TUNING GUIDE – PC_LINK_TCFI.exe & TCFI_LOG.exe

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

⚠ **DESIGNED FOR RACING → CAREFULLY READ INSTRUCTIONS BEFORE PROCEEDING.**

Part Num	Application	Engine Type	MAP Sensor Type
17800	2014-2016 Touring	Twin Cam – NA Engine	Use OE 1 Bar
17801	2016-2016 Touring	Twin Cam – Turbo (15psi)	Inc – 2 Bar Sensor
17802	2014-2016 Touring	Twin Cam – Turbo (21psi)	Inc – 2.5 Bar Sensor
17803	2014-2017 Softail	Twin Cam – NA Engine	Use OE 1 Bar
17804	2014-2017 Softail	Twin Cam – Turbo (15psi)	Inc – 2 Bar Sensor
17805	2014-2017 Softail	Twin Cam – Turbo (21psi)	Inc – 2.5 Bar Sensor
17808	2017-2020 Touring	M8 – NA Engine	User OE 1 Bar
17809	2017-2020 Touring	M8 – Turbo (15psi)	Inc – 2 Bar Sensor
17810	2017-2020 Touring	M8 – Turbo (21psi)	Inc – 2.5 Bar Sensor
17811	2018-2020 Softail	M8 – NA Engine	Use OE 1 Bar
17812	2018-2020 Softail	M8 – Turbo (15psi)	Inc – 2 Bar Sensor
17813	2018-2020 Softail	M8 – Turbo (21psi)	Inc – 2.5 Bar Sensor
17818	2021-2023 Touring (2021-2024 Ultra)	M8 – NA Engine	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

🛠 ***OVERVIEW*** - Our 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

⚠ **All of the applications listed above require 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, the uploaded from the ECU and applied to the tune (AUTO-TUNE 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**.

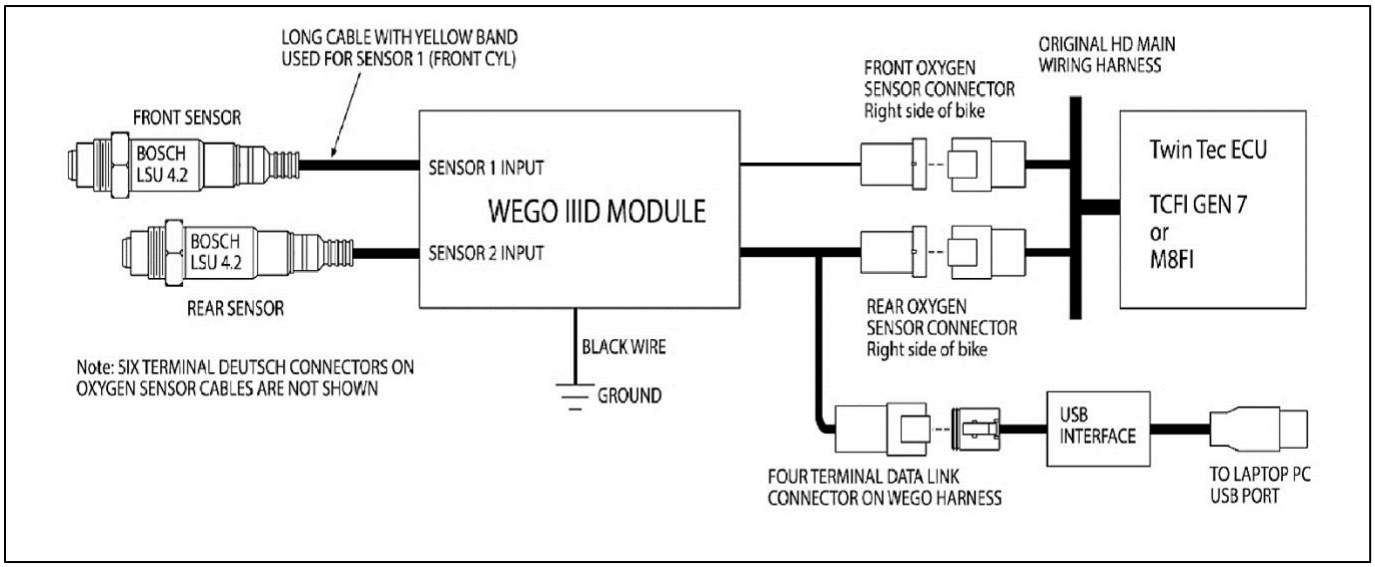
⚠ **IMPORTANT NOTE:** ***Occasionally new features are added. To take advantage of a new feature, you MUST send us the ECU for an update. We want to avoid any issues with customers updating via the internet.***

⚠ **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.

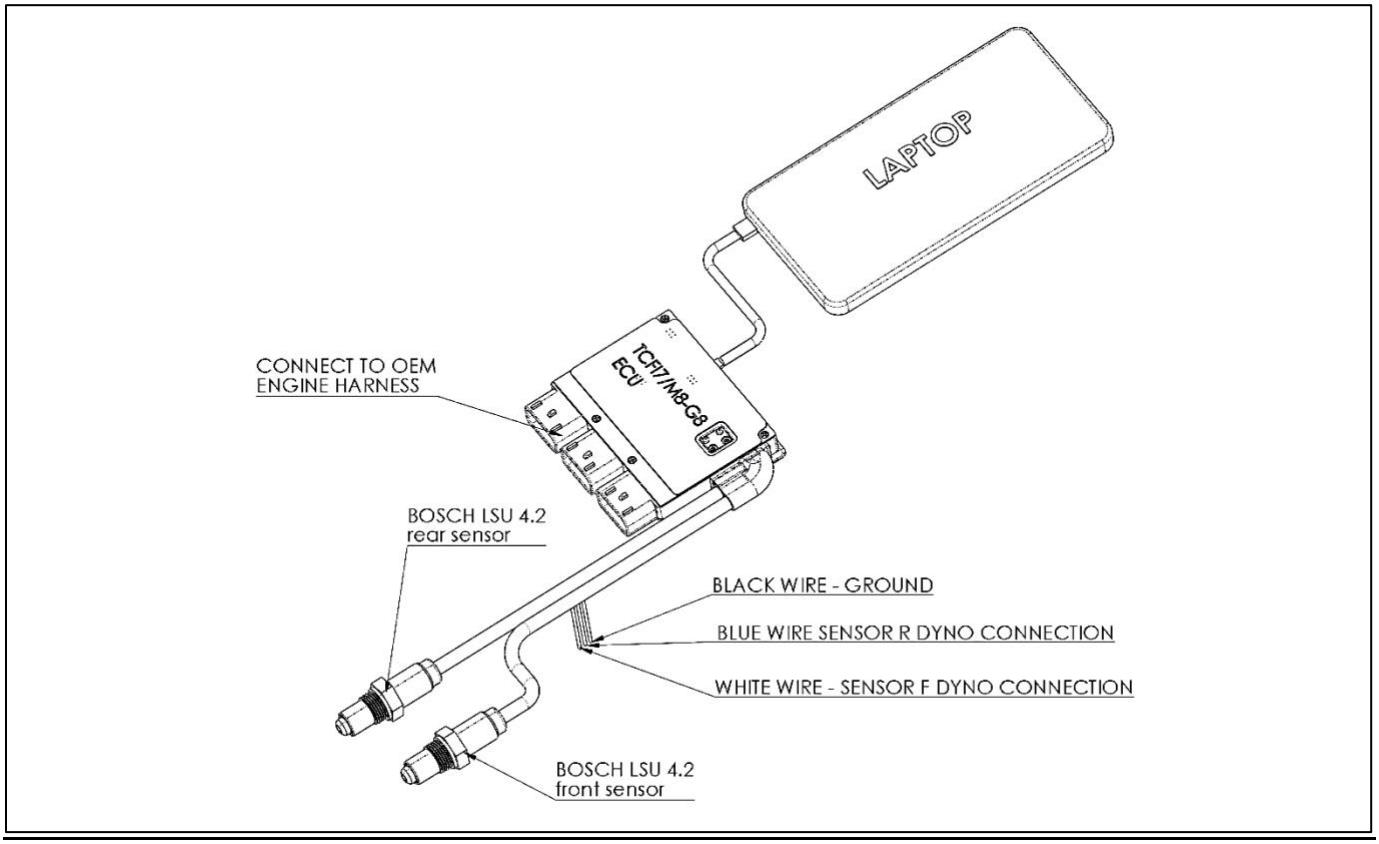
⚠ **Tuning, monitoring, and data log playback** are performed using the **USB-C Interface** integrated into the ECU. Connect the USB-C interface directly to a USB port on your PC (refer to the M8FI GEN 9 System Diagram). ECU tuning adjustments are made via the **PC_LINK.exe** software. For live data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

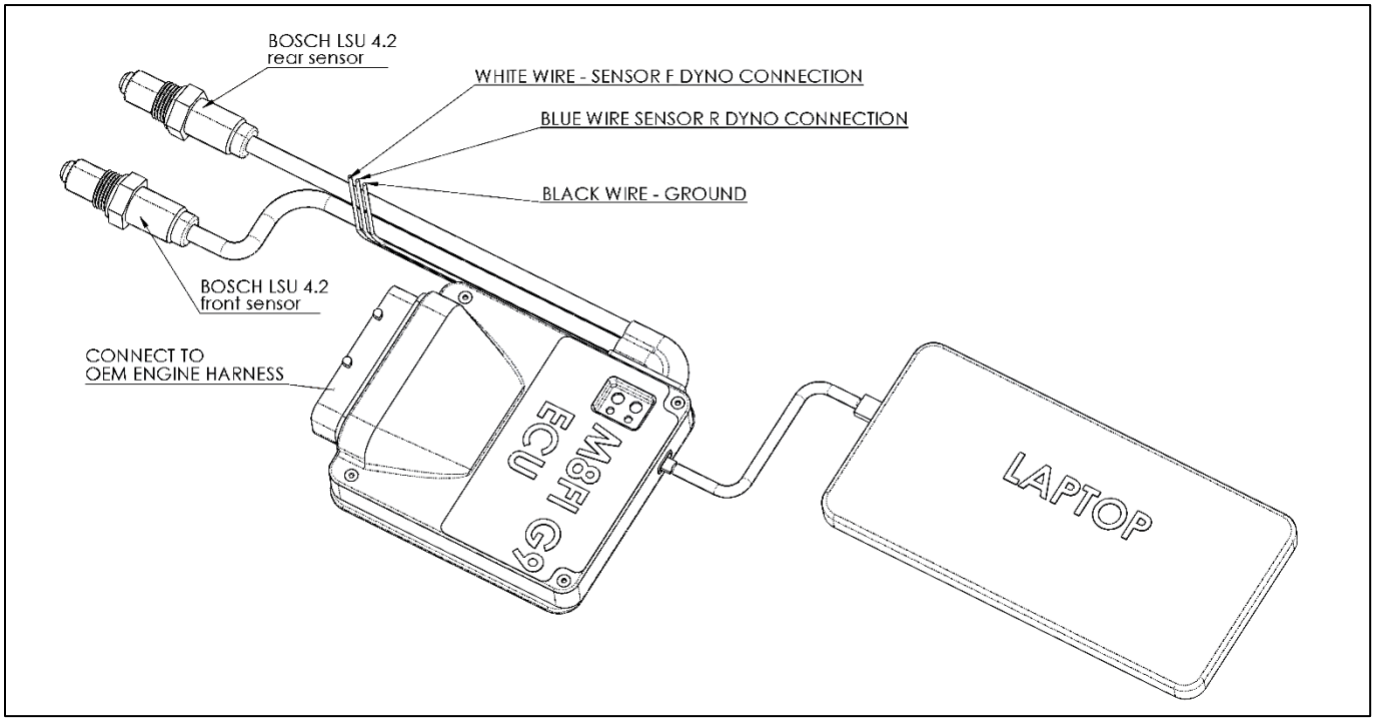
🛠 Twin Cam (TCFI7-G8) & M8 (M8FI G8 & G9) EFI SYSTEM DIAGRAM



Twin Cam (TCFI7-G8) & M8 (M8FI G8) EFI SYSTEM – WEGO & USB INTEGRATED INTO ECU



M8 (M8FI G9) EFI SYSTEM – WEGO & USB INTEGRATED INTO ECU



⚠ ***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.

💻 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"

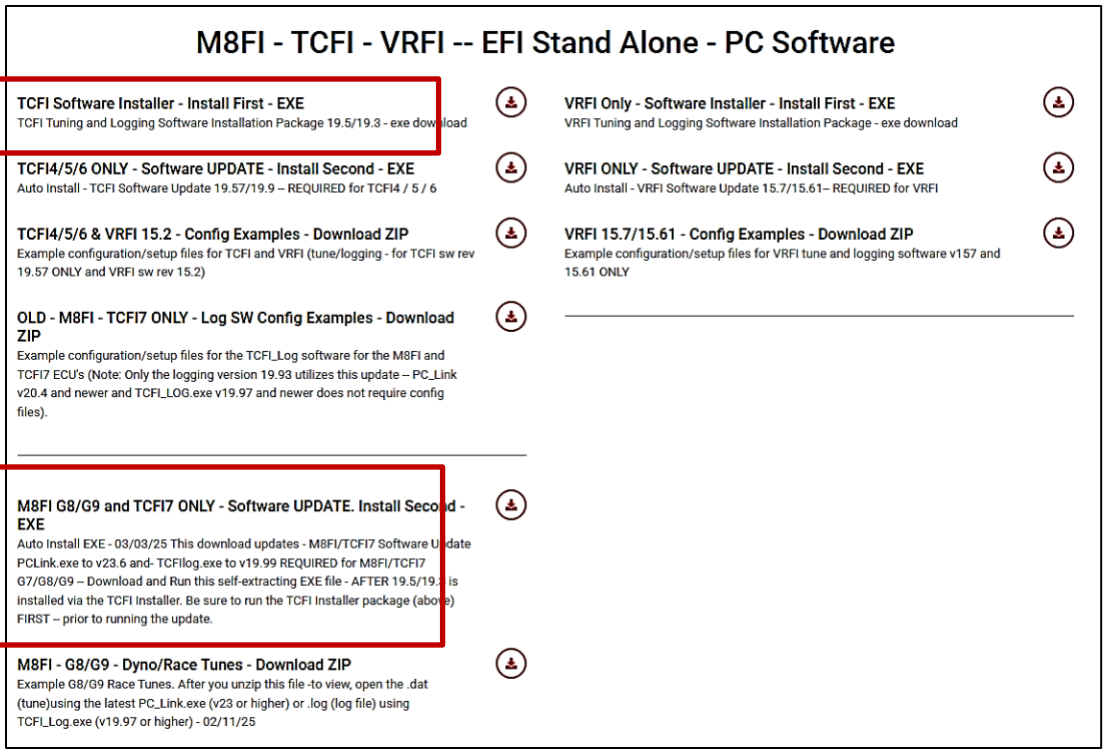
3 – Download the original TCFI Software Installer: Look for: **TCFI Software Installer - Install First - EXE**

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**.**



⚠ **YouTube software install video** and overview is available at: https://youtu.be/QQCByMf6wpk

🔍 *PC_LINK_TCFI.exe APPLICATION*

Scalars, Tables, Functions and Basic Tuning Procedure

⚠ **Before you begin**, we recommend that you **read the installation and setup documentation**, available for download at: daytona-twintec.com

- **TCFI7-G7_M8FI-G7_NONIntegrated_Install_setup.pdf** (Separate WEGO and USB interfaces)
- **TCFI7-G8_M8FI-G8_Integrated_Install_Setup.pdf**
- **M8FI_G9_Integrated_Install_Setup.pdf**

⚠ **You MUST perform the initial setup** as outlined in the install document **prior to starting the vehicle**.

⚠ *RUNNING the SOFTWARE*

→ After a successful software install: PC_LINK and TCFI_LOG software exe files are located at:

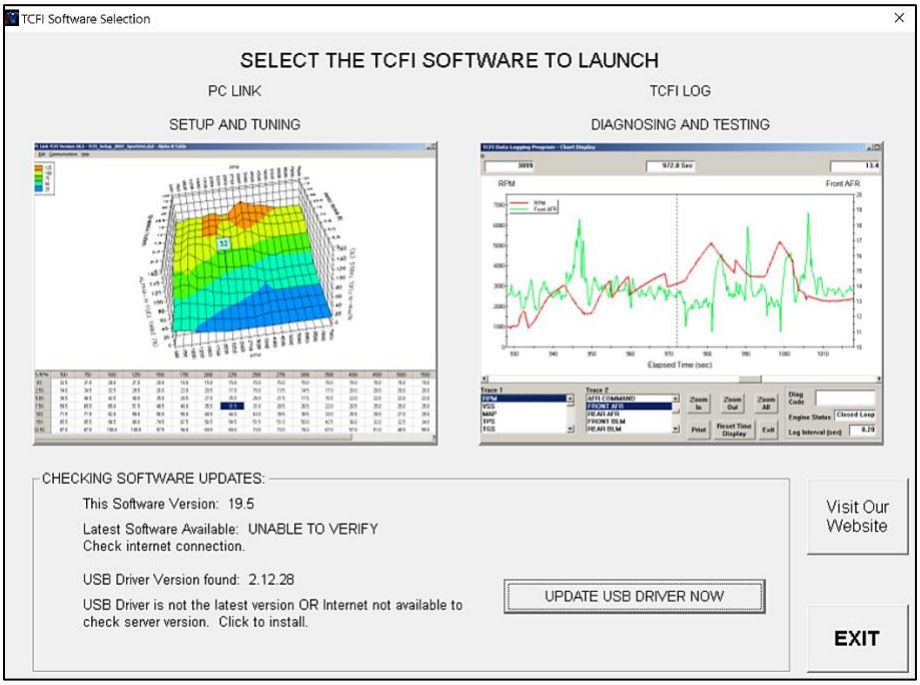
Windows (C:) > Program Files (x86)>Daytona TwinTec>TCFI_Software

→ The default directory to save your tune and log files is located under Documents or My Documents.

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



ECU setup/tuning click the icon image to the LEFT → **PC_LINK_TCFI.exe**.
Data logging and other special features, click the icon image on the RIGHT→ **TCFI_LOG.exe**.

⚠ **For the initial** ECU setup/tuning, you will need to access the **PC_LINK_TCFI.exe** program.
⚠ **ALL G7, G8 & G9** ECU's require 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 now saves the setup options in the tune file and ECU.

⚠ **G7, G8 & G9 → This is the hardware generation of the product. Each generation functions the same, however we have integrated the Wideband and the USB into version G8 & G9.**

⚠ **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.

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

The current version of PC-LINK (23.6) has incorporated some new features which makes tunning easier:

- Opening and editing older file versions → eliminates switching back and forth between PC-Link versions (Note: Older file types will not have some of the latest new & advanced parameters).
- New compare option → The tuner can now see the difference between 2 files (tables and functions only)
- New configuration/option pop-up window → setup and configuration info is now stored with the file.
- Increased resolution → additional table rows and columns
- 3D view button → use this button to view your table in 3D or go back to spreadsheet mode
- View Functions – View configuration items that previously were not available to view.
- Scan+Read ECU and Scan+Program ECU → simple one click buttons to Read or Program your ECU
- TCFI_LOG.exe: Scan+View Live Data or Scan+Download Logged Data → easy to use single click buttons that allow you to view live data on your motorcycle or download previously logged data.

EDITING, CREATING and SAVING TUNE FILES

After initial setup, tuning an engine often requires multiple edits using the PC_Link_TCFI.exe software. Start by opening a saved tune file from your PC or reading the current tune directly from the G7, G8, or G9 ECU. Make the required edits. When prompted, always click "Yes" to save your changes. After editing, save your modified tune file to your PC before uploading it to the ECU. Before saving, update the User Data Area in the Edit Basic Module Parameters section.

Helpful tips for managing your files clearly:

- Include customer details and date in the filename (e.g., JSmith_23-Ultra-465cam-stkinj.dat).
- Create a dedicated folder for tuning files.
- Take screenshots or print out tables and parameters.
- Keep detailed notes on changes and filenames.

⚠ **Important Notes:**

- **Basic Windows file management skills are required. Unfortunately, we can't provide technical support for the general use of a PC. We recommend practicing using copy/paste and the right mouse button.**
- **The PC software (both PC_Link_TCFI.exe and TCFI_Log.exe) was created with a Microsoft programming language from 1998. In Windows OS 10 or 11, occasional issues may arise, such as screens not appearing or displaying incorrectly. If this occurs, simply retry the command or restart the software (after saving your file). This occurs due to an OS interpretation error.**

ACRONYMS USED IN THIS DOCUMENT

ACR – automatic compression release; eases starting by slightly opening valves
AFR – air fuel ratio; ratio of air to fuel in combustion, controls engine efficiency
BCM – body control module; manages electrical functions and security system
BLM – block learn multiplier; wideband O2 learning adjusts long-term fuel delivery per tuning cell
BTDC – before top dead center; timing reference before piston reaches top
CL – closed loop; ECU actively adjusts fuel using feedback from O2 sensors
DTC – diagnostic trouble code; indicates specific faults detected by ECU
ECM/ECU – electronic control module/unit; manages engine operation parameters
ECT – engine coolant temperature; monitors coolant temp on certain Harley models
ET – engine temperature; measures cylinder head or engine component temperature
ETC – electronic throttle control; uses electronic signals instead of throttle cables
FUNCTION – table linking one ECU value to another (e.g., as temp ↑, fuel ↓)
G7, G8, G9 – Daytona Twin Tec ECU series; current versions include G4-G9
IAC – idle air control valve; controls engine idle (not used with electronic throttle)
IAT – intake air temperature; air temp entering engine, influences fuel calculation
LONG TERM FUEL TRIM – also called BLM(Block Learn Multiplier); learned value adjusts long-term fuel delivery per cell
MAP – manifold absolute pressure; sensor measuring intake manifold vacuum/pressure
M8FI – Milwaukee Eight Fuel Injection ECU/system; EFI specifically for M8 engines
NORMALIZER – Reference value used for X/Y axis lookups in tuning functions and tables
PCM – powertrain control module; another term for ECM/ECU managing engine/trans
PW – pulse width; duration injector stays open, controls fuel amount
PWM – pulse width modulation; controls devices by varying electrical pulse timing
SCALAR – single number adjusting ECU setting; think of it as a single adjustment knob
TABLE – organizes ECU data in spreadsheet form, e.g., fuel vs RPM/throttle position
TB – throttle body; controls air entering engine based on throttle input
TCFI – Twin Cam Fuel Injection ECU/system; EFI for Twin Cam engines
TDC – top dead center; highest piston position in cylinder, used for timing reference
TPS – throttle position sensor; monitors throttle opening percentage
TGS – twist-grip sensor (or TGA actuator); measures rider's throttle twist position
USB – universal serial bus; standardized connector for devices to computer
VSS – vehicle speed sensor; measures wheel or transmission output shaft speed
WOT – wide open throttle; fully open throttle, maximum engine airflow

DOWNLOADING and UPLOADING DATA

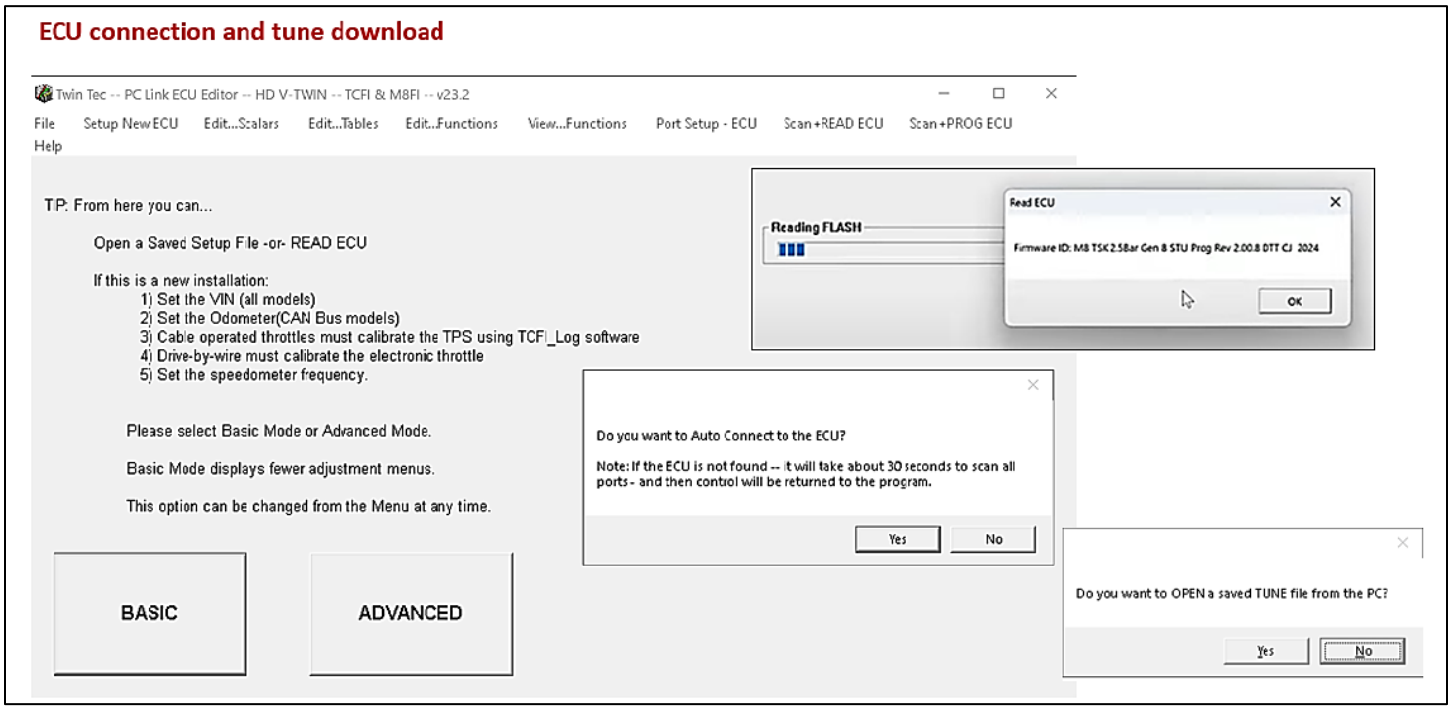
⚠ **G8/G9 ECMs connect directly into your PC using the included USB-C cable. On these units, both the AutoTune/Wideband O2 System and the USB interface is integrated into the hardware.**

Our other ECM's: G4, G5, G6 & G7 utilize a separate USB interface, P/N 102004, to communicate with the ECM. The USB interface connects to the four terminal Deutsch data link connector that is built into the AutoTune Wideband WEGO harness. The USB Interface has a switch that selects the operating mode, you must use the TC88A And All Others switch position. DO NOT use the OE diagnostic port to program our ECM.

Turn the bike on, DO NOT START the engine → Turn the ignition key switch and the engine run/stop switch to the "ON" position. This provides power to our ECM. Some HD models only have a engine run/stop switch.

Both PC_LINK.exe and TCFI_LOG.exe have the ability to automatically Scan and Connect to the ECM. For this to function, the motorcycle must be turned on, the ECM installed and connected via USB to the PC.

PC_LINK.exe → Scan+Read ECU: One click to Read your ECM. To read the file from your ECM, click: SCAN+READ ECU. Do not forget to save your file after the file has been read.
Scan+Program ECU → When you are finished editing the tune file, reprogram by clicking Scan+PROG ECU.

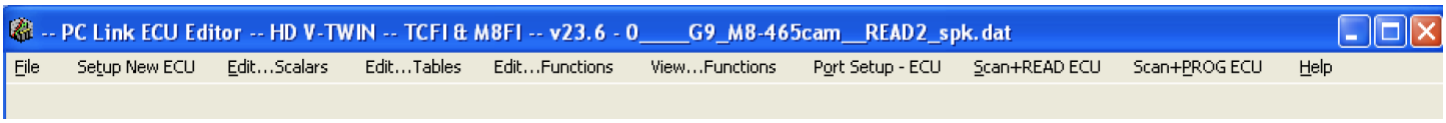


Before adjusting a tune file, verify that:

- Your engine is in good condition (without) mechanical or electrical issues
- Ignition system works well; if not, replace spark plugs, wires & coils (if necessary)
- Prior to installing our ECM that the OEM ECM was functioning without and issues or DTC's.
- Perform the system installation and initial setup as described in the install and setup guide, available for download on the daytona-twintec.com website.
- Watched the instructional video on YouTube: https://youtu.be/QQCByMf6wpk
- Read this tuning manual to gain a basic understanding of how the tuning/logging software works

BASIC CONCEPTS – PC_Link_TCFI.exe

⚠ The top menu bar contains the items that will use to tune the engine.



TOP MENU BAR ITEMS

📌 File Menu Bar

Open saved tune files, **Save** Tune files, **Edit Config file** (old method to configure the software, no longer used with the latest hardware), **Print** various items of interest, **Configure – Units and Program Options** (new method to configure the software, saved in the tune and tune file), **Open recent files** (reopen recent files)

📌 Setup New ECU Menu Bar

→ Setup New ECU -> Edit TCFI or M8FI VIN - Enter the Vin

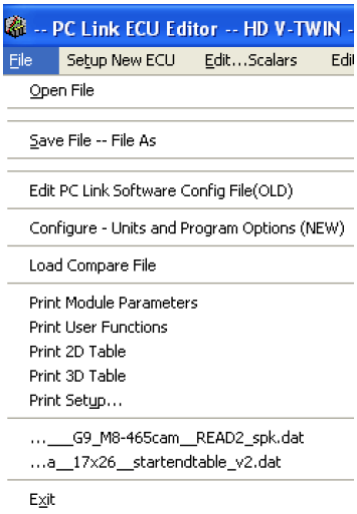
⚠ **Caution:** ***The body control module (BCM) may not allow starter engagement if the ECM is programmed with an incorrect VIN. The speedometer will also display a VIN error message. If your bike is equipped with RDRS. You must program your VIN into the ECU. If the correct vin is not programmed the 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***

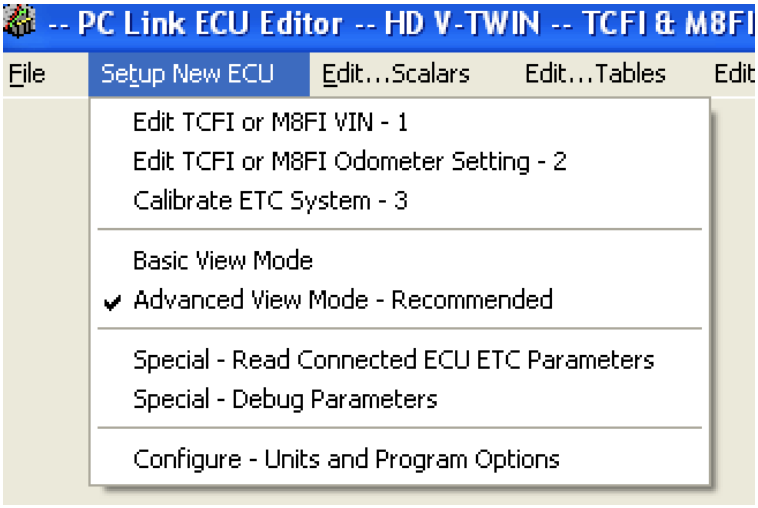
→ Setup New ECU ->Edit TCFI or M8FI Odometer Setting – enter the Odometer reading.

The ECM, BCM and Speedometer store accumulated odometer mileage.

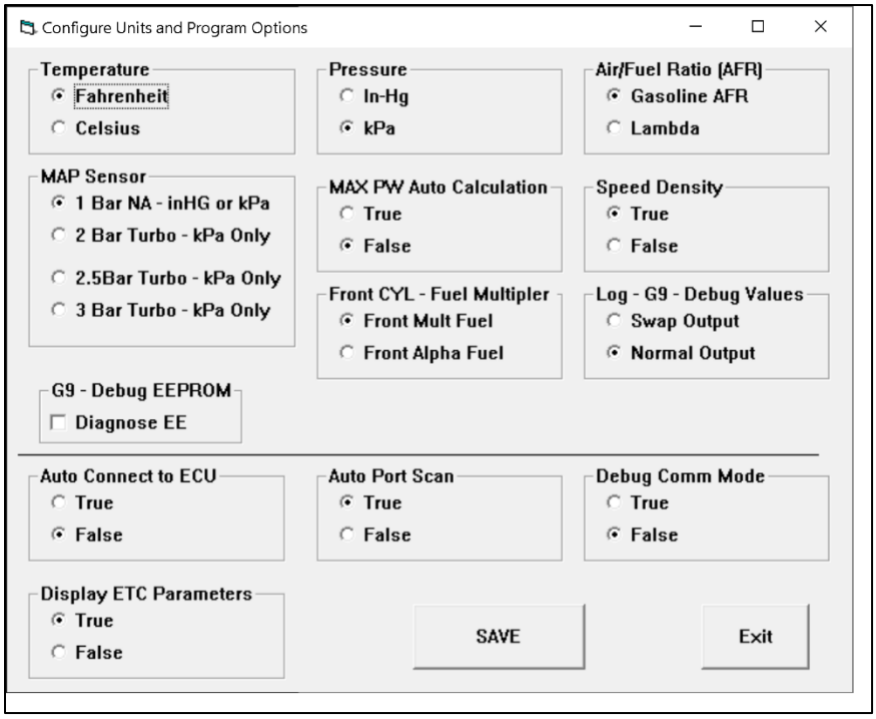
⚠ **Caution: if you program a higher odometer value, the odometer display will the higher value. If you mistakenly program the wrong odometer value, and it is higher, the only solution is for the Harley-Davidson dealer to replace the speedometer and BCM and any other modules that might store the speedometer 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.**

→ Setup New ECU ->Calibrate ETC System – Run the ETC auto-calibration routine (follow the instructions on the screen, the initial test takes about 150 seconds to complete.





Configure – Units and Program Options: Your choice of units and options are programmed into the ECU and saved with your tune file. When opening or reading a file, these values are automatically updated based on the settings in the file. Note: The new ECU setup routine is fully explained (step by step) in the install and setup document.



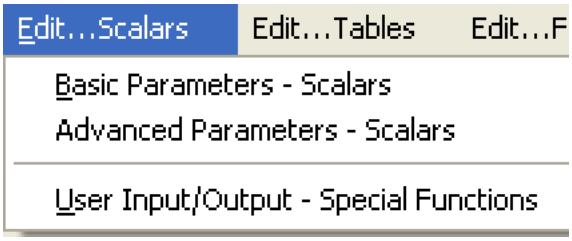
- Fahrenheit or Celsius units
- In-Hg or kPA pressure units
- AFR (10-19) or Lambda (0.70 – 1.1)
- 1 Bar, 2 Bar, 2.5 Bar or 3 Bar Map
- Front CYL – Fuel Multiplier choose from either Front Mult Fuel or Front Alpha Fuel. If - Front Mult Fuel is chosen the Front Cyl Fuel Table becomes a multiplier of the Rear Cyl Fuel Table and no change equals a value of 100. If – Front Alpha Fuel is chosen, the Front Cyl Fuel Table becomes a second Main Fuel table (independent of the Front Fuel Table).

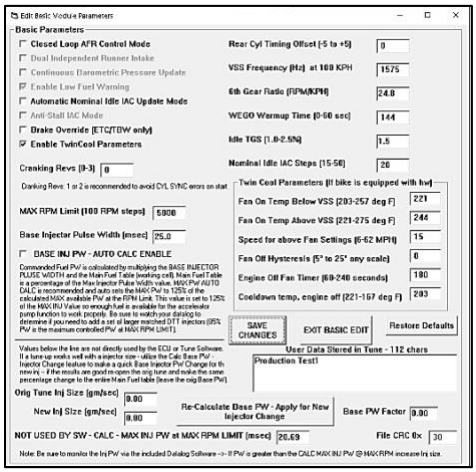
Basic Mode and **Advanced Mode** – Advanced Mode is always selected; this mode shows ALL tuning parameters.

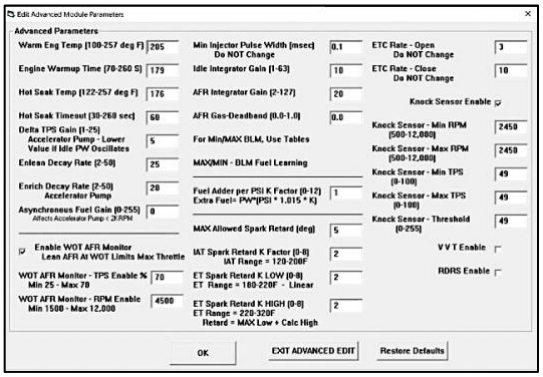
Special – Read Conneted ECU ETC Parameters and Special – Debug Parameters – Normally only used by DTT Tech Support.

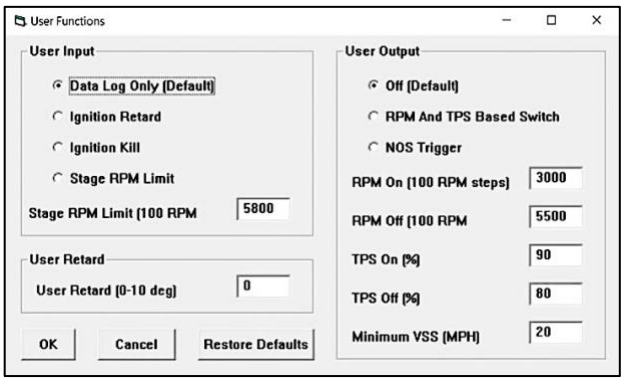
📌 Edit…Scalars Menu Bar

Scalars are single values, switches, injector size, rev limits, etc. When you click on **Edit…Scalars** in the main window, a sub-menu opens and revealing Basic Parameters – Scalars, Advanced Parameters – Scalars and User Input/Output – Special Functions. All of the items in these menus are single values(scalars).









Edit...Tables – *The same procedure is used to edit and modify all Tables and Functions*

Tables contain multi-row & multi-column data. Two normalizer inputs (X,Y) are looked up to determine the output cell (Z). These are often called Tuning Maps. In the example below, X=RPM and Y=in-Hg and Z=Spark.

Table editing occurs using standard Windows copy and paste operations. First select/highlight cells to modify and then click the right mouse button to access the Modify Cell Pop Up Menu.

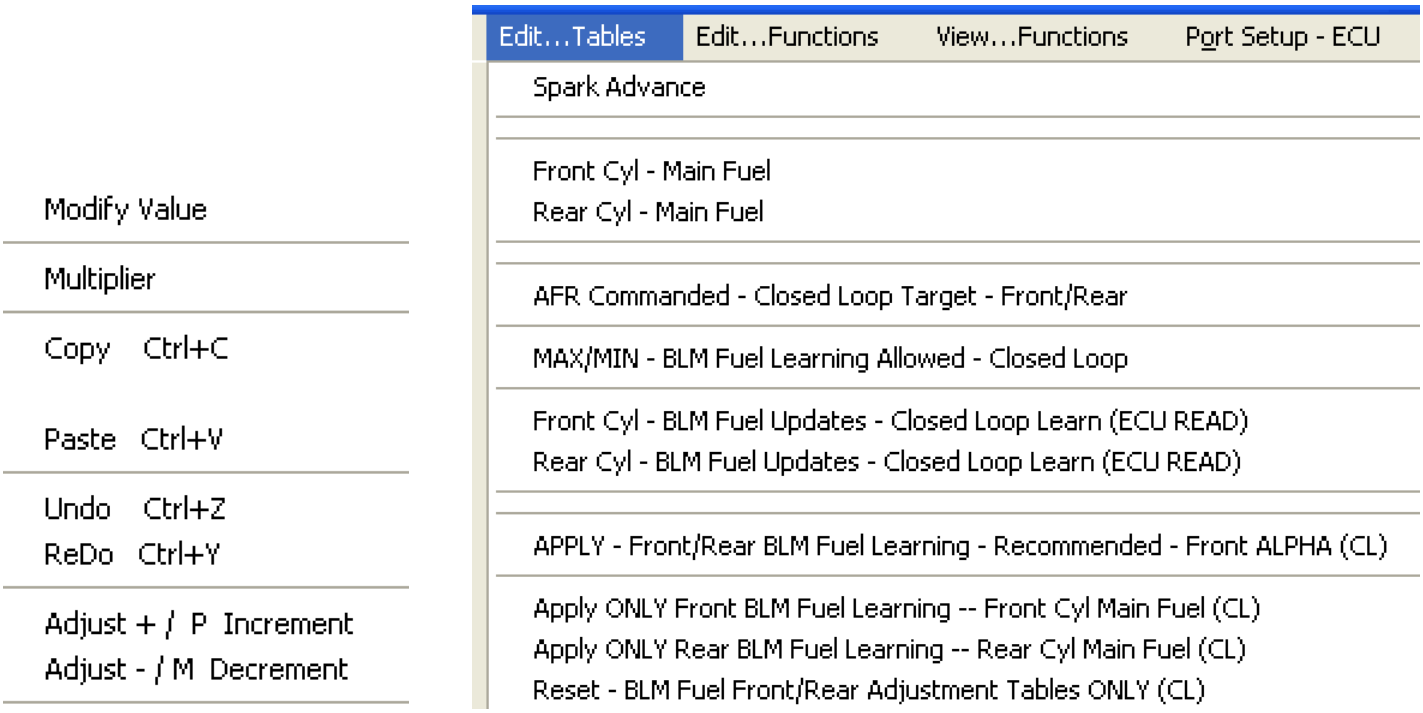
Multiple methods can be used to select cells to edit: Dragging the mouse with left button down or you can click on a cell and use the arrow keys, you can also select all cells in the table by clicking on the top left corner normalizer cell, individual rows and columns can be selected by clicking on the corresponding normalizer.

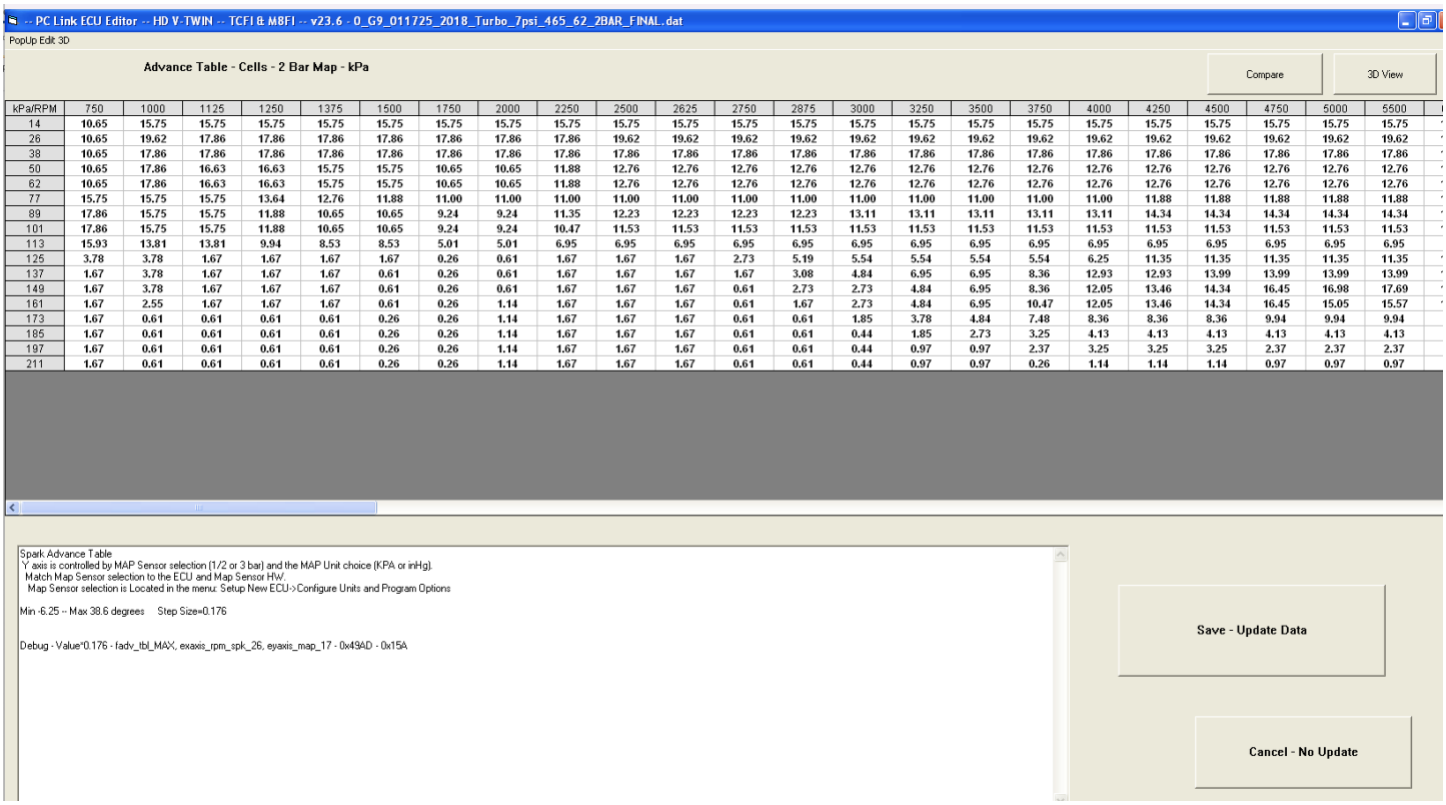
After cells are selected, you can enter a new value or you can right click the mouse to access the Modify Cell Pop Up Menu. Modify Value: Enter a value, notice that the presence of optional sign (+ or -) or percent (%) characters affects the outcome of the Modify Value command. Multiplier: Uses percentage math.

Note: Pressing the + or – Keys (or P or M) can also modify the selected values based on a values pre-defined in the Modify Cell Pop Up Menu (Adjust + and Adjust -)

Data Export and Import – Our software supports the ability to paste/export or copy/import table data to or from another application such as Microsoft Excel. Arrange the program windows so that both the source and destination are visible (one on the left side of the screen and the other on the right side seems to work best). To export from PC Link TCFI to Excel, select a range of data on the spreadsheet grid. Right Click and choose Copy from the menu or press Ctrl+C together to copy the information. In Excel, choose your gride area and click Paste from the menu or press Ctrl+V together to paste the information. When you are done working, reverse the procedure.

⚠ *Tip: To view the table in 3D, click the button 3D View. You can rotate the 3D chart display for a better view of a particular region by dragging the mouse while holding the left mouse button down.*





Spark Advance Table Example -- 2 Bar M8 Turbo

📌 Edit…Tables → Spark Advance Table

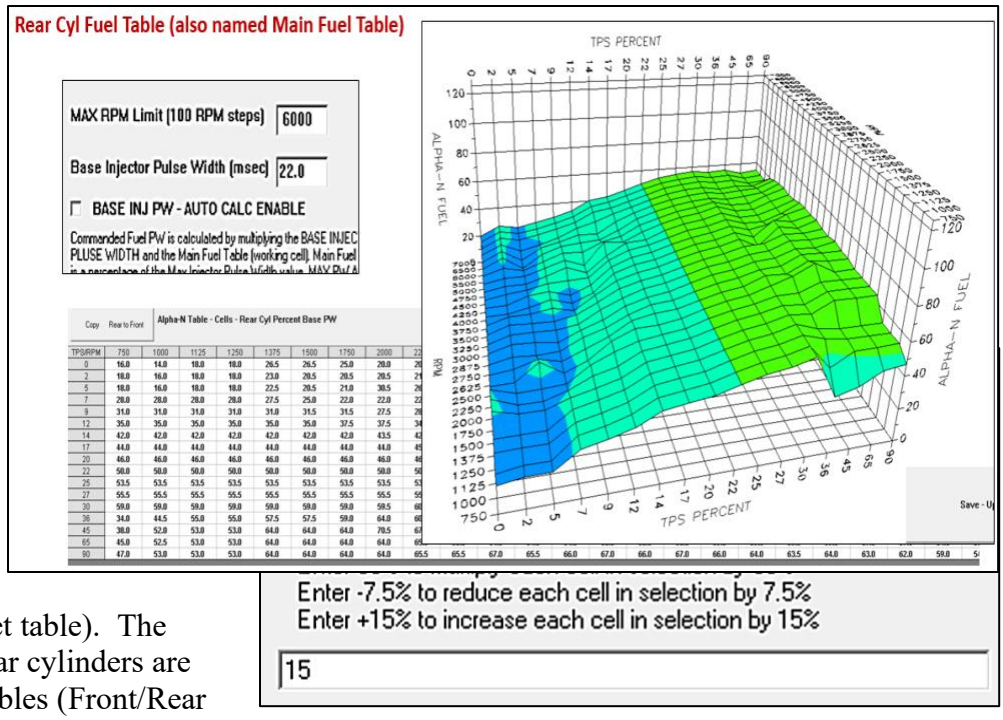
Edit table data by modifying the numeric data in the spreadsheet grid. Enter values or right click for Modify Cell Pop Up Menu.

The Spark Advance Table consists of 26 columns (X) from 750 to 7,000 RPM and 17 manifold pressure (MAP) rows (Y). The values for MAP automatically rescale based on the type of MAP sensor that is selected. It is recommended to use the unit kPA for MAP. We also support In-Hg, but we do not recommend it because the values are reversed for what is used on a vacuum gauge. Note: 10 In-Hg corresponds to a high vacuum deceleration or idle condition and that 30 In-Hg corresponds to wide open throttle (WOT). Advance values (Z) are in degrees and they must be between -6.26 and +38.6 degrees.

⚠ **Important Notes:** Normalizer values (X,Y) that are less than or greater than the min/mx normalizer values automatically use the corresponding Z lookup value in min or max cell. For example: RPM X value is 430rpm this is less than 750 so it will use the value in the 750 RPM column. If greater than 7000, it will use that value. **After you have edited the table**, you must save the modified tune information into memory. Click the button labeled: SAVE – Update Data. Click Yes to save your edits to buffer memory. If you click NO, your table edits will be lost.

📌 Edit…Tables → Rear Cyl - Main Fuel Table

Alpha-N is the technical term for this fuel lookup table (Throttle Position vs RPM). The Alpha-N table values are in percent units.



The values in this table are multiplied with the Base Injector Pulse Width value located in **Edit…Scalar Basic Parameters – Scalars** to determine the injector pulse width.

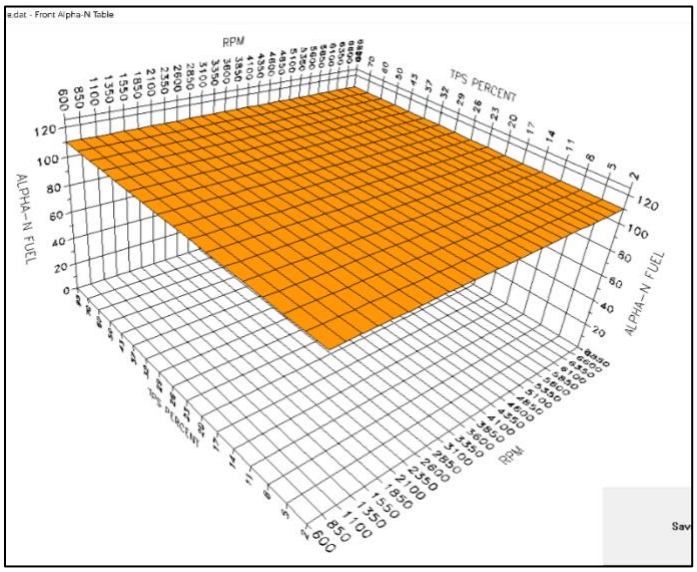
After the engine enters Closed Loop, the values in this table then corrected for the desired air/fuel ratio (set by the AFR Commanded – Closed Loop Target table). The learned values for the front and rear cylinders are saved in Long Term Fuel Trim Tables (Front/Rear Cyl - BLM Fuel Updates [Block Learn Multiplier]) to arrive at the corrected injector pulse width. The correction is applied based on the information learned by the wideband oxygen sensor signal.

From a practical standpoint, the Alpha-N table must be within about ±35% of the required values for the AutoTune system to successfully correct the injector pulse width based on closed loop feedback from the wideband exhaust gas oxygen sensor.

The Rear Cyl – Main Fuel table is automatically corrected when the **Apply - Front/Rear BLM Fuel** command is executed (after riding the bike in closed loop and reading in the tune from the ecu – updates are in the tune).

📌 Edit…Tables → Front Cyl – Multiplier vs Main Fuel Table

If the option for Front Mult Fuel is selected, the Front Cyl Fuel Table becomes a multiplier of the Rear Cyl Fuel Table. The front cylinder trim table values are in percent units.



A value of 100 in this table means to use 100% of the Rear Cyl Fuel Table Pulsewidth Value for the Front Cylinder Pulsewidth.

Another way to look at this is that the calculated injector pulse width for the front cylinder is generated by multiplying the value from the Rear Cyl Fuel Table by the Front Cylinder Multiplier/Trim value to arrive at the front injector pulse width.

The front cylinder trim table is automatically corrected when the **Apply - Front/Rear BLM Fuel** command is executed (after riding the bike in closed loop and reading in the tune from the ecu).

📌 Edit…Tables → Front Cyl – Main Fuel Table

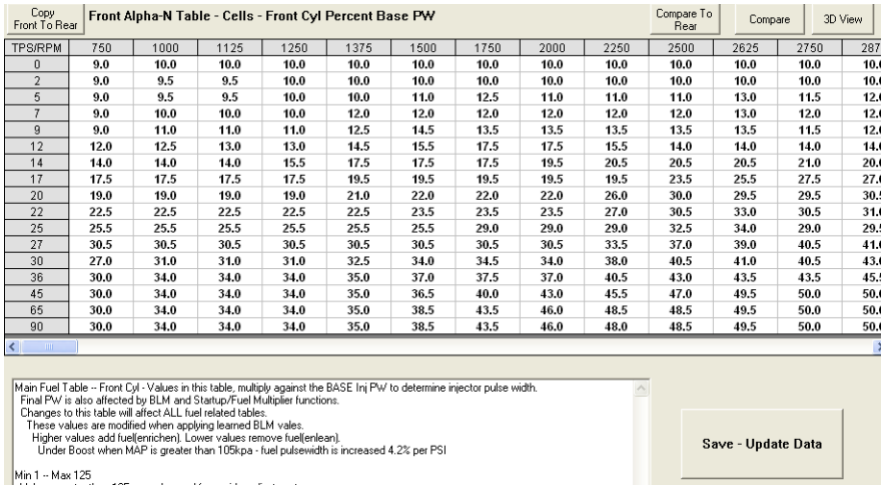
If the option for Front Alpha Fuel is chosen, the Front Cyl Fuel Table becomes a second Main Fuel table (independent of the Front Fuel Table). The Front Cylinder – Main Fuel Table values are in percent units.

The values in this table are multiplied with the Base Injector Pulse Width value located in **Edit…Scalar Basic Parameters – Scalars** to determine the injector pulse width. After the engine enters Closed Loop, the values in this table then corrected for the desired air/fuel ratio (set by the AFR Commanded – Closed Loop Target table).

The learned values for the front and rear cylinders are saved in Long Term Fuel Trim Tables (Front/Rear Cyl - BLM Fuel Updates [Block Learn Multiplier]) to arrive at the corrected injector pulse width. The correction is applied based on the information learned by the wideband oxygen sensor signal.

From a practical standpoint, the Alpha-N table must be within about ±35% of the required values for the AutoTune system to successfully correct the injector pulse width based on closed loop feedback from the wideband exhaust gas oxygen sensor.

The Front Cyl – Main Fuel table is automatically corrected when the **Apply - Front/Rear BLM Fuel** command is executed (after riding the bike in closed loop and reading in the tune from the ecu – updates are in the tune).


Copy Front To Rear | Front Alpha-N Table - Cells - Front Cyl Percent Base PW | Compare To Rear | Compare | 3D View

TPS/RPM	750	1000	1125	1250	1375	1500	1750	2000	2250	2500	2625	2750	287
0	9.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.(
2	9.0	9.5	9.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.(
5	9.0	9.5	9.5	10.0	10.0	11.0	12.5	11.0	11.0	11.0	13.0	11.5	12.(
7	9.0	10.0	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0	13.0	12.0	12.(
9	9.0	11.0	11.0	11.0	12.5	14.5	13.5	13.5	13.5	13.5	13.5	11.5	12.(
12	12.0	12.5	13.0	13.0	14.5	15.5	17.5	17.5	15.5	14.0	14.0	14.0	14.(
14	14.0	14.0	14.0	15.5	17.5	17.5	17.5	19.5	20.5	20.5	20.5	21.0	20.(
17	17.5	17.5	17.5	17.5	19.5	19.5	19.5	19.5	19.5	23.5	25.5	27.5	27.(
20	19.0	19.0	19.0	19.0	21.0	22.0	22.0	22.0	26.0	30.0	29.5	29.5	30.(
22	22.5	22.5	22.5	22.5	22.5	23.5	23.5	23.5	27.0	30.5	33.0	30.5	31.(
25	25.5	25.5	25.5	25.5	25.5	25.5	29.0	29.0	29.0	32.5	34.0	29.0	29.(
27	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	33.5	37.0	39.0	40.5	41.(
30	27.0	31.0	31.0	31.0	32.5	34.0	34.5	34.0	38.0	40.5	41.0	40.5	43.(
36	30.0	34.0	34.0	34.0	35.0	37.0	37.5	37.0	40.5	43.0	43.5	43.5	45.(
45	30.0	34.0	34.0	34.0	35.0	36.5	40.0	43.0	45.5	47.0	49.5	50.0	50.(
65	30.0	34.0	34.0	34.0	35.0	38.5	43.5	46.0	48.5	48.5	49.5	50.0	50.(
90	30.0	34.0	34.0	34.0	35.0	38.5	43.5	46.0	48.0	48.5	49.5	50.0	50.(

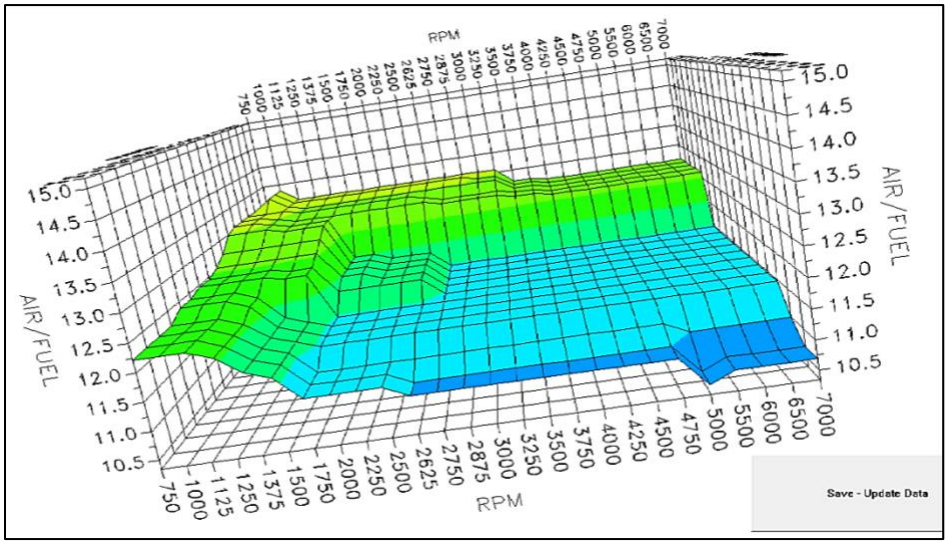
Main Fuel Table -- Front Cyl - Values in this table, multiply against the BASE Inj PW to determine injector pulse width.
Final PW is also affected by BLM and Startup/Fuel Multiplier functions.
Changes to this table will affect ALL fuel related tables.
These values are modified when applying learned BLM vales.
Higher values add fuel(enrichen). Lower values remove fuel(enlean).
Under Boost when MAP is greater than 105kpa - fuel pulsewidth is increased 4.2% per PSI

Min 1 -- Max 125

Save - Update Data

📌 Edit…Tables → AFR Commanded – Closed Loop Target – Front/Rear Table

The AFR (air/fuel ratio) table sets the desired air/fuel ratio under various operating conditions. The air/fuel ratio values are used as a target for both the front/rear injector pulse width calculation (explained above). Typical petrol air/fuel ratios are 13.0 for idle, 13.5 for cruise, and 12.5 for wide open throttle. To prevent engine overheating, avoid lean air/fuel ratios exceeding 14.0 under cruise conditions. **This table should not be adjusted during the initial tuning process.**



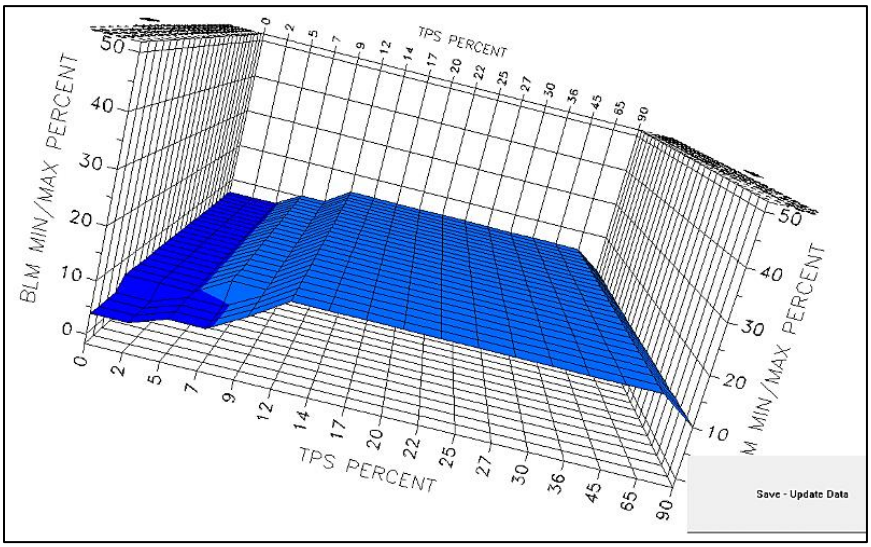
Important Note - related to turbocharged applications:

If O2 sensors are installed in-between the exhaust port and the Turbo, the pressure in the exhaust pipe will cause the O2 sensors to show leaner than they actual. This is a normal, due to read slightly different, depending on the pressure. This can skew the air fuel that is reported by the sensor up to a full air fuel point. 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.

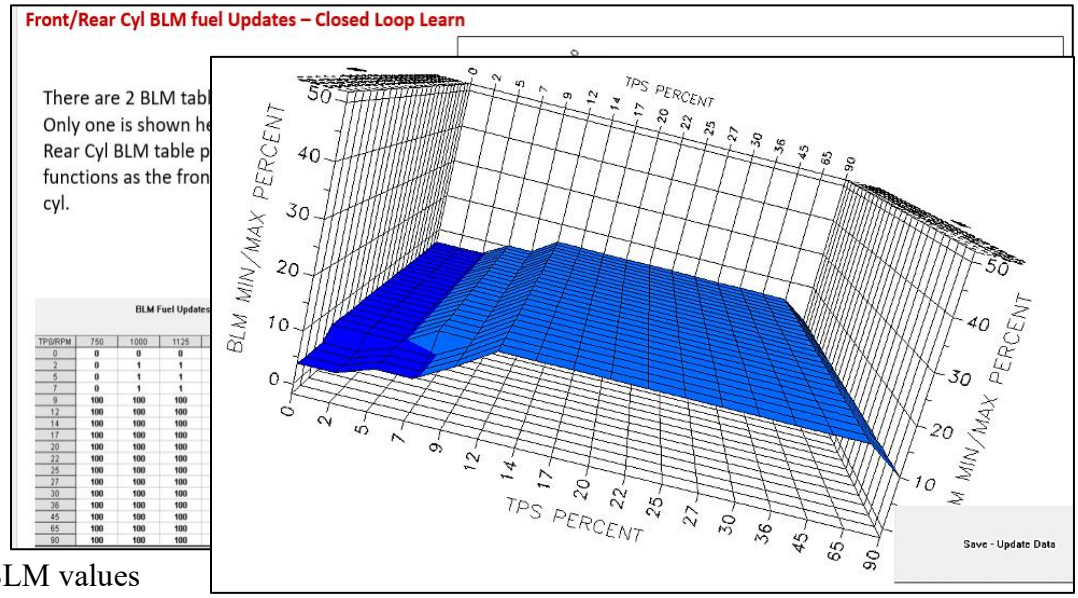
This is not a huge issue - it is important to run a commanded AFR that is slightly richer than you desire to achieve the expected results.

📌 Edit…Tables → Max/Min BLM Fuel Learning Allowed Table – Closed Loop (CL)

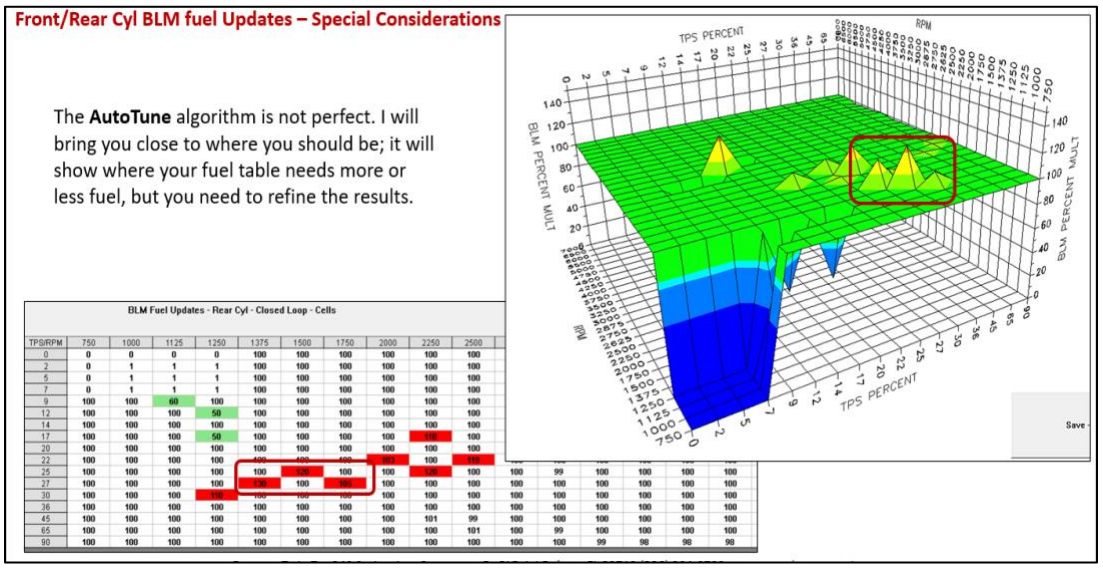
The values are in percentages. They represent the maximum and minimum allowed Long Term Fuel Trim Learning in a given cell for both the Front and Rear BLM learning tables. The Front/Rear Cyl – BLM Fuel Updates tables are limited (+/-) to the range of values that are set in this table. A value of 4 in this table allows for the fuel to be adjusted a maximum of either 4% positively or negatively. It is recommended to expand the entire learning are in this table to +-30% when initially dialing in a new combination. Once you understand where the reversion areas are located, the values in this table should be reduced to lower values. Typically 4 in reversion areas, 10 at lower throttle openings, 20 in the midrange and 15 at WOT.



📌 Edit…Tables → Front Cyl/Rear Cyl BLM Fuel Updates – Closed Loop Learn (ECU READ)



These two tables contain the Long-Term Fuel Trim Learning / BLM Fuel Updates that occur for the Front and Rear Cylinders. Long-Term Fuel Trims are also called BLM (Block Learn Multiplier), because the learned value multiplies against the main fuel table values. The BLM values are in percent units and represent a correction factor required to maintain the air/fuel ratio set on the AFR table. BLM values are updated based on closed loop feedback from the exhaust gas oxygen sensors. BLM learning values are limited in range from 50% to 150%. A value of 100 equals no change or use 100% of the main fuel table value. A value of 110 adds 10% additional fuel to the corresponding cell in the main fuel table, a value of 90 subtracts 10% of fuel from the same cell. BLM cell values 0 and 1 are special function values. A cell with the **value of 0** forces Open Loop (no BLM learning. This can be useful in operating areas where severe exhaust reversion causes incorrect sensor readings. Cells with the **value of 1** disable Long Term Fuel Trim learning in that cell, this means that each time the engine is restarted, the learning in this cell is automatically reset to 100. Learning is limited in the cell to the Max/Min BLM Fuel Learning Allowed Table Value that corresponds with the cell. This is the preferred method for dealing with exhaust wideband O2 learning reversion.



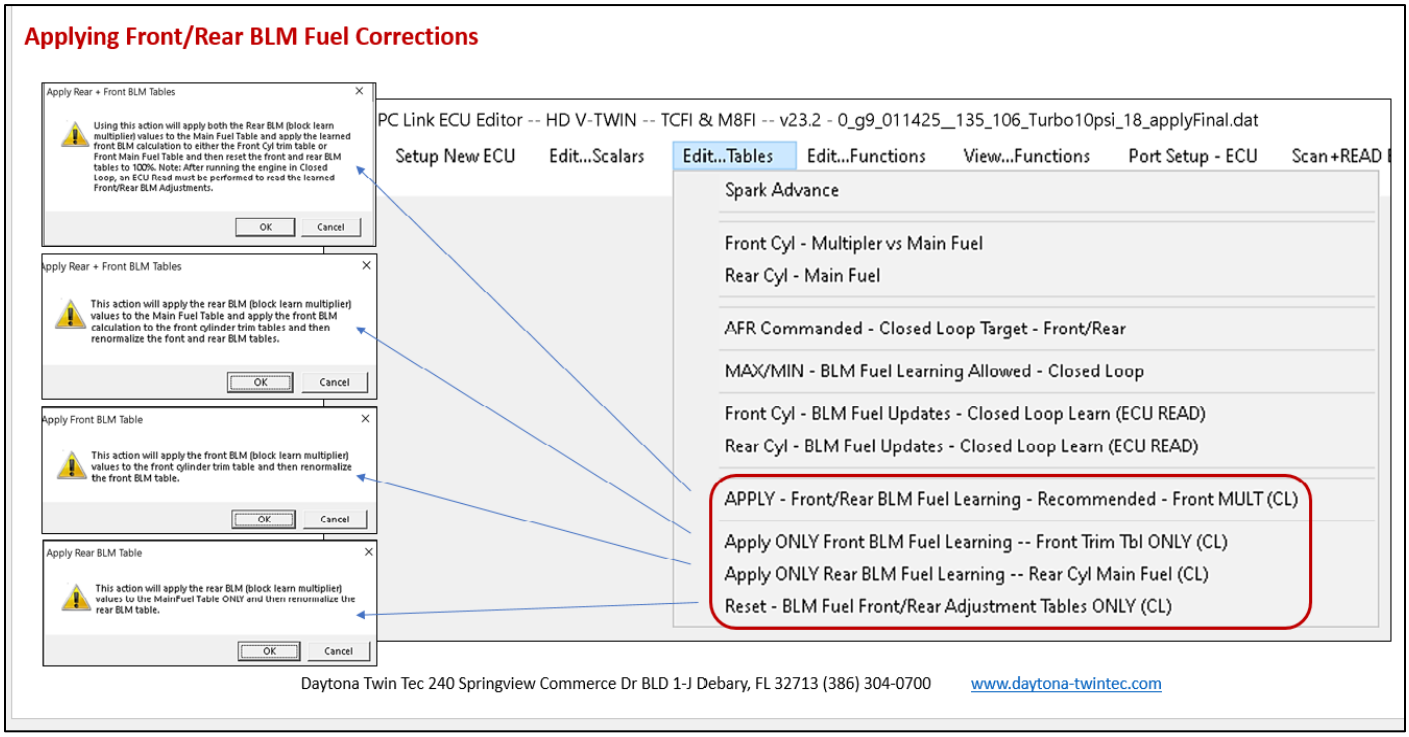
Exhaust Reversion:

Sometimes you will see higher or lower than expected values in some cells in the table. It is not realistic for adjacent cells to have values that vary wildly. The reason for this variation is Exhaust reversion.

Reversion is the term for a negative pressure wave that can suck ambient air back into the exhaust and cause an erroneous lean AFR indication. Reversion effects typically occur at one or two different rpm levels and can be noticeable at idle, part throttle low RPM cruise, and decel. Open drag pipes suffer from reversion effects. Please note that if you use drag pipes or other open pipes, auto-tuning may not be possible at idle or part throttle due to reversion effects. To tune the engine, you might be forced to force open loop in these areas.

When you see values that vary by a large amount, you may need to manually adjust and smooth the cells around that peak or dip (edit the 8 cells around the spike – and the spike itself), then run the engine again, covering the area of interest; download the data and the engine map and analyze. This is an iterative process, you may need to repeat it, but in the end, it will bring you very close to the ideal fueling. In some instances, you may need to disable **AutoTune** feature by using the 0 and/or 1 values.

After operating the engine, **read the ECU by choosing the Scan+Read ECU feature and examine the BLM tables** (Edit…Tables → Front Cyl/Rear Cyl BLM Fuel Updates – Closed Loop Learn (ECU READ)). If the data in the BLM tables looks good (Front and Rear) use the sub command under **Edit…Tables → Apply – Front/Rear BLM Fuel** to apply the learning changes to the Rear Cyl - Main Fuel Table and Front Cylinder Fuel Table. It is recommended to apply to both tables; however you can choose to apply the learning to only the front or rear table. After running any of the Apply BLM Table commands, after the tables are modified, the BLM table cells will automatically return to 100% and the learning process will start again. If you don't like the learning in the BLM tables, you can choose the command Reset - BLM Fuel Front/Rear Adjustment Tables ONLY (CL) to resets all BLM cells in the Front/Rear BLM tables to 100% (without applying the learning).



Edit...Functions – *The same procedure is used to edit and modify all Tables and Functions*

Functions are two column tabular data, 2D maps. An input normalizer value (top row, X) gives an output value (bottom row, Z). Before you can edit one of these tables, you must either open a data file or download data from a ECU unit. Each table consists of 17 columns with the upper row corresponding to the independent variable (throttle position, engine temperature, elapsed time, or IAC position.

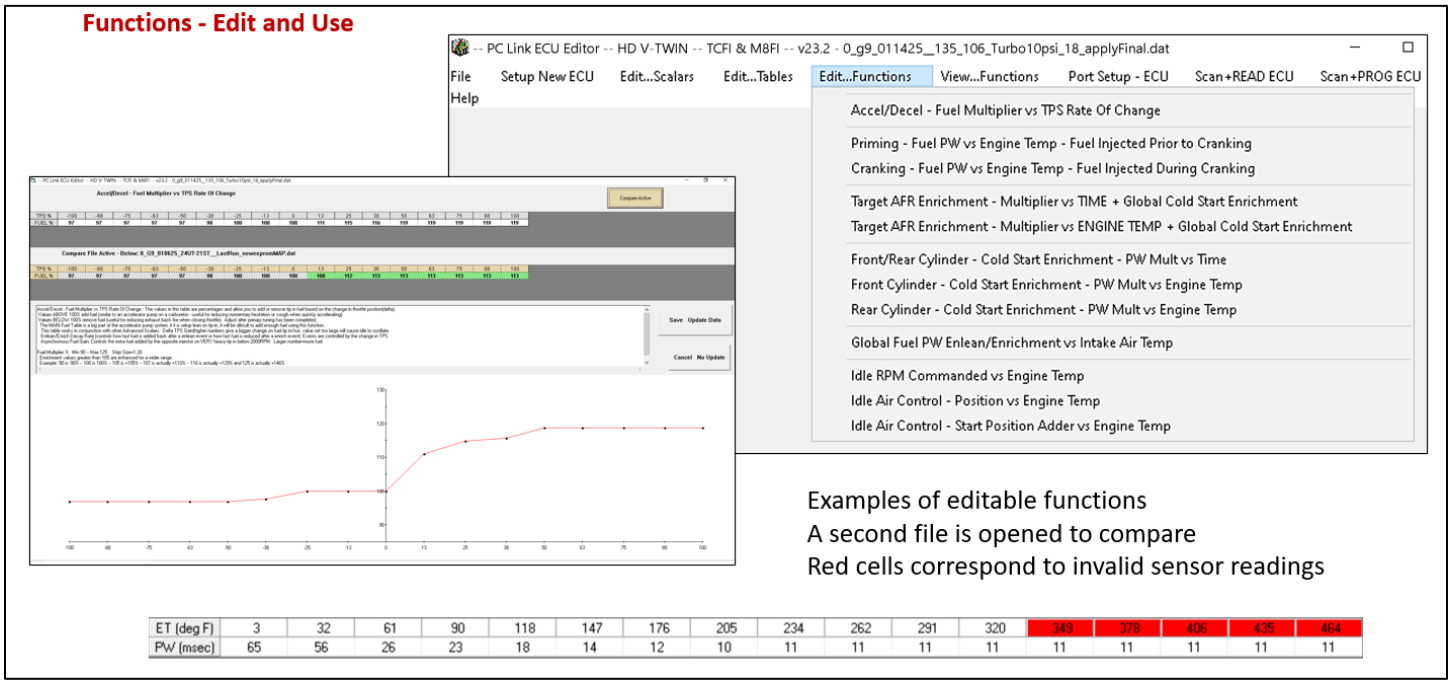
Function editing occurs using standard Windows copy and paste operations. First select/highlight cells to modify and then click the right mouse button to access the Modify Cell Pop Up Menu.

Multiple methods can be used to select cells to edit: Dragging the mouse with left button down or you can click on a cell and use the arrow keys, you can also select all cells in the table by clicking on the top left corner normalizer cell, individual rows and columns can be selected by clicking on the corresponding normalizer.

After cells are selected, you can enter a new value or you can right click the mouse to access the Modify Cell Pop Up Menu. Modify Value: Enter a value, notice that the presence of optional sign (+ or -) or percent (%) characters affects the outcome of the Modify Value command. Multiplier: Uses percentage math.

Note: Pressing the + or – Keys (or P or M) can also modify the selected values based on a values pre-defined in the Modify Cell Pop Up Menu (Adjust + and Adjust -)

Data Export and Import – Our software supports the ability to paste/export or copy/import function data to or from another application such as Microsoft Excel. Arrange the program windows so that both the source and destination are visible (one on the left side of the screen and the other on the right side seems to work best). To export from PC Link TCFI to Excel, select a range of data on the spreadsheet grid. Right Click and choose Copy from the menu or press Ctrl+C together to copy the information. In Excel, choose your gride area and click Paste from the menu or press Ctrl+V together to paste the information. When you are done working, reverse the procedure.



You can edit the numeric data corresponding to the dependent variable on the lower row of the spreadsheet grid. A typical 2D table is shown. Some of the engine temperature cells are highlighted in red. These red cells correspond to extreme sensor readings. After you have edited the table, you must click **Save Update Data** to save your changes into memory.

📌 Short description of each editable Function – Edit…Functions

Accel/Decel - Fuel Multiplier vs TPS Rate Of Change - The values in this table are percentages and allow you to add or remove tip in fuel based on the change in throttle position (delta).

→ Value of 100 does not add or reduce fuel, no change in fuel.

→ Values ABOVE 100% add fuel, ex 110 = add 10% more fuel. This function is similar to adjusting the accelerator pump on a carburetor - useful for adding fuel on quick throttle transitions (can reduce momentary hesitation or cough when quickly accelerating).

→ Values BELOW 100% remove fuel (useful for reducing exhaust back fire when closing throttle). Adjust after primary tuning has been completed.

⚠ The MAIN Fuel Table is a big part of the accelerator pump system, if the main fuel table is setup too lean, on heavy tip-in the AFR will be lean and it will be difficult to add enough fuel using the Accel Fuel Multiplier function.

🛠 The Accel/Decel – Fuel Multiplier vs TPS Function also works in conjunction with several other Scalars (Edit…Scalars→Advanced Parameters – Scalars).

Scalar → Delta TPS Gain (higher numbers give a bigger change on fuel tip in/out, be careful, to large of a value will cause the fuel pulse width at idle to oscillate, recommended 7 or lower).

Scalars → Enlean or Enrich Decay Rate (controls how fast fuel is added back after a enlean event or how fast fuel is reduced after a enrichment event). Events are controlled by the change in TPS.

Priming - Fuel PW vs Engine Temp - Fuel Injected Prior to Cranking - Values in this table are pulse width in msec. Priming Fuel Pulse Width is based on Engine Temp. This is the amount of fuel that is injected as the engine is first starting to turn over. Note: If you add too much fuel here the engine could kick back with a hard start that sounds like detonation when warm. If too lean, the engine might not start smoothly when cold or the engine might take an extra revolution before starting. Once the engine is rotating at greater than 50rpm, the ECU switches over to the Cranking – Fuel PW vs Engine Temp Table.

Cranking - Fuel PW vs Engine Temp - Fuel Injected During Cranking - Values in this table are pulsewidths in msec. Cranking Fuel Pulse Width is based on Engine Temp. This is the amount of fuel that is injected AFTER the engine starts to turn over. Too much fuel, and the engine will blow black smoke after startup. Too little fuel(lean), and the engine might not start reliably or the engine might backfire when it is turning over.

Target AFR Enrichment - Multiplier vs TIME + Global Cold Start Enrichment - Values in this table are a percentage AFR multiplier based on time. Works in combination with Function: Target AFR Enrichment - Multiplier vs ENGINE TEMP. The multiplier values in this table are looked up vs Time (seconds), these value multiply with the value in the table: Target AFR Enrichment Multiplier vs ENGINE TEMP. Result modifies the AFR or PW for both cylinders, the product of these two table values do two things 1-->If closed loop is active (modify the commanded AFR) OR 2-->If open loop is active, they globally modify commanded fuel. Note: If either table value is ZERO - no modification will be added at that Time/Engine Temp. Global = Modifies Both Cylinders ET=Engine Temp

Target AFR Enrichment - Multiplier vs ENGINE TEMP + Global Cold Start Enrichment – Values in this table are a percentage multiplier values based on Engine Temp. Works in combination with Function: Target AFR Enrichment - Multiplier vs TIME. The values in this table are looked up vs Engine Temp, they multiply with the value in the table: Target AFR Enrichment - Multiplier vs TIME. Result modifies the AFR or PW for both cylinders, the product of these two table values do two things 1-->If closed loop is active (modify the commanded AFR) OR 2-->If open loop is active, they globally modify commanded fuel. Note: If either table

value is ZERO - no modification will be added at that Time/Engine Temp. Global = Modifies Both Cylinders ET=Engine Temp

Front/Rear Cylinder - Cold Start Enrichment - PW Mult vs Time - Values in this function is a Fuel Pulse width percentage multiplier based on time. Works in combination with two other functions to provide unique fuel control to each cylinder: Front/Rear Cylinder - Cold Start Enrichment - PW Mult vs Engine Temp. The multiplier values in this table are looked up vs Time (seconds), they multiply with the value in the specific table and this allows for engine temperature-based control specific to the Front or Rear Cylinder. The product/output of the two tables directly modify Fuel Pulsewidth based on time and engine temperature. Note: If either table value is ZERO - no modification will occur at that Time/Engine Temperature.

Front Cylinder - Cold Start Enrichment - PW Mult vs Engine Temp - Values in this table are Fuel Pulse width percentage multipliers based on Engine Temp. Works in combination with: Front/Rear Cylinder - Cold Start Enrichment - PW Mult vs Time, to provide unique fuel cold start fuel control for the Front cylinder. The multiplier values in this table are looked up vs Engine Temperature (ET), they multiply with the value in the table: Front/Rear Cylinder - Cold Start Enrichment - PW Mult vs Time. The product/output of the two tables directly modify Fuel Pulsewidth for the front cylinder based on Time & Engine Temperature. Note: If either table value is ZERO - no modification will occur at that Time/Engine Temp.

Rear Cylinder - Cold Start Enrichment - PW Mult vs Engine Temp - Values in this table are Fuel Pulse width percentage multipliers based on Engine Temp. Works in combination with: Front/Rear Cylinder - Cold Start Enrichment - PW Mult vs Time, to provide unique fuel cold start fuel control for the Rear cylinder. The multiplier values in this table are looked up vs Engine Temperature (ET), they multiply with the value in the table: Front/Rear Cylinder - Cold Start Enrichment - PW Mult vs Time. The product/output of the two tables directly modify Fuel Pulse width for the rear cylinder based on Time & Engine Temperature. Note: If either table value is ZERO - no modification will occur at that Time/Engine Temp.

Global Fuel PW Enlean/Enrichment vs Intake Air Temp - Values in this table are percentage multipliers that modify Fuel Pulse width for both cylinders based on Intake Air Temperature (IAT). A value of 100 does not modify fuel pulse width, values below 100% Remove Fuel and Values above 100% ADD Fuel. Examples: 100=Do not modify, 110=Add 10% of additional Fuel Pulsewidth, 90=Remove 10%

Idle RPM Commanded vs Engine Temp - Values in this function set the target Idle RPM based on Engine Temperature. Typically, the target Idle RPM is set higher when the engine is colder. As the engine warms up, the target Idle RPM is lowered.

→Final Idle RPM is also modified by: Edit…Scalars→Basic Parameters - Scalars->Nominal Idle IAC Steps and by Edit…Functions→Intake Air Control – Position vs Engine Temp and Functions→Idle Intake Air Control – Start Position Adder vs Engine Temp.

⚠ If you have an intake leak, the system might not be able to match the commanded RPM. Typical values: 1300rpm below 60F, 1200 below up to 120F, 1100-1000rpm above 180F

Idle Air Control - Position vs Engine Temp - Values in this function represent BASE commanded airflow through the Idle Air System based on Engine Temperature (ET). Larger IAC values, typically result in more idle air passing into the engine and a higher Idle RPM engine speed. IAC values should be reduced as the engine temperature increases. This table is utilized to set the minimum throttle position for idle (25=2.5% throttle).

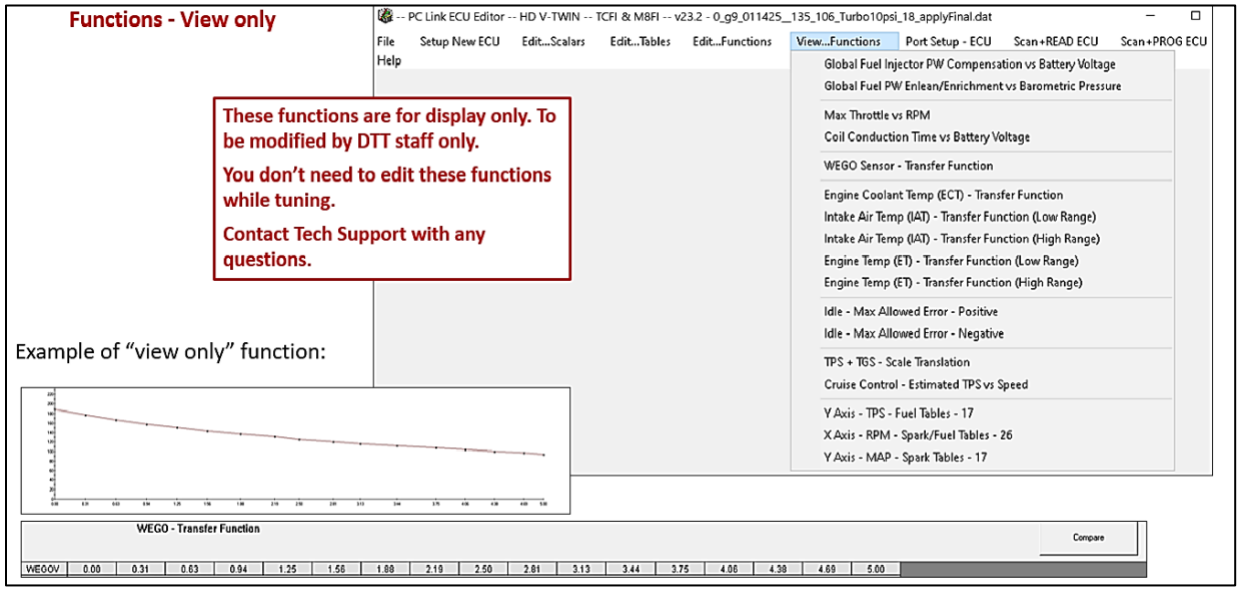
→Final Idle RPM is also modified by: Edit…Scalars→Basic Parameters - Scalars->Nominal Idle IAC Steps and by Edit…Functions→Idle RPM Commanded vs Engine Temp and Functions→Idle Intake Air Control – Start Position Adder vs Engine Temp.

Idle Air Control - Start Position Adder vs Engine Temp - Values in this function represent additional airflow through the Idle Air System at startup based on Engine Temperature (ET). Generally, additional air is required for hot start after heat soak. Immediately after engine start up, engine should reach 1200-1300 rpm and steadily decrease to command idle speed. If engine RPM is low after start or stumbles before the idle stabilizes, increase the value in this function at the observed engine temperature. Before the engine idle stabilizes, if excessively high rpm is experienced, reduce value at the observed engine temperature.

→Final Idle RPM is also modified by: Edit…Scalars→Basic Parameters - Scalars->Nominal Idle IAC Steps and by Edit…Functions→Idle RPM Commanded vs Engine Temp and Functions→Idle Intake Air Control – Position vs Engine Temp.

View…Functions – Not editable

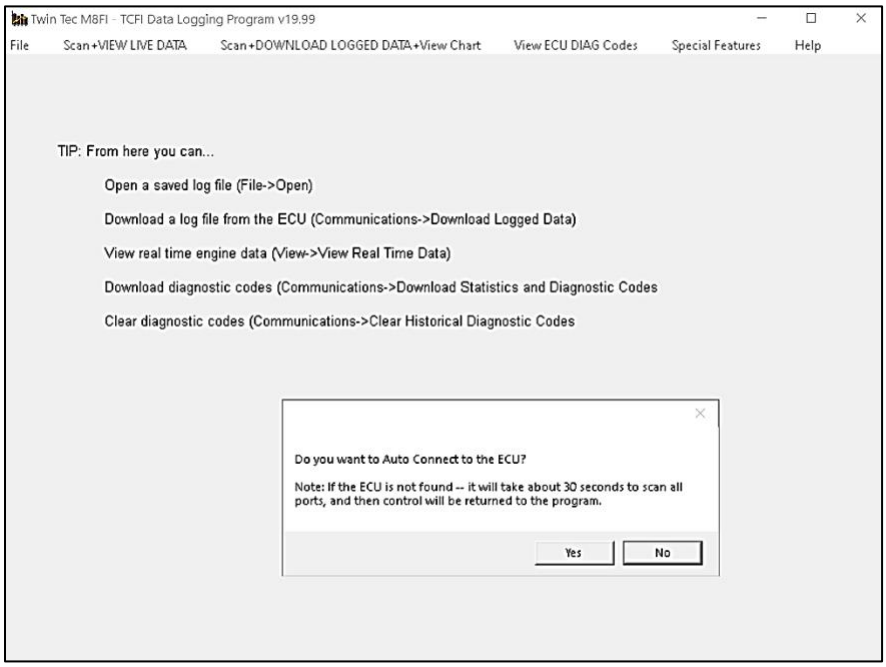
These functions are not normally changed during normal tuning. These functions are provided for information purposes only. To learn, contact Daytona Twin Tec Tech Support for assistance.



THE TCFI LOG APPLICATION

Overview, real time data view and logging

After TCFI_Log.exe is launched, several questions are asked to make it easy to automatically monitor or download saved data from the ECU. **Be sure to turn both the ignition key on and set the engine run/stop switche ON to provide power to the ECU unit prior to starting the software.**



You can display real time engine data on an instrument panel type screen by using the command **Scan+VIEW LIVE DATA.** Or you can download and display data that has been automatically logged by the ECU by using the command **Scan+DOWNLOAD LOGGED DATA + View Chart**. Data automatically logged by the ECU must be downloaded before it can be displayed. Anytime the engine is running, the ECU automatically saves the data. After data has been downloaded, it is automatically displayed on a chart recorder type screen. You can save this data by using the Save File command from the File menu. You can display a previously saved data file by first using the Open File command on the File menu and then using the View Chart command on the View menu.

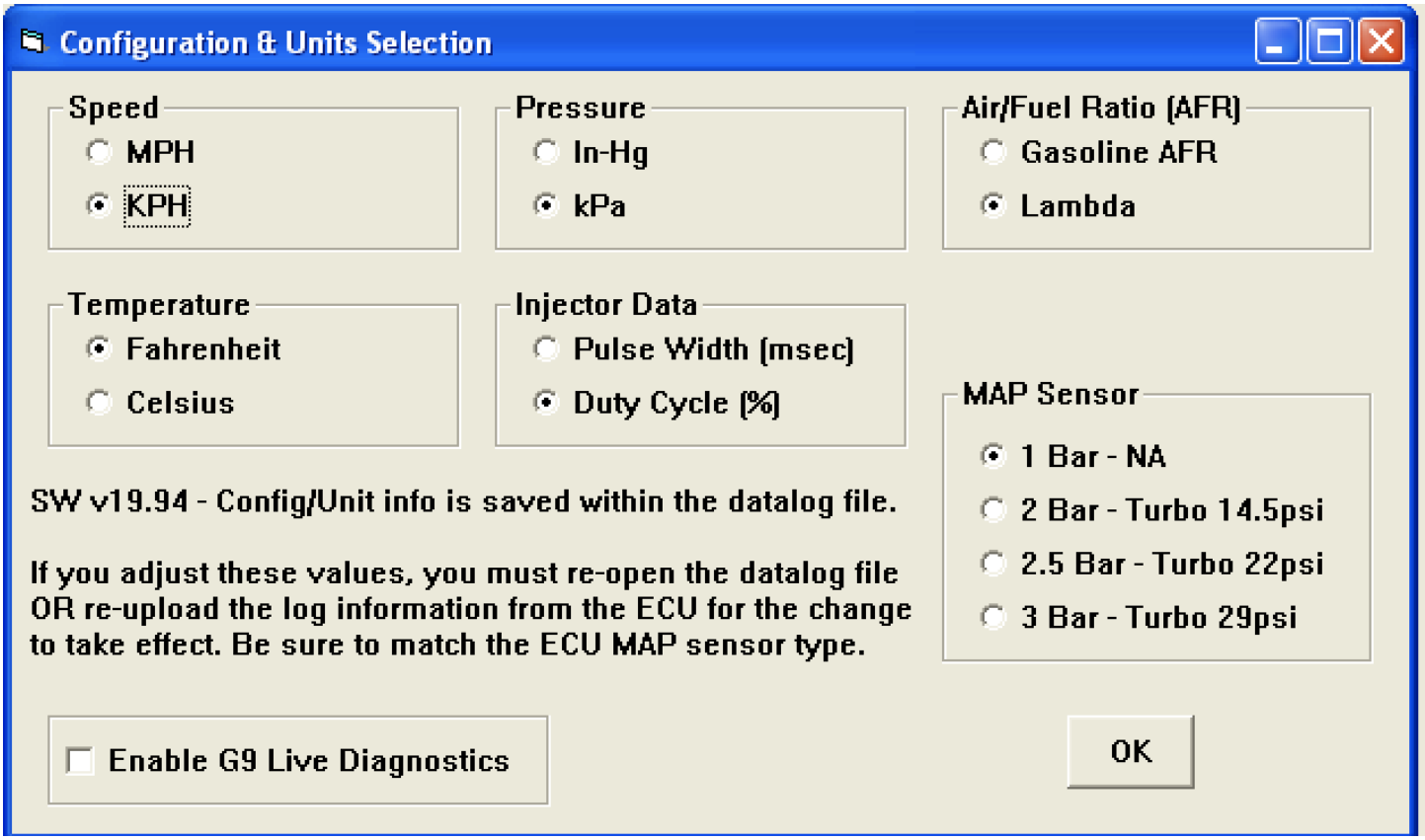
You can also download, view, and print engine operating statistics and historical diagnostic codes by using the Download Statistics and Diagnostic Codes command from the **Special Features** menu.

On the G7 version of the ECU, our USB interface, P/N 102004, is required for communication between the PC and ECU. The USB interface connects to the four terminal Deutsch data link connector that is part of the WEGO harness. The USB Interface has a switch that selects the operating mode. For communication with the TCFI, you must use the **TC88A And All Others** switch position.

⚠ G8 & G9 ECU versions DO NOT require that additional USB interface; they plug directly into PC using a USB-C cable that is included in kit.

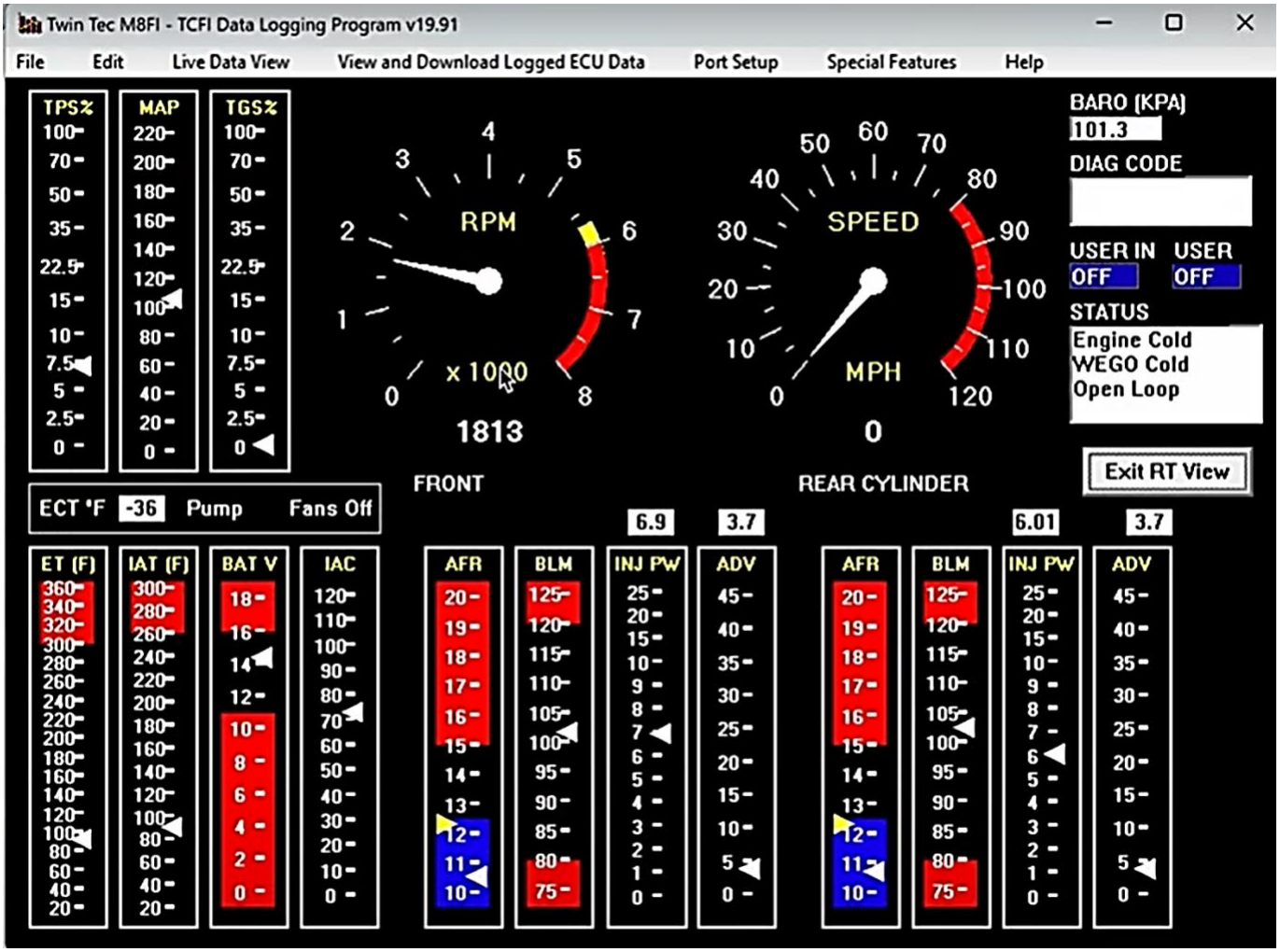
File→Configure Units – Program Options (NEW)

The old manual configuration file has been replaced with **File→Configure Units – Program Options (NEW).** A dialog box will appear as shown below. You can select the configuration units to use for the software display: Speed: miles per hour (MPH) or kilometers per hour (KPH), Temperature: Fahrenheit (F) or Celsius (C), Pressure: inches of mercury (In-Hg) or kilopascals (kPa) manifold pressure units, Injector Data: Pulse width in milliseconds or duty cycle in percent, Air/fuel ratio in gasoline AFR or Lambda units and the MAP sensor type 1,2, 2.5 or 3 bar. Note: The program remembers the selections you have made.



Scan+VIEW LIVE DATA →v REAL TIME ENGINE DATA DISPLAY

When the engine is running, you can display real time engine data on an instrument panel type screen by selecting the command Scan+View Live Data. Clicking this command will automatically scan and connect you to the ECU. Please note that real time engine data cannot be directly saved by means of the TCFI_Log.exe program. However, this data is constantly being logged by the ECU and can be downloaded and viewed via the command Scan+DOWNLOAD LOGGED DATA+View Chart (for example at the end of series of dyno runs).



Real time engine data is displayed on an instrument panel type layout with round tach and speedometer gauges and bar graph type gauges for most other parameters. Barometric pressure, any diagnostic codes, status of the user input and output, and status messages are displayed in additional windows. If the engine is not running most values will appear as zero.

Displayed parameters include:

RPM – engine crankshaft RPM (numeric value displayed beneath gauge)

VSS – vehicle speed in MPH or KPH (numeric value displayed beneath gauge)

TPS – throttle position (0 to 100%)

TGS – twist grip position (0 to 100%)

MAP – manifold pressure in In-Hg (29.92 In-Hg or 101.3 kPa corresponds to atmospheric pressure)

ECT – engine coolant temperature (On TwinCooled™ models only). Coolant pump and cooling fans status also displayed.

ET – engine cylinder head temperature

IAT – intake air temperature

BAT – battery voltage

IAC – idle air control value in 0.1% throttle position units (higher number means more idle air)

AFR – the air/fuel ratio bar graph has dual pointers. The yellow pointer on the left side is the air/fuel ratio command (from AFR table). The white pointer on the right side is the actual air/fuel ratio based on the exhaust gas oxygen sensor reading. Note that the value will remain near 10 until the sensor has warmed up. Front and rear cylinder AFR values are displayed for all TCFI Gen 7 units when the WEGO IIID is installed.

BLM – block learn multiplier (main fuel table correction factor based on exhaust gas oxygen sensor feedback, shown as percent value from 75-125%). Separate front and rear cylinder BLM values are displayed.

FRONT INJ, REAR INJ – injector pulse width in milliseconds or duty cycle in percent

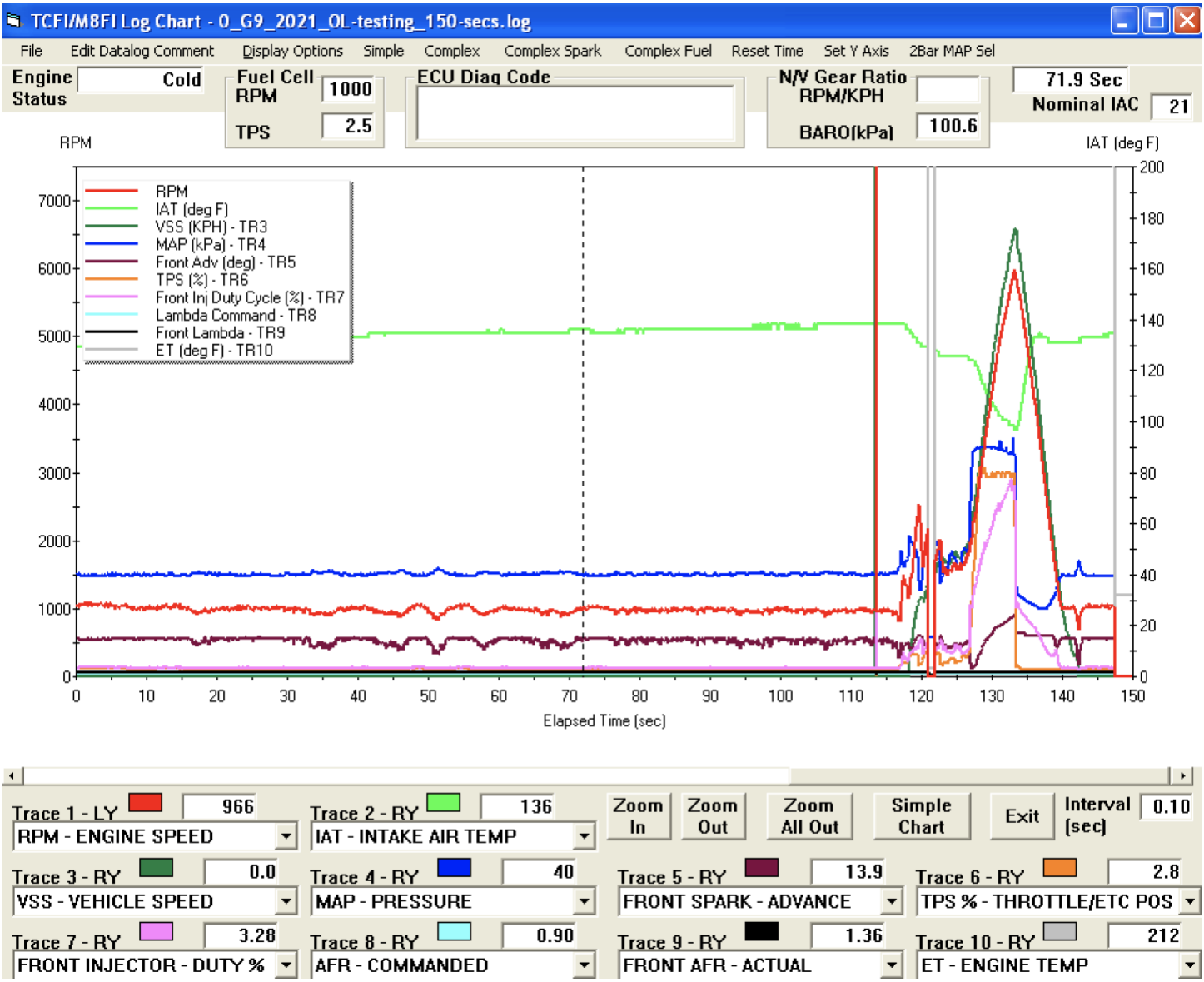
FRONT ADV, REAR ADV – ignition advance in degrees BTDC

You can also select the vehicle speed, temperature, pressure, and injector data units used for real time engine data display and data logging chart display. Use the Configuration & Units Selection command File→Configure Units – Program Options (NEW). A dialog box will appear and you can select miles per hour (MPH) or kilometers per hour (KPH) vehicle speed units, Fahrenheit (F) or Celsius (C) temperature units, inches of mercury (In-Hg) or kilopascals (kPa) manifold pressure units, pulse width in milliseconds or duty cycle in percent for injector data, and air/fuel ratio in gasoline AFR or Lambda units. The program remembers the selections you have made.

Scan + DOWNLOAD LOGGED DATA + View Chart

You can download and display the data that is automatically logged by the ECU into a chart recorder type screen. The data logging memory within the ECU stores the last 60 minutes of data at 10 samples/second. Clicking this command will automatically connect to the ECU and allow you to Download logged data for review. You can select the length of the data set that will be downloaded. Once data has been downloaded, it is automatically displayed. **The last data logged will appear at the right end of the chart.** You can save the data by using the Save File command from the File menu after closing the chart display (data is not lost by closing the chart display). You can display a previously saved data file by first using the Open File command on the File menu and then using the View Chart command on the View menu. Each time the engine is started or shut off, the log will automatically start a few seconds prior to the engine running and turn off a few seconds after it stops running.

⚠ **Remember** → Real time engine display data cannot be directly saved via the TCFI_Log.exe program. However, this data is constantly being logged by ECU and it can be downloaded and saved (for example at the end of series of dyno runs). All saved data files use the file extension: .log. It is recommended to create a separate folder to store these files.



You can select up to ten parameters to display and graph. The X axis is always elapsed time. Trace 1 is displayed in red with its Y axis legends on the left side of the chart. Trace 2 is displayed in green with its Y axis legends on the right side of the chart. The other trace colors are built into the graph and they are always the same, in the same order. You can zoom in, zoom out, or zoom all (displays entire data file). At the maximum zoom in level, approximately 100 data samples will be displayed on the chart. You can use the scroll bar to move the chart display window in terms of elapsed time. If you hold the left mouse button down within the chart area, a cursor line appears. The exact values of the selected parameters are displayed above each trace box. If you want to see use a parameter's range on chart's display, the selected parameter needs to be selected as either trace 1 or 2, or you can select Set Y Axis and setup customer ranges for the signals. When you zoom in or zoom out, the displayed data will always be centered about the cursor line. This allows you to quickly select and closely examine an area of interest. As you move the cursor, the current value displayed above each parameters is updated. If you want to analyze the elapsed time between two events (for example the time required to accelerate from 0 to 60 MPH), you can move the cursor to the first event and then click on the Reset Time Display button. You can also print the displayed chart to any Windows printer by clicking on the Print button.

Data parameters include:

RPM – engine crankshaft RPM

VSS – vehicle speed in MPH or KPH

MAP – manifold pressure in In-Hg (29.92 In-Hg or 101.3 kPa corresponds to atmospheric pressure)

TPS – throttle position (0 to 100%)

TGS – twist grip position (0 to 100%)

AFR CMD – air/fuel ratio command (10:1 to 20:1). This is the AFR value the TCFI is attempting to maintain.

FRONT AFR, REAR AFR – air/fuel ratio based on the exhaust gas oxygen sensor reading (10:1 to 20:1). Front and rear cylinder AFR values are displayed for all TCFI Gen 7 units when the WEGO IIID is installed.

FRONT BLM, REAR BLM – block learn multiplier (main fuel table correction factor based on exhaust gas oxygen sensor feedback, shown as percent value from 75-125%). Separate front and rear cylinder BLM values are displayed.

IAC – idle air control value in 0.1% throttle position units (higher number means more idle air)

IAT – intake air temperature

ET – engine cylinder head temperature

COOLANT TEMP – engine coolant temperature (on TwinCooled models only)

COOLING PUMP – On/Off pump operation (on TwinCooled models only)

COOLING FANS – On/Off fan operation (on TwinCooled models ony)

FRONT INJ, REAR INJ – injector pulse width in milliseconds or duty cycle in percent

FRONT ADV, REAR ADV – ignition advance in degrees BTDC

BAT – battery voltage

USER IN – user input displayed as digital (on/off) signal. On means that the input is active (grounded).

USER OUT – user output displayed as digital (on/off) signal. On means that the output is grounded.

CLUTCH – On means that the clutch is pulled in

BRAKE – On means that a brake has been applied

NEUTRAL – On means that neutral light is illuminated (transmission in neutral)

TGS ROLLOFF – On means the twist grip is in the roll-off position

CRUISE ENABLE – On mean the cruise switch is on.

CRUISE ENGAGED – On means the cruise control system is controlling vehicle speed

CRUISE SET – On means the cruise set button is pressed

CRUISE RESUME – On means the cruise resume button is pressed

ETC PWM – ETC system pulse width modulation command to the TCA motor (±100% range with negative values below limp back and positive values above)

⚠ **Additional ECU information is displayed at the top of the screen. This data includes:**

ECU Diag Code – Normally blank unless a diagnostic code is set.

Engine Status – Statis based on engine temperature – Cold or Warm

Fuel Cell Display –Active cell in terms of RPM and TPS percent at the cursor position. TPS percent is compensated for idle air. This function is useful for determining what fuel table cell is active at any given point in time. The same RPM and TPS cell is active in all fuel tables.

N/V Gear Ratio Display – shows the calculated gear ratio (RPM/KPH) at the cursor position. This function is useful for determining the 6th gear ratio required for Module Parameter setup in PC Link TCFI for the 6th gear indicator light.

BARO(kPa) Display – current barometric pressure

Nominal IAC Display - Nominal IAC value (value learned by system when engine is completely warmed up and at stable idle condition).

Interval(sec) – the actual data logging interval in seconds

IMPORTING DATA INTO EXCEL

Data files saved from TCFI_Log.exe are in comma delimited ASCII format. You can easily import a saved .log data file into other programs such as Microsoft Excel for further analysis. You can also view data files with a text editor such as Windows WordPad. To import a data file into Excel:

1. Start Excel. In the File Open dialog box, select Files of type: All Files (*.*). Then browse for the data file.
2. The Text Import Wizard appears. For step 1, select delimited file type. For step 2, select comma delimiter. For step 3, select general column data format. Then click on Finish.
3. You can then format the data and save the spreadsheet as an Excel file.

📌 *SPECIAL FEATURES*

Special Features→ETC Test Mode

The ETC Test Mode command on the Communications menu has two options that allow you to test the electronic throttle control system without the engine running:

Manual test. Throttle control actuator (TCA) throttle position follows twist grip sensor (TGS) command. This option is useful for a quick check of TCA operation. Enter “1” to enable ETC manual test mode or “0” to disable. Then select View Real Time Data on the View menu to view TGS and TPS data.

Characteristic curve. The system plots out the characteristic curve of TCA throttle position versus TCA motor pulse-width modulated (PWM) drive. This option allows detection of defects such as excessive friction, incorrect or noisy TPS signals, and broken gear teeth. Refer to Appendix A for more details.

Special Features→USER OUTPUT MANUAL OVERRIDE

The User Output Manual Override command allows you to manually override the user output on the ECU. This command can be used as a diagnostic aid to test accessory systems connected to the user output.

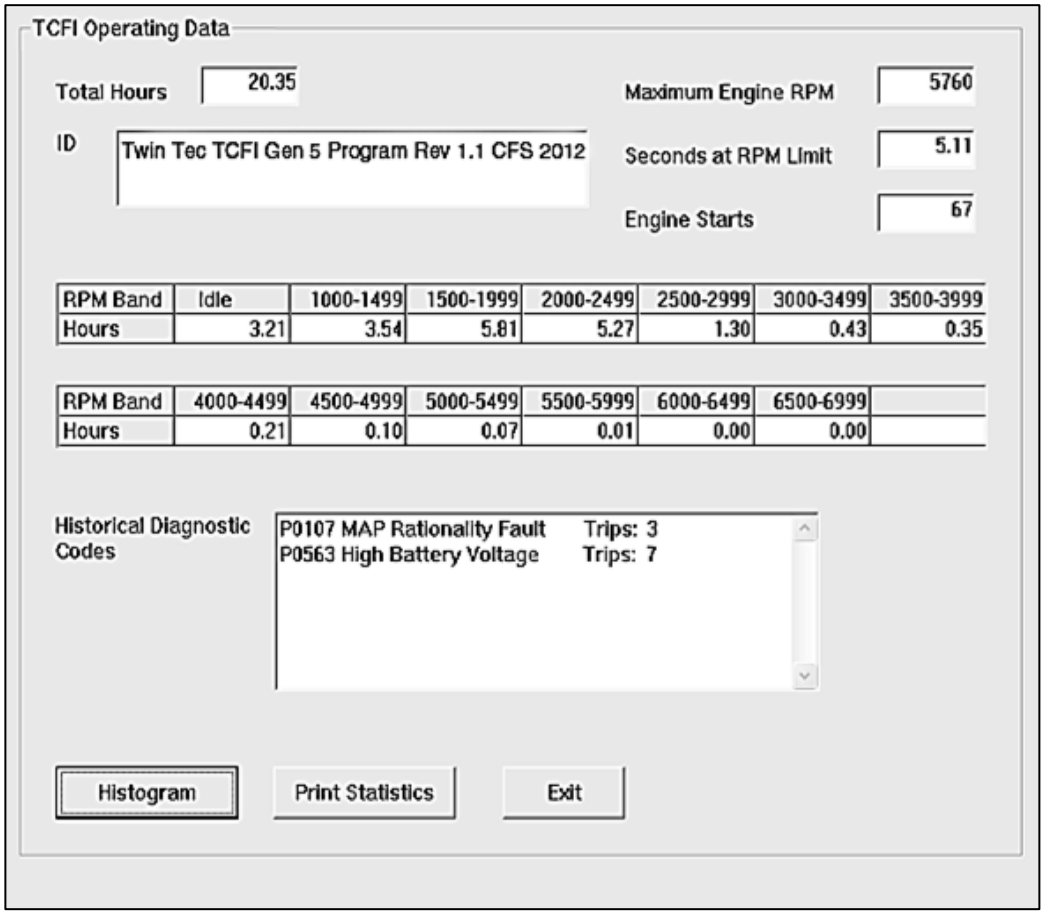
OPERATING STATISTICS

You can also display and download engine operating statistics logged by the TCFI unit. Data logged by the TCFI unit must be downloaded before it can be displayed, by using the **Download and View Statistics/Diagnostic Codes/ Diagnostic Codes** command on the **View and Download Logged ECU Data** menu. Once data has been downloaded, it will automatically be displayed. Please note that this data is not saved.

The data is fairly self-explanatory. Total hours represents the total time that the engine was running. ID represents the firmware identification. This field typically includes the manufacturer (Twin Tec), model number, program revision and author's initials, and date. Note that the date is not a manufacturing date code, just the date for the particular firmware release.

Elapsed time is displayed for 13 RPM bands from idle to 6999 RPM. Note that elapsed time data is rounded off during each engine run, so the sum of the elapsed time figures may not precisely match the total hours. The program also displays the maximum engine RPM, time at the RPM limit (in seconds for better resolution) and the number of engine starts.

Clicking on the Print Statistics button prints a report. When you click on this button, a small data entry screen pops up and allows you to add a serial number or comment that will appear on the printout. You can also use the Print command from the File menu.



Any historical diagnostic codes logged by the TCFI unit 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.

Customers are often confused about the meaning of the term "trips." This 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.

You can clear historical diagnostic codes by using the **Clear Historical Diagnostic** Codes command from the **Special Features** menu.

The elapsed time data in the various RPM bands can be displayed in the form of a histogram chart by clicking on the Histogram button. Color coding of the bars helps to interpret the data. The idle RPM band is blue, normal operating RPM bands are green and high RPM bands are yellow and red. The chart is automatically scaled for best display. You can print the chart along with a complete statistics report by clicking on the Print Chart button.

BASIC TUNING RECOMMENDATIONS AND PROCEDURES

ENGINE STARTING PROCEDURE

With alpha-N fuel control, the proper engine starting procedure must be followed. When the run/stop switch is turned on, the ETC system runs an auto-calibration routine that establishes the zero (closed throttle) position. During this time, the check engine light is on and the fuel pump is energized for several seconds,

making an audible buzz. Do not press the starter button until the check engine light goes out and the fuel pump stops buzzing.

We recommend that you let the engine idle for about 20-30 seconds before operating the motorcycle. This allows the closed loop idle air control system to stabilize idle RPM.

IDLE TUNING

Please note that during the initial period after engine start, fuel control is open loop (no feedback from the WEGO sensors) and relies entirely on correct values in the Alpha-N table. The TCFI will enter closed loop AFR control mode after the WEGO warm up time (nominal value of 30 seconds) has elapsed.

To allow viewing and logging AFR data immediately after engine start, turn the ignition switch on but leave the run/stop switch in the stop position. Wait at least 15 seconds for the WEGO sensors to warm up and then start the engine. Monitor engine data and status with TCFI Log software.

Allow the engine to idle until it reaches normal operating temperature of 110° C or 230° F. A fan should be used to direct cooling air on the engine to more realistically simulate actual warm up conditions and prevent the engine from overheating. If the engine does not start or stalls, please refer to the diagnostic tips at the end of this section.

Monitor front and rear cylinder AFR and BLM, engine temperature, and IAC values. Keep notes on your observations of these values. After 30 seconds, the system should be operating in closed loop and maintaining the desired idle AFR (nominal value of 13.5). The BLM values should remain within the range of 80-120%. The IAC value should slowly go down as the engine reaches operating temperature and requires less idle air.

BLM values below 100% indicate that the TCFI is removing fuel in closed loop to correct a rich condition. BLM values above 100% indicate that the TCFI is adding fuel in closed loop to correct a lean condition.

If the BLM values go below 80% or above 120% anytime during the warm up period, the system is running out of adjustment range and the idle cells in the Alpha-N fuel table should be edited before proceeding with further tuning.

Download the current setup with PC Link TCFI software and use the Edit 3D Table – Alpha-N Table command to edit the idle cells in the Alpha-N fuel table. Depending on engine temperature, IAC value and idle RPM, the TCFI will be using the cells in the 750, 1,000, 1,250, and 1,500 RPM columns and the 0%, 2.5% (IAC between 15-40), and 5% TPS (IAC above 40) rows. You can select all these cells, right click the mouse, and then use the Modify command on the pop-up menu. Add a percentage corresponding to the BLM error. For example, if the worst-case BLM value noted was 120%, add 20% fuel by entering +20% (not +20). Likewise, if the worst-case BLM value was 80%, subtract 20% fuel by entering -20%. Remember to use the Save Table Edits to Buffer command after editing the table. Then use the Edit 3D Table – BLM Tables – Reset BLM Tables command to reset all BLM values to 100%. Save the edited setup file to disk and upload it to the TCFI.

As mentioned above, the IAC value should slowly go down as the engine reaches operating temperature. The IAC value should drop to near the nominal value (15-30 as set under basic module parameters). If the IAC value stays above 40 or drops below 15, there may be an electromechanical problem with the TCA or a manifold vacuum leak (very low IAC).

After making any required edits repeat the start test and allow the engine to reach normal operating temperature. **Make sure the engine runs for at least 5 minutes and the status display shows warm closed loop operation – otherwise BLM values will not be saved.**

The idle tuning step is complete when BLM values stay within the range of 85-115% during the warm up phase and the IAC value is within the range of 15-30 once the engine reaches normal operating temperature. If these criteria cannot be met, please contact our tech support before proceeding.

Diagnostic tips if the engine does not start:

1. Verify that the TCFI is properly installed and set up, that the battery is fully charged, and that the engine is not flooded from excessive priming caused by repeatedly cycling the run/stop switch during setup. Disconnect the fuel pump relay and crank the engine to clear flooding.
2. Try the following starting procedure: set the run/stop switch to run, wait until the fuel pump stops running, slightly open the throttle, and then press the starter switch. If the engine starts, the problem may be insufficient air caused by an incorrect IAC value. Please contact our tech support before proceeding.
3. Ether starting spray can be used as a diagnostic aid. Try starting the engine after an application of ether spray. If the engine starts and runs at a normal idle RPM, the problem is insufficient fuel. Try increasing the priming and cranking fuel values by 10-20%. Download the current setup with PC Link TCFI software and use the Edit 2D Table – ET Based Priming Fuel Table and ET Based Cranking Fuel Table commands. Select all cells, right click the mouse, use the Modify command on the pop-up menu, and enter +10% (not +10). Remember to use the Save Table Edits to Buffer command after editing each table. Save the edited setup file to disk and upload it to the TCFI. Retest and repeat if additional fuel seems to be required.
4. If larger fuel injectors were installed, cranking and priming fuel values may need to be decreased. Try decreasing the priming and cranking fuel values by 20%. Download the current setup with PC Link TCFI software and use the Edit 2D Table – ET Based Priming Fuel Table and ET Based Cranking Fuel Table commands. Select all cells, right click the mouse, use the Modify command on the pop-up menu, and enter -20% (not -20). Remember to use the Save Table Edits to Buffer command after editing each table. Save the edited setup file to disk and upload it to the TCFI.
5. Try re-installing the stock ECM. If the engine does not start with the stock ECM, there may be an underlying problem that requires correction. If the engine starts with the stock ECM but not the TCFI, please contact our tech support for assistance.

Diagnostic tips if the engine stalls:

1. If the engine momentarily starts, runs for several revolutions (less than 2 seconds), and then stalls, priming and cranking fuel values may be insufficient to build up the required fuel film in the intake manifold. Try using ether starting spray or cycling the run/stop switch several times to add additional priming fuel before starting the engine. If the engine starts normally, you have confirmed that more fuel is required. Try adding 10-20% more priming and cranking fuel as explained in Paragraph 2 in the preceding section.
2. If the engine stalls after running for several seconds, observe AFR values. To do this you must allow the WEGO sensors to warm up for at least 15 seconds before starting the engine. You can observe data in real time or download data logged using TCFI Log. For best results, select the 10 samples/sec download option. In most cases, the problem is caused by excessively lean AFR. Based on observed AFR values, make appropriate corrections to the idle cells in Alpha-N table. If the AFR is lean, try adding 10-20% fuel (use the procedure explained on page 6). If this does not solve the problem, please contact our tech support for assistance.
3. In some cases, changes to the cold start enrichment tables may be required. There are independent ET (engine temperature) based front and rear cylinder cold start enrichment tables. To allow viewing and logging AFR data immediately after engine start, turn the ignition switch on but leave the run/stop switch in the stop position. Wait at least 15 seconds for the WEGO sensors to warm up and then start the engine.

Monitor engine data and status with TCFI Log. Download the logged data. Compare the front and rear AFR values after engine start to determine if adjustments are required. Refer to the TCFI Idle Tuning Tech Note for more details.

AUTO-TUNING

The closed loop auto-tuning process consists of operating the motorcycle through a wide range of loads and speeds while periodically monitoring progress using the PC Link TCFI software. Long rides at constant speed and load are of no value. The best technique is to very slowly accelerate through the useable RPM range in every gear, allowing several seconds of operation in each RPM and throttle position-based cell. Also operate the motorcycle at various fixed speeds likely to be encountered during normal riding. For safety reasons, wide open throttle runs should be done on a closed course.

We recommend auto-tuning under actual riding conditions. If this is not possible, you can auto-tune on a load control dyno and use TCFI Log to monitor AFR and other engine parameters.

If AFR values appear very lean (above 14.5), we suggest that you edit the Alpha-N table to add 15-20% fuel to all cells except idle cells before proceeding. Auto-tuning works best if you start with a slightly rich Alpha-N table. Download the current setup with PC Link TCFI software and use the Edit 3D Table – Alpha-N Table command. You can select groups of cells, right click the mouse, use the Modify command on the pop-up menu, and enter +15% (not 15). Remember to use the Save Table Edits to Buffer command after editing each table. Save the edited setup file to disk and upload it to the TCFI.

After 1-2 hours of engine operation, download the current setup with PC Link TCFI software and use the Edit 3D Table – BLM Tables – Edit Front and Edit Rear BLM Table commands to examine the BLM tables. Cells that are shaded red indicate that the system has run out of correction range. Then use the

Apply Front and Apply Rear BLM Table commands to automatically correct the Alpha-N fuel table and front cylinder trim table. This also resets all the BLM values back to 100% and allows auto-tuning to continue. Save the edited setup file to disk and upload it to the TCFI.

Auto-tuning is a statistical process. The longer the operating time, the greater the probability that more cells will be covered. However, even a varied operating cycle can miss some cells. After you use the Apply BLM Table commands, take some time to examine the modified Alpha-N and front cylinder trim tables. Unless your engine has some unusual camshaft and exhaust interactions, the tables should appear smooth (with gently rising slopes). If you spot sharp spikes or dips, these cells have probably been missed during auto-tuning and will require some manual edits to smooth them into the surrounding terrain.

The Alpha-N table represents percent injector pulse width (fuel flow) before correction for BLM, front cylinder trim, barometric pressure, intake temperature, and cold start enrichment. You can use the following guidelines to smooth the Alpha-N table:

1. At part throttle (low TPS%), Alpha-N values in each row will tend to decrease as RPM increases (because the throttle is choking air flow).
2. At wide open throttle, Alpha-N values in each row will tend to follow the engine torque curve.
3. In any given RPM column, Alpha-N values must always increase with TPS.

The front cylinder trim table may appear more complex and irregular, with peaks and valleys corresponding to gas flow interactions within the intake and exhaust system. However, very sharp spikes and dips may require some smoothing.

If you edit the Alpha-N or front cylinder trim table to smooth out values, remember to use the Save Table Edits to Buffer command after editing each table. Save the edited setup file to disk and upload it to the TCFI.

Continue to operate the motorcycle under varying conditions for another 1-2 hours. Then repeat the process of downloading setup data, examining the BLM tables, using the Apply BLM Table commands, smoothing the Alpha-N and front cylinder trim tables, saving, and uploading back to the TCFI as previously described.

Continue this auto-tuning process until most of the BLM cells remain in the 90-110% range.

If spark knock is noted under wide open throttle or throttle roll-on, use PC Link TCFI software to edit the ignition advance table and reduce the ignition advance 3-5 degrees under the conditions that cause spark knock. Using the TCFI Log software to examine engine data may be very helpful for determining exactly what manifold pressure and RPM values were encountered. A common error is to assume spark knock only occurs at high MAP (manifold absolute pressure) values. Large displacement engines are prone to spark knock at relatively low MAP values during throttle roll-on. You may need to reduce the ignition advance throughout the entire MAP range.

FUEL INJECTOR SIZING

Accepted engineering practice is to use the smallest possible injectors (in terms of flow) for best control at idle and part throttle. The original equipment throttle body and similar aftermarket units with Siamese runners are subject to fuel imbalance problems between the front and rear cylinders. When the fuel injector duty cycle exceeds 50%, fuel will start being inducted into the wrong cylinder (i.e. front injector spraying fuel while rear intake valve is still open). **The TCFI system cannot correct this problem.**

Table 1 lists conservative horsepower limits based on injector size. You can use TCFI Log software to check the injector duty cycle at wide open throttle.

Recommended Horsepower Limits

Injector Size	Horsepower Limit
4.34 gm/sec (stock)	100 HP
4.89 gm/sec (Screamin Eagle® P/N 27654-06)	110 HP

IDLE TUNING CONSIDERATIONS

Some large displacement engines with high overlap/long duration camshafts may not idle properly at the nominal 1,000 RPM and 13.5 AFR settings used in the standard setup files. You may have to increase the idle RPM to a higher value such as 1,100 RPM and enrich the idle to 12.5-12.8 AFR.

Download the current setup with PC Link TCFI software and use the Edit 2D Table – ET Based Idle RPM command to increase the idle RPM. Do not decrease values at the left of the table (corresponding to a cold start condition) that are already higher than your desired idle RPM. If you significantly increase idle RPM, you may also have to make corresponding edits to the ET Based IAC Position table. Then use the Edit 3D Table – AFR Table command and change the applicable idle cells (750 -1,500 RPM at 0-5% TPS) to the desired AFR value. Remember to use the Save Table Edits to Buffer command after editing each table. Save the edited setup file to disk and upload it to the TCFI.

DYNO TUNING CONSIDERATIONS

Auto-tuning using the procedures listed on page 7 will get you within a few horsepower of the maximum that the engine can deliver. If you decide to do dyno tuning for maximum power, you can experiment with wide open throttle (WOT) ignition timing and AFR. **Please pay careful attention to the following dyno tuning considerations:**

1. **Only edit the ignition advance and AFR tables.** Don't edit any other tables (never make any changes to the BLM or Alpha-N tables once auto-tuning is completed). The usual range for WOT ignition timing at 4,000-6,000 RPM is about 28-34 degrees BTDC. The usual range for WOT AFR is about 12.5-12.8. Some engines may require a richer mixture, possibly down to 11.5, to avoid detonation problems.
2. **The TCFI should be operated in closed loop.** Make sure that the engine is warmed up (oil temperature is in the 150-180° F range) before doing a run and that engine status in TCFI Log shows closed loop operation. If you have made any table edits, allow one run for auto-tuning before capturing data.
3. **Inadequate air flow for engine cooling is a major problem with many dyno systems.** Always let the engine cool off between dyno runs. The use of a separate heavy duty industrial grade fan capable of generating at least 50+ MPH air velocity at the front of the engine is recommended. You can measure the air velocity with a handheld anemometer such as Extech P/N 45118 available from Grainger.
4. **Use the TCFI data logging capability.** Always download data with TCFI Log software at the end of every run and study the results (use the 10 samples/sec download option). Check engine and air temperatures, throttle position, manifold pressure, and AFR. TCFI Log is a very powerful tool that can help you identify potential problems that may be affecting engine performance. Inconsistent dyno test results are often the result of thermal problems (engine temperature variations or hot soak effects).
5. **Dyno exhaust sniffer limitations.** Some of the older sniffers monitored CO and CO_2. These systems are so slow and inaccurate that they should be totally disregarded. Modern sniffers from Dynojet and Horiba use a wideband sensor similar to the WEGO sensor. These sniffers are still subject to erroneous lean readings caused by reversion of atmospheric oxygen if the probe cannot be inserted past the baffles in the exhaust. Sensor degradation caused by leaded racing gas is a common occurrence. Another problem is sampling delay due to the long hose between the sniffer tip and actual sensor. The bottom line is to trust your WEGO sensors and disregard any errant readings from an exhaust sniffer.

ENGINE TUNING GUIDELINES

Higher AFR values correspond to a leaner (less fuel) condition. The practical operating range for most engines using gasoline fuel is from approximately 11.5 to 14.7 AFR. Combustion of a stoichiometric mixture (exactly enough air to burn all the fuel) results in 14.7 AFR indication. Automotive engines with catalytic converters operate near 14.7 AFR during cruise and idle. Air-cooled motorcycle race engines usually require a richer mixture to limit cylinder head temperature and prevent detonation. Table 2 lists recommended AFR values for race engines without emission controls.

Recommended AFR Values

Operating Mode	Recommended AFR
Cold Start (first 30 sec)	11.5-12.5
Idle	12.8-13.5
Part Throttle Cruise	13.0-14.0
Wide Open Throttle	12.5-12.8 (values down to 11.5 may be used to reduce detonation)

EXHAUST CONSIDERATIONS

The use of a WEGO system for closed loop fuel control places constraints on the choice of exhaust system. The WEGO system may give inaccurate results in certain situations:

Exhaust reversion. Reversion is the term for a negative pressure wave that can suck ambient air back into the exhaust and cause an erroneous lean AFR indication. Reversion effects will be most noticeable at idle, part throttle low RPM cruise, and decel. Open drag pipes suffer from reversion effects. Please note that if you use drag pipes or other open pipes, auto-tuning may not be possible at idle or part throttle due to reversion effects. In this case, you have three options:

1. Modify the exhaust to allow auto-tuning at idle and part throttle by adding a restriction such as the washers shown in Figure 1 or some other type of baffling. For race applications, you can remove the restriction after auto-tuning the idle and part throttle cells and then lock out closed loop operation by using the special value 0 in the BLM tables for these cells.
2. Use a rubber hose to extend the exhaust length during auto tuning at idle and part throttle. For more information, please contact our tech support.
3. Manually tune the fuel tables for idle and part throttle cells. This involves trial and error and is not recommended. Closed loop operation in idle and part throttle cells must be locked out by using the special value 0 in the BLM tables for the affected cells.

You can reduce reversion effects in open drag pipes and mufflers without restrictive baffles with the modification shown in figure below. Use washers with an OD that is 2/3 to 3/4 the ID of the pipe (for example, 1-1/2” OD washers are suitable for pipes with an ID of 2” to 2.25”). Weld ¼-20 socket head cap screws to the washers as shown. Drill holes at the bottom of the pipes about 2” from the end and use decorative acorn nuts to secure the washer assemblies. We suggest that you use stainless steel hardware.

The washers will reflect positive pressure waves that will cancel out the negative pressure waves reflecting from the end of the pipes. You can turn the washers just like throttle blades to provide more or less restriction. Dyno tests will show a significant increase in midrange torque and a small drop in top end horsepower as the restriction is increased.

Note: If you can insert a broomstick through the mufflers, you have the equivalent of open drag pipes and the WEGO sensors will not read accurate AFR values, except at wide open throttle.

Reducing reversion effects in open drag pipes

Excessive scavenging. Tuned exhausts in combination with a high overlap camshaft profile can pull unburned air and fuel mixture through the cylinder into the exhaust and cause an erroneous rich AFR indication. Some aftermarket 2-into-1 systems, such as the Thunderheader appear to suffer from this problem, whereas others such as the Supertrapp seem less affected.

Misfiring. If the AFR is so rich that the engine misfires, high levels of oxygen will remain in the exhaust gas and result in an erroneous lean indication.

HOT STARTING PROBLEMS

Some engines are prone to hot starting problems. When cranked after a short hot soak, the engine may "kick back." Over time, this will cause damage to the ring gear and starter pinion.

The TCFI module uses an improved starting algorithm that includes a programmable cranking delay. The TCFI module is shipped with a zero-cranking delay: it fires on the first recognized compression stroke. This works best on stock and mildly modified engines.

High compression engines will generally require compression releases. When compression releases are installed, best starting results will be obtained by programming the TCFI module for a 1-2 revolution cranking delay. This can be done by means of the PC Link TCFI software.

SPARK KNOCK PROBLEMS WITH HIGH COMPRESSION ENGINES

Spark knock problems may be encountered with high compression engines. If engine parts were "mixed and matched" from different suppliers, the actual compression ratio may differ substantially from the expected value. You cannot estimate compression ratio with cranking compression tests, as camshaft timing usually causes an erroneous low reading.

To accurately calculate compression ratio, you must measure the combustion chamber volume and use the formula:

$$\text{Compression Ratio} = \frac{\text{(Head cc + Deck cc + Cylinder Volume)}}{\text{(Head cc + Deck cc)}}$$

The practical limit for compression ratio is about 10.5:1 to 11:1 when running 93 octane pump gas. Any higher compression ratio will require retarding the ignition timing to the point where more power is lost from the retarded timing than is gained from the higher compression.

If spark knock is encountered during operation, you can use the TCFI Log software to download data and examine the operating conditions (RPM and manifold pressure) where spark knock occurred. You can then make appropriate reductions to the ignition advance table. Large displacement, high compression engines are prone to spark knock at relatively low MAP values during throttle roll-on. You may need to reduce the ignition advance throughout the entire MAP range.

ACR SYSTEM

Engines on some models are equipped with an automatic compression release (ACR) system. The TCFI Gen 7 supports the ACR system. No modifications or other special considerations are required. The ACR output on pin 19 of the ECM connector is active during the cranking revolutions set under Module Parameters (refer to page 26) if this parameter is set to a non-zero value.

SUPPORT FOR TWINCOOLED™ ENGINES

2014+ engines that have factory liquid cooling systems can have full compatibility and adjustability with the use of version 1.80 firmware and PC Link 18.1 and TCFI Log 18.1. No hardware changes are necessary; however, you must have TCFI7 firmware version 1.80 to utilize the coolant pump and cooling fans (see TCFI Gen 7 Rev 1.80 Firmware Update Tech Note).
The coolant pump will run when the engine is running, or when the conditions below exist:
Fans are turned on based on coolant temperature and vehicle speed. These are the stock settings:
Fan On Temp Below VSS : 105°C. This is the temperature setting that fans will turn from zero vehicle speed up to the programmed vehicle speed.
Fan On Temp Above VSS: 118°C. This is the temperature setting at which the fans will remain on above the programmed vehicle speed.
Speed for above Fan Settings 24 KPH. This is the vehicle speed breakpoint that the fan logic will follow to turn on the fans.
Fan Off Hysteresis: 8°, any scale. This is a temperature hysteresis value so the cooling system doesn't constantly turn itself on/off.

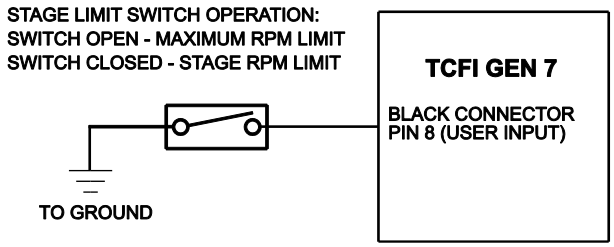
When the engine is switched off and the cooling system needs to continue running (ex: Turbo Timer), the following can be adjusted:
Engine Off Fan Timer: 180 seconds
Engine Off Cooldown Temp: 95°C

Finally, the coolant temperature, coolant pump operation, and fans operation are logged in version 18.1+ of the TCFI Log software.

USER FUNCTIONS

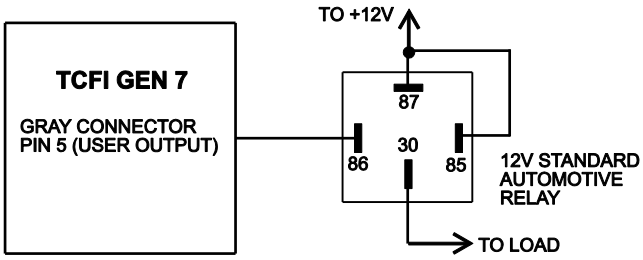
The TCFI user input on pin 56 of the ECM connector can be connected for a stage RPM limit function as shown in Figure 2. The stage limit switch must be normally open. You can use a microswitch attached to the clutch lever. When the clutch lever is pulled in, the switch contacts should close to activate the stage RPM limit. Refer to the User Functions section on page 28 for details on programming the stage RPM limit.

Stage Limit Switch Wiring Diagram



The TCFI user output on pin 20 of the ECM connector can drive a standard automotive relay connected as shown in Figure 3. When the user output is active, +12V power is applied to the load. Refer to the User Functions section on page 28 for details on programming the user output.

User Output Relay Wiring Diagram



CUSTOM BIKE AND AFTERMARKET ACCESSORY CONSIDERATIONS

Tight integration exists between the engine control module (ECM) and body control module (BCM) on Harley-Davidson® models with CAN data bus. It is not possible to run one of these models without a BCM.

The original equipment ECM has no connector terminal assignment for a tach signal. Engine RPM data is only available on the CAN data bus. Any aftermarket accessories that require engine RPM data will require an appropriate CAN data bus interface.

TECH SUPPORT

If you require tech support for tuning issues, we will ask you to start a Tech Support ticket at:

https://support.jmschip.com/support-help/

Attach both the current setup file (downloaded by means of PC Link TCFI) and a data logging file (downloaded by means of TCFI Log) that shows the problem. Please make sure that you include your full name, phone number, complete information about the engine setup, and a detailed description of the problem. We suggest that you call us first to discuss the situation.

ENGINE DIAGNOSTICS

The TCFI Gen 8 version has extensive diagnostics. When the ignition switch is first turned on, the check engine LED 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 TCFI 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.

P1607 refers to a diagnostic trouble code indicating a problem with the "Throttle Position Sensor (TPS) Signal Out of Range. Pops up within 5 sec after start.

P0371 indicates a problem with the "Timing Reference High Resolution Signal A" which is typically related to a faulty crankshaft position sensor, meaning the engine control module is detecting an abnormal signal from the sensor regarding the engine's position, potentially causing issues with ignition timing and fuel delivery; essentially, the bike's computer is not getting a clear signal about where the crankshaft is in its rotation cycle.

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 5 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.

How to tell if it is a sync issue or other problems: CEL will take longer to set is a sensor is faulty, example: if O2 sensors are not connected, it will not set a code for 30 seconds – that’s how you can tell the difference.

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 WEGO IIID unit. P0134 and/or P0154 will be set if the WEGO signal connection (white and blue wires) or WEGO power is lost. These codes may also be set if a Bosch sensor fails or becomes contaminated by leaded gasoline.

If the engine “pings” on hot start => reduce PW in function table “Priming Fuel PW vs Engine temp”

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

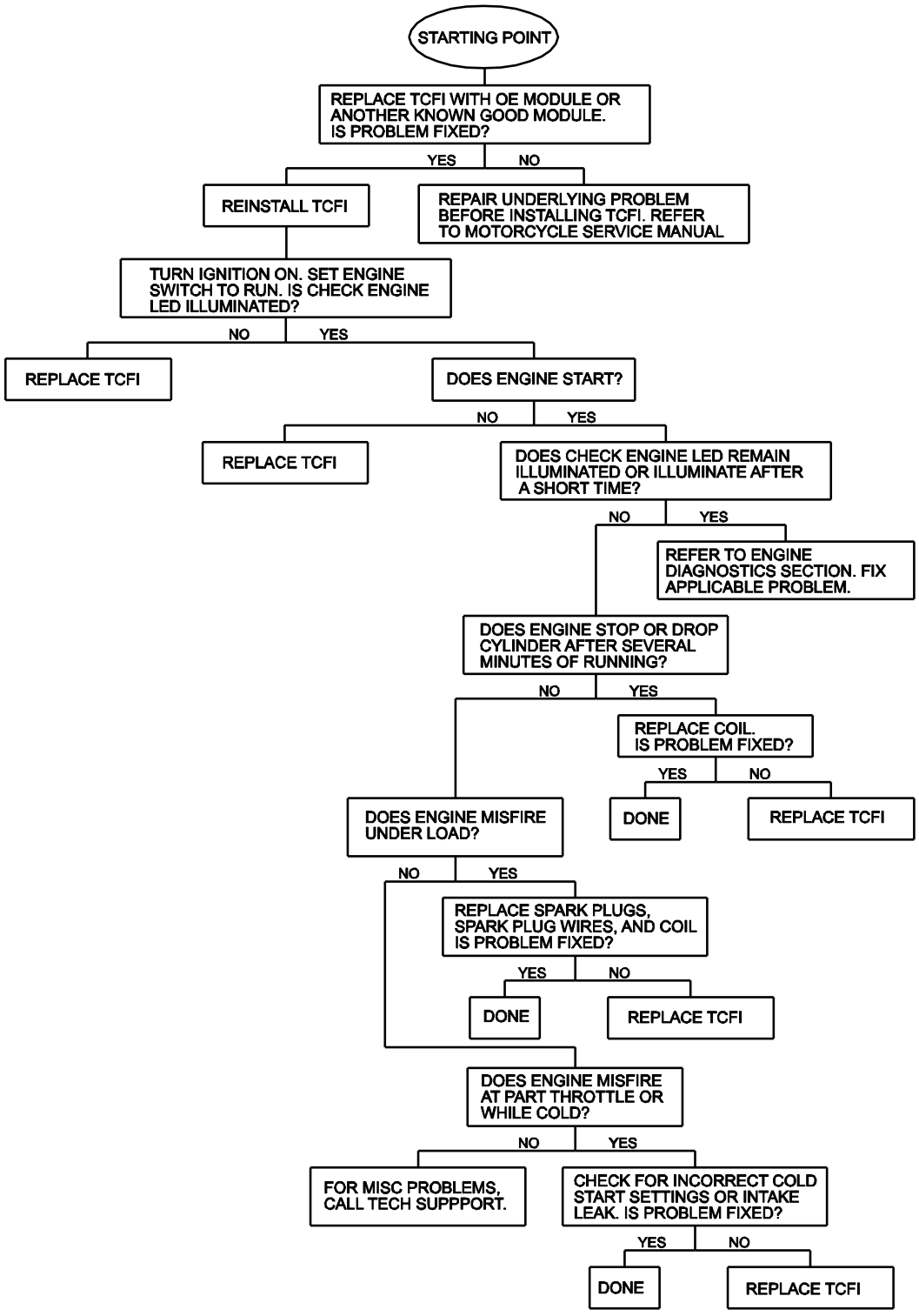
ET F	3	32	61	90	118	147	176	205	234	262	291	320	349	378	406	435	464
PW msec	33.02	26.88	18.43	8.45	4.86	3.07	2.05	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

REINSTALLING THE ORIGINAL EQUIPMENT ECM

Removal of the WEGO system is not required for simple operational tests such as verifying that the engine will start and run.

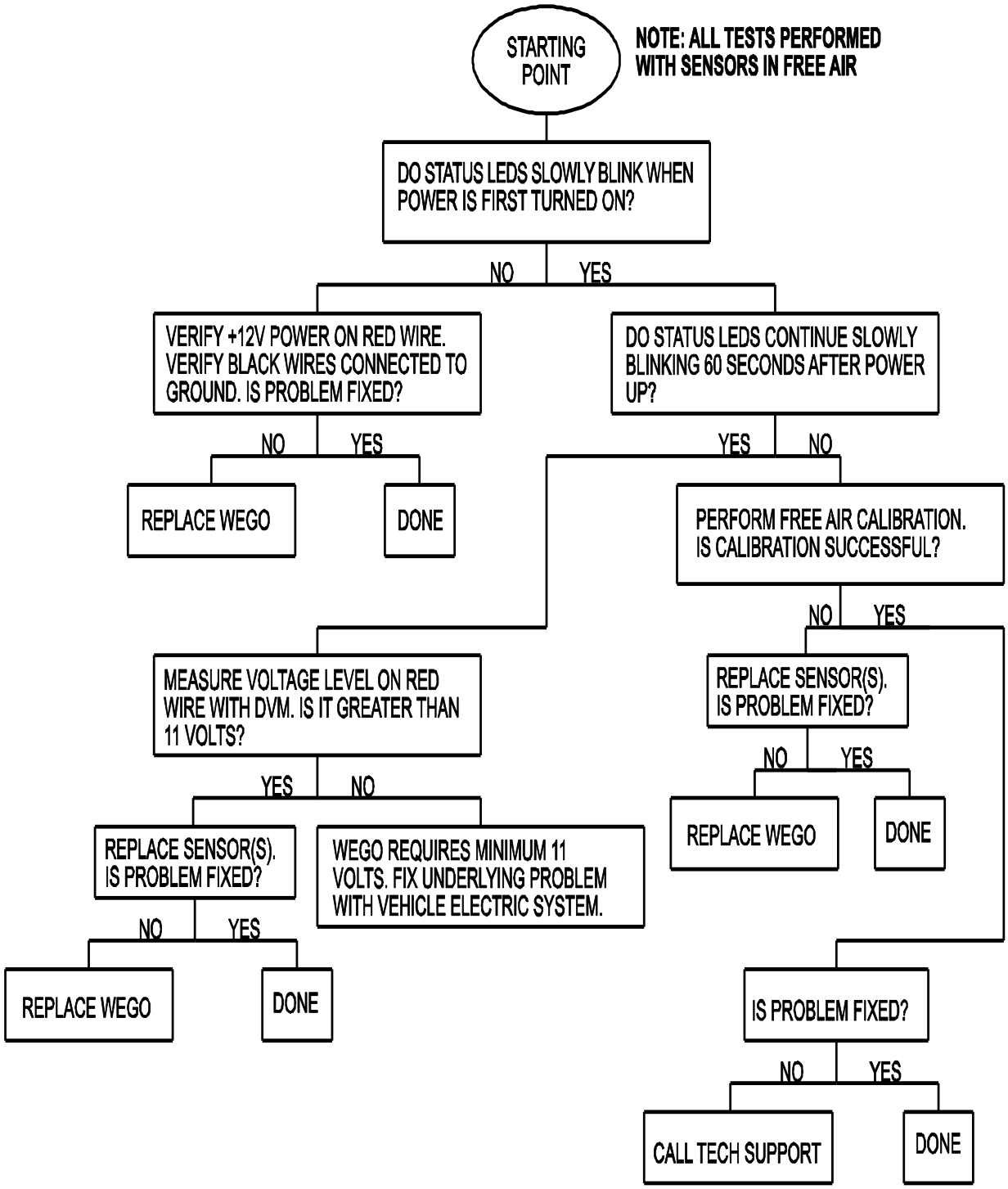
FAIL to START TROUBLESHOOTING FLOWCHAR

Experience has shown that most units returned for warranty are OK and another problem, such as user error including improper setup or tuning, an intermittent wire harness connection, or defective coil, fuel injector, or sensor is later identified.



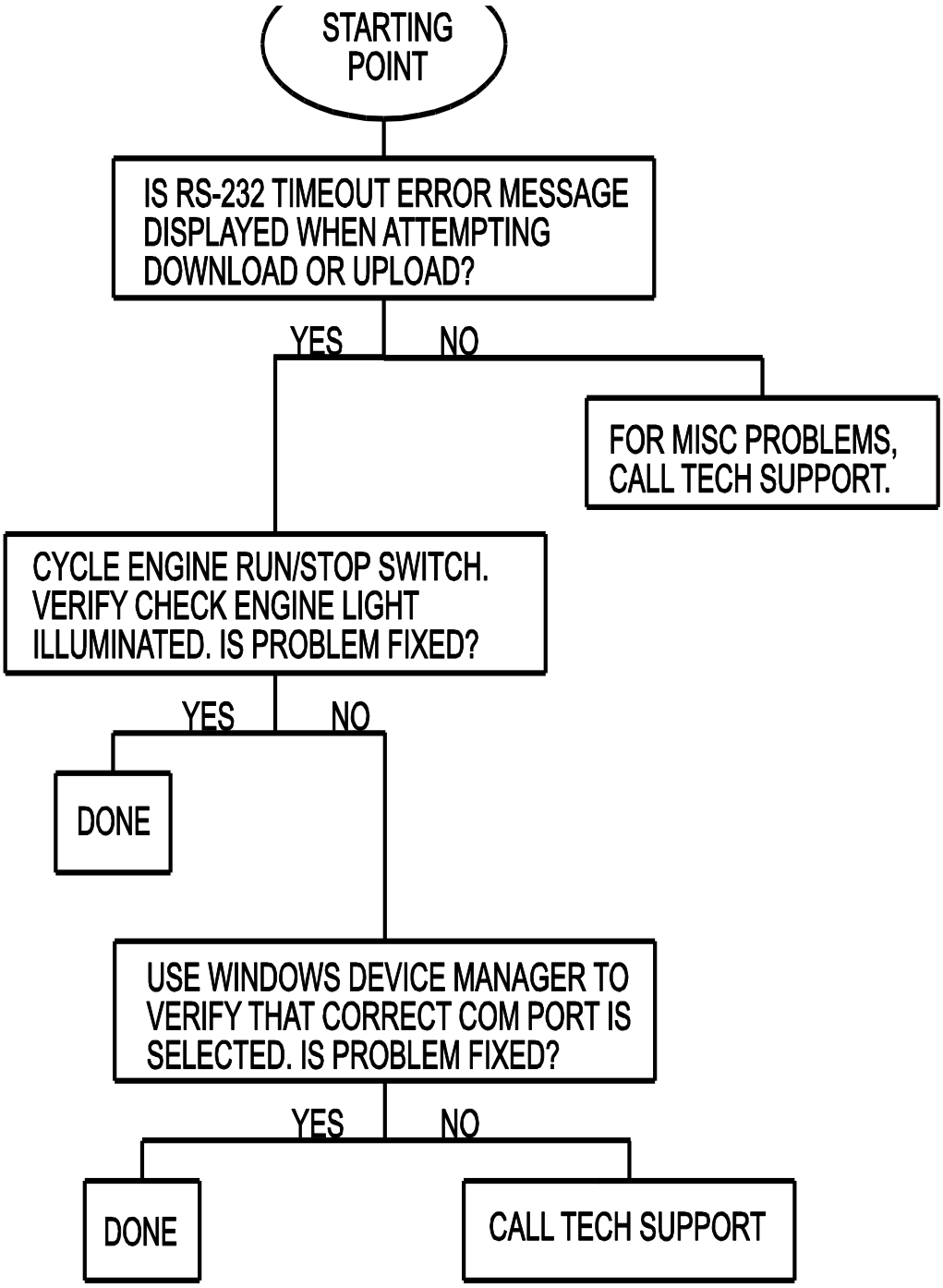
WEGO TROUBLESHOOTING FLOWCHART

Follow the troubleshooting flowchart shown below. Experience has shown that most units returned for warranty are OK and another problem, such as user error, a degraded sensor, or bad power connections is later identified.



COMMUNICATIUONS TROUBLESHOOTING FLOWCHART

Follow the troubleshooting flowchart shown below. Experience has shown that most communication problems are user error or PC compatibility issues.


STARTING POINT
IS RS-232 TIMEOUT ERROR MESSAGE DISPLAYED WHEN ATTEMPTING DOWNLOAD OR UPLOAD?
YES
NO
FOR MISC PROBLEMS, CALL TECH SUPPORT.
CYCLE ENGINE RUN/STOP SWITCH. VERIFY CHECK ENGINE LIGHT ILLUMINATED. IS PROBLEM FIXED?
YES
NO
DONE
USE WINDOWS DEVICE MANAGER TO VERIFY THAT CORRECT COM PORT IS SELECTED. IS PROBLEM FIXED?
YES
NO
DONE
CALL TECH SUPPORT