Spark Adv Front	10.50	deg	Knock Retard Front	0.00	deg	Plac # 1	
Spark Adv Rear	10.75	deg	Knock Retard Rear	0.00	dog		
Injector PW Front	3.95	1015	Accel Enrichment	0.00	015	SIOW PAR	Start 1
Injector PW Rear	3.49	1005	Decel Enleanment	0.00	1916		Count 1
	· · · · · · · · · · · · · · · · · · ·		······			COREV FORDS	Stop
-00000000000000000000000000000000000000	A			M	Jup	Rec # 1 Item Engine Speed (PPM) MAP Load (kPa) Vehicle Speed (kPa) Vehicle Speed (kPa) Spark Adv Front (deg) Restore Grep	vi 5 1001 34.7 0 10.50

Data Mode Main Functions

- Main Display Displays the data collected of one frame of the total recording session
- Status Bar Data File name Date and time recording began Total number of frames recorded – If a DTC was set – turns red
- Status Bit Name Displays: What Engine mode the engine was in If vehicle fell over – If security system alarmed in the frame being viewed
- Playback Control Allows user to set controls for automatic playback of entire recording session
- 5. Graph Control Allows user to select what to graph and in what format

DATA MODE BASICS - CONT'D

		Menu Bar Commands
File		
Оре	en Data File	Open window for List of Data Files
Rec	ord Data*	Open window to Record New Data File
Prin	nt Data	Open window to Print Hard Copy of Data Mode screen being
Rec	ord*	viewed
Exp	ort Data*	Open window to Export Recorded Data File as a CSV, (Comma Separated Values) file
View File	Comments*	Open window to Read/Edit Information attached to data file
DTC	Codes*	Open window to View Any DTC, that were set during the recording session
Spe Cale	ed/Distance culator*	Open window to Calculate Elapsed Time and "G" Force of an acceleration run within the recorded session
Qua Calo	urter Mile culator*	Open window to Calculate Speed, Time and "G" Force of an acceleration run within the recorded session. 60-feet, 1/8- mile, 1/4 –mile and 60-mph options
Dyn	o Graph*	Open window to Graph Horsepower and Torque of an acceleration run within the recorded session

WDate Mode	Edu Pla	uhurik Active			1.000				
Eile View	Setup:	Help (1999)							
	FLSTCI-04	10L016355.DM2	3	/31/2002	14.12.06	Becs:	1888 / 0	DIC	DIK

	Menu Bar Commands
Setup Display	Set Main Display Size - Adjusts screen to preferred size - clicking on this feature brings up same window as Tuning Mode which is displayed on 4.9 and 5.10 Prompt to Save Display Assignment Changes - Toggles prompt when closing program or loading new file ON/OFF that notifies you if you made a change to Main Display or Graph Assignments Save Display Assignments Now - Saves current selection of Main Display and Graph Assignments
Preferences	None
Graph	Line Width – Selection of thick or thin graph line
Help Contents	View Information about Tuning Mode Program
About	View Info about software, revisions, licensing, etc.
* Indicates more inform	ation on this item in following pages

MAIN DISPLAY DESCRIPTIONS

Main Display Commands

The table of up to 26-data items is part of the Data Mode main screen and lists all of the data items collected in the data file that's currently loaded. The values listed are for a single frame and determined by the position of the cursor on the graph.

- To View Specific Frame of Data position cursor over graph and left click
- To Locate Specific Frame of Data
 - Left click on graph and use left and right Arrow Keys to Move 1-Frame each
 - Use Playback Control Center to View Frames in Slow to Fast Transition, (see Playback Control Center)
- Double-click on data item in table to Open Assign Main Display Item window if you want different data items in different positions

Item	Value	Unit	ton line	(alua	
Engine Speed	1044	RPM	Assign Main Display Ilan	<u> </u>	Assign Main Display
Vehicle Speed	0	MPH	herr Units Selection		Item Window
Vehicle Speed	0	km/hr	C Freish		Commands
Throttle Position %	0.0	%	i in the second s		1. Click on scroll bar
Throttle Position V	0.35	Volts	Date Oroma Coding		arrow and click on
MAP Load	34.7	kPa.	C Strebed		2 Select Metrie or
AFR Desired	11.8	-	e presento		English massure
VE Front	77.0	%	Item Assignment		3 Click on Apply to set
VE Rear	67.5	%	Borometer		4. Click on Exit to close
Spark Adv Front	10.50	deg			window
Spark Adv Rear	10.75	deg			deg
Injector PW Front	3.95	mis	Apply		ms
Injector PW Rear	3.49	mis.	Decer Enteanment	0.00	ms

	Main Display Descriptions
Engine Speed	Engine Crankshaft Revolutions Per Minute
Vehicle Speed (In mph or km/hr)	Vehicle ground speed in miles per hour or kilometers per hour
Throttle Position (In % or volts)	Position of TP sensor in percentage from 0% -(closed) to 100% -(wide open) or as actual voltage measurement collected by ECM
MAP Load	A pressure measurement that reflects changes in engine speed and load. A product of atmospheric pressure and manifold pressure.
AFR Desired	ECM Air-Fuel Ratio target for the present conditions
VE-Front or Rear	ECM front or rear cylinder VE targets for the present conditions

MAIN DISPLAY DESCRIPTIONS - CONT'D

	Main Display Descriptions
Spark Advance – Front or Rear cyl.	ECM spark timing target measured in degrees before TDC for the current engine load and engine speed
Injector P/W – Front or Rear cyl.	ECM Injector Pulse Width target for front or rear cylinder for the present conditions. Measured in mS. (milliseconds, 1/1000 of a second) Enrichments and enleanments increase or reduce actual "delivered" pulse width at the injectors.

concernition approxim	Value	Unit	item	Value	Unit
Engine Speed	1044	RPM	Battery Voltage	13.2	Volts
Vehicle Speed	0	MPH	Engine Temp	97	10
Vehicle Speed	0	km/hr	Engine Temp	207	"F
Throttle Position %	0.0	74	Intake Air Temp	42	°C
Throttle Position V	0.35	Volts	Intake Air Temp	108	Ψ
MAPLoad	34.7	kPa.	Barometer	97.4	kPa
AFR Desired	11.8	-	IAC Position	35	Steps
VE Front	77.0	%	Desired Idle	1000	RPM
VE Rear	67.5	%	Warm-up Fuel	10	% rich
Spark Adv Front	10.50	deg	Knock Retard Front	0.00	deg
Spark Adv Rear	10.75	deg	Knock Retard Rear	0.00	deg
Injector PW Front	3.95	ms	Accel Enrichment	0.00	ms
Injector PW Rear	3.49	ms	Decel Enleanment	0.00	ms

	Main Display Descriptions
Battery Voltage	Electrical supply voltage measured at the ECM
Engine Temp – Celsius / Fahrenheit	Engine temperature measured at cylinder head. Offered in Celsius or Fahrenheit
Barometer	Atmospheric pressure.
IAC Position	Actual position of IAC valve in steps, (rotations from fully closed)
Desired Idle	ECM target rpm for idle for current engine temperature
Warm-up Fuel	Additional fuel that's delivered to front & rear injectors for engine warmup. Shown as a percentage of AFR at normal temp.
Knock Retard – Front or Rear cyl.	Actual reduction of spark advance timing, measured in degrees of crankshaft rotation. Is the result of the Ion Sense function in the ECM that monitors combustion event and retards spark timing to reduce detonation.
Accel Enrichment	Actual increase of front and rear injector pulse width when throttle position increases and MAP rises.
Decel Enleanment	Actual decrease of front and rear injector pulse width when throttle position decreases and MAP decreases.

STATUS BIT NAMES



To Assign Status Bit Items

- Double-left Click on Status Bit name to Open Assign Status Bit Item window
- Click on Arrow and click on preferred Item to Assign to Status Bit Name window
- Click on Apply to Set
- Click on Exit to Close window

PLAYBACK CONTROL CENTER

Playback Control Center Functions

This feature is used to automatically play through a recording so that the user can spot particular changes in a sensor reading or cell value.

- Auto Playback Will Move Across Graph Display Direction & speed adjustable
- Cell Values in Main Display & Graph Display Update as each frame is encountered
- Status Bar Indicates Frame Number of Auto-Scroll Position
- Auto-Scroll Bar Indicates Travel position through Data File
- Rec # Indicates Frame Number of Cursor Position in Auto-Playback mode

tom tom	Value	Unit	to the new second	Value	Unit
Engine Speed	1044	RPM	Battery Voltage	13.2	Volts
Vehicle Speed	0	MPH	Engine Temp	97	°C
Vehicle Speed	0	km/hr	Engine Temp	207	Έ
Throttle Position %	0.0	3%	Intoke Air Temp	42	°C
Throttle Position V	0.35	Volts	Intoke Air Temp	1.08	F
MAPLoad	34.7	kPa	Barometer	97.4	kPa -
AFR Desired	11.8		IAC Position	35	Steps
VE Front	77.0	- 56	Desired Idle	1000	RPM
VE Rear	67.5	26	Warm-up Fuel	10	% rich
Spark Adv Front	10.50	deg	Knock Retard Front	0.00	deg
Spark Adv Rear	10.75	deg	Kacok Retard Rear	0.00	deg
Injector PW Front	3.95	ma	Accel Enrichment	0.00	ma
Injector PW Rear	3.49	ms	Decel Enleanment	0.00	ma





	Playback Control Commands		
Slow – Fast	Click on scroll bar to set Travel Speed		
Auto-Scroll Bar	Click and Drag Marker on scroll bar to set travel speed		
REV – FOR	Click on FOR or REV to set Direction of Travel		
Start - Stop	Click on Start or Stop to control auto play action		

GRAPH CONTROL

Graph Information

This feature provides the ability to plot any value in the Main Display as a graph.

- Zoom Feature Allows close-up viewing of specific graph areas
- View Cell Values Up to 4-different cell value in Main Display can be viewed as a Graph
- View Frame by Frame To pinpoint specific value changes

Note: Rec # - indicates cursor position on graph Cursor movement across graph updates the 4-values in the lower graph box



		Graph Control Commands
Zoom		 Position cursor at desired area of graph, Right Click, Hold & Drag to form box around desired area of graph to zoom-in on – release right mouse button to zoom, (See example of Zoomed section below) Zoom in again if more detail is desired Left click on Restore Graph to return graph to normal size
View Va Main Di	lues in ^m splay	Position cursor over graph and left click – all Recorded Values for That Frame will update in Main Display
View Fra Frame	ame by	Left click on graph and then use keyboard left and right arrow buttons to move forward or reverse 1 Frame At a Time



GRAPH CONTROL - CONT'D



RECORDING DATA FILES

To open Data Recording Control:

Click on File in menu bar and then click on Record Data

Data Rec	ording Control F	unctions
C:\FLSTCIFile name being recorded to		0 Recs - Number of Frames Recorded
Com 1 Open – Com Port Status No selection Number 1, 2, 3 or 4 Com Port		Engine Data – (File Type) could be: Engine Data – Maximum number of data items measured <u>Dyno Data</u> – Minimum number of data items recorded, (provides greatest amount of data points recording for each item)
0 Rec/Sec – Number of recordings per second, (varies with computer speed and type of Data File selected, Dyno Data provides greatest number of recordings per second)	Recording ON – Indicates recording mode is active	Waiting – Data recording status Waiting – ready to record Running – recording

Com	Engine Deta			
-0- Flec/Siec	Recording UN	Waiting		
Record Data 28 Feames/Sec	ECM Disgnostic Code Current DTC List	Click for description)		
• <u>.</u>	DTC Number	Cerrent Historic		
Ascellanous Functions				
ECM Internation Display	C View All	View Carront View Historic		
E CM Internation Display	View All View Set DTC Description.	Vice Carnet Vice Historic		
ECM Intornation Display	Yiew All Yiew Set DTC Description.	View Carnet View Historic		

Data Recording Control Functions

Record Data:

- 20 Frames/Sec Range of maximum frame recording rate. (rate also dependent on computer processing and Data File Type)
- · Stop/Start Control for start and stop of recording session

RECORDING DATA FILES - CONT'D

Data Recording Control Functions

Miscellaneous Functions:

- Message Window is used to provide warnings, status reports and additional directions regarding Com Port function
- Test Com Checks connection to the ECM by sending a test command. Results are displayed in Message Window
- Get ECM Info Retrieves various information from the ECM

C:\Program Files	N. Volv16355-001.DM2	Fre	me 🛃 1003	
Data Co	direction Active	En En	gine Data	
5.6 F/S	Recording ON		Runsing	
Record 0802 Date	ECM Diagnostic Co	des		
20 Frames/Sec	Current DTC U	st: (Click for d	escription)	
	OTC Number	Current	Historic	
Constant Constant of the	P0107		<u>B</u>	
and the second s	PC100			
19100000000000000000000000000000000000	P0112	- X-	E H	
MISCHIERDUS PARCIUS	P0117	- ă	- Ö	
ALLA.	P0118			
ECM HW P/N: 3277241	Contraction of the	1991 Landa and and a	3.3.5.5	
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tcle Offset/RPM: 00.00.00.00.00	00 N available DTC's re Filmonari Tana - 2243	ceived, total co #5	untile 42	
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Data Recording Control Functions

Click on Options – then click on "Collect Set DTC's During Data Recording" to collect any DTC's set during recording session.

ECM Diagnostic Codes :

- DTC Number Identifies malfunction, sensor, etc. (Click on Help section for list of DTC descriptions, 6.6)
- Current DTC set and still active
- Historic DTC set, but didn't remain active
- View Selections View DTC's set as ALL DTC's possible, just DTC's set, just DTC's set & still existing or just DTC's that set and disappeared
- Message Window Explanation of DTC information collected
- Clear DTC's Deletes all DTC's
- Get DTC's Collects and displays any DTC's currently in ECM

0 Recs

RECORDING DATA FILES - CONT'D

File	
Record Data Mode File	Opens Select Data Mode File to Save window to Create File Name
Save Data Mode File	Saves Data File just recorded
Com Port No Selection	Indicates Com Port Not Selected
Com 1, 2, 3, 4	Use to select one of 4-different Serial Com Ports on computer
Edit	
File Comments	Opens File/View Comments Window – use to document info about data file
Data Type	
Engine Data	Records All Data Items in Main Display
Dyno Data	Records 7- Data Items - for use with dynamometer: Engine rpm, Vehicle Speed, Run Time, Barometer, Engine Temperature, Intake Air Temperature and Front & Rear Spark Advance. Improves resolution, (detail) of data.

Eile Com Port Edit Data Type	Options
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Data Recording Control Functions				
Options				
Always On Top	When checked On the Data Recording Mode window Will Display on Top of Other Windows			
Show File Dialog On Startup	When checked On, will Automatically Display "Show File Dialog On Startup" when opening Data Recording Control			
Collect Set DTC's During Data Recording	When checked On, Any DTC's That Are Active during recording session will be saved			
Advanced	 Click on DTC Log Time Intervals to open Setup DTC Timing Constants window Set Interrogation Time – Click & drag scroll bar to set duration of "snapshot" from 1000-20000 mS Set Request Rate – Click & drag scroll bar to set frequency of "snapshot" from 1000-20000 mS Set Defaults – Click to use standard settings OK – Click to save settings and return to Recording Data Control 			
RECORDING DATA FILES - CONT'D

Connecting Computer, Interface & Cables to Record Data Starting with Data Recording Control Window On-Screen...

- 1. Make sure vehicle ignition is OFF
- 2. Plug 4-pin Data Cable into 4-Pin Data connector on bike & verify snapped in place
- 3. Plug 9-Pin female end of Data cable into Interface Module & tighten thumb screws
- 4. Plug 9-Pin Serial cable male end into Interface Module & tighten thumb screws
- 5. Plug 9-Pin Serial cable female end into computer Serial port & tighten thumb screws

Continued on next page



Note: The EFI Tuner Interface Module is a "single unit" design that permanently links to the ECM the first time communication is established. The Interface Module can then be used an infinite number of times with that ECM, but the Interface Module will not communicate with any other ECM's.

Owner must Store Interface Module in a Secure Place for future tuning or data recording. If the Interface Module is lost or broken a new Screamin' Eagle EFI Tuner kit must be purchased to obtain a new Interface Module that can communicate with the ECM.

RECORDING DATA FILES - CONT'D

Connecting Computer, Interface & Cables to Record Data Continued from previous page

- 6. Turn ignition ON
- 7. Click on Get ECM Info to establish ECM communication and retrieve information
 - You should see the following information:
 - VIN (2002 and later ECM's)
 - ECM Hardware PN indicating OE PN of ECM in vehicle
 - ECM Software Calibration ID indicating Calibration PN of ECM in vehicle, (will match ECM Hardware PN up to 3-digit extension)
 - ECM Software Calibration PN
 - If you get an error message, "A serial Com Port has not been selected" you should:
 - Check cable connections
 - Verify ignition is ON
 - Select a Com Port, see 6.15
- 8. Select data type for recording, (Engine Data or Dyno Data) see 6.15
- 9. Select Collect DTC's if desired, see 6.15
- 10. Start engine and let idle briefly
- 11. Click on Start Box to begin recording data
 - You should see frame number at top right portion of screen increasing as frames are being recorded
 - You should see Frames/sec speed, (Engine Data selection usually around 5 frames/sec and Dyno Data considerably higher)

Note: Data Mode main screen will go blank during data recording session Continued below



- 12. Perform dyno or closed-course track tests as desired
- 13. When testing is finished safely park bike and turn ignition is OFF
- 14. Click on Stop box to stop recording
- Disconnect cables, laptop computer and Interface Module if no additional data recording is planned

PRINTING DATA RECORD

Start: Clic	k on File in main menu bar – then click on Print Data Record
File	
Select Font	Select Text Font Style and Size for print-out
Page Setup	Set Page Margins, page size and page layout
Print Setup	Select paper size, source and edit Printer Properties
Print	Printer Commands
Options	
Show Cell Colors	Toggle Status Bit Cell Colors ON/OFF for print-out
Zoom	Enlarge or Reduce document view size



EXPORTING DATA FILES

Exporting Data Files Explanation

Recorded Data can be exported to other programs as "Comma Separated Values", or CSV's. This allows the user to manipulate the data in a multitude of ways. One example of how this can be accomplished is provided below.

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	C Num	Time	Stamp	Click to	Click to	Click to	Click to	Valu
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ſ							Item Ingine Speed (RPM) VAP Load (KPa)	Val 165 98

Exporting Data Commands

Start: Click on File in main menu bar - then click on Export Data

- Click on File in the menu bar of the Data Mode Playback screen and then click on Export File in the drop down list
- 2. Determine frame number to start data export and type into Start Rec:
- 3. Determine how many frames to export and type into Count:

Continued on next page

EXPORTING DATA FILES - CONT'D

Experience The Edd	N Assign Export Variable	Assign Export Variable X
Start Rec. 7345 Coart. 70 Data New Time Data Chick to C	Veneble Units Selection	Variable Units Selection
0 0.000 Assign As	Variable Assegment for the Cel.	C Lugat
	Oloneo	Engine Speed
a	Engine Temp AC Poston	Apply Ext
1	Injector PW Reor	

Exporting Data Commands

- 4. Double click on Assign Var to open Assign Export Variable window
- 5. Select Item you want to export using drop down list
- 6. Select English or Metric measure
- 7. Click on Apply to set item in that column
- 8. Click on Exit to close and Save selection
- 9. Repeat this procedure for each Variable you want to export

User can set as many as 30 different items in the 30-Assign Var Columns available

- 9. Click on Extract Data to bring item values into Export Data Window
- 10. Click on File and Click on Save as CSV
- 11. Type in a File Name and Select a Folder to save in
- 12. Open CSV file with a Spreadsheet program like Microsoft Windows Excel™

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h	. Ban	Time Stamp	Engine Speed RPM	APR Desited.	NAP Look	Speck Adv Fre Res	(Internation)	Time Stonp	Expire	VE Front	Speck Adv	Reock
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	1947	254.022	1795	12.4	91.3	10.21		212.241				<u>8</u>
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	1944	257,649	20%	0.7	501.5	20.75	1.15					
	1945	207.303			191.3	38,275	1.05					
	1966	257,509	982	0.7	162.2	26.5	1.05	-				
	1943	757,05	3852	0.4	102.3	8.25	1.05					
	094	267,07	3197	0.5	100.3	N	1.0	-1				
	643	110.15	3021	0.5	162.0	8.23	1.15	_				
	11 M	254,231	1293	0.4	100.2	25.5	L/5					

ENTER/VIEW COMMENTS

Enter/View Comments Suggestions

The Enter/View Comments feature provides a notepad to save valuable information relating to a Data File. Suggestions for comments that could be useful are:

- Engine configuration
- · What, if any, Screamin' Eagle Calibration file is installed
- · What, if any, tuning modifications you have made to the calibration
- What specific recorded frame or frames you may want to identify for tuning or troubleshooting

2002 FLS Stock eq SE Cal Tuning m	TCI-016355 uipped 328700-02 nodification to VE at WOT,	, 1500 rpm to 6500	~
3rd gear	roll-on starts at 1944		
			*

Enter/View Comments Commands

Start: Click on View in main menu bar – then click on File Comments

- 1. Type Desired Comments into Enter/View Comments for this Data Recording
- Click on Save Changes (If you don't click on Save Changes what you typed will not be saved when you close the window)
- 3. Click on Exit to close Enter/View Comments window

DTC CODE

View ECM DTC Functions

This feature allows the user to view DTC's that were recorded in the Data Recording File currently being viewed.

When "Collect Set DTC's During Data Recording" is switched ON during a recording session the following may be available:

- DTC Number Identifies the malfunction, sensor type, etc., (see Help Contents Data Playback & Analysis – DTC Descriptions
- · Current A DTC that is currently active
- · Historic A DTC that was set, but is no longer active
- View Selections View DTC's set as ALL DTC's possible, just DTC's set, just DTC's currently active or just DTC's that were set and are no longer active
- DTC Description: Provides explanation or description of DTC

t (Click for description) Current Historic
C View Carrent C View Historic
<u>ia</u>

View DTC Codes Commands

Start: Click on View in main menu bar - then click on DTC Codes

- Dismiss Closes window
- Options Toggles "Always on Top" ON/OFF to keep View DTC Codes window on top of other windows & screens displayed
- Views See View ECM DTC Functions above

TIME TO DISTANCE ESTIMATOR

Time to Distance Estimator Functions

This feature estimates the distance traveled between 2 User-selected recorded frame numbers by using the speed measured and its own high-resolution time data. It then calculates the average forces of acceleration.

- Begin Speed Beginning speed of run at selected record frame number
- End Speed Ending speed of run at selected record frame number
- Distance Distance traveled, (in feet or meters and miles or kilometers), between the 2 recorded frame numbers selected
- Elapsed Time Time to complete the distance between the 2 recorded frame numbers
- Average "G" Average force of acceleration in "G" force

Data Mode File File View Set	Flayback ap ^{ro} Help	Active		Fime to Distance Estimator Select Units	
C:\FLSTCI-02 v0k016355 SE3267002 mod2			mod2	Record Bounds	ecs: 2775 / 0 DTC OK
Ren Acces	Value	Unit	1000	SetBegin Record 1945	Status Bit Name Value
Engine Speed	1657	RPM	Botter	and the second sec	Engine Run Mode
Vehicle Speed	25	MPH	Engin	Sel End Record 2012	Vehicle Tipped
Vehicle Speed	40	km/hr	Engin		VTD Active 0
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Throttle Position V	4.16	Volte	Intoke	Begin Speed (MPH) 25	
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VE Rear	78.5	26	Worr	Distance Mile) ID 191 m	353.751
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				Ext Calculate	KREV FOR>> Stop
	1				David 1845

Time to Distance Estimator Commands

Start: Click on View in main menu bar - then click on Speed/Distance Calculator

- 1. Click on Select Units to choose Metric or English
- Move Cursor across graph to locate preferred Start and End Record frame numbers.

Example: We located the 25 mph and 75 mph frames of a 3rd gear roll-on test.

- With cursor positioned on preferred graph location, Click on Set Begin Record or Set End Record to transfer graph frame number to Time to Distance Estimator – or:
 - Type numbers into Set Begin or Set End Record box
- 4. Click on Calculate for Time, Distance & Acceleration measurements
- 5. Click on Exit to close

QUARTER MILE CALCULATOR

Quarter Mile Time Calculator Explanation This feature estimates the 60-foot, 1/8-mile and 1/4 -mile distance traveled from a User-selected Beginning point using the speed measured and its own highresolution time data. It then calculates the elapsed time and average forces of acceleration. Record Bounds - The starting point of the Quarter mile run that can be inserted manually or with the Auto Find feature Measure – The distance estimated Time – The time to complete that distance Speed - The speed at the end of the distance measured Accel G's - The average "G" force of acceleration during the distance traveled Record # - The recorded data frame number at the time the measurement was made Ounder Ade Time Estimator Tip: Use the Quarter Mile Time Calculator to compare 2 or more "like" Record Bounds runs. Calculate Manual Set Beginning Record Example: We did a full throttle, roll-on 1945 acceleration run in 3rd gear on a flat Auto Find Beginning Record E de stretch of racetrack. We set the Beginning Record frame number at Speed/Ovistance 1945, when bike speed was 25 mph at Measure Accel 6's Record # Time Speed 100% throttle. Begn 025 0 24.0 1945 Now, we can Compare our 60-foot, 1/8th **STEer** 02965 19532 1.64% 224 mile and 60 mph times to other runs by 1.50 miles 68.3 021361 9 307 1996.6 performing the same exact acceleration run and starting its Beginning Record 1.16 miles 1.400 05.0 0120-6 2000.4 when that bike's speed is also at 25 60 MPH 6962 80.0 0.230.61 1963.5 mph. Note: In this 3rd gear run the throttle was

closed before a quarter mile was reached. When this happens, compare only distances where the throttle was still at 100%.

Quarter Mile Time Calculator Commands

Start: Click on View in main menu bar - then click on Quarter Mile Calculator

1. Enter Beginning Record frame number - Options:

- Type in number
- Move Cursor on Graph to desired beginning frame & click on Manual Set Beginning Record to transfer that frame number
- Click on Auto Find Beginning Record to simulate a quarter mile drag race from a standing start
- 2. Click on Calculate for 60', 1/8 mile, ¼ mile and 60 mph numbers.
- 3. Click on Exit to close window

DYNO HORSEPOWER ESTIMATOR

Dyno Horsepower Estimator Explanation

This feature graphs horsepower and torque by interpreting the weight of vehicle & rider, the rate of acceleration and the engine rpm in the User-selected range of recorded data. Additionally, the Dyno Estimator can factor in the aerodynamic drag of the selected motorcycle model, drivetrain losses due to friction, and the effects of drive ratios.



Open Dyno Horsepower Estimator by: Clicking on View in main menu bar – then click on Dyno Graph

File	
Print	
Print DYNO Graph	Select Font – Font style & size for print-out
	Page Setup - Margins, page size & page layout
	Print Setup - Printer Properties: paper size/source and adjustments
	Print – Sends Dyno Graph to Printer
Options	N/A
Magnifying Glass Icon	Zoom Preview Dyno Graph in Different Sizes
Save as JPEG Image	Creates Image File of Graph
Export CSV Data	Creates CSV File that can be imported into a spreadsheet program Like Microsoft Excel™

Dyno Horsepower Estimator Functions					
Options Always on Top	Positions Dyno Graph window In front of other windows				
Data Corrections					
Apply Aerodynamic	Applies correction factor for Wind Resistance when				
Correction	user wants to graph closes course track test				
Filter MPH Data	Smoothing filter for ECM				
Filter RPM Data	Smoothing filter for ECM				
Filter Time Data	Smoothing filter for ECM				



Set Start Rec	Graph Smoothing	Plot Data
Use to insert starting frame of graph	Indicates Smoothing selection – a feature that applies trend lines to raw ECM data	Use to create graph from current selections
Set End Rec	Scroll Bar Adjuster	Exit
Use to insert ending frame of graph	User-selection of Graph Smoothing	Use to close Dyno Calculator window
	Set Start Rec Use to insert starting frame of graph Set End Rec Use to insert ending frame of graph	Set Start Rec Graph Smoothing Use to insert Indicates Smoothing starting frame of selection – a feature graph that applies trend lines to raw ECM data Set End Rec Scroll Bar Adjuster Use to insert ending User-selection of frame of graph Graph Smoothing



Dyno Setup Ir	nformation Functions
The values in this window are used to create	e the Dyno Horsepower Graph by calculating
horsepower and torque. When vehicle is sel	ected Data Mode automatically inserts Default Values.
Vehicle Selection (Will Set Defaults)	Gearing:
Opens drop down list of vehicle models	Tire Revs Per Mile – Based on stock rear wheel &
and inserts Default Values for weight &	tire size
wind resistance.	Trans Gear Ratio – Bases on stock transmission
Abbreviations:	gear ratio
WS – Windshield	Gear Selection – User-Selected Gear – must match
SB – Saddlebags	gear used in test
Vehicle Test Weight	Primary Drive Ratio – H-D ratio for stock primary
Used to calculate total mass	drive system
Vehicle Weight – H-D Default	Secondary Drive Ratio – H-D ratio for stock
Rider + Payload Weight – H-D default	secondary Drive system
is 170lbs. When closed-course testing,	Drivetrain Loss – User-Selected percentage to
enter the actual rider's weight for	estimate frictional losses between engine and track.
Aerodynamic Information: Displays H-D wind resistance values for bike selected Frontal Area – H-D Default Value Drag Coefficient – Correction Factor for wind resistance of Frontal Area	OK – Command box to accept current values & close Dyno Setup window Cancel – Command box to cancel changes made and close Dyno Setup window



Dyno Horsepower Estimator Commands

Start: Click on View in main menu bar - then click on Dyno Graph

- Select and insert Set Start Rec and Set End Rec frame numbers Example: We zoomed in on a section of the data above where we performed a 3rd gear acceleration run on a flat section of racetrack. We set the start at 1950, a frame that measured about 2000 rpm & set the End at 2019, the last frame indicating 100%, (WOT) throttle. The numbers can be entered 2-ways:
 - Click on section of graph to start and click on Set Start Rec. Do the same for the Set End Rec – or:
 - Type recorded frame numbers into Set Start and End Rec.
- Click on Data Corrections and select functions you want turned on. We suggest: Aerodynamic Correction – ON Filter MPH Data – ON
 - Filter RPM Data ON
 - Filter Time Data ON
- Click on Setup Vehicle Test Information to set parameters for graphing

See Next Page

Dyno Horsepower Estimator Commands

Before creating a dyno graph you'll need to set the parameters and functions in the Dyno Setup Information window.

- Click on the Down Arrow of the Vehicle Selection and click on the model and setup that best matches your vehicle. Note abbreviations for saddlebags & windshield
- Click on Rider + Payload Weight if you need to increase or decrease the weight. Default is 170lb; we set ours at 200 for a heavier rider.
- Click on Gear Selection and click the appropriate gear you tested the bike in. We choose 3rd.
- Click on Drivetrain Loss and insert a number if you want this factored in for results closer to crankshaft forces, (use 15-20 percent depending on speed, [frictional power loss increases with speed]). Set at zero for rear wheel power.
- Click OK to accept your settings
 All other values are H-D defaults and user would only change them if they changed primary or secondary gear ratios, added an accessory that greatly changes aerodynamic resistance or changed wheel and tire size.

Venicle Selection (Will Set Defau	as perioni	Geang	9099 <u>90</u> 0000099
FLSTCI Heritage Classic WS +	SB 1	Tire Revs Per Mile	815
	h	Tians Gear Flato	1.570
Vehicle Test Weight		Gear Selection	3
Vehicle Weight (Lbs)	734	Primary Drive Ratio	1.440
Rider + Payload Weight (Lbs)	200	Secondary Drive Ratio	2.188
	L	Drivetran Loss (Percent)	0
Aerodynamic Information		Y	
Frontal Area (Sg Ft)	10.4	C	
Dran Coefficient (Cd)	0.700	Cancel	OK

Continued on next page

Note: Once you have set the parameters for your bike, DO NOT CHANGE PARAMETERS. The value in using a tool like the Dyno Horsepower Estimator to compare performance is lost if the Dyno Setup Parameters are different from test to test.



EFI RACE TUNING GUIDE

Introduction to EFI Race Tuning

The Screamin' Eagle EFI Race Tuner System will provide you with the tools to tune a Fuel Injected, performance-enhanced Harley-Davidson Twin Cam engine for optimum performance. It has the flexibility to be used as a simple fuel and spark timing adjustment device or as an engine data acquisition tool with the ability to make specific, detailed adjustments to several different tuning tables within the ECM. No other product has this capability, and, after the user has made the desired tuning adjustments and programmed the new calibration into the ECM, the Screamin' Eagle EFI cabling and Interface Module are removed from the vehicle. Only the calibrations of the vehicle's ECM have been changed – no additional devices are "piggy-backed" to the vehicle's EFI system. The vehicle's EFI system remains just as dependable as it was stock.

What Can the Screamin' Eagle EFI Race Tuner Do for Me?

Until now, the customer who wanted to enhance the racing performance of their Fuel Injected Twin Cam equipped Harley-Davidson would install a Screamin' Eagle Stage I or Stage II Calibration to match the engine configuration of the bike; both to optimize performance and protect the engine from damage. There was no effective way to fine-tune the EFI system to achieve the "edge" that wins races, and there was no effective way to tune the ECM for engine configurations that were different than what was currently offered. That's where the Screamin' Eagle EFI Race Tuner comes into play.

When the racer modifies any area of the engine that affects engine performance, (cylinder heads, intake components, exhaust components, engine displacement, cylinder compression or cam profile) the ECM Tuning tables will require adjustment to fully realize the performance potential of the modified engine and prevent potential engine damage. With the Screamin' Eagle EFI Race Tuner the user can edit up to 9-different ECM tuning tables that affect fuel delivery and spark timing. That means the user can adjust the calibration of the ECM to optimize fuel delivery or spark timing to each individual cylinder. The EFI Race Tuner provides the user with tools and data that are very similar to what Harley-Davidson's engineers use to create the Screamin' Eagle Performance Calibrations.

What Can This EFI Race Tuning Guide Do for Me?

This EFI Race Tuning Guide will provide the user with a foundation for tuning EFI systems that have been enhanced with Screamin' Eagle performance accessories. It cannot, however provide detailed answers for every possible scenario. It is also worth mentioning here that Screamin' Eagle performance accessories are designed to work together and compliment each other, and because of that, the user will often enjoy the greatest success in performance enhancement by installing Screamin' Eagle products, rather than mix-matching a collection of components with no history of complimenting each other. In fact, it is the mix-matching scenario that most often creates the tuning quirks that can be quite frustrating to deal with. Fine-tuning the ECM of a Screamin' Eagle equipped engine usually requires only minor adjustments. **Before reading further**, please read the Introduction in Section 2. This section describes the design and function of the current Harley-Davidson EFI system. You'll need to fully understand how the EFI system functions, to be able to tune it successfully.

The 3-Tuning Environments of the EFI Race Tuning Guide

The layout of the Tuning Guide will be arranged into 3-sections, separated into their "Tuning Environment". This will allow the user to concentrate on one area of the Tuning Guide, instead of jumping from one section to another for the information they need.

- 1. EFI Race Tuning with Basic Tuning Mode By Feel on Closed-course Track
- 2. EFI Race Tuning with Advanced Tuning Mode & Data Mode on Closed-course Track
- 3. EFI Race Tuning with Advanced Tuning Mode, Chassis Dynamometer & AFR Meter

Each of the 3-Tuning Environments will contain the following information, provided in the form of a question. The answers will relate to the specific Tuning Environment so the user can focus on one section of the Tuning Guide for their particular situation.

The questions are:

- 1. Where do I start?
- 2. Why would I want to adjust the AFR?
- 3. How would I adjust the AFR?
- 4. Why would I want to adjust the spark timing?
- 5. How would I adjust spark timing?

Included are also separate sections about:

- 1. Why and how to adjust idle speed
- 2. Why and how to adjust IAC Warmup Steps
- 3. Why and how to adjust Cranking Fuel

The 2-Basic Performance Tests

In each of the 3-Tuning Environments, directions will be provided on how to perform 2-basic performance tests that will help the user identify areas that may need fine-tuning with the EFI Race Tuner:

- 1. Steady throttle/light load cruising in 1st, 3rd & 5th gears at various engine rpm's
- 2. Full throttle/heavy load Roll-on acceleration runs in 2nd, 3rd or 4th gears starting at 2000 rpm and safely accelerating to the engine's redline

These two tests will operate the engine under very different loads and engine rpm's. This is important because most venues of racing require that the bike is able to both hold a steady throttle and to accelerate strongly. The tuners may, of course, opt to perform different types of tests that they feel are more relevant to their intended type of racing.

Consistencies and Concerns in Testing

The EFI Race Tuner was designed to provide the user with tools necessary to optimize engine performance by fine-tuning the fuel and spark delivery. But, as good as the EFI Race Tuner is, it cannot fix mechanical problems in the engine. **You cannot effectively tune a troubled engine**.

It's up to the user to be sure that their engine is in excellent mechanical condition. The engine should have good cylinder compression, with the front and rear cylinder cranking compression measurements equal within 10%. **Example:** If the front cylinder measures 145psi, then the rear cylinder should produce 130-160psi. If a front and rear cylinder leak-down test is performed it should result in no more than a 10% leak-down measurement for either cylinder. Follow the instructions provided in the Harley-Davidson Service manual or the instructions provided with the specific testing equipment. The engine should also be tested for intake manifold, (throttle body) air leaks. If you are unsure about how to perform this test, see your Harley-Davidson Dealer.

Additionally, it should be mentioned that some open exhaust systems, (typically known as drag pipes) on the market today contribute greatly to a situation called **"exhaust reversion"**. Exhaust reversion can limit Twin Cam engine performance in the 2000-4000 rpm rev range. The EFI Race Tuner can be used to target this rpm and through fine-tuning, some of this power-robbing effect can be reduced, but it cannot fix the situation completely. The problem is in the exhaust system design.

Engines fitted with extremely long duration cams can also contribute to **intake and exhaust reversion** problems due to the overlap condition where both the intake and exhaust valves are open at the same time and trading fuel, fresh air and exhaust gases back and forth. The EFI Race Tuner can be used to improve this situation, but it cannot completely fix the situation in all engine rpm's.

Consistency in testing is mandatory for successful tuning results. Without consistency the tuner will not be able to properly measure the performance of the engine. The testing must be performed in the same manner every time. For example, when testing a bike on the chassis dynamometer, the "road conditions" are controlled, but the user may mistakenly test the bike with the engine in different states on comparison tests. **Example:** If the bike was tested at operating temperature on one test, and tested again when the bike is cool and still in the warm-up mode on another, the two tests are not comparable due to different engine conditions.

Another factor in consistent testing, when on a closed-course, is that the acceleration tests should be performed on a flat and straight section of track. If one test is performed on a flat section of track and another is performed on a section with a grade, the tests cannot be compared objectively.

Checklist of Consistency Concerns

- The motorcycle must be track-worthy for the rider's safety and the safety of others a pre-ride inspection must be performed following the guidelines provided in the Harley-Davidson Factory Service Manual for the bike being tested.
- The primary and secondary drives must be adjusted to Factory specification and at the same tension for every test. Differences in primary or secondary drive adjustment can vary the amount of frictional losses between tests and cause inconsistent performance measurements.
- The front and rear tire pressure should be set to the Factory specification and must be the same pressure for every test or the frictional losses may vary and cause an inconsistent performance measurement.
- The engine must be at operating temperature and the Warmup Enrichment mode must be inactive or the performance measurements will vary from test to test.
- The fuel the bike is running on should be fresh and it is recommended that the same type of fuel is used for comparison tests or the performance measurements may vary.
- Wind and road surface conditions on the closed-course track being used for testing should be the same for every test or the performance test measurements will be inconsistent. The closed-course track environment should allow for a safe testing event.
- If a chassis dynamometer is used for testing it should be operated according to the instructions provided by the chassis dynamometer manufacturer to produce consistent performance measurement results.

Explaining Air-Fuel Ratio

The Air/fuel ratio, (AFR) of an engine is determined as the <u>weight</u> ratio of the air entering the engine in relation to the amount of fuel being mixed with the air that creates a combustible mixture. The *stoichiometric* AFR is 14.7 to 1, (14.7 grams of oxygen to 1 gram of fuel). Stoichiometric means that a ratio of *14.7 grams of oxygen to 1 gram of fuel, when burned, will theoretically result in complete combustion*. Stoichiometric isn't the only AFR that supports combustion. Most engines, including Harley-Davidson Twin Cam models, will run with rich AFR's of about 8 to 1, (more fuel) up to *lean* AFR's of about 15 to 1, (less fuel).

When does an engine need a rich fuel mixture? It needs a rich fuel mixture to start a cold engine and to achieve peak power under heavy load. Cold engines need extra fuel because it's only the fuel vapor that will ignite and burn, not the fuel liquid. When the engine is cold the fuel tends to condense on the walls of the intake manifold and cylinders, (like water condensation on a cold window). Additional fuel is needed to provide enough fuel in <u>vapor</u> form to start and run the engine. The cold air also contributes to the need for more fuel because the gases in the air contract when it's cold and that means there's more oxygen in a given volume of air entering the engine, (creating a leaner mixture than normal). Engines under heavy load create more heat in their combustion chambers because of the additional stress. Heavy loads also lower the engine's intake manifold vacuum, which can cause some of the fuel to drop out, or puddle in the manifold. The extra fuel of a rich mixture helps to cool the engine and to provide enough fuel to support combustion when some of the fuel drop sout.

When can an engine run on a lean mixture? The engine can run on lean mixtures of say, 15 to 1, when the engine is fully warmed up and being operated under light loads, such as when holding a steady throttle, steady speed on a flat stretch of track. A hot engine though, under severe load, (such as in top gear, and accelerating for a speed record), could have a tough time running on a lean mixture, and could overheat to the point of causing itself severe damage. As a rule of thumb, for:

- Peak power at 12.8 to 1 AFR is preferred
- Severe loads at 11.0 to 1 AFR is preferred
- Cruising under light load a 14.0 to 1 AFR is preferred

These AFR's are all approximate and your results may vary slightly.

Why Would I Want to Adjust the AFR?

Each motorcycle, (and each cylinder of an engine) has its own unique requirement for the amount of fuel that would achieve maximum performance. That's where the Screamin' Eagle EFI Race Tuner system comes in. It provides the tools necessary to adjust the AFR in the exact engine rpm and engine load needed to unleash the potential of virtually any performance-enhanced Harley-Davidson Twin Cam engine.

Symptoms of a Rich or Lean AFR

The tuner should be familiar with the symptoms of an overly rich or overly lean AFR. The symptoms are the signal to us that we have not achieved maximum performance – that we need to adjust the EFI.

Lean running symptoms

- Bike hesitates when throttle is increased
- Bike runs jerky or surges at steady throttle openings
- Engine detonates, (knocks) when accelerating
- Engine spits back or coughs through intake system
- Exhaust pipe deposits are light gray in color
- Bike runs poorly when cold engine runs better as it warms up to operating temperature
- Spark plug color is white
- Fuel consumption is abnormally low

Rich running symptoms

- Engine blubbers when throttle is increased
- Bike emits black exhaust smoke, (a little black exhaust smoke is normal when accelerating hard or operating engine when cold)
- Exhaust pipe deposits are dark, or black in color
- Engine blubbers at steady throttle
- Engine fouls spark plugs
- Bike runs well when cold engine runs worse as it warms up to operating temperature
- Spark plug color is black
- Fuel consumption is abnormally high

This section is for those users who plan on measuring the performance of the bike by feel and observation, not by Data Mode recording or dynamometer and AFR measurement. EFI Race Tuning by Feel can provide successful results, but the user should realize that tuning in this manner will be more "broad-brush" because it will be impossible to target the exact rpm and engine load where AFR or spark timing adjustment is needed.

Overview – Tuning By Feel

- Inspect and prepare bike for testing.
- Test bike and determine if the symptoms indicate a need for tuning adjustment.
- Adjust the AFR or Spark Timing with the Basic Tuning Mode of the Screamin' Eagle EFI Race Tuner to achieve the performance desired.
- Retest bike to determine if additional tuning adjustments are needed.

Where do I start?

Start by making sure the bike is safe to ride, the engine is in excellent condition and the best Screamin' Eagle Tuning file is programmed into the ECM. Read on:

Inspect and Prepare Bike for Testing

- 1. **Perform a thorough inspection** of the bike before performance testing by following the directions provided in the Maintenance section of the Official Harley-Davidson Service manual for your vehicle. You must make sure the bike can be safely ridden before performing any tests. If you are not sure that you can perform this inspection properly, then the motorcycle should be inspected and serviced by a Harley-Davidson dealership technician. Do not take chances with your safety or the integrity of the motorcycle.
- 2. **Temporarily label the throttle** assembly on the bike to identify when the throttle is at the 0, 6, 12, 25, 50 and 100% position. This will help the rider identify what range of MAP, (Manifold Absolute Pressure) the engine is operating in when performing the test. The picture below

shows a throttle assembly with pieces of tape applied to the right side switch housing and the throttle grip itself. Mark a single arrow on the switch housing tape and then mark the 0%, (idle or closed) position and the 100%, (WOT position) with a dash and number. The midpoint is 50% and should be marked with a dash and number. Mark the midpoint between 0 and 50 as 25, the midpoint between 0 and 25 as 12 and the midpoint between 0 and 12 as 6.



The throttle position marks will correspond roughly with the MAP readings in the table provided in this section.

3. If you haven't done so already, Program the ECM with the Screamin' Eagle Tuning File that best matches the performance components installed on your motorcycle. Example: If you own a 2002 Softail and you have installed the components of the 1550 Stage II with Screamin' Eagle Performance Heads kit, you would Program the ECM with Tuning file number 3286002A-MT2. Follow the instructions in the Basic Tuning Mode section of the EFI Race Tuner User's Manual.

If you don't know which Tuning File would be the best match for your bike, search the list of **Screamin' Eagle Tuning Files with their Engine Configuration notes in Section 9: Calibration Information**. Or, open the Comments Window in the Basic or Advanced Tuning Mode programs with a Tuning File loaded. In the Comments Window a list of Screamin' Eagle components are provided for the Tuning File currently being viewed.

4. **Disable Knock Control** using the ECM Tuning Constants selection in the Basic Tuning Mode. This will turn the ECM's Ion Sense feature off and the ECM will not retard spark timing if detonation is present. If the AFR is too lean or the spark timing is too advanced and causing detonation the test rider will be more able to sense this as an audible engine knocking on acceleration under load.

Note: Remember to Enable Knock Control when your tuning session is completed. This will ensure that the engine receives an extra measure of protection.

Test Bike to Determine if There Is a Need for a Tuning Adjustment

After following the directions listed in **Inspect and Prepare Bike for Testing** the bike should be ready for testing.

Use a closed-course track to carry out a performance test if a dyno is not available. A closed course track is used because:

- It is unsafe to carry out a performance test on a public street.
- It is unsafe and illegal to carry out some performance tests that may require the rider to exceed the speed limits of public streets.

Note:It is illegal to operate a motorcycle with certain performance accessories, including, but not limited to the Screamin' Eagle EFI Race Tuner system because some performance accessories are for Race Use Only.

- 1. **Start bike and allow engine to warm-up fully.** Engine cylinders should be hot enough to feel heat if hand is placed within 1-inch of fins. Use care to avoid being burned. Listen to idle and make a note if idle seems too low or too high.
- 2. Carry out a Steady throttle/Light load cruising test in 1st, 3rd & 5th gears at various engine rpm's. The engine should run smoothly with no misfires, no bucking or surging and no unusual exhaust rhythms. Try cruising at various speeds. The ability to run smoothly with light, steady throttle is particularly important when holding a steady speed as the racer navigates a broad curve in the track. Racing is not always about acceleration. Refer to the Symptoms of a Rich or Lean AFR for help in identifying symptoms.
 - If any undesirable symptoms are identified, note the throttle position and engine rpm the bike is in. As soon as safely possible, write this information down for tuning.
 - Compare the throttle position to the table on the following page.

Throttle Position vs. MAP Table

This table provides a rough guide to matching throttle position to engine load. Note that a broad range is listed in some throttle positions. This is due to the amount of load on the bike at that time. **More Load = More MAP**. To identify the exact MAP the symptom is present in, the user will need to record the performance test using the EFI Race Tuner Data Mode.

Throttle Position	MAP- (Manifold Absolute Pressure)
0-6%	10-50 kPa
12%	40-55 kPa
25%	55-90 kPa
50%	90-100 kPa
50-100%	90 and higher kPa

- 3. Carry out a Full throttle/Heavy load Roll-on acceleration run in 2nd, 3rd or 4th gears starting with the bike cruising steady at light throttle and 2000 rpm engine speed. Then roll throttle fully open and accelerate until engine reaches rpm redline, (only test in 4th gear if closed-course track allows for a safe acceleration to engine rpm redline and doesn't exceed your limit for a safe road speed). Then decelerate and apply brake until engine is again running at 2000 rpm. Repeat test in another gear if desired. The bike should accelerate briskly with no misfires or hesitation, no loud engine knocking and no excessive black exhaust smoke. Refer to the Symptoms of a Rich or Lean AFR for help in identifying symptoms.
 - If any undesirable symptoms are identified, note the engine rpm the bike is in. As soon as safely possible, write this information down for tuning.

Why would I want to adjust the AFR?

If your performance tests indicated any undesirable symptoms of a rich or lean AFR condition you should adjust the ECM Tuning Tables with the Screamin' Eagle EFI Race Tuner Basic Tuning Mode.

If the bike exhibited no undesirable symptoms and you want to see if you can improve the acceleration performance you can adjust the ECM Tuning Tables with the Screamin' Eagle EFI Race Tuner Basic Tuning Mode.

How would I adjust the AFR?

You should already have read the closed-course track testing instructions and performed both the steady throttle and full throttle tests and determined what, if any symptoms you felt you wanted to correct, along with the engine rpm and MAP the symptoms are present in.

Example 1: A Steady Throttle test showed a surging symptom, indicating a lean AFR at about 6% steady throttle around 2500 rpm with the bike under a light engine load. In this example you would:

- 1. Consult the Throttle Position vs. MAP Table and see that MAP runs a wide range of 10-50 kPa, but you know the load was light so you focus on the lower numbers.
- 2. The suggested tuning for a lean condition like this is to use the Basic Tuning Mode Main Fuel Table to increase the percentage of fuel delivered at 2250 to 2750 rpm from the lowest MAP to about 30 kPa. Increment an increase by 2-5 units. Program the ECM with the new Tuning Table and carry out another performance test. Refer to Section 4: Basic Tuning Mode; Main Fuel Table and Programming ECM for specific directions.

C:Vhogram	Files/TTS1_\Exe	mple2.MT2	4/2	7/2002 06:32	20 FM	Tuning Mode File Saved	TWINCAM					
ihow Graph	Set Baseline	Set Refer	ence D	ecrement	Increment	C 1 Unit C 5 Units © 2 Units C 10 Units	C 20 Units C 100 Units					
004	H L Server			1999 (MA)	MAP (kPa)		1					
nr M	20	30	40	50	60	No.						
750	0.0	0.0	0.0	0.0	0.0	Note:						
1000	0.0	0.0	0.0	0.0	0.0	In this example	e a lean					
1250	0.0	0.0	0.0	0.0	0.0	AER condition	at about					
1500	0.0	0.0	0.0	0.0	0.0	APR condition	alaboul					
1750	0.0	0.0	0.0	0.0	0.0	2500 rpm, steady throttle, light load is						
2000	0.0	0.9	0.0	0.0	0.0							
2250	15		0.0	0.0	0.0							
2500	1.5			-		incrementing the cells 2						
2750	14		0.0	0.0	0.0							
3000	0.0	0.0	0.0	0.0	0.0	Units richer from 2250 t						
3500	0.0	0.0	0.0	0.0	0.0	0750	0010					
4000	0.0	0.0	0.0	0.0	0.0	2750 rpm at 20	-30 kPa					
4500	0.0	0.0	0.0	0.0	0.0	MAP.						
5000	0.0	0.0	0.0	0.0	0.0							
5500	0.0	0.0	0.0	0.0	0.0	-						

Example 2: In a Full Throttle Test you hear engine knocking at 2000 to 6000 rpm under heavy load, indicating: 1) a lean AFR or 2) over-advanced spark timing or 3) a lean AFR and over-advanced spark timing.

In this example you'll want to determine if the AFR or the spark timing was causing most of the engine knocking. Start by looking for additional symptoms of a lean AFR such as light-gray colored exhaust pipe deposits, light colored spark plugs or that the engine seems to be running very hot. If you don't know which of the 3 causes, (AFR, spark timing or both) are the main reason the engine is knocking, then you'll want to either increase the fuel delivered or decrease the spark timing in separate tuning adjustments. Experienced tuner's only change one item at a time.

In our example we'll assume that the exhaust pipe deposits inside the end of the pipe were a very light gray, indicating a lean AFR. We would then:

- 1. **Consult the Throttle Position vs. MAP Table** and see that the MAP at 100% throttle runs from 90 kPa and higher.
- 2. Use the Basic Tuning Mode Main Fuel Table to make the **suggested tuning** adjustments for a lean condition like this by increasing the percentage of fuel delivered at 2000 to 6000 rpm and 90 kPa to 100 kPa MAP. We'll increment an increase in fuel by 2-5 units.
- 3. **Program the ECM with the new Tuning Table** and carry out another performance test. Refer to Section 4: Basic Tuning Mode; Main Fuel Table & Programming ECM for directions.

If this tuning adjustment had no or little effect on engine knocking, then retard the spark timing, (see How I Would Adjust Spark Timing.)



Why Would I Want to Adjust the Spark Timing?

If your performance tests indicated undesirable symptoms such as excessive engine knocking, sluggish acceleration or the miles per gallon, (mpg) indicated excessive fuel consumption, you should adjust the spark timing with the Screamin' Eagle EFI Race Tuner Basic Tuning Mode; Main Spark Table.

If the bike exhibited no undesirable symptoms, but you want to see if you can improve the acceleration performance you can adjust spark timing with the Screamin' Eagle EFI Race Tuner Basic Tuning Mode; Main Spark Table.

How Would I Adjust Spark Timing?

You should already have read the closed-course track testing instructions and performed both the steady throttle and full throttle tests and determined what, if any symptoms you felt you wanted to correct. And, you should have determined what area of the engine rpm and MAP these symptoms were present in.

Example 1: Steady Throttle opening of 6% at 2000-4000 rpm under light load indicates no undesirable symptoms, but fuel consumption is high. This situation is probably telling us that we need to increase spark timing so that the engine is more efficient. We know that at steady throttle openings of about 6% that the MAP is between 10-50 kPa because we consulted the Throttle Position vs. MAP Table.

- 1. The **suggested tuning** for this "retarded spark timing" condition is to use the Basic Tuning Mode Main Spark Table to increase the spark timing in the 2000 to 4000 rpm range from the lowest MAP to 50 kPa. We will Increment an increase by 10-Units because we want to change the spark timing by about 2-4 degrees at a time.
- 2. **Program the ECM** with the new Tuning Table and carry out another performance test. Refer to Section 4: Basic Tuning Mode & Programming ECM for directions.

C. Program	Files/TTS/VExe	nple2MT2	4/27	/2002 06:32	20 PM	TuningMode File Saved TWINCAM								
Show Graph Set Baseline Set Reference				eciement	Increment	C 1 Unit C 5 Units C 20 Units C 2 Units C 10 Units								
DOM					MAP (kPa)	Note								
FIP-M	20	30	40	50	60	Note.								
750	0.00	0.00	0.00	0.00	0.00	In this example we want to								
1000	0.00	0.00	0.00	0.00	0.00	improve fuel consumption at								
1250	0.00	0.00	0.00	0.00	0.00	2000 to 4000 ram under store								
1500	0.00	0.00	0.00	0.00	0.00	2000 to 4000 rpm under stead								
1750	2.50				0.00	throttle, light load by increasing								
2000	2.50				0.00	spark timing in 1750 to 4500								
2250	2.50				000	spark aning in 1700 to 4000								
2500	2.50				0.00	rpm and 20-50 kPa MAP. He								
2750	2,50				0.00	we incremented the highlighte								
3000	250				0.00	cells 10-I Inits more for a 2.50								
3500	2.50				000									
4000	250				000	degree spark timing increase.								
4500	2.50				0.00									
5000	0.00	0.00	0.00	0.00	0.00									
5500	0.00	0.00	0.00	0.00	0.00									

Example 2: Full Throttle, heavy load Roll-on acceleration run from 2000-5000 rpm produced excessive engine knock, indicating excessive spark timing. This symptom may be caused by: 1) over-advanced spark timing, 2) a lean AFR or 3) an over-advanced spark timing <u>and</u> a lean AFR.

In this example you'll want to determine if the AFR or the spark timing was causing the engine knocking. Start by looking for additional symptoms of a lean AFR such as light-gray colored exhaust pipe deposits, light colored spark plugs or that the engine seems to be running very hot. If you don't know which of the 3 causes, (AFR, spark timing or both) are the main reason the engine is knocking, then you'll want to either increase the fuel delivered or decrease the spark timing in separate tuning adjustments. Experienced tuner's only change one item at a time.

For this example we'll assume that the color of the exhaust deposits is black, indicating a rich AFR and that over-advanced spark timing is the likely cause of the engine knocking. We know that at WOT under heavy load that the MAP is 90 kPa and higher because we consulted the Throttle Position vs. MAP Table.

- 1. The **suggested tuning** for this "overly advanced spark timing" condition is to use the Basic Tuning Mode Main Spark Table to decrease the spark timing in the 2000 to 5000 rpm range from the 90 to 100 kPa MAP. We will Decrement a decrease by 10-Units because we want to change the spark timing by about 2-4 degrees at a time.
- 2. Program the ECM with the new Tuning Table and carry out another performance test. Refer to Section 4: Basic Tuning Mode & Programming ECM for directions.



What Do I Do if the Starting, Idle or Warmup Performance Needs Adjustment?

If you experience a situation with the starting, idle or warmup performance that you want to remedy, refer to the section titled: **Miscellaneous Tuning**, at the end of this Tuning Guide.

This section is for those users who plan on testing the bike on a closed-course track and measuring engine performance with the Screamin' Eagle EFI Race Tuner Data Mode. With the Data Mode the user can view ECM engine data as either numbers or graphs and use Data Mode internal programs such as the Quarter Mile Calculator or Dyno Horsepower Estimator to determine the value of their adjustments to the tuning tables. Recording and reviewing ECM engine data with the Data Mode can be a very effective method of pinpointing the Tuning tables and particular tuning cells that need adjustment. But, don't turn off your sense of sight, sound and feel, as they will also help you identify undesirable symptoms or a lack of power.

Overview – Tuning With Data Mode & Advanced Tuning Mode

- Inspect and prepare bike for testing.
- Carry out the 2-basic performance tests; Steady Throttle/Light Load and Full Throttle/Heavy Load Roll-on acceleration run, to determine if there are any undesirable symptoms or a lack of power that indicates a need for a tuning adjustment.
- If undesirable symptoms or a lack of power are noticed, connect computer to vehicle to record ECM engine data using the EFI Race Tuner Data Mode program.
- Retest bike.
- Review ECM engine data using the Data Mode and determine what ECM Tuning Tables you want to adjust.
- Adjust fuel delivery with the Basic or Advanced Tuning Mode programs. The Advanced Tuning Mode program will allow individual adjustment of the front and rear cylinders.
- Adjust Spark Timing with the Basic or Advanced Tuning Mode programs. The Advanced Tuning Mode program will allow individual adjustment of front and rear cylinder spark timing.
- Retest bike to determine if additional tuning adjustments are needed.

Where do I start?

Start by making sure the bike is safe to ride, the engine is in excellent mechanical condition and the best Screamin' Eagle Tuning file is currently programmed into the ECM.

Inspect and Prepare Bike for Testing

- 1. **Perform a thorough inspection** of the bike before performance testing by following the directions provided in the Maintenance section of the Official Harley-Davidson Service manual for your vehicle. You must make sure the bike can be safely ridden before performing any tests. If you are not sure that you can perform this inspection properly, then the motorcycle should be inspected and serviced by a Harley-Davidson dealership technician. Do not take chances with your safety or the integrity of the motorcycle.
- 2. **Temporarily label the throttle** assembly on the bike to identify when the throttle is at the 0, 6, 12, 25, 50 and 100% position. This will help the rider identify what range of MAP, (Manifold Absolute Pressure) the engine is operating in when performing the test. The picture below shows a throttle assembly with pieces of tape applied to the right side switch housing and the throttle grip itself. Mark a single arrow on the switch housing tape and then mark the 0%, (idle or closed) position and the 100%, (WOT position) with a dash and number. The midpoint is

50% and should be marked with a dash and number. Mark the midpoint between 0 and 50 as 25, the midpoint between 0 and 25 as 12 and the midpoint between 0 and 12 as 6.



The throttle position marks will correspond roughly with the MAP readings in the table provided in this section.

3. If you haven't done so already, Program the ECM with the Screamin' Eagle Tuning File that best matches the performance components installed on your motorcycle. Example: If you own a 2002 Softail and you have installed the components of the 1550 Stage II with Screamin' Eagle Performance Heads kit, you would Program the ECM with Tuning file number 3286002A-MT2. Follow the instructions in the Basic Tuning Mode section of the EFI Race Tuner User's Manual.

If you don't know which Tuning File would be the best match for your bike, search the list of **Screamin' Eagle Tuning Files with their Engine Configuration notes in Section 9: Calibration Information.** Or, open the Comments Window in the Basic or Advanced Tuning Mode programs with a Tuning File loaded. In the Comments Window a list of Screamin' Eagle components are provided for the Tuning File currently being viewed.

4. **Make sure that Knock Control is Enabled** using the ECM Tuning Constants selection in the Basic Tuning Mode. The Ion Sense feature should be on so that the ECM will retard spark timing if detonation is present. You can also use the Data Mode to spot tuning needs by looking for Knock Retard activity

Note: If for any reason you disabled Knock Control, **remember to Enable Knock Control** when your tuning session is completed. This will ensure that the engine receives an extra measure of protection.

Test Bike to Determine if There Is a Need for a Tuning Adjustment

After following the directions listed in Inspect and Prepare Bike for Testing the bike should be ready for testing.

Use a closed-course track to carry out a performance test if a dyno is not available. A closed course track is used because:

- It is unsafe to carry out a performance test on a public street.
- It is unsafe and illegal to carry out some performance tests that may require the rider to exceed the speed limits of public streets.

Note: It is illegal to operate a motorcycle with certain performance accessories, including, but not limited to the Screamin' Eagle EFI Race Tuner system because some performance accessories are for Race Use Only.

- 1. **Start bike and allow engine to warm-up fully.** Engine cylinders should be hot enough to feel heat if hand is placed within 1-inch of fins. Use care to avoid being burned. Listen to idle and make a note if idle seems too low or too high.
- 2. Carry out a Steady throttle/Light load cruising test in 1st, 3rd & 5th gears at various engine rpm's. The engine should run smoothly with no misfires, no bucking or surging and no unusual exhaust rhythms. Try cruising at various speeds. The ability to run smoothly with light, steady throttle is particularly important when holding a steady speed as the racer navigates a broad curve in the track. Racing is not always about acceleration. Refer to the Symptoms of a Rich or Lean AFR for help in identifying symptoms.
 - If any undesirable symptoms are identified, note the throttle position and engine rpm the bike is in. As soon as safely possible, write this information down for tuning.
 - Compare the throttle position to the table below.
- 3. Carry out a Full throttle/Heavy load Roll-on acceleration run in 2nd, 3rd or 4th gears starting with the bike cruising steady at light throttle and 2000 rpm engine speed. Then roll throttle fully open and accelerate until engine reaches rpm redline, (only test in 4th gear if closed-course track allows for a safe acceleration to engine rpm redline and doesn't exceed your limit for a safe road speed). Then decelerate and apply brake until engine is again running at 2000 rpm. Repeat test in another gear if desired. The bike should accelerate briskly with no misfires or hesitation, no loud engine knocking and no excessive black exhaust smoke. Refer to the Symptoms of a Rich or Lean AFR for help in identifying symptoms.
 - If any undesirable symptoms are identified, note the engine rpm the bike is in. As soon as safely possible, write this information down for tuning.

If Undesirable Symptoms Were Noted, Record ECM Engine Data Using Data Mode Program

- 1. **Connect computer and Screamin' Eagle EFI Race Tuner Interface and cables to bike.** Refer to Data Mode; Recording Data Files section in the User's Manual for directions.
- 2. Setup Data Mode to Record Data Files and Start Recording ECM Data. Refer to Data Mode; Recording Data Files section in the User's Manual for directions.

Retest Bike to recreate undesirable symptoms while recording ECM engine data

Why Would I Want to Adjust the AFR?

If your performance **tests indicated an undesirable symptom of a rich or lean AFR** condition you should adjust the ECM Tuning Tables with the Screamin' Eagle EFI Race Tuner Basic or Advanced Tuning Mode.

If the bike exhibited no undesirable symptoms, but you want to see if you can improve the **acceleration performance** you can adjust the ECM Tuning Tables with the Screamin' Eagle EFI Race Tuner Basic or Advanced Tuning Mode.

If the ECM data recording shows an **excessive amount of Knock Retard Activity** when the engine is under load, it means that the ECM has detected detonation and is retarding the ignition timing to counter it. Detonation is an uncontrolled burn in the combustion chamber and it can be caused by a lean AFR. See example below.

And A company of a			3/31/200	(14.43.32	and the second	📜 bike at normal	
Item	Value	Unit	Item	Value	Unit	operating tem	perature
Engine Speed	4256	RPM	Battery Voltage	13.9	Volts	(indicated by C	ACO E
Vehicle Speed	63	MPH	Engine Temp	119	°C	(indicated by 2	.40° F
Vehicle Speed	101	km/hr	Engine Temp	246	F	Engine Temp.	& Zero
Throttle Position %	100.0	%	Intake Air Temp	29	°C	Warm-up Enric	chment
Throttle Position V	4.16	Volts	Intake Air Temp	84	Ŧ	The Keesel De	tand Da
MAPLoad	101.5	kPa	Barometer	99.3	kPn	The Knock Re	tard Re
AFR Desired	11.3	-	IAC Position	48	Steps	is an excessive	e 9-
VE Front	92.5	%	Desired Idle	1000	RPM	degrees The	
VE Rear	92.0	%	Warm-up Fuel	0	% rich	augroos. The	in a solit
Spark Adv Front	17.75	deg	Knock Retard Front	7.00	deg	suggested tun	ing eait
Spark Adv Rear	19.75	deg	Knock Retard Rear	9.00	deg	is:	
Injector PW Front	15.59	rn:s	Accel Enrichment	0.00	ms	1. Increase fue	al or
Injector PW Rear	15.50	ms	Decel Enleanment	0.00	ma	2. Descence at	n, or
			+		*****	timing	Jaik
	<u></u>					ltem V	alue
~						Engine Speed (RPM)	4256
nm	1	-				MAP Load (kPa)	101.5
		-		~		Knock Retard Rear	9.00
1 1 1							

Using Knock Retard as an Indicator of Lean AFR

Example: Recording of Full Throttle Acceleration Roll-on Run indicates excessive Knock Retard activity and a potential lean AFR.

The Knock Retard Front or Rear is an excellent indicator of where to focus attention for adjusting fuel or spark delivery. When the Ion Sense feature in the ECM detects abnormal combustion, (usually detonation) it tells the ECM to decrease spark timing. Detonation can be caused by either a lean AFR or spark timing that's too advanced, or a little of both, and the engine is under moderate to heavy load. As a safe practice, it's suggested that you try richening the AFR first, and if that has little or no affect on Knock Retard activity, then retard the spark timing.

To use the Data Mode recording to identify where and what to do, follow the steps below:

- 1. **Set Graph parameters** to Engine Speed, MAP Load, Knock Retard, (front or rear) and Throttle position
- 2. **Zoom** in on any portion of recorded graph that indicates 4- or more degrees of Knock Retard activity See example recording below
- 3. **Note** in example below that **Engine Temperature** is 246° F, which indicates engine is at operating temperature, not excessively hot.
- 4. **Note** in example below that **Warm-up Fuel** is zero, indicating engine is at operating temperature and not receiving any fuel enrichment that might confuse your diagnosis
- 5. **Note** in example below that **Knock Retard** is over 5-degrees from about 3700 to 5300 rpm at WOT. Knock Retard usually becomes active when engine is under heavy or moderate load and AFR is too lean or spark timing is too advanced for engine configuration.



EFI RACE TUNING WITH ADVANCED TUNING MODE & DATA MODE ON CLOSED-COURSE TRACK - CONT'D

How Would I Adjust the AFR with Advanced Tuning Mode?

You should already have performed both the steady throttle and full throttle tests while recording ECM engine data and determined what, if any symptoms you felt you wanted to correct. And, you should have determined what area of the engine rpm, MAP and throttle position you want to tune.

Example 1: Knock Retard data of a Full Throttle/Heavy Load test indicates a potential lean AFR at WOT from about 3700 to 5300 rpm and a MAP of about 100 kPa. See example Data Mode recording on previous page.

1. With the Advanced Tuning Mode you have **2-options** to richen the AFR:

- Use the **Air-Fuel Ratio Tuning Table** to edit both front and rear cylinder at the same time.
- Use the Front & Rear Cylinder VE Tuning Tables to edit front and rear cylinders individually.

See EFI Race Tuning with Advanced Tuning Mode, Chassis Dynamometer & AFR Meter for directions about using VE Tuning Tables

In either option, it's suggested that the tuner edit the cells just a little before and a little after the rpm and MAP that the Knock Retard indicated activity of about 5-degrees or more.

2. Program the ECM with the new Tuning Table and carry out another performance test. Refer to Section 5: Advanced Tuning Mode; Air-Fuel Ratio and Programming ECM for directions.

C/Piogan I	Rev/1151_VEver	gle2NT2	11515 (11.27)	Apr-02 6 32 20	farmer (see P	In this example we saw Knoc			
Show Braph	Set Baseline	Set Rele	ence De	connert	Increment	1 2 20	na Ge na Ci	IOUnits C	Retard was very active from a
DOM	(City on the second			MAP	(kPa)				MAP Here we are using the
HO-W	30	0.40	60	60	70	80	90	100	MAP. Here, we are using the
1500	14500	14.3	14.3	14.2	13.8	13.0	11.6	11.4	Advanced Tuning Mode Air-F
1750	145	14.3	14.2	14.2	13.8	13.5	12.5	12.3	Ratio Tuning Table to richer
2000	145	14.4	142	14.2	13.8	13.2	12.5	125	AED hotware 2500 and 5500
2250	145	14.3	142	142	14.1	13.2	12.6	12.4	AFR between 3500 and 5500
2500	145	14.4	14.3	14.3	14.3	13.2	12.6	12.4	at 100 kPa by Decrementing
2750	145	14.5	STATES:	14.3	14.3	13.2	12.6	12.4	highlighted cells by 5-1 laits
3800	145	345	141	14.3	143	13.2	12.6	121	rightighted cells by 5-01its.
3500	145	145	14.3	14.3	14.2	13.2	12.8	11.6	
4000	145	142	14.1	13.8	13.3	12.9	12.7	11.6	Caution: The Advanced Tuni
4500	12.9	12.5	12.9	12.9	12.8	12.8	12.4	115	Made Air Fuel Detie cell num
5000	12.9	12.5	12.5	12.5	12.5	12.5	12.3	115	Mode Air-Fuel Ratio cell num
5500	125	12.5	12.5	12.4	12.4	12.3	12.2	11.3	indicate the actual AFR targe
6000	12.4	12.4	12.4	12.4	12.4	12.3	12.2	11.5	Lower Cell Numbers = MOE
6500	12.4	12.4	12.4	12.4	12.4	12.2	12.1	11.5	Lower Cen Numbers - MON

ve

EFI RACE TUNING WITH ADVANCED TUNING MODE & DATA MODE ON CLOSED-COURSE TRACK - CONT'D

Example 2: Steady/Moderate Throttle & Heavy load shows Knock Retard activity and indicates a lean AFR from 3000 rpm to 3500 rpm. See example screen below.

- 1. The suggested tuning to correct this lean condition is to use the Advanced Tuning Mode AFR Tuning Table to add more fuel by Decrementing the AFR target number in the 80 kPa MAP cells at 3000-3500 rpm by 2-Units. This tells the ECM to richen the AFR in this area.
- 2. Program the ECM with the new Tuning Table and carry out another performance test. Refer to Section 5: Advanced Tuning Mode; Air-Fuel Ratio & Programming ECM for directions.

Itom	Value	Unit	hem	Value	Unit	In this avample we are Kneck Poterd acti
Engine Speed	3220	RPM	Battery Voltage	140	Volts	In this example we see Knock Retard acti
Vehicle Speed	60	MPH	Engine Temp	118	°C	at a steady 27% throttle, steady rpm and
Vehicle Speed		km/hr	Engine Temp	244		MAD of about 90 kDa. This was probably
Throttle Position %	27.7	- %	Inteke Air Temp	21	10	MAP of about ou kPa. This was probably
Throtte Position V	1.58	Volts	Intoke Air Temp	84	۴.	point in the test where the bike was head
NAP Load	80.1	kPa	Beromotor	96.9	kPa	und ill
AFR Desired	12.7		IAC Position	48	Steps	upnili.
VE Front	83.5	- %	Desired idle	1000	RPM	
VE Rear	84.0	- 54	Warm-up Fuel	0	% lich	To summa have a standal loss AFD south
Spark Adv Front	32.25	deg	Knock Reterd Front	1.75	deg	To remedy a potential lean AFR condition
Spark Adv Rear	31.25	deg	Knock Retard Rear	6.25	de	we used the Advanced Mode AFR Tuning
Injector PW Front	9.21	ms	Accel Enrichment	0.00	115	We used the Advanced Wood All Channy
Injector PVI/ Retar	9.26	ms	Decel Enlearment	0.00	ms	Table to add fuel in the 3000-3500 rpm ar
					~	80 kPa MAP range by Decrementing the highlighted cells by 2-units.
/	6			H	\subset	MAP Load 6-Pa) 80.1 Reack Retard Rear 6.25 Throttle Position N (N) 27.7

CVPtoper	Files/UTS/L VEnn	naded TwittiGam							
Diese Graph	SetBaselve	Set Rateiro Sat Roleance		Decrement		C 10# # 20#	C 5 Units C 20 C 10 Units C 10		C 20 Units C 100 Units
DOM	·· ···································				MAP (kPa)		120		
	20	10.000	40	N 10 50 10	60	78.55 as1.	0	90	108
750	13.6	13.7	13.8	13.8	13.5	130	.4	11.0	1 11.8
1000	13.6	13.7	13.8	14.1	13.8	130	.4	11.6	1001118
1258	13.7	145	143	141	141	138	7	11.0	11.3
1500	11.7	145	143	14.3	142	138	.0	11.6	11.4
1758	13.7	145	14.3	14.2	14.2	138	5	12.6	12.3
2000	13.9	141	14.4	14.2	14.2	138	2	12.5	12.5
2258	13.9	145	14.3	14.2	142	141	2	12.6	12.4
2500	13.9	145	14.4	14.3	14.3	143	2	12.6	12.4
2750	13.5	1000	115	14.5	14.3	143	25	12.6	12.4
3000	13.0	0.145	145	1. 145	14.3	143	30	12.6	12.1
3508	12.6	145	145	14.3	14.3	142		12.0	12.0
4000	12.5	145.5	142	141	13.8	133	2.8	12.7	12.8
4500	12.3	12.9	12.9	12.9	12.9	128 1	2.8	12.4	11.9
5000	12.3	12.9	12.5	12.5	12.5	125 1	2.5	12.3	11.8
5500	12.3	12.5	12.5	12.5	12.4	124	23	12.2	11.5
EFI RACE TUNING WITH ADVANCED TUNING MODE & DATA MODE ON CLOSED-COURSE TRACK - CONT'D

Why Would I Want to Adjust the Spark Timing?

If your performance tests **indicated any undesirable symptoms** such as excessive engine knocking, sluggish acceleration or a mileage test indicated excessive fuel consumption; you should adjust the spark timing with the Main Spark Table of the Basic Tuning Mode or the Front or Rear Spark Advance Tables of the Advanced Tuning Mode.

If the bike exhibited no undesirable symptoms, but you want to see if you can **improve the acceleration performance** you can adjust spark timing with the Main Spark Table of the Basic Tuning Mode or the Front or Rear Spark Advance Tables of the Advanced Tuning Mode

If the ECM data recording shows an **excessive amount of Knock Retard Activity** when the engine is under load, it means that the ECM has an incorrect combustion event and is retarding the ignition timing to counter it. Most often this is the result of detonation, which is an uncontrolled burn in the combustion chamber that causes colliding flame fronts. It can be caused by spark timing that's too advanced. See example below.

C:\Program File	#\TT\$\\L	.canAFR.C	M2 3/31/200	2 14:49:32	11 10000 F	may indicate too much spark
Item	Value	Unit	Item	Value	Unit	advance too much spark
Engine Speed	3362	RPM	Battery Voltage	14.0	Volts	advance.
Vehicle Speed	50	MPH	Engine Temp	119	°C	Example below shows over
Vehicle Speed	80	km/hr	Engine Temp	246	Ŧ	decrees Knock Retard activit
Throttle Position %	100.0	76	Intake Air Temp	- 30	°C	in both front & rear cylindere
Throttle Position V	4.16	Volts	Intake Air Temp	86	Ŧ	In bour none & rear cynnoers
MAPLoad	103.0	kPa	Barometer	99.3	kPa	a Full I hrottle Acceleration ru
AFR Desired	12.1	-	IAC Position	-48	Steps	
VE Front	89.5	%	Desired Idle	1008	RPM.	Front activity is around 3100
VE Rear	90.5	%	Warm-up Fuel	0	% rich	5100 rom at 100 kBa MAB ar
Spark Adv Front	21.00	deg	Knock Retard Front	8.50	deg	5100 rpm at 100 kPa MAP an
Spark Adv Rear	26.00	deg	Knock Retard Rear	2.00	deg	rear activity is around 3300 to
Injector PW Front	1418	ms	Accel Enrichment	0.00	ms	5300 rpm at 100 kPa MAP.
Injector PW Rear	14.33	ms	Decel Enlearment	0.00	ms	
[Rec # 2745
1				- 1		llem Value
					\sim	Engine Speed (RPM) 3362
and the second s						MAP Load (kPa) 1030
		-		and the second se	/	Knock Reterd Rear 2.00
					-	

EFI RACE TUNING WITH ADVANCED TUNING MODE & DATA MODE ON CLOSED-COURSE TRACK - CONT'D

How Would I Adjust Spark Timing with Advanced Tuning Mode?

You should already have performed both the steady throttle and full throttle tests while recording ECM engine data and determined what, if any symptoms you felt you wanted to correct. And, you should have determined what area of the engine rpm, MAP and throttle position you want to tune.

Example 1: Recorded data of a Full Throttle/Heavy Load Roll-on Acceleration run shows excessive Knock Retard indicating too much spark advance, (See previous page) at WOT from about 3100 to 5300 rpm and a MAP of about 100 kPa both front & rear Knock Retard Activity is active, but slightly different.

Use Advanced Tuning Mode to adjust spark timing for each individual cylinder. Adjust spark timing using Advanced Mode Spark Advance Tables.

- 1. Adjust spark timing of front cylinder from 3100 to 5100 rpm and 100 kPa MAP by decrementing spark timing in the 100 kPa cells at 3000-5000 rpm of the Front Spark Advance table. See below.
- 2. Adjust spark timing of rear cylinder from 3700 to 5300 rpm and 100 kPa MAP by decrementing spark timing in the rear cylinder 100 kPa cells at 3500-5500 rpm of the Rear Spark Advance table. See below
- 3. **Program the ECM** with the new Tuning Table and carry out another performance test. Refer to Section 5: Advanced Tuning Mode; Spark Advance Tables & Programming ECM for directions.

Note: In our Data Recording from the previous page we saw Knock Retard was over 5-degrees in the front cylinder from around 3100 to 5100 rpm at 100 kPa MAP and in the rear cylinder from around 3300 to 5300 rpm at 100 kPa MAP. Different Knock Retard activity between the front and rear is normal and the Advanced Tuning Mode allows for individual spark timing adjustment to correct just the area you need. After saving your edits, Program the ECM with the new Tuning Table and carry out another performance test to evaluate. Refer to Section 5: Advanced Tuning Mode; Air-Fuel Ratio and Programming ECM for directions.



EFI RACE TUNING WITH ADVANCED TUNING MODE & DATA MODE ON CLOSED-COURSE TRACK - CONT'D

Example 2: Recorded data of Knock Retard looks OK, but fuel consumption is high. If there is no indication of Knock Retard activity at steady throttle/light to moderate load it may be possible to improve fuel mileage by increasing, (advancing) spark timing.

In the **Example Data Recording Below**, there is no Knock Retard activity at about 2800 rpm and 20-50 kPa MAP. To improve fuel consumption in this rpm range we could **increase spark timing in the front and rear cylinders** around 3000 rpm and 20-50 kPa MAP

						Charles Diskland	
nem	Value	Unit	Rem	Value	Unit	Status Dit Name	Value
ingine speed	2017	FIPM	Dattery voltage	13.9	vons	Engine Hun Mode	
/ehicle Speed	65	MPH	Engine Temp	101	°C	Vehicle Tipped	0.0
/ehicle Speed	105	km/hr	Engine Temp	214	74	VTD Active	
hrottle Position %	3.6	76	Intake Air Temp	38	°C	1	
Throttle Position V	0.53	Vots	Intake Air Temp	100	Ψ	1	
AP Load	20.7	kPa	Barometer	97.1	kPa.	1	
FR Desired	13.3	-	IAC Position	27	Steps	Planchack Control C	ontor
E Front	84.0	36	Desired Idle	1000	RPM	141 207	
'E Rear	78.0	26	Warm-up Fuel	0	% rich	1 141.237	
perk Adv Front	44.50	deg	Knock Retard Front	0.00	deg	Hec # ///	
park Adv Rear	45.00	deg	Knock Retard Rear	0.00	deg		
njector PW Front	2.43	ms	Accel Enrichment	0.10	ms	Slow Fast	-
njector PW Flear	2.40	ma	Decel Enleanment	0.00	me	1 <u>-</u>	Ster
						COREV FORMA	Stop
				Π		Rec # 777	
				- 11		the Hom Sector	Valu
	And in case of the local division of the loc		Contraction of the local division of the loc	11		Engine Speed (PPM)	2817
						MAP Load (kPa)	20.7
	2		6	2	0 1	Knock Retard Rear	0.00
and the second s	1				111	Marcal Balance Bana	

Note: Improve Fuel Consumption by increasing spark timing.

In this **example** there was no Knock Retard activity at a steady 2800 rpm and 20-50 kPa MAP, so we increased spark timing at 3000 rpm and 20-50 kPa MAP by 10-units in both front & rear cylinders. If a performance retest doesn't indicate an undesirable symptoms and the Knock Retard Data is OK, we should enjoy an improvement in fuel consumption.

CiPropun	FilesUTS), VExa	egie29672	20	40-036123	SPM 1	Tuning Mo	de File Loadied	0.55	TWNDAM	
ShowGraph	Se Banke	Set Rela	ence D	Instant	homent			C Links	C 2004	
-					MAP (RPb)					
HPM	20	38	10480	50	60	78	81	0.980	100	
750	25.00	25.00	25.00	27.00	25.00	25.00	20.00	20.00	1500	
1000	25.00	25.00	25.03	27.00	27.00	25.00	20.00	22.30	15.00	
1250	25.00	25.00	25.01	29.00	29.00	28.00	24.00	21.00	15.00	
1500	30.00	30.00	30.03	32.00	32.00	29.00	26.00	2430	1800	
1758	35.00	35.00	33.00	33.00	33.00	30.00	29.00	25.00	21.00	
2000	40.00	40.00	34.00	34.00	33.00	31.00	29.00	27.90	2408	
2250	45.00	63	. 68.	40.00	36.00	33.00	21.00	28.00	25.00	
2500	45.00	45.00	-6.0	611	38.00	34.00	31.00	29.10	25.00	
2758	45.00	右向	45.03	希腊	68	35.00	31.80	28.00	25.00	
3899	0.40400				5830	35.00	31.00	28.00	26.00	
3500	45.00	45.00	410	1.11.22		35.00	31.00	28.00	26.00	
4000	45.00	45.00	-60	-6.0	43	39.00	35.00	30.00	26.00	
4500	45.00	45.00	45.03	45.00	43.00	39.00	35.00	29.00	26.00	
5000	45.00	45.00	45.00	45.00	43.00	40.00	32.00	29.00	25.00	
5500	45.00	45.00	.4500	-45.00	43.00	. 40.00	32.00	29.00		

This section is for those professional users who plan on testing the bike on a chassis dynamometer and measuring exhaust gases with an Air-fuel meter. This is the most efficient method of EFI Race Tuning because the results of combustion can be accurately measured at the exhaust. It does, however, require an in-depth understanding of internal combustion engine theory, dynamometer operation and AFR meter use. Dyno-testing a motorcycle is generally preferred over closed–course track testing because it's quicker, more efficient and safer if the operator follows the dyno manufacturer's instructions.

With a chassis dyno the tuner can measure, view and compare the horsepower and torque of recorded runs and thereby know if their tuning adjustments have accomplished the ultimate goal of producing more power. With the AFR meter the tuner can adjust the tuning tables to achieve the AFR desired for maximum power. The combination of dyno testing and AFR measurement is particularly important when building high-performance race engines with unknown combinations of performance accessories. New engine configurations can offer the biggest tuning challenges and the tuner will find the AFR measurement invaluable.

Overview – Tuning With a Chassis Dyno, AFR Meter & the Advanced Tuning Mode

- Inspect and prepare bike for testing
- Mount bike on dyno and connect AFR meter probes according to manufacturer's instructions
- Carry out the 2-basic performance tests; Steady Throttle/Light Load and Full Throttle/Heavy Load Roll-on Acceleration Run on the chassis dyno while measuring AFR at the exhaust. Refer to the appropriate equipment manuals to properly operate the dyno and AFR meter.

Caution: Follow all safety instructions listed by the dynamometer manufacturer when operating the dyno. Note that excessive dyno loading of the motorcycle builds heat quickly and may harm motorcycle engine/drivetrain or tires.

- Determine if there are any **undesirable symptoms or a lack of power** that indicates a need for a tuning adjustment and **make a note of the throttle position, engine rpm and AFR** where they exist
- **AFR with 1-probe:** Use the VE Front & Rear Tuning Tables of the Advanced Tuning Mode program to adjust the AFR in equal amounts.
- **AFR with 2-probes:** Use the VE Front & Rear Tuning Tables of the Advanced Tuning Mode program to adjust the AFR in different amounts for each cylinder.
- Adjust Fuel delivery and Spark Timing with the Advanced Tuning Mode programs and program ECM with new tuning tables.
- **Dyno-test bike for power** to determine if additional tuning adjustments are needed. Use dyno power graphs to compare performance before and after.

Where do I start?

Start by making sure the bike is safe to dyno test and ride, that the engine is in excellent mechanical condition and that the best Screamin' Eagle Tuning file is currently programmed into the ECM.

Inspect and Prepare Bike for Testing

- 1. **Perform a thorough inspection** of the bike before performance testing by following the directions provided in the Maintenance section of the Official Harley-Davidson Service manual for your vehicle. You must make sure the bike can be safely ridden before performing any tests. If you are not sure that you can perform this inspection properly, then the motorcycle should be inspected and serviced by a Harley-Davidson dealership technician. Do not take chances with your safety or the integrity of the motorcycle.
- 2. Temporarily label the throttle assembly on the bike to identify when the throttle is at the 0, 6, 12, 25, 50 and 100% position. This will help the rider identify what range of MAP, (Manifold Absolute Pressure) the engine is operating in when performing the test. The picture below shows a throttle assembly with pieces of tape applied to the right side switch housing and the throttle grip itself. Mark a single arrow on the switch housing tape and then mark the 0%, (idle or closed) position and the 100%, (WOT position) with

a dash and number. The midpoint is 50% and should be marked with a dash and number. Mark the midpoint between 0 and 50 as 25, the midpoint between 0 and 25 as 12 and the midpoint between 0 and 12 as 6.



The throttle position marks will correspond roughly with the MAP readings in the table provided in this section.

3. If you haven't done so already, **Program the ECM with the Screamin' Eagle Tuning File** that best matches the performance components installed on your motorcycle. **Example:** If you own a 2002 Softail and you have installed the components of the 1550 Stage II with Screamin' Eagle Performance Heads kit, you would Program the ECM with Tuning file number 3286002A-MT2. Follow the instructions in the Basic Tuning Mode section of the EFI Race Tuner User's Manual.

If you don't know which Tuning File would be the best match for your bike, search the list of **Screamin' Eagle Tuning Files with their Engine Configuration notes in Section 9: Calibration Information.** Or, open the Comments Window in the Basic or Advanced Tuning Mode programs with a Tuning File loaded. In the Comments Window a list of Screamin' Eagle components are provided for the Tuning File currently being viewed.

Enable Knock Control if you want to tune the EFI system using Data recordings to spot Knock Retard activity. **Disable Knock Control** if you want to use dyno measurements to tune for optimum power.

Note: If for any reason you disabled Knock Control, **remember to Enable Knock Control** when your tuning session is completed. This will ensure that the engine receives an extra measure of protection.

Dyno-Test Bike to Determine if There is a Need for a Tuning Adjustment

There are two basic performance tests to carry out that should provide enough range of operation to determine if additional EFI Race Tuning is needed to correct undesirable running symptoms or increase specific performance areas.

- 1. **Start bike and allow engine to warm-up fully.** Engine cylinders should be hot enough to feel heat if hand is placed within 1-inch of fins. Use care to avoid being burned. Listen to idle and make a note if idle seems too low or too high.
- 2. Mount bike on chassis dyno according to dyno manufacturer's instructions and program dyno for testing.
- 3. Connect AFR meter probes according to manufacturer's instructions.
- 4. **Carry out a Steady throttle/Light load cruising test** in 1st, 3rd & 5th gears at various engine rpm's by varying dyno load device. The engine should run smoothly with no misfires, no bucking or surging and no unusual exhaust rhythms. Try cruising at various speeds. The ability to run smoothly with light, steady throttle is particularly important when a racer needs to hold a steady speed through a broad curve in the track. Racing is not always about acceleration.

Measure AFR and note readings. The AFR at Steady Throttle & Light to Moderate load is usually best in a range of 13.5 - 14.5 to 1 AFR

- 5. If any undesirable symptoms are recognized, note the throttle position, engine rpm and AFR for tuning purposes.
- 6. Carry out a Full throttle/Heavy load Roll-on Acceleration run in 2nd, 3rd and 4th gears starting with the bike cruising steady at light throttle and 2000 rpm engine speed. Then roll throttle fully open and accelerate until engine reaches rpm redline. Then close throttle and decelerate until engine is again running at 2000 rpm. Repeat test in another gear if desired. The bike should accelerate briskly with no misfires or hesitation, no loud engine knocking and no excessive black exhaust smoke. Refer to the Symptoms of a Rich or Lean AFR for help in identifying symptoms.
- 7. If any **undesirable symptoms** are identified, note the engine rpm the bike is in when the symptoms took place. As soon as safely possible, write this information down for tuning purposes.

If possible, chart the horsepower and torque with the dyno while measuring the AFR. **The AFR at Full Throttle/Heavy Load that usually makes the most power is in a range of 12 – 12.8 to 1 AFR.**

Why Would I Want to Adjust the AFR?

If your **AFR measurements using a single or two-probe AFR meter indicated a rich or lean AFR** condition you should first adjust the VE Front & Rear Cylinder Tuning tables in the Advanced Tuning Mode. The objective is to use the VE Tuning Tables to adjust the fuel delivery so that the measured AFR matches the AFR values in the Air-Fuel Ratio Table in the Advanced Tuning Mode. This procedure will properly set the VE values where they belong for that engine configuration.

If the user has **built a unique engine configuration** that combines performance accessories never run together before, they should adjust the VE Tuning Tables in the Advanced Tuning Mode. The objective is to use the VE Tuning Tables to adjust the fuel delivery so that the measured AFR matches the AFR values in the Air-Fuel Ratio Table in the Advanced Tuning Mode. Once this is achieved the tuner can use the dyno to measure power output and then adjust the AFR in the Air-Fuel Ratio Table to achieve optimum power.

How Would I Adjust AFR with Advanced Tuning Mode, Dyno & AFR Meter?

You should already have performed both the steady throttle and full throttle tests on the chassis dyno and measured the AFR using a meter with one or two probes, (either measured front & rear exhaust gases blended together or separately). If the AFR measured significantly leaner or richer than the recommendations below, the Front & Rear VE Tuning Tables in the Advanced Tuning Mode should be adjusted.

- Steady Throttle/Light Loads: 13.5 14.5 to 1 AFR
- Full Throttle/Heavy Loads: 12.0 12.8 to 1 AFR

Example 1: You measured the AFR with 1-exhaust probe and the measured AFR is too lean at WOT from 2000 to 6500 rpm.

- 1. Use the Advanced Mode VE Front & Rear Cyl. Tuning Tables to adjust the AFR of both the front & rear cylinders an equal amount.
- 2. After programming ECM with the new calibration, retest and again measure AFR. The objective is to obtain AFR measurements that match the AFR values in the Air-Fuel Ratio Table.
- 3. When your tuning has achieved AFR measurements that match the AFR in the Air-Fuel Ratio tables, then use the dyno to measure power output and adjust the fuel delivery with the Air-Fuel Ratio Tuning Table in the Advanced Tuning Mode to achieve maximum power.

C: Program Show Graph	Filec(JTS)1208 Set Baseline	Set Fale	314 ence De	Dec-81 3:50.0	Increment	TuringHo	de File Loaded něl – C t něs – C t	i Unis ID Units	measured a little Lean AFR at WOT, heavy load from 2000-6500
0.04		10000		holle Post	tion (Percen	49			rpm.
	5 02:10:00	15	29	51.30.00	48.00	505 60 (1)	10.000000	100	
1500	66.0	74.0	76.0	77.0	77.0	78.0	84.0	80.0	
1750	66.0	74.0	760	80.0	80.0	81.0	87.0	87.0	In this example we want to richen
2000	000	75.0	76.0	0.00	020	05.0	05.0	05.0	the AED at WOT & heavy load T
2250	70.0	75.0	84.0	80.0	83.0	85.0	85.0	88.0	the AFR at wor a neavy load. In
2500	700	75.0	85.0	82.0	81.0	85.0	8E.0	0.98	MAP would be 100 kPa at heavy
2750	750	80.0	80.0	87.0	830	86.0	85.0	0.68	land an use
3060	900	82.0	87.0	BR D	- 95.0	96.0	95.0	05.0	load so we:
3500	900	84.0	86.0	96.0	90.0	87.0	90.0	90.0	 Incremented the highlighted V
4000	90.0	90.0	940	98.0	91.0	87.0	94.0	95.0	Deer Out cells 4 weit to sicher
4500	80.0	88.0	94.0	99.0	91.0	91.0	92.0	95.0	Rear Cyl. cells 1-unit to richen
5000	95.5	90.0	950	96.0	910	96.0	87.0	90.0	the AFR.
5500	96.5	90.0	990	96.0	91.0	86.0	86.0	86.0	A lassesse to d the bishted if
6000	875	92.5	990	100.0	91.0	87.0	86.0	85.0	Incremented the highlighted V
6560	975	87.5	95.0	95.0	90.0	97.0	96.0	05.0	Front CvL cells 1-unit to richer
									the AFR, (same as rear cylind

Example 2: You measured the AFR with 2-exhaust probes and both cylinders measured a little lean, although in different amounts.

- 1. Use the Advanced Mode VE Front & Rear Cyl. Tuning Tables to adjust the AFR of both the front & rear cylinders a different amount to achieve the AFR values of the Air-Fuel Ratio table in the Advanced Tuning Mode.
- 2. After programming ECM with the new calibration, retest and again measure AFR.
- 3. When your tuning has achieved AFR measurements that match the individual front and rear AFR values in the Air-Fuel Ratio tables, then use the dyno to measure power output and adjust the fuel delivery with the Air-Fuel Ratio Tuning Table in the Advanced Tuning Mode to achieve maximum power.

Note: Using VE Table to adjust AFR

In the example below we have measured AFR with a **2-probe AFR Meter** during a Full Throttle/Heavy Load Roll-on Acceleration Run on the dyno. We found that just the front cylinder AFR was a little lean at 1750-6500 rpm so we want to richen just the front cylinder AFR.

In this **example** we will increase the amount of fuel delivered to the Front Cylinder by Incrementing the highlighted VE cells by 5-units. This will tell the ECM that more air is entering the cylinder and the ECM will deliver more fuel to achieve its target AFR.

C:\Piogram	Files\TTS_\Exa	mple2.MT2	666 BB	27 Apr 02 6:32 2	8 PM	Turing Mo	de File Loaded	1	TWINCAM
Show Graph	Set Baseline	Set Fieler	ence	Decrement	Increment		init (Fit Inita (Fit	5 Units 10 Unit	C 20 Units C 100 Units
DDM	(anno 1997)	20000090	000007	hrottle Posi	ition (Perce	ent)	11119200	202 22	
PIPM	10	15	20	30	40	60	80	1 0	
1500	82.0	85.0	86.0	86.0	89.0	97.0	94.0	0.3	
1750	82.0	86.0	88.0	78.0	83.0	85.0	89.0	88.5	
2000	88.0	91.0	\$2.0	94.0	81.0	82.0	82.0	505	
2250	91.0	95.0	93.0	94.0	94.0	91.0	92.0	95.5	
2500	94.0	100.0	101.0	99.0	97.0	90.0	92.0		
2750	95.0	103.0	108.0	101.0	97.0	90.0	98.5		
3000	98.0	104.0	105.0	101.0	101.0	95.0	95.0	100.5	
3500	98.0	110.0	109.0	104.0	100.0	94.0	94.0	108.5	
4000	92.0	102.0	109.0	106.0	94.0	92.0	92.0	102.5	
4500	92.0	105.0	\$8.0	107.0	96.0	94.0	100.0	101.5	
5000	92.0	107.0	98.0	95.0	104.0	94.0	92.0		
5500	92.0	107.0	98.0	95.0	96.0	94.0	92.0	109.5	
6000	92.0	107.0	\$8.0	95.0	96.0	94.0	98.0	109.5	
6500	92.0	107.0	\$8.0	95.0	96.0	94.0	90.0	945	

Example 3: You have built a new engine configuration and the dyno testing and 2-Probe AFR meter measurements indicate that the ECM calibration needs significant tuning in several areas. In this example the suggested method of tuning is to do the following:

1. Open Advanced Tuning Mode: Air-Fuel Ratio Table, and set all cells to a flat 13.5 AFR using the increment/decrement boxes, (see example below). This will tell the ECM to calculate fuel delivery under all conditions to achieve a 13.5 to 1 AFR. Program ECM with this new tuning table.

C:\Program F	Files (TTS). (Exa	nple2.MT2	27.	Apr-02 6:32:2	9 PM	TuningMo	de File Loaded	require extensive
ihow Graph	Set Baseine	Set Fieler	ence De	screment	Increment	C 20	ni C5Ur Inits C10U	edits, it's probably
0.014					MAP (kPa)			1. Set AFR Table
HPM	20	30	40	50	60	70	80	90 flot 12 5 in all
1250	13.5	13.5	13.5	13.5	13.5	135	13.5	nat 13.5 in all o
1500	13.5	135	13.5	13.5	13.5	135	13.5	Adjust VE tabl
1750	13.5	135	13.5	13.5	13.5	135	13.5	needed to ach
2000	13.5	13.5	13.5	13.5	13.5	13.5	13.5	needed to doi
2250	13.5	13.5	13.5	13.5	13.5	13.6	13.6	measured 13.
2500	13.5	135	13.5	13.5	13.5	135	13.5	with your AFR
2750	13.5	135	13.5	13.5	13.5	135	13.5	in all running
3000	13.5	135	13.5	13.5	13.5	135	13.5	1 in an running
3500	13.5	135	13.5	13.5	13.5	135	13.5	conditions
4000	13.5	13.5	13.5	13.5	13.5	135	13.5	12
4500	13.5	13.5	13.5	13.5	11.5	13.5	13.5	Soo port page for
5000	135	13.5	13.5	13.5	.115	13.5	13.5	See next page for
5500	13.5	13.5	13.5	13.5	115	135	13.5	info on this.
6000	125	13.5	13.5	13.5	13.5	135	13.5	12
6500	135	135	135	10.5	13.5	195	12.5	1

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Example 3: You have built a new engine configuration – cont.

- 2. Perform a complete set of tests while measuring front and rear cylinder AFR with a 2-probe AFR meter
- 3. Adjust VE Front and Rear Cylinder Tuning tables as necessary to produce a measured 13.5 AFR in both the front and rear cylinders, (using the 2-probe AFR meter) at all engine rpm's and all MAP. Remember to save tuning edits and Program ECM with your new Tuning File. See Advanced Tuning Mode: Programming ECM for directions.
- 4. When you have finished adjusting the VE Tables to achieve a measured 13.5 AFR, then load the Tuning file into the Advanced Tuning Mode and open the Air-Fuel Ratio Tuning Table, (it should still indicate 13.5 in all cells).
 - Click on Set Reference box to reset AFR to original Screamin' Eagle calibration which, in combination with the tuning edits you made to the VE Tables, should provide a Tuning File that is very close to optimum
- 5. Perform a complete set of tests to verify and measure performance. Measure AFR with the AFR meter and use Data Mode to record ECM data for Knock Retard activity, etc.
- 6. When you have achieved the measured AFR objectives, use the dyno to measure power output and adjust the fuel delivery with the Air-Fuel Ratio Tuning Table in the Advanced Tuning Mode to achieve maximum power.

Why Would I Want to Adjust the Spark Timing?

If your performance tests indicated any undesirable symptoms such as excessive engine knocking, sluggish acceleration or a mileage test indicated excessive fuel consumption; you should adjust the spark timing with the Main Spark Table of the Basic Tuning Mode or the Front or Rear Spark Advance Tables of the Advanced Tuning Mode.

If the bike exhibited no undesirable symptoms, but you want to see if you can **improve the acceleration performance** you can adjust spark timing with the Main Spark Table of the Basic Tuning Mode or the Front or Rear Spark Advance Tables of the Advanced Tuning Mode

If the ECM data recording shows an **excessive amount of Knock Retard Activity** when the engine is under load, it means that the ECM has an incorrect combustion event and is retarding the ignition timing to counter it. Most often this is the result of detonation, which is an uncontrolled burn in the combustion chamber that causes colliding flame fronts. It can be caused by spark timing that's too advanced. See example below.

C:\Program File	ATTSL	eanAFR.	3/31/200	2 14:49:32	19 (1997) (may indicate too much spark
Item	Value	Unit	Item	Value	Unit	nay indicate too much spark
Engine Speed	3362	RPM	Battery Voltage	14.0	Volts	advance.
Vehicle Speed	50	MPH	Ergine Temp	119	°C	Example below shows over 5
Vehicle Speed	08	km/hr	Engine Temp	246	1F	degrees Knock Retard activity
Throttle Position %	100.0	36	Intake Air Temp	30	°C	in both front & rear cylinders of
Throttle Position V	4.16	Volts	Intake Air Temp	86	F	a Doll none a real cylinders of
MAPLoad	103.0	kPa	Barometer	99.3	kPa	a Full I hrottle Roll-on
AFR Desired	12.1	-	IAC Position	48	Steps	Acceleration run on the dyno.
VE Front	89.5	%	Desired Idle	1000	RPM	-
VE Reer	90.5	%	Warm-up Fuel	0	%rich	Eropt activity is around 2100 to
Sperk Adv Front	21.00	deg	Knock Retard Front	8.50	deg	Front activity is around 3100 to
Spark Adv Rear	26.00	deg	Knock Retard Rear	2.00	deg	5100 rpm at 100 kPa MAP and
injector PWFront	1418	ms	Accel Enrichment	0.00	ms.	rear activity is around 3300 to
injector PWRear	14.33	ms	Decel Enlearment	0.00	ms	5200 rpm at 100 kPa MAP
ſ						Rec # 2745
				_	_ /	Engine Speed (RFM) 3362
					7	MAP Load (kPa) 103.0
			and the second se			Knock Reterd Reter 2.00
					C	Kennik Dataud Frank A 66

How Would I Adjust Spark Timing with Advanced Tuning Mode?

You should already have performed both the steady throttle and full throttle tests and determined what, if any symptoms you felt you wanted to correct. And, you should have determined what area of the engine rpm, MAP and throttle position you want to tune.

Example 1: Data Mode recording of ECM data of a Full Throttle/Heavy Load Roll-on Acceleration run shows excessive Knock Retard activity indicating too much spark advance, (See previous page) at WOT from about 3100 to 5300 rpm and a MAP of about 100 kPa both front & rear Knock Retard Activity is active, but slightly different.

Use Advanced Tuning Mode to adjust spark timing for each individual cylinder.

- 1. **Adjust spark timing of front cylinder** from 3100 to 5100 rpm and 100 kPa MAP by decrementing spark timing in the 100 kPa cells at 3000-5000 rpm of the Front Spark Advance table. See below.
- 2. Adjust spark timing of rear cylinder from 3700 to 5300 rpm and 100 kPa MAP by decrementing spark timing in the rear cylinder 100 kPa cells at 3500-5500 rpm of the Rear Spark Advance table. See below

Note: In our Data Recording from the previous page we saw Knock Retard was over 5-degrees in the front cylinder from around 3100 to 5100 rpm at 100 kPa MAP and in the rear cylinder from around 3300 to 5300 rpm at 100 kPa MAP. Different Knock Retard activity between the front and rear is normal and the Advanced Tuning Mode allows for individual spark timing adjustment to correct just the area you need. After saving your edits, Program the ECM with the new Tuning Table and carry out another performance test to evaluate. Refer to Section 5: Advanced Tuning Mode; Programming ECM for directions.

late: Frant Culi	adar Kna	ak Date	and wo	~	opr-02 6: 32:26	PM	Tuning Hor	de File Loaded	lanna la	TWINCAM
excessive at 100	kPa MAP	in 310	0 to 51	00	crement	Increment		nt PS nts C1	Units O Units	C 20 Units C 100 Units
pm range. To re	medy, we	e decrer	mented	1	MAP	(kPa)			Vistaitis	
ront Cylinder Sp	ark Timin	a by 5-	Units to	o	60	70	80	90	100	
atard enark timin	a by abo	# 2 5 d	ogroop		29.00	28.00	24.00	21.00	20.00	
staru spark umm	g by abo	ut 2.0-u	eyrees		33.00	23.00	26.00	24.00	20.00	
					34.00	30.00	28.00	26.00	21.00	
lext, we would o	pen Spar	ar	34.00	30.00	29.00	27.00	23.00			
ul. Tables and a	stard timi	ng in th	~		36.00	34.00	30.00	28.00	23.00	1
yi. Tables and r	etard timi	ng in th	e		40.00	35.00	31.00	28.00	23.00	
ppropriate cells	for the re	ar cyline	der.		40.00	15.00	31.00	28.00	24.00	
		-			40.00	35.00	31.00	28.00	22.75	
		42.00	40.00	44.00	43.00	35.00	31.00	28.00		
	9966			15 0.0	42.00	41.00	34.00	29.00		
	4000	45.00	45.00	45.00	40.00	10.00				
	4000 4500	45.00 45.00	45.00	45.00	43.00	41.00	34.00	30.00	22.75	
	4000 4500 5000	45.00 45.00 45.00	45.00 45.00 45.00	45.00 45.00 45.00	43.00	41.00	34.00 32.00	30.00 30.00	22.75 23.75	
	4000 4500 5000 5500	45.00 45.00 45.00 45.00	45.00 45.00 45.00 45.00	45.00 45.00 45.00	43.00 44.00 44.00	41.00 41.00 41.00	34.00 32.00 32.00	30.00 30.00 30.00	22.75 23.75 23.75	
	4000 4500 5000 5500 6000	45.00 45.00 45.00 45.00 45.00	45.00 45.00 45.00 45.00 45.00	45.00 45.00 45.00 45.00	43.00 43.00 44.00 44.00 44.00	41.00 41.00 41.00 40.00	34.00 32.00 32.00 32.00	30.00 30.00 30.00 30.00	22 75 23 75 23 75 23 75 26 00	

Example 2: Data Mode recording of ECM data shows Knock Retard activity is OK, but fuel consumption is high and AFR measurement is not richer than 14.5 to 1. If there is no indication of Knock Retard activity at steady throttle/light to moderate load it may be possible to improve fuel mileage by increasing, (advancing) spark timing.

• In the **Example Data Recording Below**, there is no Knock Retard activity at about 2800 rpm and 20-50 kPa MAP

To improve fuel consumption in this rpm range we could increase spark timing in the front and rear cylinders around 3000 rpm and 20-50 kPa MAP



Note: Improve Fuel Consumption by increasing spark timing.

In this **example** there was no Knock Retard activity at a steady 2800 rpm and 20-50 kPa MAP, so we increased spark timing at 3000 rpm and 20-50 kPa MAP by 10-units in both front & rear cylinders. If a performance retest doesn't indicate any undesirable symptoms and the Knock Retard Data is OK, we should enjoy an improvement in fuel consumption.

C'Progan	FleATTS YEar	epie2MT2	27	Ap-126122	IPM	Turing Mod	le File Loaded	(;;;;;) [2	THINOU
Show Graph	SetBasire	Serficie	ance D	easter	Increment	J C 10	e fis n Fi	Unit: II Uniti	C 2004
	1		95050	10100	MAP (KPa)	1999	0.000		1949
10-16	21	38	41	51	68	70	88	51	100
758	25.10	25.10	25.00	27.00	2510	25.10	20.30	20.10	15.00
1000	25.30	25.30	25.00	27.30	27.10	25.10	20.30	22.00	15.00
1250	25.10	25.10	25.00	29.10	29.10	28.00	24.30	21.00	15.00
1500	30.30	30.00	30.00	32.10	32.10	29.00	26.10	24.10	1800
1758	35.10	35.30	33.00	33.00	33.10	30.10	29.30	25.30	21.00
2000	40.10	40.30	34.00	34.00	33.10	31.00	29.00	27.00	2400
2258	45.10	6.8	6.8	40.00	36.10	33.30	31.10	29.00	25.00
2500	45.10	45.30	6.2	6.0	38.10	3430	31.00	29.00	25.00
2750	45.30	45.30	45.00	6.8	68	35.10	31.30	28.30	25.00
James	004/34/00	4/16	43		10.00	35.10	31.30	28.00	26:00
3500	45.30	45.00	-45.00	16.0	62	35.30	31.30	28.00	26.00
4000	45.10	45.10	45.00	45.10	6.8	39.30	35.10	30.00	26.00
4500	45.10	45.10	45.00	-610	43.10	39.00	35,10	29.00	26.00
5000	45.10	45.30	45.00	45.10	43.00	40.00	32.30	29.00	25.00
\$500	45.10	45.10	45.00	45.10	4330	40.00	32.10	29.10	25.00

This section will provide information on how to use the Advanced Tuning Mode tables for:

- Cranking Fuel
- Warmup Enrichment
- Idle RPM
- IAC Warmup Steps

Cranking Fuel

The Cranking Fuel Table, located in the Advanced Tuning Mode program, tells the ECM what the front and rear cylinder fuel injector pulse width should be when the engine is being started.

Use this Tuning Table to increase or decrease fuel for starting.

- If engine is hard starting and odor of fuel is noticed, decrement injector pulse width for less cranking fuel
- If engine is hard starting and no fuel odor is noticed, increment injector pulse width for more cranking fuel

Chrisgiam	Files/TTS/_VEND	nple2MT2	27 Apr 02 6:32:2	19 PM	Tuning Node File	Loaded	TWINCAM
ihow Graph	Set Baseline	Set Relevence	Decrement	Increment	C 2Units	C 5 Units C 10 Units	C 20 Units C 100 Units
Deg C	mS						
-16	1000 (51 1000)						
0.000	36.1						
16	25.9						
32	19.7						
48	15.6						
64	12.8						
80	11.3						
96	9.5						
112	9.5						
128	95						
144	95						
160	9.5						
176	95						

MISCELLANEOUS TUNING - CONT'D

Warmup Enrichment

The Warmup Enrichment Table, located in the Advanced Tuning Mode, tells the ECM how much Additional Fuel, (indicated as AFR of enrichment) the front and rear cylinders should receive to properly run an engine that's warming up.

When the ignition is first turned on the ECM checks engine temperature one time to determine where in the Warmup Enrichment Table it should start. When the engine is started the Warmup Enrichment affect "decays", or diminishes over a set period of time until it reaches zero, or no effect. The "Decay Time" is time-based, not "table-based".

Any changes made to the Warmup Enrichment table increase or decrease the amount of fuel delivered while the Warmup Enrichment mode is in effect. Changes to the Warmup Enrichment Table will not affect how long the Warmup Enrichment period lasts.

Use this Tuning Table to increase or decrease the fuel for a cold engine that's warming up so that it runs properly.

- If engine coughs, or dies, or hesitates, or surges when running in the warmup mode increment the Warmup Enrichment cells to increase the amount of fuel enrichment.
- If engine sputters, or blows excessive black smoke, or fouls spark plugs when running in the warmup mode – decrement the Warmup Enrichment cells to decrease the amount of fuel enrichment
- Use data recordings and the Data Mode program to identify what engine temperature the problem is located in.

	des(TTS)_\Exam	nple2.MT2	27-Apr-02 6:32	28 FM	Tuning Mode File	Loaded	TWINCAM
Show Braph	Set Baseline	Set Reference	Decrement	Increment	C 2Units	C 5 Units C 10 Units	C 20 Units C 100 Units
Deg C	AFR						
-16	43						
0	41						
16	3.3						
32	3.0						
48	3.0						
64	3.0						
80	3.0						
96	3.0						
112	3.0						
128	3.0						
144	3.2						
160	3.5						

Idle RPM

The Idle RPM Table tells the ECM what the target engine rpm should be for different engine temperatures.

Use this Tuning Table to set idle rpm to desired setting and to correct idle-related problems.

- If engine idle speed seems too low or engine occasionally dies, increment Idle RPM cells in appropriate engine temperature to correct
- If engine idle speed seems too high, decrement Idle RPM cells in appropriate engine temperature to correct
- Use Data Mode program to record engine data that allows user to pinpoint exact engine temperature that Idle needs to be adjusted



MISCELLANEOUS TUNING - CONT'D

IAC Warmup Steps

The IAC Warmup Steps Table is used by the ECM to Control the IAC Steps Position of a just started engine so the engine can achieve its desired idle speed during engine warmup.

Use this table to improve engine idle performance during engine warmup.

- If engine idle rpm increases and then decreases excessively just after start up, IAC steps may be set too high. Decrement Steps Cells to reduce IAC effect
- If engine idle rpm dips and then increases excessively just after start up, IAC steps may be set too low. Increment Steps Cells to increase IAC effect
- Use Data Mode program to record engine data and focus attention on IAC steps and engine temperature at time of startup

de Advance Setup Ial	d Mode Activ	Table Comparis	con Hel	р		
Files/ITS\\Exa	mple2MT2	27 Apr 02 6 32 28 PM	un haard	Tuning Mode File	Loaded	TWINCAM
Set Baseline	Set Relevence	Decrement	ncrement	I Unit C 2Units	C Stinks C 10Units	C 20 Units C 100 Units
Steps						
110						
100						
70						
52						
4)						
35						
30						
25						
20						
20						
20						
20						
	and a second second second	ME Warnup Steps - I	dil Enabled	La constantina de la		
	Steps 100 Set Baceline Steps Steps 110 100 70 52 40 35 30 25 20 20 20	de Advanced Mode Activ Setup Table Selection Flec/ITS\\Exarple2MT2 Set Baseline Set Relevence Steps 110 100 70 52 40 35 30 25 20 20 20 20	Steps Itelesterce Decement Itelesterce Steps 110 100 70 52 100 70 52 40 35 30 25 20 20 20 20 20 20 20 20	Setup Table Selection Table Comparison Hell Flex/ITS: Accord Mode Active Set Baseline Set Relevence Decrement Increment Steps 100 100 100 100 100 100 70 52 40 35 30 25 20 20 20 20 20 20 20 20 20 20 20 20	Setup Table Selection Table Comgarison Help FlexhTISL_VExample2MT2 27 Apr 02 & 32 29 PM Turing Mode Flex Set Baseline Set Relevence Decriment Increment T Turing Mode Flex Steps 110 Turing Mode Flex T Units T Units Steps 110 T Units T Units T Units Steps 110 T Units T Units T Units 100 70 52 40 T Units T Units 35 20 20 20 T Units T Units 20 20 20 T Units T Units T Units ME Warnup Steps - Edd Enabled Steps Edd Enabled T Units	Setup Table Selection Table Comparison Help Fier/ITS: Visuarple2MT2 27 Apr 02 & 32 20 PM Turing Mode FierLoaded Set Baseline Set Relevence Decrement Increment 110m 5 thats Steps 100 70 52 40 35 30 25 30 25 20 20 20 20 20 20 201 201 201 20 20 20 20 20 20 201 201 201 201 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20

Q: What bikes does the Screamin' Eagle EFI Race Tuner work with?

A: 2001 and later Softail models and 2002 and later Touring models.

Q: Will the Screamin' Eagle EFI Race Tuner work on Buell and/or V-Rod?

A: Not at this time.

Q: Can the user program more than one bike?

A: No. The Screamin' Eagle EFI Race Tuner Interface Module is a "single unit" design that permanently "mates" itself to the first ECM that it communicates with. The Interface Module can then be used an infinite number of times to program or record data with it's ECM mate, but will not be able to communicate with any other ECM's.

Q: How do I choose a starting calibration?

A: If you know what Screamin' Eagle components are installed in your engine then refer to section 9.1, Screamin' Eagle Calibration Information in this User's Manual. You should install the Screamin' Eagle calibration file that exactly, or best matches your cam profile, cylinder head configuration and engine displacement. Example: You are installing Screamin' Eagle performance accessories into a 2001 or later Softail motorcycle. The accessories include a SE 257 cam set, Screamin' Eagle Performance cylinder heads and big bore cylinders and pistons. Referring to the Screamin' Eagle Calibration Descriptions Table on page 9.1, the best Screamin' Eagle calibration to start with would be number 3286102A.

Q: What if I forget how to adjust a parameter while I am in Tuning Mode?

- A: Three suggestions: 1) You can have the User's Manual open while you are tuning and can refer to it at any time, 2) you can click Help in the menu bar of the Tuning Mode and Data Mode programs, or 3) you can print the User's Manual from the AdobeTM 5.0 Reader program that is included in the Screamin' Eagle EFI Race Tuner CD for a permanent hard copy to refer to.
- Q: When do I actually Program the ECU? Does my bike need to be connected to the computer in order for me to change the numbers in the table?
- A: You can edit the supplied calibrations at your desk, without having your computer connected to the motorcycle. You connect your computer to the bike when you want to load a new program into your motorcycle's ECU.

Q: How long can I record in Data Mode?

A: As long as MS Windows will allow. Practically, this means 30 minutes, since Windows generally crashes after about 30 minutes of recording.

Q: Can I use this tool with a Turbo-charged or Super-charged bike?

A: No, the Screamin' Eagle EFI Tuner is not written to deal with a 3-atmosphere range of intake pressure.

Q: What does VE mean?

A: VE represents Volumetric Efficiency. VE is the percentage rating of how much air is flowing through the engine while running as compared to its theoretical capacity. For example, an engine with a displacement of 88-cubic inches running at 5600 rpm at full throttle has a theoretical airflow capacity of 100% when it flows about 143-cubic feet of air per minute, (cfm). If the same engine flows 107cfm at 5600 rpm it would have a VE of about 75%. The ECM of the ESPFI system uses the VE values to calculate the amount of fuel that it delivers.

SCREAMIN' EAGLE CALIBRATIONS DESCRIPTIONS TABLE (WITH CROSS REFERENCE)

	CAL # in					``	410	v.350	Old Calib.
Application	EFI Tuner	Configuration	Piston	Cam	Head	Calibration ID 2005 ECM	Calibration ID 2001–2004 ECM	Calibration ID	Filename Cross Reference
	-	1450 SE A/C & Mufflers	Stk	Stk	Stk	127HO103	105HO103	105HO101	3287002
	2	1550 SE A/C & Mufflers	Ŀ	Stk	Stk	127HP103	105HP103	105HP101	3287102
MY01-05 Softail except FLSTSi or	3	1550 Stage II	Ŀ	203	Stk or Perf	127HD019	105HD019	105HD012	3283401A
FLSI SCI	4	1550 High Output	Forged	257	Реп	127HB025	105HB025	105HB017	3286102B
and MV01.05	5	1690 High Output	Forged	258	Реп	127HK034	105HK034	105HK028	3288202A
Dyna Dyna	17	1550 HTCC	нтсс	251	нтсс	127LK010	105LK010	n.a.	n.a.
	18	1690 Super High Output w/ SE Pro 2-into-1 Tunable	103+	257	103+	127LM006	105LM006	n.a.	n.a.
MY05 FLSTFSE	19	1690 CVO w/ SE Mufflers	сло	CV0253	CVO	127MK004	105MK004	n.a.	n.a.
MV02-03 Touring	9	1450 SE A/C & Mufflers	Stk	Stk – "B"	Stk	127HM005	105HM004	105HM002	3285102
	7	1550 SE A/C & Mufflers	ΕT	Stk – "B"	Stk	127HN005	105HN004	105HN002	3286802
MY04-05 Touring and MY01-03 FLSTSi	8	1450 SE A/C & Mufflers	Stk	Stk – "A"	Stk	127LF004	105LF003	105LF001	3287702
MY05 FLSTSCi	6	1550 SE A/C & Mufflers	ΕT	Stk – "A"	Stk	127LG004	105LG003	105LG001	3287802

	10	1550 Stage II	FΤ	203	Stk or Perf	127EV100	105EV100	105EV076	3285302A
MY02-05 Touring	1	1550 High Output	Forged	257	Perf	127HG019	105HG018	105HG017	3285602B
MY01-03 FLSTSi And	12	1690 High Output	Forged	258	Perf	127HL026	105HL025	105HL024	3288102A
MY05 FLSTSCi	20	1550 HTCC	нтсс	251	НТСС	127LJ011	105LJ011	n.a.	n.a.
	21	1690 Super High Output	103+	264	103+	127LL005	105LL005	n.a.	n.a.
MY03 FLHRSEI2 MY04 FLHTCSE MY05 FLHTCSE2	13	1690 CVO SE A/C & Mufflers	СVО	CV0253	CVO	127HX022	105HX021	105HX020	3292503
MY02-05 VRSC	14	HDI SE A/C & Slip-fit Mufflers	Stk	Stk	Stk	127NG002	105NG002	105GQ017	3202802A
(MY02 requires	15	SE A/C & Slip-fit Mufflers	Stk	Stk	Stk	127NE002	105NE002	105GY001	3200802
IAT relocation kit)	16	SE A/C & 16 Gauge Double Barrel Mufflers	Stk	Stk	Stk	127NF002	105NF002	105LS001	3260702
VRSCSE	22	CVO 1250CC SE A/C & Slip-fit Mufflers	CVO	CVO	CVO	127XP001	n.a.	n.a.	n.a.

SE = Screamin' Eagle CVO = Custom Vehicle Operations Stk = Stock Component FT = Flat Top Pistons Perf = SE Performance Heads 203, 257, etc. = Screamin' Eagle Cam Profile

Notes:

- All calibrations developed for Screamin' Eagle Air Cleaner and Mufflers
 All V-Rod calibrations listed can be run with or without the airbox lid

- 1) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSCi) Calibration # 1 in EFI Race Tuner Configuration: 1450 SE A/C & Mufflers File Name 2001-2004 Models: 105HO103.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HO103.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE II Slip-Fit Mufflers P/N 80448-03 or 80258-99A
- 2) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSCi) Calibration # 2 in EFI Race Tuner Configuration: 1550 SE A/C & Mufflers File Name 2001-2004 Models: 105HP103.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HP103.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE 1550 Flat Top Pistons P/N 22851-99A
 - SE II Slip-Fit Mufflers P/N 80448-03 or 80258-99A
- 3) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSCi) Calibration # 3 in EFI Race Tuner Configuration: 1550 Stage 2 with or without Performance Heads File Name 2001-2004 Models: 105HD019.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HD019.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE 1550 Flat Top Pistons P/N 22851-99A
 - SE Performance Heads P/N 16952-99A or 16953-99A (or Stock Heads)
 - SE 203 Cams P/N 25937-99B
 - SE II Slip-Fit Mufflers P/N 80448-03 or 80258-99A
- 4) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSCi) Calibration # 4 in EFI Race Tuner Configuration: 1550 High Output File Name 2001-2004 Models: 105HB025.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HB025.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE High-Compression Forged Pistons P/N 22868-00
 - SE Performance Heads P/N 16952-99A or 16953-99A
 - SE 257 Cam P/N 25155-00
 - SE II Slip-Fit Mufflers P/N 80448-03 or 80258-99A

- 5) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSCi) Calibration # 5 in EFI Race Tuner Configuration: 1690 Stroker High Output File Name 2001-2004 Models: 105HK034.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HK034.XXX.MT5 Components:
 - SE 103 CI Stroker Flywheels or P/N 23600-00 or 23703-02
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE Stroker Forged Pistons P/N 22942-00
 - SE 258 Cam P/N 25137-00
 - SE Air Cleaner P/N 29440-99B
 - SE Performance Heads P/N 16952-99A or 16953-99A
 - SE II Slip-fit Mufflers P/N 80448-03 or 80258-99A
- 6) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSci) Calibration # 17 in EFI Race Tuner Configuration: 1550 HTCC File Name 2001-2004 Models: 105LK010.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127LK010.XXX.MT5 Components:
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE HTCC Piston Kit P/N 22439-00A
 - SE 251 Cam P/N 25121-03
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE Performance HTCC Heads P/N 16933-99A or 16926-99A
 - SE HTCC Intake Manifold Kit P/N 29608-02
 - SE II Slip Fit Mufflers P/N 80445-03
- 7) Application: 2001 –2005 Softail and 2004 2005 Dyna (Except FLSTSi or FLSTSCi) Calibration # 18 in EFI Race Tuner Configuration: 1690 Super High-Output w/ SE Pro 2-into-1 Tunable Exhaust

Configuration: 1690 Super High-Output w/ SE Pro 2-into-1 Tunable Exhaust File Name 2001-2004 Models: 105LM006.XXX.MT5

File Name 2005 Models / '01-'04 Models with 2005 ECM: 127LM006.XXX.MT5 Components:

- SE 103 CI Stroker Flywheels or P/N 23600-00 or 23703-02
- SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
- SE HTCC Piston Kit P/N 22439-00A
- SE 257 Cam P/N 25155-00
- SE Air Cleaner and Breather Kit P/N 29440-99B
- SE 103+ Performance Heads P/N 17071-03 or 17072-03
- SE Pro 2-into-1 Tunable Exhaust P/N 80093-03 (26 discs, p/n 80110-03) for Softails and P/N 80091-03 (26 discs, p/n 80110-03) for Dynas

- 8) Application: 2005 CVO FLSTFSE Softail Calibration # 19 in EFI Race Tuner Configuration: 1690 CVO FLSTFSE Softail & Mufflers File Name 2001-2004 Models: 105MK004.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127MK004.XXX.MT5 Components:
 a SE II Slip fit Mufflers D/N 80448-02
 - SE II Slip-fit Mufflers P/N 80448-03
- 9) Application: 2002 –2003 Touring
 Calibration # 6 in EFI Race Tuner
 Configuration: 1450 SE A/C & Mufflers
 File Name 2002-2003 Models: 105HM004.XXX.MT5
 File Name 2002-2003 Models with 2005 ECM: 127HM005.XXX.MT5
 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE Performance Touring Mufflers P/N 65115-98B
- 10) Application: 2002 –2003 Touring Calibration # 7 in EFI Race Tuner Configuration: 1550 SE A/C & Mufflers File Name 2002-2003 Models: 105HN004.XXX.MT5 File Name 2002-2003 Models with 2005 ECM: 127HN005.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE 1550 Flat Top Pistons P/N 22851-99A
 - SE Performance Touring Mufflers P/N 65115-98B
- 11) Application: 2004-2005 Touring, 2001 2003 FLSTSi, and 2005 FLSTSCi Calibration # 8 in EFI Race Tuner Configuration: 1450 SE A/C and Mufflers File Name 2001-2004 Models: 105LF003.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127LF004.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE Performance Touring Mufflers P/N 65115-98B or 65116-98A

- 12) Application: 2004-2005 Touring, 2001 2003 FLSTSi, and 2005 FLSTSCi Calibration # 9 in EFI Race Tuner Configuration: 1550 SE A/C and Mufflers File Name 2001-2004 Models: 105LG003.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127LG004.XXX.MT5 Components:
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE 1150 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE 1150 Flat Top Pistons P/N 22851-99A
 - SE Performance Touring Mufflers P/N 65115-98B or 65116-98A
- 13) Application: 2004-2005 Touring, 2001 2003 FLSTSi, and 2005 FLSTSCi

Calibration # 10 in EFI Race Tuner

Configuration: 1550 Stage 2

File Name 2001-2004 Models: 105EV100.XXX.MT5

File Name 2005 Models / '01-'04 Models with 2005 ECM: 127EV100.XXX.MT5 Components:

- SE Air Cleaner and Breather Kit P/N 29440-99B
- SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
- SE 1550 Flat Top pistons P/N 22851-99A
- SE 203 Cams P/N 25937-99B
- SE Performance Touring Mufflers P/N 65115-98B or 65116-98A

14) Application: 2004-2005 Touring, 2001 – 2003 FLSTSi, and 2005 FLSTSCi Calibration # 11 in EFI Race Tuner Configuration: 1550 High Output File Name 2001-2004 Models: 105HG018.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HG019.XXX.MT5 Components:

- SE Air Cleaner and Breather Kit P/N 29440-99B
- SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
- SE High-Compression Forged Pistons P/N 22868-00
- SE Performance Heads P/N 16952-99A or 16953-99A
- SE 257 Cam P/N 25155-00
- SE Performance Touring Mufflers P/N 65115-98B or 65116-98A

- 15) Application: 2004-2005 Touring, 2001 2003 FLSTSi, and 2005 FLSTSCi Calibration # 12 in EFI Race Tuner Configuration: 1690 Stroker High Output File Name 2001-2004 Models: 105HL025.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HL026XXX.MT5 Components:
 205 100 OL Stroker Elements on P/NL020202, 00 an 00700, 00
 - SE 103 CI Stroker Flywheels or P/N 23600-00 or 23703-02
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE Stroker Forged Pistons P/N 22942-00
 - SE 258 Cam P/N 25137-00
 - SE Air Cleaner P/N 29440-99B
 - SE Performance Heads P/N 16952-99A or 16953-99A
 - SE Performance Touring Mufflers P/N 65115-98B or 65116-98A
- 16) Application: 2004-2005 Touring, 2001 2003 FLSTSi, and 2005 FLSTSCi Calibration # 20 in EFI Race Tuner Configuration: 1550 HTCC File Name 2001-2004 Models: 105LJ011.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127LJ011.XXX.MT5 Components:
 - SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
 - SE HTCC Piston Kit P/N 22439-00A
 - SE 251 Cam P/N 25121-03
 - SE Air Cleaner and Breather Kit P/N 29440-99B
 - SE Performance HTCC Heads P/N 16933-99A or 16926-99A
 - SE HTCC Intake Manifold Kit P/N 29608-02
 - SE Touring Muflers P/N 65115-98B and 65309-96
- **17) Application:** 2004-2005 Touring, 2001 2003 FLSTSi, and 2005 FLSTSCi

Calibration # 21 in EFI Race Tuner

Configuration: 1690 Super High Output

File Name 2001-2004 Models: 105LL005.XXX.MT5

File Name 2005 Models / '01-'04 Models with 2005 ECM: 127LL005.XXX.MT5 Components:

- SE 103 CI Stroker Flywheels or P/N 23600-00 or 23703-02
- SE 1550 Big Bore Cylinders P/N 16546-99 or 16549-99
- SE HTCC Piston Kit P/N 22439-00A
- SE 257 Cam P/N 25155-00
- SE Air Cleaner and Breather Kit P/N 29440-99B
- SE 103+ Performance Heads P/N 17071-03 or 17072-03
- SE Touring Muflers P/N 65115-98B and 65309-96

- 18) Application: 2003 FLHRSEi², 2004 FLHTCSE, and 2005 FLHTCSE² Calibration # 13 in EFI Race Tuner Configuration: 1690 CVO with SE A/C and Mufflers File Name 2001-2004 Models: 105HX021.XXX.MT5 File Name 2005 Models / '01-'04 Models with 2005 ECM: 127HX021.XXX.MT5 Components:

 SE Air Cleaner P/N 29440-99B
 SE Slip-Fit Mufflers P/N 65115-98B

 19) Application: 2002 – 2005 VSRC (2002 requires IAT Relocation Kit)
- Calibration: 2002 2005 VSRC (2002 requires IAT Relocation Kit)
 Calibration # 14 in EFI Race Tuner
 Configuration: HDI Slip-Fit Mufflers and SE A/C
 File Name 2002-2004 Models: 105NG002.XXX.MT5
 File Name 2005 Models / '02-'04 Models with 2005 ECM: 127NG002.XXX.MT5
 Components:
 - SE Performance Air Cleaner P/N 29793-02
 - SE Slip-fit Muffler Kit P/N 65030-02
- 20) Application: 2002 2005 VSRC (2002 requires IAT Relocation Kit) Calibration # 15 in EFI Race Tuner Configuration: Domestic Slip-Fit Mufflers and SE A/C File Name 2002-2004 Models: 105NE002.XXX.MT5 File Name 2005 Models / '02-'04 Models with 2005 ECM: 127NE002.XXX.MT5 Components:
 - SE Performance Air Cleaner P/N 29793-02
 - SE Slip-fit Muffler Kit P/N 65030-02
- 21) Application: 2002 2005 VRSC (2002 requires IAT Relocation Kit) Calibration # 16 in EFI Race Tuner Configuration: Domestic 16 Gauge Double Barrel Mufflers and SE A/C File Name 2002-2004 Models: 105NF002.XXX.MT5 File Name 2005 Models / '02-'04 Models with 2005 ECM: 127NF002.XXX.MT5 Components:
 - SE Performance Air Cleaner P/N 29793-02
 - SE 16 Gauge Double Barrel Muffler Kit P/N 64798-02
- 22) Application: 2005 VRSCSE

Calibration # 22 in EFI Race Tuner Configuration: CVO 1250cc, SE A/C, and Slip Fit Mufflers File Name 2005 Models / '02-'04 Models with 2005 ECM: 127XP001.XXX.MT5 Components:

- SE Performance Air Cleaner P/N 29793-02
- Slip Fit Mufflers P/N 65030-02

GLOSSARY

AFR – *Air-Fuel Ratio:* The ratio, by weight of air to fuel.

BAS – *Bank Angle Sensor* – The sensor located in the turn signal module that sends a signal to the ECM if the bike leans over more than 45° from vertical.

BPW – *Base Pulse Width:* The length, in time, that the fuel injector opens to deliver fuel. Usually expressed in milliseconds, (1/1000 of a second.)

CKP – *Crank Position Sensor* – The sensor that provides input signals to the ECM to indicate engine rpm, (how fast the engine is running in **R**evolutions **P**er **M**inute.)

Detonation – An uncontrolled, violent burning of fuel resulting in colliding flame fronts.

DTC – Diagnostic Trouble Code.

ECM – *Electronic Control Module* – The brain of the electronic fuel injection system that collects input signals from multiple sensors, makes decisions and sends output signals to deliver fuel and spark to the engine.

ECT – Engine Coolant Temperature sensor.

EFI – Electronic Fuel Injection.

ESPFI – *Electronic Sequential Port Fuel Injection* – A system that delivers fuel to each individual cylinder at a precise time.

ET – Engine Temperature.

EVAP – *Evaporative* – A system used to prevent fuel vapor from escaping into the atmosphere. Typically includes a charcoal canister to store fuel vapors. California vehicles.

FP – Fuel Pump.

HP – *Horsepower* – A measure of mechanical power, the work an engine performs. One horsepower equals 33,000 ft-lb of work performed in 1-minute. Calculated as torque X engine rpm divided by 5252.

IAC – *Idle Air Control* – An electric valve that's threaded, (each rotation is a "step") and controlled by output signals from the ECM to open and close as needed and allow enough air into the engine for starting and idle operation.

IAT – *Intake Air Temperature* sensor – Provides input signals to the ECM as it reacts to the temperature of the air entering the engine.

GLOSSARY - CONT'D

Ion Sensing System – The system that uses ion-sensing technology to detect detonation or engine misfire in either the front or rear cylinder by monitoring the electrical energy at the spark plug following every timed spark.

Look-up Tables – *AKA: Tuning Tables* – The tables that the ECM uses to make decisions on fuel and spark delivery.

MAP – *Manifold Absolute Pressure* – The sensor that provides the ECM with an indication of engine load. Reacts to intake manifold pressure and ambient barometric pressure.

Millisecond – 1/1000th of second.

MPG – *Mile Per Gallon* – An indication of fuel consumption.

OBD – On Board Diagnostic.

Open Loop Control – When the ECM monitors sensors positioned on the intake side of the engine and does not monitor the end result of internal combustion at the exhaust.

PN – Part Number.

Pulse-width – A unit of measure for the length of time that the fuel injector remains open, usually measured in milliseconds.

RPM – Revolutions Per Minute.

Sequential Port Fuel Injection – When the injector nozzle is positioned in the manifold near the intake valve and is precisely timed to deliver fuel to each cylinder.

Speed/Density System – The type of fuel injection system that monitors manifold absolute pressure, intake air temperature, throttle position and engine rpm to calculate the amount of oxygen entering the engine.

TDC – *Top Dead Center* – The position of the crankshaft when the piston of interest is at its closest position to the cylinder head.

Torque – *Twisting Fforce* – In an internal combustion engine torque is measured engine at the crankshaft or final drive as the twisting force created by the expansion of gases in the event of combustion.

TPS – *Throttle Position Sensor* – The sensor that provides input signals to the ECM that indicates the throttle opening, if the throttle is opening or closing, and how fast it's opening or closing.

VE – *Volumetric Efficiency* – Is a percentage rating of how much air is flowing through the engine while running as compared to its theoretical capacity. For example, an engine with a displacement of 88-cubic inches running at 5600 rpm at full throttle has a theoretical airflow capacity of 100% when it flows about 143-cubic feet of air per minute, (cfm). If the same engine flows 107cfm at 5600 rpm it would have a VE of about 75%.

VSS – *Vehicle Speed Sensor* – The sensor that provides input signals to the ECM to indicate if the bike is moving or sitting still and, if moving, at what speed.

WOT – *Wide Open Throttle* – When the throttle is 100% open.

AFR - Air-Fuel Ratio 20, 49, 91, 92,
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