

**Instruction 510-0009  
10-20-10**

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## **Installation Instructions for S&S USB Magneti Marelli® Style VFI (Variable Fuel Injection) Module and ProTune II Software**

### **DISCLAIMER:**

S&S parts are designed for high performance, closed course, racing applications and are intended for the very experienced rider only. The installation of S&S parts may void or adversely affect your factory warranty. In addition such installation and use may violate certain federal, state, and local laws, rules and ordinances as well as other laws when used on motor vehicles used on public highways, especially in states where pollution laws may apply. Always check federal, state, and local laws before modifying your motorcycle. It is the sole and exclusive responsibility of the user to determine the suitability of the product for his or her use, and the user shall assume all legal, personal injury risk and liability and all other obligations, duties, and risks associated therewith.

The words Harley®, Harley-Davidson®, H-D®, Sportster®, Evolution®, and all H-D part numbers and model designations are used in reference only. S&S Cycle is not associated with Harley-Davidson, Inc.

### **SAFE INSTALLATION AND OPERATION RULES:**

Before installing your new S&S part it is your responsibility to read and follow the installation and maintenance procedures in these instructions and follow the basic rules below for your personal safety.

- Gasoline is extremely flammable and explosive under certain conditions and toxic when breathed. Do not smoke. Perform installation in a well ventilated area away from open flames or sparks.
- If motorcycle has been running, wait until engine and exhaust pipes have cooled down to avoid getting burned before performing any installation steps.
- Before performing any installation steps disconnect battery to eliminate potential sparks and inadvertent engagement of starter while working on electrical components.
- Read instructions thoroughly and carefully so all procedures are completely understood before performing any installation steps. Contact S&S with any questions you may have if any steps are unclear or any abnormalities occur during installation or operation of motorcycle with a S&S part on it.
- Consult an appropriate service manual for your motorcycle for correct disassembly and reassembly procedures for any parts that need to be removed to facilitate installation.
- Use good judgment when performing installation and operating motorcycle. Good judgment begins with a clear head. Don't let alcohol, drugs or fatigue impair your judgment. Start installation when you are fresh.
- Be sure all federal, state and local laws are obeyed with the installation.
- For optimum performance and safety and to minimize potential damage to carb or other components, use all mounting hardware that is provided and follow all installation instructions.
- Motorcycle exhaust fumes are toxic and poisonous and must not be breathed. Run motorcycle in a well ventilated area where fumes can dissipate.

### **IMPORTANT NOTICE:**

Statements in this instruction sheet preceded by the following words are of special significance.



**WARNING**

Means there is the possibility of injury to yourself or others.



**CAUTION**

Means there is the possibility of damage to the part or motorcycle.

**NOTE**

Other information of particular importance has been placed in italic type.

S&S recommends you take special notice of these items.

### **WARRANTY:**

All S&S parts are guaranteed to the original purchaser to be free of manufacturing defects in materials and workmanship for a period of twelve (12) months from the date of purchase. Merchandise that fails to conform to these conditions will be repaired or replaced at S&S's option if the parts are returned to us by the purchaser within the 12 month warranty period or within 10 days thereafter.

In the event warranty service is required, the original purchaser must call or write S&S immediately with the problem. Some problems can be rectified by a telephone call and need no further course of action.

A part that is suspect of being defective must not be replaced by a Dealer without prior authorization from S&S. If it is deemed necessary for S&S to make an evaluation to determine whether the part was defective, a return authorization number must be obtained from S&S. The parts must be packaged properly so as to not cause further damage and be returned prepaid to S&S with a copy of the original invoice of purchase and a detailed letter outlining the nature of the problem, how the part was used and the circumstances at the time of failure. If after an evaluation has been made by S&S and the part was found to be defective, repair, replacement or refund will be granted.

### **ADDITIONAL WARRANTY PROVISIONS:**

- (1) S&S shall have no obligation in the event an S&S part is modified by any other person or organization.
- (2) S&S shall have no obligation if an S&S part becomes defective in whole or in part as a result of improper installation, improper maintenance, improper use, abnormal operation, or any other misuse or mistreatment of the S&S part.
- (3) S&S shall not be liable for any consequential or incidental damages resulting from the failure of an S&S part, the breach of any warranties, the failure to deliver, delay in delivery, delivery in non-conforming condition, or for any other breach of contract or duty between S&S and a customer.
- (4) S&S parts are designed exclusively for use in Harley-Davidson® and other American v-twin motorcycles. S&S shall have no warranty or liability obligation if an S&S part is used in any other application.

**NOTE:** All brand names, trademarks or registered trademarks mentioned in these instructions are the property of their respective holders and are used in a reference capacity only.

**CAUTION**

**S&S® Fuel Injection is not compatible with E85 fuel. Use of E85 fuel may cause your engine to run poorly and/or damage system components.**

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**INTRODUCTION**

The S&S VFI (Variable Fuel Injection) module directly replaces the stock fuel injection module and works with the stock sensors and injectors. This Magneti Marelli® Style replacement module works with all 1995 – 2001 EFI touring motorcycles.

This instruction sheet describes the installation of the S&S Magneti Marelli® Style replacement module with a USB computer interface.

**KIT CONTENTS**

- VFI Module – Also referred to as an ECM (Engine/Electronic Control Module)
- ProTune II Software CD
- USB Port Plug and Hardware Packet



**Kit Contents**

## ADDITIONAL PARTS REQUIRED

In most instances, the VFI module will be pre-programmed. If the VFI module included in this kit has not been programmed, this will be indicated by a label on the VFI module.

If programming is required, the following items are needed:

- A PC capable of running the included ProTune II software (see minimum requirements in Installation section).
- A standard USB-A to 5-pin mini-B cable.

Some applications may require the installation of the **Baro Sensor Relocation Kit (P/N: 55-1599)**. This kit is usually required for applications using the S&S T-Series oil pump or other configurations that do not for the use of a camshaft position sensor. Calibrations requiring the installation of this kit will indicate this with the term "MAP Synch" in the title and a reference to the Baro Sensor Relocation Kit in the comment field of the calibration.

## OPTIONAL ACCESSORIES

All S&S VFI modules are capable of closed-loop fuel control. Optional Closed Loop Oxygen Sensor kits are available for S&S Magneti Marelli® Style and Delphi® Style VFI modules.

The S&S part number for the Closed Loop Oxygen Sensor kit to be used with the VFI module described in this instruction sheet is listed below:

- 106-2067 – Magneti Marelli Style VFI Closed Loop Sensor Kit

## INSTALLATION

### VFI Module Installation

**NOTE:** *Included in this kit are components used to cover the USB port of the VFI module (o-ring, cover, and 2 screws). After the module is installed and any required work with the ProTune II software is complete, install these components before it is put into service. This is required to protect the module from the elements.*

- 1- Disconnect the negative battery cable.
- 2- Refer to the appropriate H-D® service manual to remove the OEM module and disconnect it from the motorcycle. Save the mounting hardware for reuse.
- 3- Connect the S&S VFI module by inserting the hook on the left side of the 35-position connector into the hinge on the VFI module. Push the connector onto the VFI module contacts until the connector fully engages the latch.
- 4- Install the VFI module in the same location as the OEM module using the original mounting hardware.
- 5- Connect the negative battery cable.
- 6- Before starting the motorcycle power must be cycled to allow the Idle Air Control (stepper) motor to recalibrate. To cycle the power, turn the ignition switch on with the run/stop switch in the "run" position then turn the ignition switch off and allow at least 15 seconds for the module to completely power down.
- 7- In most instances, the VFI module will be pre-programmed. If the VFI module included in this kit has not been programmed, this will be indicated by a label on the VFI module. If the VFI module has not been programmed, proceed with **ProTune II Software Installation** followed by **Installing USB Drivers** and **Loading a Calibration** sections of this instruction sheet. If the VFI module has been programmed, proceed with the next step.
- 8- Install the o-ring and port cover on the module using the 2 screws provided. This is required to protect the VFI module from the elements.

### WARNING

**Failure to install the provided USB port cover before use could result in damage to the VFI module not covered by warranty.**

### ProTune II Software Installation

The ProTune II Software that is included with the VFI module allows the average performance enthusiast to install existing maps and modify them to optimize the performance of a particular engine. Maps for some of the most common engine and exhaust combinations are provided on the CD that comes with the VFI module. As additional maps become available from S&S, they may be downloaded from the S&S website at [www.sscycle.com](http://www.sscycle.com). Once installed, a map may be optimized for the individual engine using a PC and S&S ProTune II software. Customized maps can also be saved and reloaded allowing a switch between street and drag strip tuning quickly and easily.

You must have the following minimum PC specifications to install and run ProTune II:

- Microsoft® Windows® XP Service Pack 2 or later, Microsoft Windows Vista™, Microsoft Windows 7 or later operating system.
- 1.0 GHz or faster processor. Intel® Core™ Duo or faster/equivalent recommended.
- 128Mb System RAM, 256 Mb or more recommended
- 200Mb of free hard drive space.
- A desktop resolution of at least 1024x768 pixels. Higher desktop resolution is recommended for optimum use.
- A modern graphics system with 3D acceleration and 64 MB or greater on board RAM is required.

If you are new to the ProTune II program, you should load it on a computer and familiarize yourself with the screen and the controls before connecting to the VFI module. All required information for the installation is explained below. For additional information on ProTune II, see the User Manual installed with the software.

**ATTENTION: Included on this installation CD is a link to the complete ProTune II manual. Print it out and keep it with you as you work with the software.**

- 1- To install Pro Tune II for the first time or to update Pro-Tune II, perform the following:
  - a- Close all applications.
  - b- Insert the Pro Tune II installation CD into your CD or DVD drive. After a few moments, the ProTune II Setup Wizard should appear on your screen and you can skip to step e. If the Setup Wizard does not appear automatically, proceed with steps c and d.
  - c- From the Start menu of your computer, select **Run**.
  - d- In the box marked **Open**: type **D:\setup.exe** and press enter or click OK. Most PCs have the CD-ROM drive letter 'D'. Replace this with the appropriate letter if your CD drive is installed differently. If done correctly the ProTune II Setup Wizard will open.

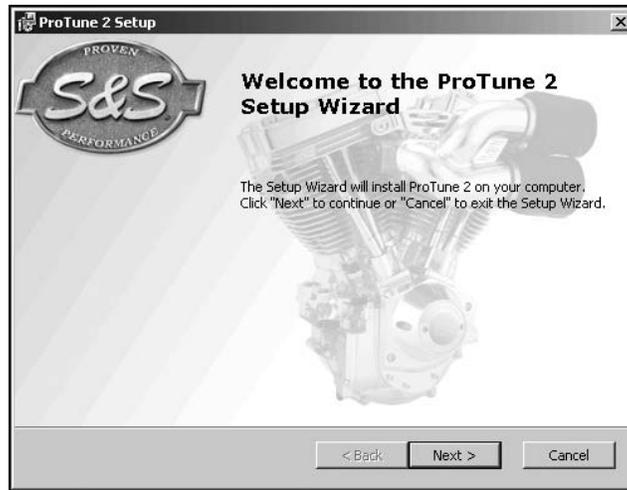


Figure 1

- e- The ProTune II Setup Wizard will appear on your screen. From the ProTune II Setup Wizard click **Next** and the **Ready to Install** window will open.
- f- If you are installing ProTune II on a PC that does not already have a copy of it installed or are updating an older version of ProTune II, click **Install**.

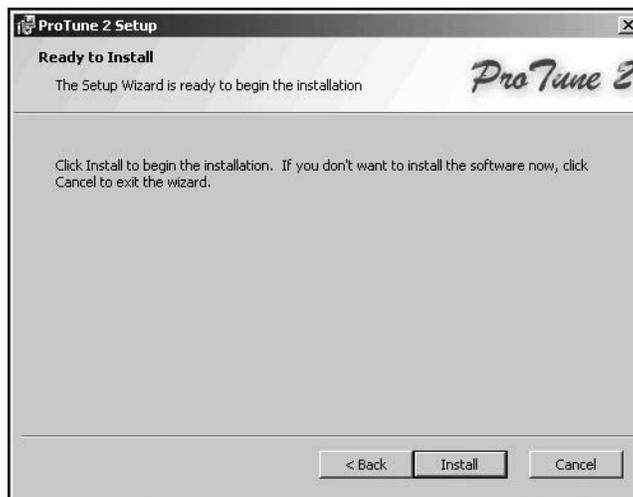


Figure 2

g- ProTune II will now install and copy files to your computer. If a warning message appears during driver installation click **Install/Continue** Anyway.

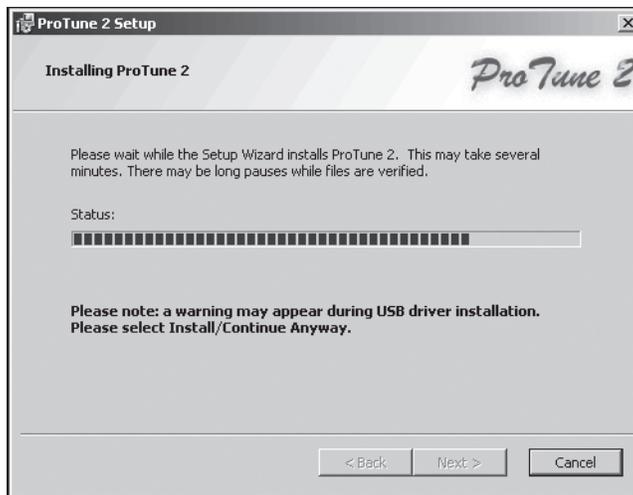


Figure 3

h- When the ProTune II installation is completed select **Finish** to exit the Setup Wizard.

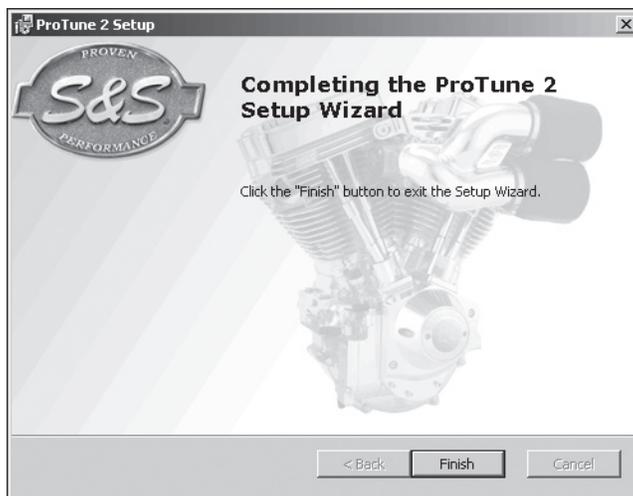


Figure 4

2- **See Figure 5.** After the installation, the ProTune II program and user manual icons will appear on your desktop. ProTune II can be opened by double-clicking on the program icon.



Figure 5: ProTune II Program and Manual Icons

## Installing USB Drivers

**NOTE:** The first time the VFI module is connected to a PC, the USB drivers will need to be installed for ProTune II to communicate with the VFI module. If drivers have already been installed, you may skip this section.

- 1- Close all window applications including ProTune II.
- 2- Using a standard USB A to 5-pin Mini b cable, connect the mini-USB port on the case of the VFI module to an available USB port on the PC.
- 3- Turn on the ignition switch of the motorcycle and set the run/stop switch to "run". Do not start the motorcycle at this time.
- 4- The PC will now recognize it has been connected to a VFI module and will start the process for installing the USB drivers. To complete the process follow the steps below for the operating system used on your PC.

### USB Driver Installation - Windows® XP

- a- After a few moments the **Found New Hardware Wizard** will appear and ask if Windows can connect to the internet to search for driver. Select **No, not this time** and click **Next**.



Figure 6

- b- Select Install the software automatically (Recommended) from the list of options and click **Next**.



Figure 7

- c- Windows will locate the correct driver file and copy the required files. Wait for this to complete.
- d- Depending on your security settings, a warning may appear indicating that the driver is 'unsigned'. **Click Continue Anyway.**
- e- When the driver installation is complete click **Finish**. You can now use ProTune II to communicate with the VFI module.



Figure 8

#### USB Driver Installation - Windows® Vista and Windows® 7

- a- After a few moments Windows will detect the presence of the new device. A small balloon window in the lower-right corner should indicate this. Windows should automatically install the USB driver and you can skip to step d. If this does not occur, proceed with step b.
- b- When the **Found New Hardware** dialog box appears, double-click the **Locate and install driver software (recommended)** option.



Figure 9

- c- Depending on your user account settings a security warning message may appear asking you to confirm the device installation. Allow the installation to continue.
- d- Depending on your security settings, the warning message shown below may appear. Double-click on the **Install this driver software anyway** option.



Figure 10

- e- When the installation is complete click **Close**. You can now use ProTune II to communicate with the VFI module.

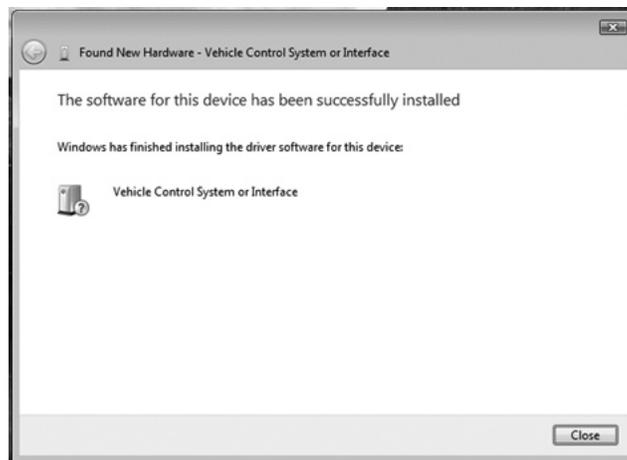


Figure 11

## Loading a Calibration

In most instances, the VFI module will be pre-programmed. If the module included in this kit has not been programmed, this will be indicated by a label on the VFI module. If there is a need to program the VFI module, proceed with the following steps:

- 1- Connect to the VFI module.
  - a- Using a standard USB A to 5-pin Mini b cable, connect the mini-USB port on the case of the VFI module to the USB port on the PC.
  - b- Open ProTune II by double-clicking the ProTune II icon on the desktop. The lower-right corner of the ProTune II window contains a communication status box. When there is no ECM (Electronic Control Module referring to the VFI module) communication this box will flash between blue and black and alternate between messages No ECM on USB and Checking USB.



Figure 12

- c- Turn the ignition switch of the motorcycle to on and set the run/stop switch to "run". Do not start the motorcycle at this time.
    - d- The communication status box in the lower-right corner of ProTune II will illuminate green to show that ProTune II is communicating with the VFI module. If it does not illuminate green see the **Basic Troubleshooting** section below.



Figure 13

- 2- Sending a Calibration file to the VFI module.
  - a- From the File menu of ProTune II, select Send all data to ECM... or click on the motorcycle icon in the upper-left corner of the screen.



Figure 14

- b- A window will open showing the list of calibration folders for each type of ECM. Open the folder "USB Port Magneti Marelli® Style ECM" to view the available files for this ECM. Select the calibration from the list that most closely matches the vehicle setup and click **Open** to start the calibration download process. Do not switch off power to the ECM at this time.
      - c- After the calibration has loaded a message will appear advising you to cycle power on the ECM for at least 15 seconds. Select OK on the message and turn the key off on the motorcycle for at least 15 seconds.
- 3- The VFI module calibration is now complete. Install the o-ring and port cover on the VFI module using the 2 screws provided. This is required to protect the VFI module from the elements.

## BASIC TROUBLESHOOTING

- 1- Problem: ProTune II is not communicating with the VFI module.
  - a- Check that the VFI module is powered. The VFI module must be supplied with vehicle power in order to operate. Your motorcycle ignition and run/stop switch should be set to the ON and RUN positions. Make sure that the battery voltage is normal. Try cycling power to the VFI module (switch off the ignition for 15 seconds and then switch on).
  - b- Check that the cable is connected firmly to the VFI module and the PC.
  - c- Try disconnecting and reconnecting the USB connection to the VFI module. This will reset the module connection and allow Windows to relocate the device.
  - d- Was the USB driver installed correctly? Please review the **Installing USB Drivers** section of this instruction sheet. Additional troubleshooting information can be found in the ProTune II Manual installed with the software on your PC.
- 2- Problem: I have the correct calibration loaded into the VFI module for my motorcycle, but it won't start or idle properly.
  - a- If the motorcycle has a stock throttle body, please review the **Stock Throttle Body Setup Procedure** section in this instruction sheet.
  - b- If the motorcycle has an S&S or other aftermarket throttle body, please review setup instructions for those components. Typical S&S throttle body closed throttle voltage setting is 0.50 V. Variation of +/- 0.02 V is typical.
  - c- Perform **Test Outputs** function using the ProTune II software (see ProTune II manual or help files installed with the software for additional information). Specifically, check to ensure that both injectors and ignition coils are working correctly and installed on the correct cylinder. Also verify that the stepper motor (Idle Air Control) is functioning properly.
  - d- Verify that the VFI module is powering down properly. When the VFI module is powering down (ignition on then off) the stepper motor will move through a recalibration process and the VFI module will remain in communication with the ProTune II software for approximately 10 – 15 seconds after the ignition switch is turned off. If this does not happen, verify components and wiring for the constant or ECM power system of the motorcycle.
  - e- If performing the above tasks does not correct the problem, please contact S&S Tech Services. Be prepared to list details about your motorcycle and engine configuration. Model year, displacement, compression ratio, camshaft, intake, and exhaust are typical items needed to determine if the calibration is correct. Also, be prepared to provide the part number or details about the calibration you are using. This information can be found in the Comment Field portion of the calibration. This is accessed through the View menu of ProTune II. You may also be asked to send your current calibration to S&S via e-mail.

## PROTUNE II DIAGNOSTICS

The recommended method for checking the VFI module for Diagnostic Trouble Codes (DTCs) is by using the ProTune II software. DTCs can be read and cleared by clicking on the DTCs button found on the upper left of the ProTune II screen when connected to a powered module. Please, refer to the ProTune II manual or help files for more information on DTCs.

## CHECK ENGINE LAMP DIAGNOSTICS

**NOTE:** The VFI module has a feature where the check engine lamp can be used as a shift light. If your VFI module is configured in this manner, the check engine lamp diagnostics function will be disabled.

The procedures to activate and read the check engine lamp are as follows:

- 1- Turn the ignition switch to the **ON** position for three seconds (one second pause after the fuel pump stops), and then switch back to the **OFF** position for three seconds. Repeat this procedure one more time and then turn the ignition to the **ON** position and wait for eight seconds for the check engine lamp to start flashing.
- 2- The transmission of a code is always preceded by a series of rapid flashes (about 3 per second). This "intermission" is followed by a 2 second pause in which the lamp is off. The lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1 second in duration. The number of times the lamp flashes indicated the first digit of the trouble code.
- 3- Following the transmission of the first digit, there is another 2 second pause in which the lamp is off. The lamp will then flash one or more times to indicate the second digit of the trouble code. The number of times the lamp flashes indicates the second digit of the trouble code.
- 4- Following the transmission of the second digit, there is a third 2 second pause in which the lamp is off. After the pause comes an "intermission", followed by transmission of the next recorded trouble code. All subsequent codes are sent in the same manner, each separated from the next by an "intermission". Once all the trouble codes have been sent the data string is repeated. See Table 1 for a list of the trouble codes supported.
- 5- Turn the Ignition Key switch to **OFF**. Wait 10 seconds for the ECU relay to click. The vehicle can now be started normally.

Check Engine Lamp Flash Code	Fault Condition
11	Throttle Position Sensor
12	Barometric Pressure Sensor
14	Engine Temperature Sensor
15	Intake Air Temperature Sensor
16	System Voltage (Battery) High
23	Front Injector
32	Rear Injector
34	Stepper Motor
42	Camshaft Position Sensor
54	EEPROM Error

**Table 1**

### STOCK THROTTLE BODY SETUP PROCEDURE

S&S calibrations for use with stock Magneti Marelli® dual bore throttle bodies are setup to use the factory base Throttle Position Sensor (TPS) calibration and hot and cold idle screw adjustments. If this module is being installed on a vehicle with a known good throttle body and TPS it is not necessary to go through the base TPS setup procedure and you can skip to step 4 below for final idle speed adjustment. If the TPS has been replaced or random adjustments made to the idle speed screws, the steps below can be used to get back to the base settings.

**NOTE:** Before performing these steps verify there are no intake manifold leaks and all vacuum caps are in place on the throttle body. Also, be sure that throttle body components such as linkage arm and bearing are not worn and are in good, operable condition.

#### 1- Base TPS Settings

- a- Connect the PC to the VFI module and open ProTune II. With the bike turned on, open the Realtime ECM Gauges by selecting "Gauge" from the top row of icons in ProTune II.
- b- On the Realtime ECM Gauges screen, locate the gauge for "Throttle Voltage" and "Stepper Motor Position". The "Stepper Motor Position" gauge will display the number of steps the stepper motor (or Idle Air Control Motor) is currently holding the plates open and the "Throttle Voltage" panel will display the current TPS voltage at that position.
- c- Turn the vehicle's ignition switch to off and observe the Stepper Motor Position. It will close to 0 steps and then open to 96 steps (1995-1998 models) or 100 steps (1999-2001 models). This is the stepper park position and is the starting point for setting the TPS base settings and initial hot and cold idle screws.
- d- After 15 seconds the VFI module will power down and communication will be lost. At this time, the Idle Air Control Motor (IAC) can be disconnected. TPS base adjustments will be made with the IAC motor disconnected and the stepper at its park position.
- e- Turn the key switch back to run and record the reading from the Throttle Voltage gauge. Remove the cold idle screw and record the TPS voltage.
- f- The Throttle Voltage will now show the base TPS voltage. This should read 0.19 to 0.21 volts. If the reading is outside of this range, verify the throttle plates are shut by pressing on them gently. If the voltage remains outside of this range, adjust the TPS to correct. After adjustment lightly open and close the plates a few times to ensure the TPS voltage will return to the proper setting.
- g- Proceed to step 2 or 3 below based on your application.

#### 2- Base Hot and Cold Idle Screw Settings for 1340cc (80") and 1450 (88")

- a- Apply a small amount of blue Loctite® to the **hot** idle screw. Install the screw and adjust until the throttle voltage is showing 0.50 V (1995-1998 models) or 0.54 V (1999-2001 models) when viewed on the Realtime ECM Gauges screen in ProTune II.
- b- Lightly open and close throttle to verify setting.
- c- Apply a small amount of blue Loctite to the **cold** idle screw. Install the screw and adjust until the throttle voltage is showing 0.61-0.64 V (1995-1998 models) or 0.64-.068 V (1999-2001 models).
- d- Lightly open and close throttle to verify setting.
- e- Reconnect the plug to the IAC motor.

### 3- Base Hot and Cold Idle Screw Settings for 1550cc (95")

- a- Apply a small amount of blue Loctite® to the **cold** idle screw. Install the screw and adjust until the throttle voltage is showing 0.64-0.68v when viewed on the gauge panel in ProTune II.
- b- Lightly open and close throttle to verify setting.
- c- Apply a small amount of blue Loctite to the hot idle screw. Install the screw and adjust until the throttle voltage is showing 0.70v
- d- Lightly open and close throttle to verify setting.
- e- Reconnect the plug to the IAC motor.

### 4- Final Idle Speed Adjustment

If issues with the engine idle hanging high or engine stalling occurs when returning to idle, the Idle Air Control (IAC) motor calibration may need to be adjusted. Engine idle RPM is controlled by a stepper motor that controls the amount of air flow to the engine during idle conditions. During idle operation the stepper will move in an increasing number of steps to raise engine RPM and will reduce the number of steps to slow the idle speed.

The process of calibrating the stepper motor involves adjusting the Stepper Position with Temperature Map so it more closely matches the values used during idle control. Use the following steps to complete the stepper motor calibration:

- a- Allow motorcycle to cool completely. Engine must be at room temperature before starting this procedure.
- b- Connect a PC to the ECM, open ProTune II on the PC, turn on the ignition switch, and set the run/stop switch to run. Do not start the motorcycle at this time. The bar in the lower right corner of ProTune II should turn green to show it is communicating with the ECM. If communication is not established see the basic trouble shooting section of these instructions.
- c- Be sure that ProTune II is operating in "Advanced" mode. Selection between the Advanced and Basic levels of ProTune II can be found in the menu item "Select User Level..." under the Options menu of ProTune II.
- d- Under the View menu in Pro Tune 2 select "Stepper Position with Temperature Map". In the window that opens select the ECM (default) and hit OK. This will open the stepper position with engine temperature map from the ECM. This map will show the number of step the stepper motor is open versus the temperature of the engine. Take note of the temperature intervals on the map.
- e- From the top row of icon in Pro Tune 2 select the "Gauge" icon this will open the gauge panel showing the current engine operation. Identify the panels for engine temperature and stepper position on the gauge panel.
- f- Start the engine and allow it to idle. As it warms up, take note of the stepper position shown in the gauge panel at each engine temperature corresponding to a point on the stepper position with engine temperature map up to 250° F engine temp.
- g- Input the values recorded above into Stepper Position with Temperature Map in ProTune II. For engine temperatures outside of the area tested, carry out the trend of the graph to smooth it out.
- h- To save the tuned map to the ECM select "Save" from the top row of icons in ProTune II. In the new window that opens select the ECM (default) and hit OK.
- i- Turn the ignition switch to off for at least 15 seconds before starting motorcycle.

If you find during the above procedure that the hot idle speed is too fast and the Stepper Position = 0 (fully closed), the hot idle screw may need to be backed out slightly and the above procedure repeated.