Twin Tec

M8FI-G9 Racing EFI - Startup Guide and System Installation

⚠ **OFF ROAD USE ONLY - NOT LEGAL FOR SALE OR USE IN CALIFORNIA OR ON POLLUTION CONTROLLED VEHICLES.**

⚠ **DESIGNED FOR RACING. CAREFULLY READ INSTRUCTIONS PRIOR TO USE.**

🛠 **M8FI-G9 Racing EFI system** has been designed for **offroad racing use** in the "King of the Baggers" racing series. Each Racing ECU has been designed to plug directly into the factory HD harness.

Part Num	Application	Engine Type	Sensor Type
17818	2021-2023 Touring (2021-2024 Ultra)	Natural Aspirated Engines	OE 1 Bar
17819	2021-2023 Touring (2021-2024 Ultra)	Turbo Engines	Incl - 2 Bar Sensor
17820	2021-2023 Touring (2021-2024 Ultra)	Turbo Engines	Incl 2.5 Bar Sensor
17821	2021-2024 Softail Models	Natural Aspirated Engines	OE 1 Bar
17822	2021-2024 Softail Models	Turbo Engines	Incl 2 Bar Sensor
17823	2021-2024 Softail Models	Turbo Engines	Incl 2.5 Bar Sensor

⚠ **G9 ECU requires the use of version 23.6+ of the PC_LINK.exe tuning software and version 19.99+ of the TCFI_LOG.exe logging software. All software is available for free on our website: daytona-twintec.com.**

⚠ **AUTO-TUNE** is included in all of our EFI systems → To enable **AUTO-TUNE**, the wideband O2 sensors must be installed in the exhaust AND closed loop must be enabled in the tune. After the engine is warm and close loop becomes active, AUTO-TUNE learns fuel trim corrections. To apply the fuel corrections to the tune. First read the tune and apply the BLM changes(AUTO-TUNE will adjust the front and rear fuel tables).

⚠ **IMPORTANT NOTE:** Even though Auto-Tune will tune your motorcycle "out of the box". You must be willing to do some basic tuning before relying on the **AUTO-TUNE** feature. This means that you must verify that the tune on your motorcycle functions at a basic level before relying on the AUTO-TUNE feature**. Your engine must start and run without popping and blowing black smoke.** Use the built in M8FI data-logging combined with TCFI_LOG.exe to monitor the tune. **M8FI tune adjustments** are made via **PC_LINK.exe**.

⚠ **IMPORTANT NOTE:** ***Occasionally new features are added. To take advantage of a new feature, you MUST send us the ECU for an update. We want to avoid any issues with customers updating via the internet.***

⚠ **Data Logging is automatically enabled** when the engine is running. The ECU continuously records 60 minutes of engine data in a loop, overwriting the oldest data with new data. To access this recorded data, use the **TCFI_LOG.exe** Data Logging program.

⚠ **Tuning, monitoring, and data log playback** are performed using the **USB-C Interface** integrated into the ECU. Connect the USB-C interface directly to a USB port on your PC (refer to the M8FI GEN 9 System Diagram). ECU tuning adjustments are made via the **PC_LINK.exe** software. For live data monitoring or reviewing automatically recorded logs, use the **TCFI_LOG.exe** software

⚠ **ECU Diagnostics** are conducted using the Live Data View feature within the **TCFI_LOG.exe** software. Current ECU error codes automatically clear once the issue is resolved. Historical ECU codes can also be cleared manually.

💻 HOW TO Download and Install Software and Device Drivers

1 – Visit the software download page: https://daytona-twintec.com/software/

2 - Navigate to the section: "M8FI - TCFI - VRFI -- EFI Stand Alone - PC Software"

3 – Download the original TCFI Software Installer: Look for: **TCFI Software Installer - Install First - EXE**

4 - Run the original TCFI Software Installer: Execute "**TCFI_Software_Installer.exe**".

5 – Download the software update: Scroll down further on the page and find " **M8FI G8/G9 and TCFI7 ONLY - Software UPDATE. Install Second – EXE** ". This update provides the latest software necessary for the G9 ECU.

6 - Run the software update: M8FI-TCFI7_SelfInstallUpdate_236-1999__030225_G7G8G9.exe. When prompted that the publisher could not be verified Click RUN, Click Extract, Click Yes to allow the App to make a change to your PC and finally Click Yes to All to confirm file replace.

Important: Ensure you install the **TCFI Software Installer package FIRST,** before running the update**.**

7 – Launch the software by clicking TCFI Launcher from the desktop.

• **Left Icon - ECU Tuning: TCFI – M8FI PC LINK** update VIN, Odometer, and calibrating the ETC system. If using the Auto-Tune feature, this software also reads data from the ECU and updates the fuel tables.

• **Right Icon - Live Data / Log: TCFI – M8FI LOGGING** access stored logs, or clear ECU codes.

⚠ **Note on Software Naming:** Our software products include "TCFI" in their names because they originally supported only the Twin Cam engine. "TCFI" stands for Twin Cam Fuel Injection, while "M8FI" refers to Milwaukee Eight Fuel Injection.

⚠ ***IMPORTANT NOTES:*** If your bike is equipped with RDRS. You must program your VIN into the ECU. If the correct vin is not programmed the RDRS/ABS module will illuminate the red trouble light on the speedometer and the ABS and Traction Control Lights will remain illuminated when the bike is moving.

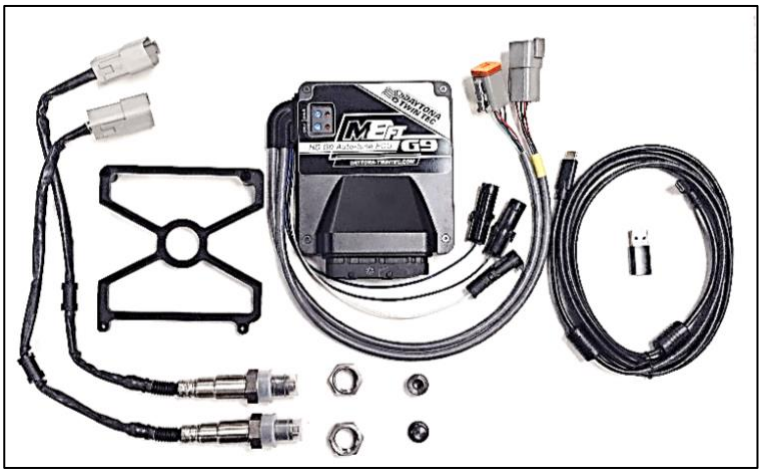
~~Once the VIN is programmed: Each time your bike is started the ABS and Traction Control Lights will blin~~k, and they will turn off after the bike starts moving.

⚠ ***CAUTION*: Proper tuning of the G9FI system requires proficiency with PC operations, familiarity with Microsoft Windows programs, and a solid understanding of basic engine tuning and fuel injection concepts. Users must also have access to standard test equipment and Harley-Davidson® factory service manuals.**

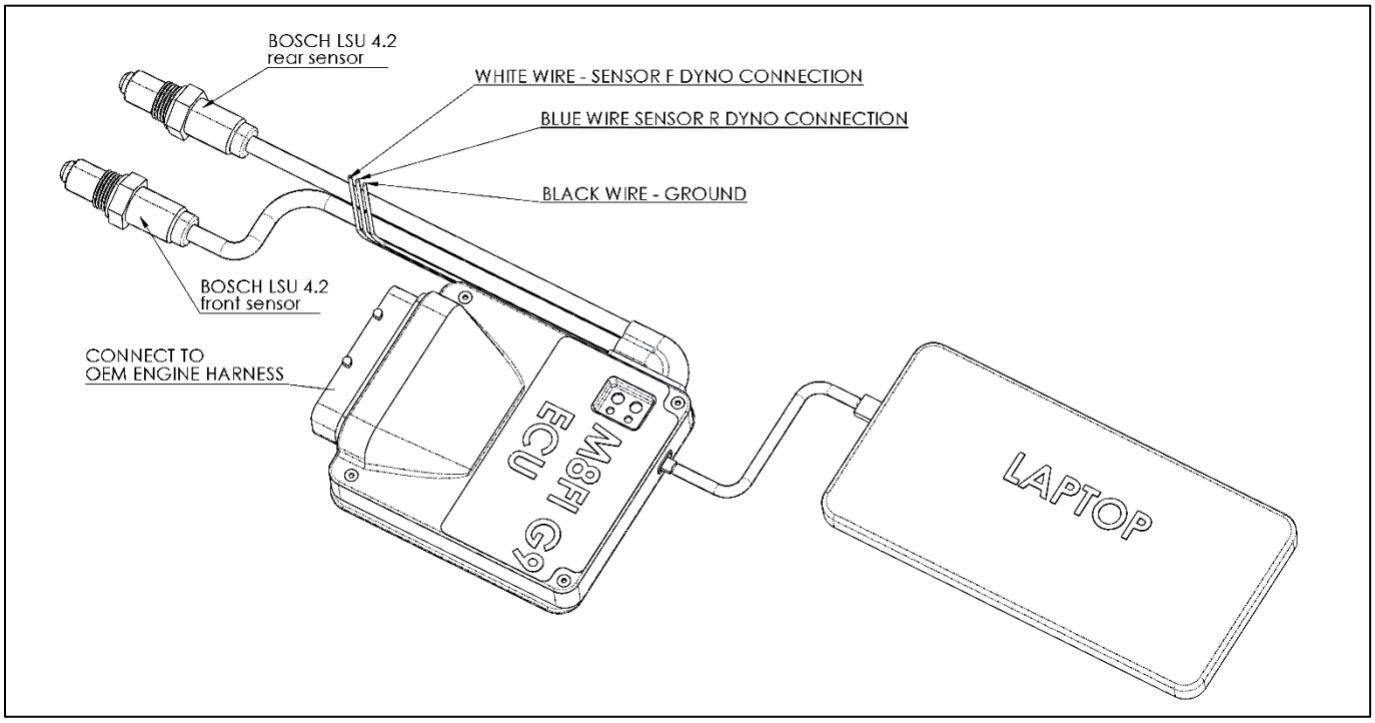
TUNING CLASSES AVAILABLE → CALL 386-304-0700 FOR DETAILS.

The M8FI GEN 9 kit includes:

- One G9 ECU
- 2 Bosch LSU 4.2 oxygen sensors
- USB interface cable
- 2 18x1.5 mm weld nuts
- Extension cable for O2 front sensor
- 3 connectors with pins and weather seals for dyno testing
- Adapter frame – ECU some models



M8FI GEN 9 SYSTEM DIAGRAM



M8FI G9 ECU PRE-INSTALLATION CHECKS

Make sure that the original equipment (OE) engine control module (ECM) is functioning correctly (other than tuning issues) before attempting installation. If the OE ECM is setting diagnostic codes, find and correct any underlying problems first.

GENERAL RECOMMENDATIONS

M8FI G9 systems have been designed to be used with the H-D® OE ignition coils. Fuel injected engines require a special coil with low primary resistance. We offer HO replacement ignition coils for all M8 engines.

Due to the short lengths involved on motorcycle applications, energy losses in spark plug wires are insignificant. OE carbon core suppression cables will deteriorate after several years. For a more durable replacement, we suggest spiral core type spark plug cables.

CAUTION: Do not use solid copper spark plug cables or non-resistor type spark plugs. The G9 TCFI unit may misfire. Aftermarket spark plug wires with excessive internal resistance have a tendency to malfunction.

M8 G9 ECU INSTALLATION

1. If motorcycle is equipped with security system, make sure system is disarmed. Turn off the ignition switch and disconnect the battery ground cable before proceeding.
2. Find and remove the OE ECM. The OE module is usually located under the seat or under a side cover.
3. Install the **M8FI-G9** module. The pictures below is a typical installation on Touring models – Softail is similar, however the ECU is located under the left hand side cover.
4. **Do not reconnect the battery ground cable until you have completed installation of the O2 sensors. Do not attempt to start the engine until you have completed the initial setup.**

TYPICAL INSTALL 2024 Touring Road Glide Limited (FLTRK) with RDRS → ECU is under the seat

REPLACEMENT - AUTOTUNE WIDEBAND O2 SENSORS

The AUTOTUNE AFR monitoring system utilizes standard Bosch LSU 4.2 sensors used on a VW production application (Bosch P/N 0 258 007 057/058 or VW P/N 021 906 262B). The proprietary VW connector is replaced with a smaller Deutsch DT-04-6P. We offer replacement sensors with the Deutsch connector installed.

WIDEBAND O2 SENSOR INSTALLATION

1. If motorcycle is equipped with security system, make sure system is disarmed. Turn off the ignition switch and disconnect the battery ground cable before proceeding.
2. In general, the Wideband O2 sensors should be mounted 2-8 inches from the exhaust head flange. Available clearance will usually dictate the optimum location. When choosing a mounting location, allow several inches clearance for the sensor wire harness. The wire harness must exit straight out from the sensor. Do not loop the harness back onto the sensor body.
3. You cannot use the original equipment (OE) 12mm x 1.25 mm oxygen sensor mounting bosses. Usually, the new and larger diameter 18mm Wideband O2 sensors are installed in the same position as the factory 12mm Sensors. Normally the original 12mm mounting bosses are removed/cut out of the original OE exhaust pipe.
4. 18mm x 1.5 mm weld nuts must be welded onto the exhaust pipes and can be located near or can replace the smaller OE oxygen sensor mounting bosses. After welding, run an 18mm x 1.5 mm tap through the threads. Failure to clean the threads may result in sensor damage. Most aftermarket exhaust systems come standard with 18mm O2 Sensor threads and utilize reducers from 18mm to 12mm for the OE O2 Sensors.
5. Do not install the new Bosch sensors until after the free air calibration procedure described in the following section. Always use a touch of anti-seize lubricant such as Permatex 133A on the sensor threads.
6. Connect the Bosch sensors to the 6 pin mating connectors on the G9 ECU wire harness. The cable with yellow band is for sensor 1 (front). For additional protection and improved cosmetics, use Techflex 1-1/4" Black Flexo Clean Cut FR expandable sleeving over the connectors (available from www.wirecare.com).
7. **Reconnect the battery ground cable. Do not attempt to start the engine until you have completed the free air calibration of the O2 sensors and initial setup of the ECU.**

ULTRA/TOURING – Typical Wideband O2 Placement

Typical Front Sensor Installation

Typical Rear Sensor Installation

SOFTAIL – Typical Wideband O2 Placement

Typical Front Sensor

Typical Rear Sensor

O2 SENSORS – FREE AIR - CALIBRATION AND OPERATION

The O2 controller (integrated into the G8 and G9 ECU) has red status LEDs for each O2 channel. When power is turned on, the LEDs blink at a slow rate until the corresponding sensor has reached normal operating temperature.

After initial installation, the ECU system requires free air calibration. This should be done with the sensors dangling in free air. The environment must be free of hydrocarbon vapors. We suggest that you perform the free air calibration outdoors. Turn the free air calibration trimpots full counterclockwise. Turn on power and wait for 60 seconds so the system can fully stabilize. Then slowly turn each free air calibration trimpot clockwise until the corresponding LED starts flashing at a rapid rate. Try to set each trimpot at the point where its LED just starts to flash. The free air calibration procedure should be performed at reasonable intervals (every 250-500 hours) or whenever a sensor is replaced. If you cannot get an LED to rapidly flash when its trimpot is turned full clockwise, you either have a damaged sensor or very high hydrocarbon levels in your environment. If both LEDs keep blinking at the slow rate, you may have a low battery voltage condition. Try connecting a battery charger. The ECU includes internal diagnostics for abnormal battery voltage (less than 11 volts or greater than 16.5 volts), sensor open circuit, and sensor short circuit conditions. A fault condition causes the status LEDs to blink at the slow rate.

⚠ **CAUTION:** Racing gasoline containing lead will quickly degrade the wideband O2 sensors. Under these conditions, expected sensor life is less than 10 hours. There is no warranty on the wideband O2 sensors.

⚠ **NOTICE:** When tuning on the dyno, it is recommended to connect the bike to a battery charger. Use a battery charger that utilizes a transformer to step the voltage down. Be sure to also choose a battery charger that is powerful enough to keep the battery charged when the bike is turned on (at least 10 AMPS of continuous output). Avoid trickle chargers and battery chargers that do not have a transformer.

⚠ **NOTICE:** **<u>After installing the ECU & Wideband O2 Sensors, several items MUST be configured using the PC_LINK_TCFI.exe software → prior to starting the engine. Configure the new ECU, after installing the PC_Link_TCFI.exe and TCFI_Log.exe software.</u>**

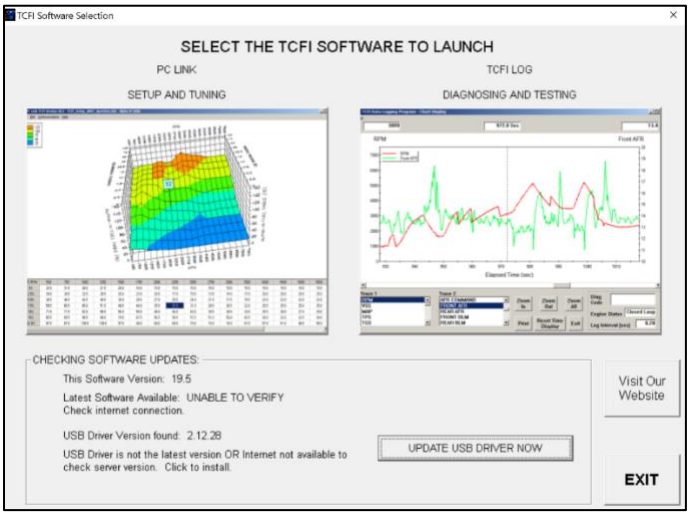
<u>FIRST START – CHECKLIST – Part 1 → Steps 1-3</u>

1. **<u>Plug the USB cable</u>** into the USB-C port on the ECU and a USB port on the PC
2. **<u>Open/Run the PC_LINK_TCFI.exe</u>** -- Tuning Software by clicking on the TCFI_Launcher.exe icon
3. **<u>Follow the next steps 4-10 located on the next page</u>**.

The TCFI_Launcher.exe icon should be located on the desktop.

Double click on the shortcut and a window will open listing the two programs available to run (Tune and Log).

If the shortcut is not located on the desktop, you can locate it in TCFI Software folder and place the shortcut on desktop. C:\Program Files (x86)\Daytona TwinTec\TCFI_Software



For setup/tuning click the icon image to the LEFT – **PC_LINK_TCFI.exe**. For data logging and some special features, click the icon image on the RIGHT – **TCFI_LOG.exe**.

⚠ **For the initial** ECU setup, you will need the **PC_LINK_TCFI.exe** program.
⚠ The **M8FI GEN 9** ECU requires the use of version 23.6+ of the **PC_LINK.exe** for tuning and v19.99+ of **TCFI_LOG.exe** logging software. The new software includes storing the options in the tune file and ECU.

⚠ **To enable communication between the PC, and ECU**, the power to the ECU must be turned on (some bikes have both an on/off switch near the twist grip and a main switch). After the power is turned on, the two RED O2 Status LEDs will turn on…. indicating that the ECU has been powered on.

⚠ **To speed up ECU read/flash time:** Set the COM port latency (delay) to 2ms using PC Device Manager.

FIRST START – CHECKLIST – Part 2 – Steps 4-10

4. **Read the file out of the ECU → Scan+READ ECU**
    a. If the bike has larger injectors, we recommend that you adjust the tune prior to starting the bike. See Tuning Basics below.
5. **Save the file to the PC → File->Save As**
6. **Program VIN (Setup New ECU -> Edit TCFI or M8FI VIN) - Enter the Vin**

⚠ **Caution:** ***The body control module (BCM) may not allow starter engagement if the ECM is programmed with an incorrect VIN. The speedometer will also display a VIN error message.***

⚠ **Caution:** ***If your bike is equipped with RDRS. You must program your VIN into the ECU. If the correct vin is not programmed the RDRS/ABS module will illuminate the red trouble light on the speedometer and the ABS and Traction Control Lights will remain illuminated when the bike is moving. Once the VIN is programmed Each time your bike is started the ABS and Traction Control Lights will blink, and they will turn off after the bike starts moving***

7. **Program Odometer (Setup New ECU ->Edit TCFI or M8FI Odometer Setting) – enter the Odometer reading.** The ECM, BCM and Speedometer store accumulated odometer mileage.

⚠ **Caution: if you program a higher odometer value, the odometer display will the higher value.**

⚠ **Caution: If you mistakenly program the wrong odometer value, and it is higher, the only solution is for the Harley-Davidson dealer to replace the speedometer and BCM and any other modules that might store the speedometer value. If this unfortunate mistake occurs, all modules will have to be replaced at the same time, otherwise any one of the modules with the incorrect odometer information will update the speedometer to the incorrect value.**

8. **Run the ETC auto-calibration routine (Setup New ECU ->Calibrate ETC System)** – follow the instructions on the screen, the initial test takes about 150 seconds to complete.
9. **Start the TCFI_LOG.exe software → Click on Scan+VIEW LIVE DATA to monitor engine data.**
10. **Verify that the bike is in neutral and start the engine.**

⚠ **NOTE:** If the bike has larger injectors, we recommend that you adjust the tune, save and upload to the ECU prior to starting the bike (Scan+PROG ECU in PC_LINK). See Tuning Basics below for more information.

⚠ **We also recommend** that you read our tuning guide: **TCFI7-G7_M8FI-G8-G9_Tuning_Manual.pdf located at: https://daytona-twintec.com/instructions/**

TUNING CLASSES AVAILABLE → CALL 386-304-0700 FOR DETAILS.

TUNING BASICS:

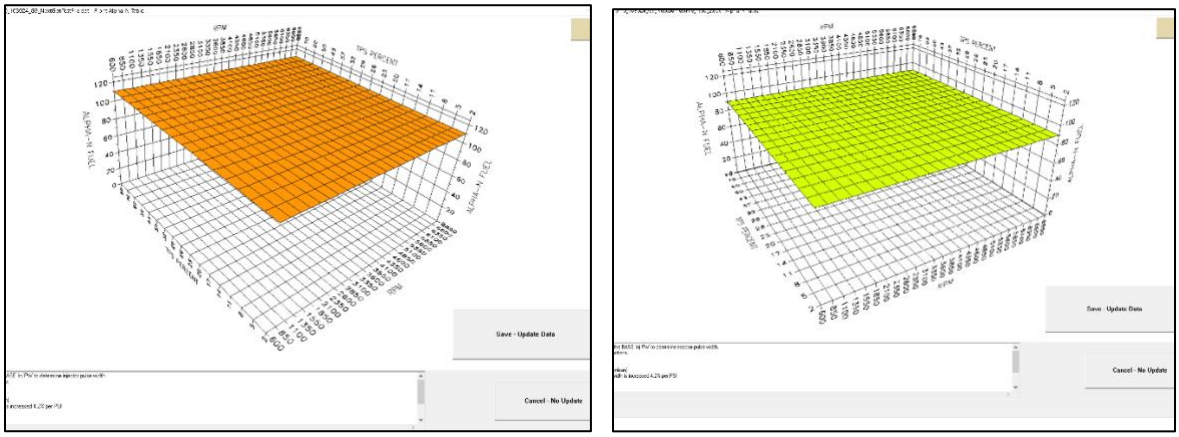
Important: Adjust the fuel tables based on a fuel injector change.
Before you make this change, you must determine what injector size was originally used in the tune that you have open in your software. The stock M8 Fuel Injectors are 4.38 gm/sec. Our system is Alpha-N, which means that Throttle Position and RPM is used to lookup the injector pulse width. Alpha = throttle position and N = RPM. This type of system is very easy to calibrate and configure (especially with our very powerful wideband AutoTune).

To adjust for larger injectors: Generate your scale factor: old injector size / new injector size = scale factor. For example, if your original tune was designed for 4.38gm/sec injectors and your new injectors are 5.38gm/sec all that is required is for you to do a minor amount of math and you can quickly adjust the main fuel table(s) into the correct range. Divide the Old/New values or 4.38/5.38=0.814 (81.4%) be sure to write the result down. This is the amount of reduction for the main fuel tables.

Next you have to determine if you are using two individual fuel tables (one for each cylinder) or a single fuel table and a multiplier (rear fuel table and front multiplier). You can do this by opening File→ Configure – Units and Program Options. If Front Alpha Fuel is selected then you have two individual fuel tables, otherwise if Front Mult Fuel is selected you have one fuel table and one multiplier table. If the option is not shown at all, then you have one fuel table and one fuel multiplier table.
If you have two fuel tables, then you will have to multiply all of the cells in each table (Front Cyl – Main Fuel or Rear Cyl – Main Fuel) by the same amount (in this case 81.4% to reduce the fuel pulse width by 18.6%). If you have a single fuel table, you will only modify the one table (Rear Cyl - Main Fuel).

To modify, open the table Edit…Tables→Front Cyl – Main Fuel and/or Rear Cyl – Main Fuel.
Next click on the top left corner cell TPS/RPM to select the entire fuel table and then right click and choose either the Modify or Multiplier option. Be sure to read the information in the pop up so you enter the correct value. If you want to use the value straight from the calculator, choose Multiplier and then enter your factor value 0.814 (for 81.4%) and click enter. The entire table should change color to GREEN to indicate that the values that you just set in the table are lower than the original values – Save the Table values and if you have to modify a second Fuel table, open it and make the same change.
Finally, Save the new tune file with a new name (File -> Save As) and then upload the modified file to the ECU (**Scan+PROGRAM ECU**).

⚠ **Important**: Scaling the Fuel Tables will only get you close. If after this change, the bike starts and responds normally, you can move to using AutoTune to finish up.



3D View Screenshot of the Fuel Tables

⚠ **NOTE:** After starting the motorcycle – if you have a check engine light – use the **TCFI_Log.exe** software to view the code. Choose **SCAN+VIEW LIVE DATA** and in the upper right-hand corner the error will be displayed. If the error is a sync error – shut off the engine and wait 30 seconds before restarting or until the lights on the **ECU** module go off and then restart the engine.

⚠ **IMPORTANT** – Occasionally when cranking a Sync Error will occur. This normally happens if the engine misfires during cranking and most likely to occur after changing the tune file. Do not worry, once you have configured the engine to crank reliably this error will not occur.

⚠ **NOTE:** If a check engine light is set during the first 20 seconds after startup…. this can only be a sync error. Shut off the engine and wait 30 seconds before restarting or until the lights on the **ECU** module go off and then restart the engine. The ECU will not set a hard fault (for example a BAD O2 Sensor until after the first 30 seconds of engine run time). This allows a customer to determine if a restart is required due to a sync error.

Fuel System Overview:

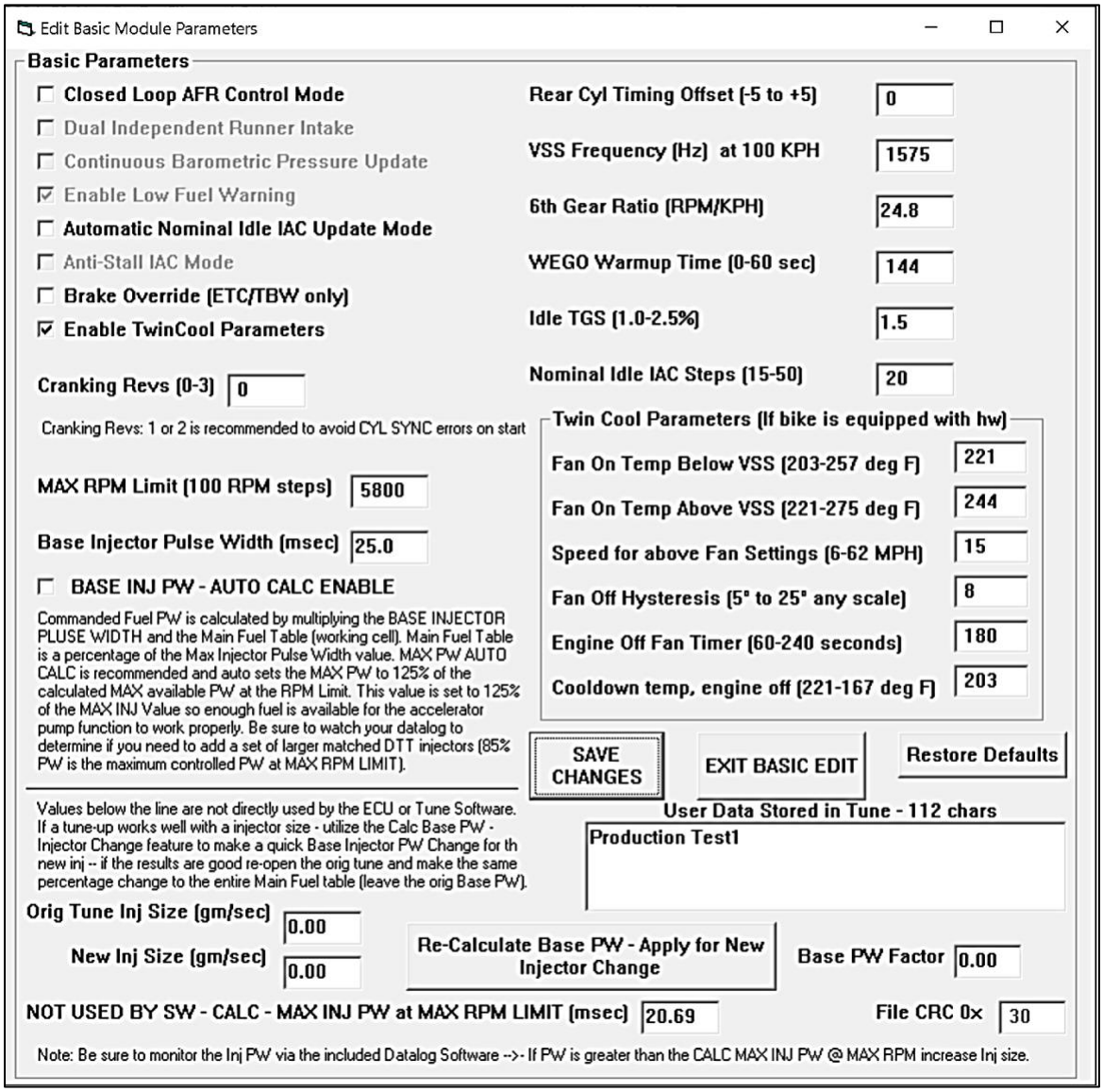
Our system is an **Alpha-N,** Fuel Pulse width based system.
All fuel tables are multiplied against a Base Fuel Pulse Width Value ms to generate the actual pulse width for the fuel injector. This type of system is easy to tune and configure.

For example, if you choose a BASE Fuel Pulse Width of 20ms and the values in your main table were 15 → the commanded pulse width would be ~3ms. Note: Your actual value will typically be higher due to other adders that are setup to start and run/trim the engine; if all of these adders were set to zero, your actual PW will be 3ms. With the default tune that is shipped with the M8 NA ECU for a stock cam → when the engine is at 220F, then the rear pulsewidth will be around 3.7ms and the AFR at idle will be around 13:1.

In this system, the Base Injector Pulse Width should be coordinated with the maximum rpm of the engine.

We do not advise adjusting the Base Injector Pulse Width Value and the MAX RPM limit unless you understand the consequences (a complete retune might be required). However, if you are adjusting the RPM Limit, our recommendation is to click the check box: BASE INJ PW under (**Edit…Scalars→Edit Basic Parameters**). Choosing this checkbox automatically calculates and sets the Base Fuel Pulse Width value to the maximum pulse width value that can be utilized at the **MAX RPM Limit** value (**Edit…Scalars→Edit Basic Parameters**) entered in the tune. We recommend setting this value to a high value (slightly higher than the ACTUAL maximum pulse width value at the max RPM) –> this is because on heavy tip in events → often times, it is possible to for the engine to require a larger value than the maximum pulse width.

Basic Module Parameters Dialog Page

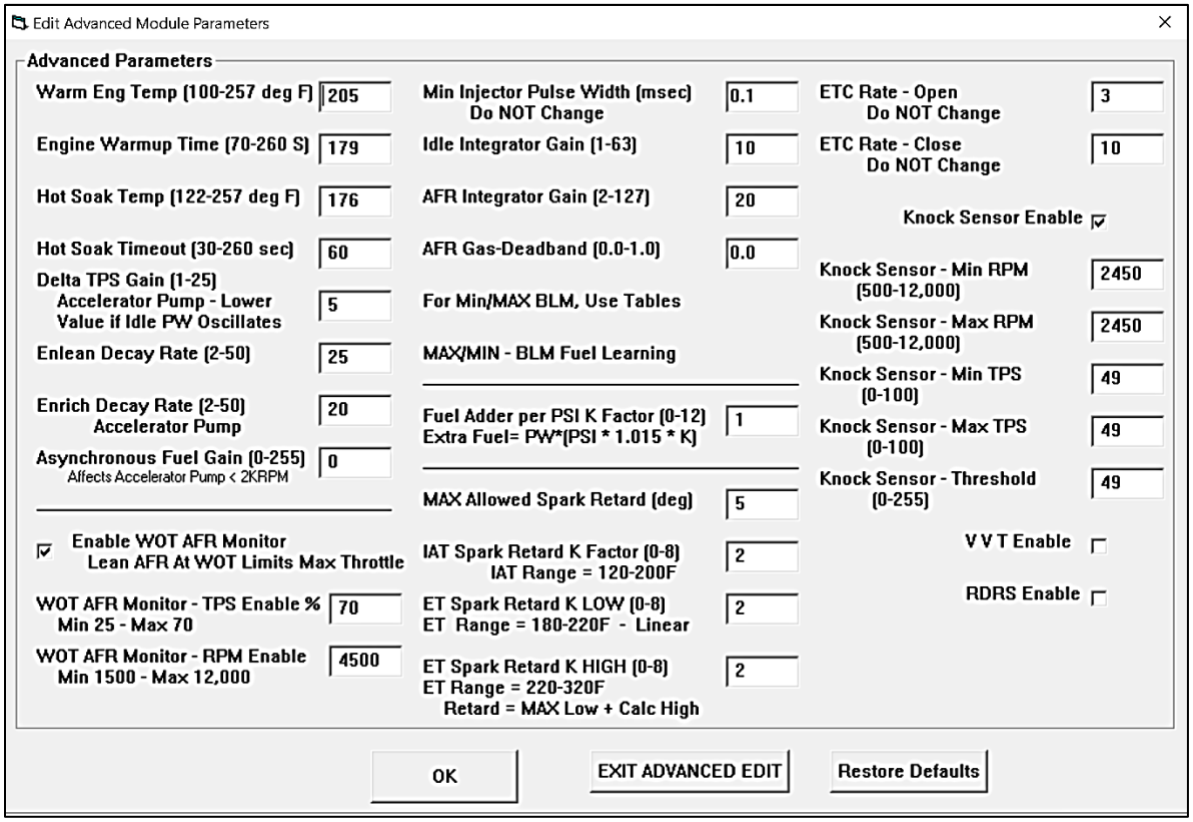


- **Base Injector Pulse Width** – in millisecond units. This is also the maximum pulse width that the injector can fire. We do not recommend adjusting this value unless you understand the results.
- **RPM Limit** – you can enter any value from 3,000 to 9,900 RPM. Values are automatically rounded to the nearest 100 RPM. You can adjust this value if required.
- **Cranking Revs** - sets the number of engine revolutions before the ignitions fires the first spark. Please note that a hot engine may exhibit preignition and appear to start on the first revolution even if the Cranking Revs parameter is set to a non-zero value. The automatic compression release (ACR) system is activated during cranking if the Cranking Revs parameter is set to a value that is greater than value (we recommend 1). NOTE: If you set this value to 0 – ACR will be turned off.
- **Rear Cylinder Timing Offset** – you can set the value over a -5 to +5 degree range. Leave the value at zero if you do not require a rear cylinder timing offset. Typically, this is not modified.

- **VSS Frequency** – this parameter sets the correct speedometer and odometer scaling. An incorrect value will also affect idle RPM control and turn signal cancellation. Not used on RDRS vehicles.
- **6th Gear Ratio** – this parameter sets the RPM/KPH ratio used to detect the transmission gear and illuminate the 6th gear light. You can use the gear ratio display function in TCFI Log software data logging chart display to determine the required value for a particular application. For most models, you can use the default value of 24.8 or 23. Typically, not modified.
- **WEGO Warmup Time** – in seconds. Engine run time before the Wideband O2 sensors are considered warm. Timer to enable closed loop AFR control. Typically, not modified.
- **Idle TGS** – in percent units. This parameter determines the maximum TGS (twist grip sensor) value for closed loop idle speed control. The default value is 1.0%. For more information on this subject, please refer to the TCFI Idle Tuning Tech Note. Typically, not modified.
- **Nominal Idle IAC** – this parameter determines the nominal IAC (idle air control) value learned by the system when the engine is completely warmed up and at a stable idle condition. IAC value is in 0.1% throttle position units (higher number means more idle air). For more information on this subject, please refer to the TCFI Idle Tuning Tech Note. Typically, not modified.
- **User Data** – you can enter up to 112 characters of information that will be saved with the tune file. User data typically contain comments about the build, CI, INJ, CAM, etc.

Once you have entered the appropriate Basic module parameters, click on SAVE CHANGES to save your edits to memory. If you click on EXIT BASIC EDIT, all your edits are lost. You can click on Restore Defaults to restore default values for a stock engine (not typically recommended).

Advanced Module Parameters Dialog Page



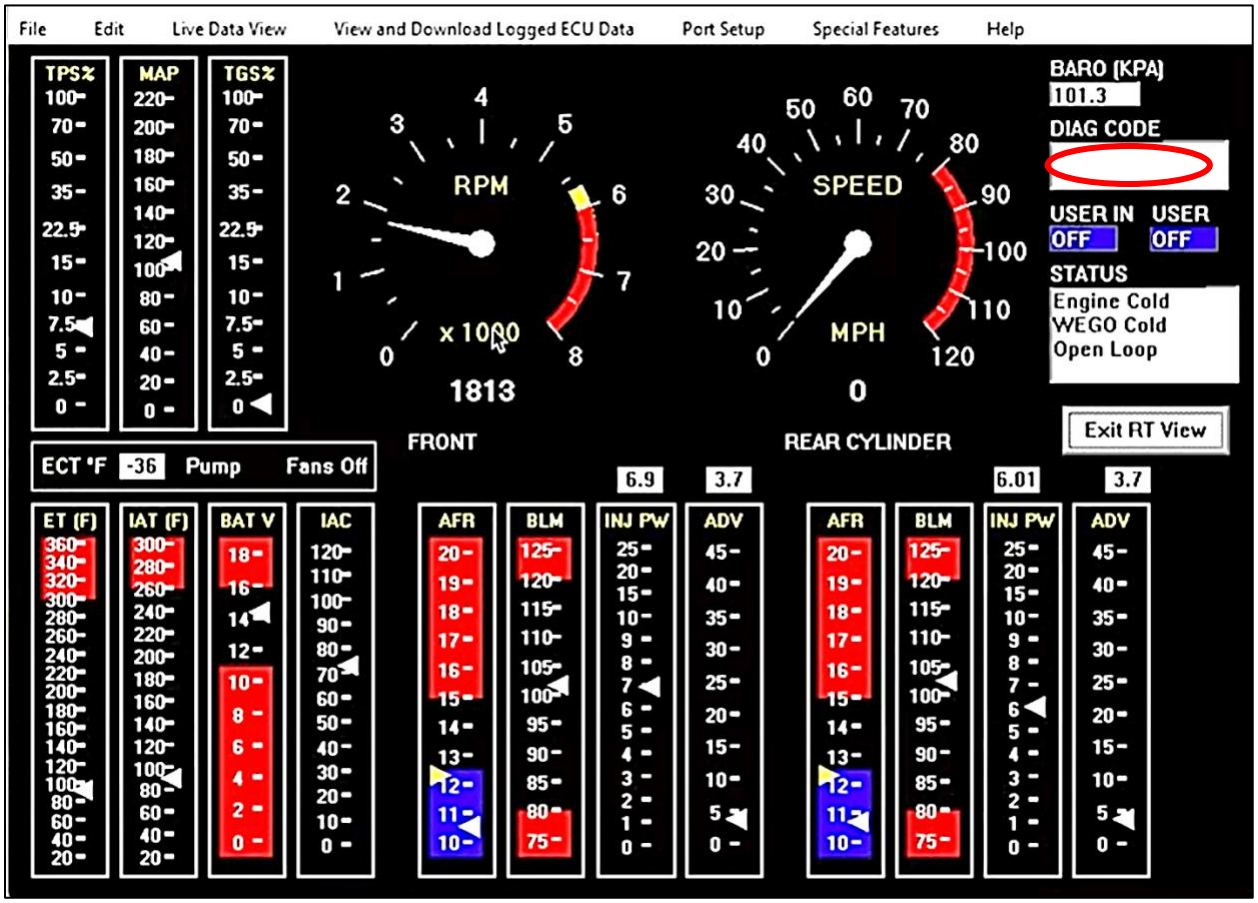
ADVANCED PARAMETERS

Advanced module parameters are displayed in a dialog box by using the **Edit Advanced Parameters** command on the **Edit…Scalars→ Edit Advanced Parameters** menu.

- **Warm Engine Temperature** – in degree C or F units. This parameter determines the minimum engine (cylinder head) temperature before closed loop corrections are saved to the BLM tables. Engine status changes from cold to warm once the warm engine temperature is reached and the engine warmup time has elapsed.
- **Engine Warmup Time** – in seconds. This parameter determines the minimum engine run time before closed loop corrections are saved to the BLM tables. Engine status changes from cold to warm once the warm engine temperature is reached and the engine warmup time has elapsed.
- **Hot Soak Temperature** – in degree C or F units. This parameter determines the minimum engine (cylinder head) temperature before special hot soak considerations apply when the engine is turned off.
- **Hot Soak Timeout** – in seconds. This parameter determines the minimum engine off time (prior to a hot restart) before special hot soak considerations apply. The default value is 60 seconds.
- **Delta TPS Gain** – this parameter determines the scaling of TPS values in the delta TPS based fuel multiplier table. This parameter can be fine-tuned, a larger value could give additional TIP IN and/or TIP OUT Accel Fuel based on the table Accel/Decel – Fuel Multiplier vs TPS Rate of Cha
- **Enlean Decay Rate** – this parameter determines the time constant of recovery from enleanment (negative delta TPS values) in the delta TPS based fuel multiplier table. This parameter can be fine-tuned based on feedback from the AutoTune System.
- **Enrich Decay Rate** – this parameter determines the time constant of recovery from enrichment (positive delta TPS values) in the delta TPS based fuel multiplier table. This parameter can be fine-tuned based on feedback from the AutoTune System.
- **Minimum Injector Pulse Width** – in millisecond units. This parameter affects linearity of the fuel tables at low values. Do not change this parameter from the default value of 0.1…. larger injectors might require a larger value for example 10.6 gm/sec inj a good value is 0.6.
- **Idle Integrator Gain** – this parameter determines the response time of closed loop idle speed control. A higher value will result in a faster response but may cause instability (oscillation). The default value is 10.
- **AFR Integrator Gain** – this parameter determines the response time of closed loop AFR control. A higher value will result in a faster response but may cause instability (oscillation). The default value is 30.
- **AFR Deadband** – in AFR units. This parameter determines the deadband (minimum error before system response) for closed loop AFR control. A small deadband value improves closed loop stability and reduces hunting. The default value is 0.3.
- **Min AFR BLM** & **Max AFR BLM** – No longer used, use the table Edit..Tables→ MAX/MIN BLM Fuel Learning Allowed – Closed Loop. The new table allows you to limits the max and min learning per BLM cell when the system is correcting a lean or rich condition.

- **Fuel adder per PSI K Factor (0-1 Extra fuel = PW*1.015*K) –** Turbo bikes only. Used to add additional fuel when under boost. A value of 1 adds 1.5% more pulsewidth per PSI.
- **Max Allowed Spark Retard (deg) –** Maximum allowed spark retard. Spark Retard is not allowed to be calculated to a higher value than this number. Max = 18, recommended = 6.
- **IAT Spark Retard K Factor (0 - 8) IAT Range = 120 - 200F** – Calculated Spark Retard based on Intake Air Temp. For example, if this number was 4 – at 120F the retard would be 0, at 140 – 1 degree at 160 – 2 degrees, at 180 – 3 degrees and at 200 4 degrees. Recommended = 3 or 4.
- **ET Spark Retard K Low (0 – 8) ET Range = 180 -200F – Linear** – Calculated Spark Retard based on Low Range of the Engine Temp. For example, if this number was 4 – at 128F the retard would be 0, at 190 – 2 degree at 200F – 4 degrees. Recommended = 2 or 3.
- **ET Spark Retard K High (0 – 8) ET Range = 220 – 230F Retard = Max Low + calculated High** – Calculated Spark Retard based on High Range of the Engine Temp. For example, if Low was 2 and this number (high) was 8 – at 220F the retard would be 2, at 232.5 – 3 degrees, at 245 – 4 degrees, at 257.5 – 5 degree at 270F – 6 degrees, at 282.5 – 7 degrees at 295 – 8 degrees at 307.5 – 9 degrees and at 320F = 10 degrees → keep in mind that the total is limited by the Max Allowed Spark Retard Value. Recommended = 7 or 8.

TCFI_LOG.exe → Scan+VIEW LIVE DATA -- Real Time Engine Data Display



⚠ **Adjust your tune based on engine data** delivered by the View Live Data Stream or by analyzing saved data logs and engine data (for example: wide-band sensor data).

Use Scan+VIEW LIVE DATA to look at the engine in real time – you do not need to save this data because if the engine is running the data is automatically saved to the logging system.

Scan + DOWNLOAD LOGGED DATA+View Chart allows you to download and graphically view and save data. This is how you access the data that is automatically saved during the last 60 minutes of run time.

⚠ **Utilize the built-in wideband sensors** and the real time data logging **– adjust the tune prior to turning on the AUTO-TUNE Feature.**

Typical SAFE Target AFR values -- IDLE: 13.0-13.3 AFR (0.88 λ - 0.9λ)

Typical SAFE Target AFR values -- CRUISE: 12.5-13.3 AFR (0.85λ - 0.9λ)

Typical SAFE Target AFR values -- WOT NA: 12.0 (0.82λ) WOT Boosted: 11.0 (0.75λ)

⚠ **Read and Clear ECU codes by** using the TCFI_Log.exe software

Use the Scan+VIEW LIVE DATA to view existing codes, they display in the upper right window.

View ECU DIAG CODES→ Download and View Statistics/Diagnostic Codes to view Historic Codes

To Clear, Special Features→Clear Historical Diagnostic Codes to clear past codes and trip counters

⚠ **Reference**: Typically, if an engine pops on acceleration, it is LEAN…when cold---if it won't start, it is usually LEAN…. otherwise, if it is too rich it blows black smoke.

⚠ *Important Wideband O2 Note - Related to turbocharged applications:*

If O2 sensors are installed in-between the Head and the Turbo will read slightly different, depending on the pressure. <u>The pressure in the exhaust will skew the air fuel that is reported by the sensor up to a full air fuel point</u>. Example: AFR reported by the sensor in the pipe before the turbo shows 11.4:1 and the actual AFR after the turbo is 12.2. This is not a huge issue – on a turbo bike, it is important to run a commanded AFR that is slightly richer than you desire to achieve the expected results.

🔍 ***ENGINE DIAGNOSTICS AND START ISSUES***

The **M8FI G9** ECU has extensive diagnostics. When the ignition switch is first turned on, the Check Engine LED (CEL) illuminates. The LED goes out when the system initialization is complete.

If a diagnostic fault is detected while the engine is running, the LED will illuminate. Diagnostic codes can be read and cleared by means of the speedometer (same as with the OE ECM) or TCFI Log software. Most of the diagnostic codes are the same as those used by H-D and the H-D Electrical Diagnostic Manual for your model should be employed as a primary troubleshooting reference. Certain diagnostic codes that are unique to the ECU or require special consideration are listed below:

> **P0373 CKP Signal Lost.** This code will appear if the engine stalls. Customers are often confused about the meaning of the term "trips" associated with codes, especially P0373. This is an industry standard terminology. If code P0373 shows 40 trips, it means that the code was set 40 engine start cycles ago, not that the code has been set 40 times and that the crankshaft position sensor is defective.

⚠ **How to tell if it is a sync issue or other problems:** With this system, a Check Engine Light will take longer to set if a sensor is faulty. Example: if one or both of the O2 sensors are not connected, it will not set a code for 30 seconds. That is how you can tell the difference between a startup sync lost or a real issue. If the check engine light stays on with in the first 30 seconds it is a sync issue and the bike should be shut off for 30 seconds and restarted to clear.
Note: any time the bike starts, if the CEL stays on => it does not have cam sync (the ECU calculates cam sync based on the cranking speed). Therefore, a pop at start or a weak battery will cause a sync issue. This issue surfaces in about 10 seconds after the engine has been running.
Remedy: let the bike run a bit to warm up and charge the battery, then key off the ignition. Wait 30 seconds for all modules to turn off. Restart. Few seconds after starting the CEL will flash on/off; that is normal.

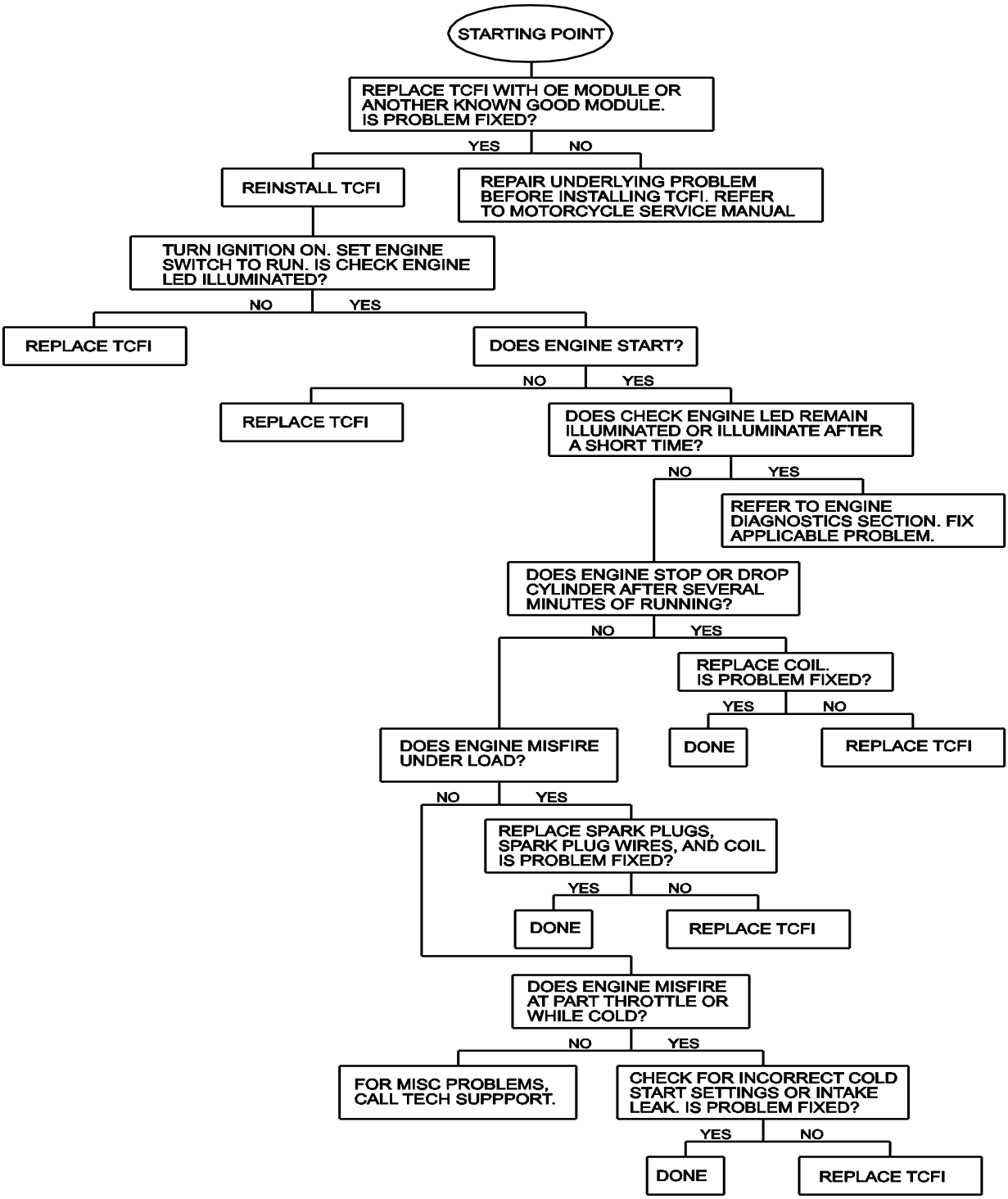
> **P0132 Rear Oxygen Sensor High, P0134 Rear Oxygen Sensor Low/Open, P0152 Front Oxygen Sensor High, or P0154 Front Oxygen Sensor Low/Open.** These codes indicate a problem with the O2 sensors controller. P0134 and/or P0154 will be set if the controller's signal connection (white and blue wires) or the power is lost. These codes may also be set if a Bosch sensor fails or becomes contaminated by leaded gasoline.

⚠ **Historical diagnostic codes** logged by the ECU are listed along with the number of trips (engine start cycles) since the individual code was last logged. Codes are automatically cleared after 50 trips. "Trips" is an industry standard terminology. If a code shows 40 trips, it means that the code was set 40 engine start cycles ago, not that the code has been set 40 times.

If the engine "pings" on hot start -> reduce PW in function table "Priming Fuel PW vs Engine temp":

PC Link ECU Editor -- HD V-TWIN -- TCFI & M8FI -- v23.2 - 0_G9_010625_24UT-21ST__LastRun_neweeprom_test1.dat

Priming - Fuel PW vs Engine Temp - Fuel Injected Prior to Cranking

ET F	3	32	61	90	118	147	176	205	234	262	291	320	349	378	406	435	464
PW msec	33.02	26.88	18.43	8.45	4.86	3.07	2.05	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

⚠ FAIL to START TROUBLESHOOTING FLOWCHART