



INSTALLATION

The Twin TEC TCFI III system includes the TCFI III engine control module (ECM) and a separate WEGO IIID wide-band oxygen sensor interface. The TCFI III module directly plugs into the original equipment (OE) wiring harness. The WEGO IIID requires separate power and ground connections and two signal output wires that are attached to the OE ECM connector. The equivalent Thundermax closed loop system has the Auto-Tune (wide-band oxygen sensor interface) module mounted on top of the ECM. Connections to the ThunderMax ECM are made via the OE data link connector. During initial installation, this approach saves a few minutes time.

The Twin Tec WEGO IIID and supplied Bosch LSU 4.2 wideband sensors use small Deutsch 6 terminal connectors. The Thunderheart Auto-Tune module and supplied Bosch LSU 4.2 sensors use the large and bulky Bosch connectors. Routing these large Bosch connectors through narrow frame openings is difficult. Most shops have the terminals and crimping tool required to service Deutsch connectors as these are a standard connector family on Harley-Davidson® motorcycles. For custom installations on a Twin Tec TCFI III system, it is a relatively simple matter to shorten the oxygen sensor cables to the exact required length and crimp on new terminals (the connector housings are re-useable). This is not possible with the Bosch connectors used on the ThunderMax system.

BOSCH CONNECTOR USED WITH THUNDERMAX SYSTEM



DEUTSCH CONNECTOR USED WITH TCFI III SYSTEM



Figure 1 – Wide-Band Oxygen Sensor Connectors

Note that the large Bosch connector requires a minimum 1-1/2" diameter hole for clearance whereas the smaller Deutsch connector will fit through a 15/16" diameter hole.

PC COMMUNICATIONS LINK

The Twin Tec TCFI III system uses a USB interface cable that plugs into the original equipment (OE) Harley-Davidson data link connector. Direct access to the TCFI III module is not required. The OE data link connector is provided with a rubber seal that makes it impervious to moisture and dirt. The ThunderMax system uses an older technology RS-232 link with an unsealed mini-DIN style connector on the top of the module. No provision is made for protecting this exposed connector from moisture and dirt. In some applications, such as Dyna models, the module is not readily accessible and connecting the RS-232 link presents a major challenge. Most laptop computers manufactured within the last 3-4 years lack RS-232 serial ports and using the ThunderMax system with one of these newer laptops requires purchase of a separate USB adapter.



Figure 2 – ThunderMax with Unsealed Mini-Din Connector

SETUP AND AUTO-TUNING

Basic setup for the Twin Tec TCFI III and ThunderMax systems is very similar. In each case, a base map is uploaded to the module, a cold start is performed, the system is then allowed to auto-tune, and some final checks are performed. There are some subtle differences. The Twin Tec base maps are very generic and easily modified for particular applications by entering the estimated horsepower and injector flow rate. During the initial cold start with the ThunderMax, a special manual step is required for the system to learn the correct idle air control (IAC) values. This function is automatic and always active with the TCFI III.

Because of the odd RPM and throttle position increments and limited real time display capability (discussed in detail in the following sections) of the ThunderMax, auto-tuning on a dyno is difficult. With the TCFI III, auto-tuning on a dyno, such as common DynoJet units with load control, is straightforward. The dyno can be setup for stepped RPM runs with simple 250 RPM increments and the required throttle position increments are clearly displayed in real time with the Twin Tec data logging software.

SOFTWARE – EDITING TABLES

Twin Tec PC Link software allows easy editing of all engine control tables. Tables are displayed in industry standard format with 3D graphics and an associated spreadsheet. Editing is very difficult and tedious with the Thunderheart Smart Link software. For example, if a customer has a high compression engine that exhibits spark knock near wide open throttle in the 2000-3000 RPM range, a few simple mouse clicks suffice to select an RPM and manifold pressure range to edit in the Twin Tec PC Link software. In the Thunderheart Smart link software there are four individual tables each with many individual points that must be individually edited. Each point on each table must be selected with the mouse and then keyboard strokes (up or down arrow) are required to change each point.

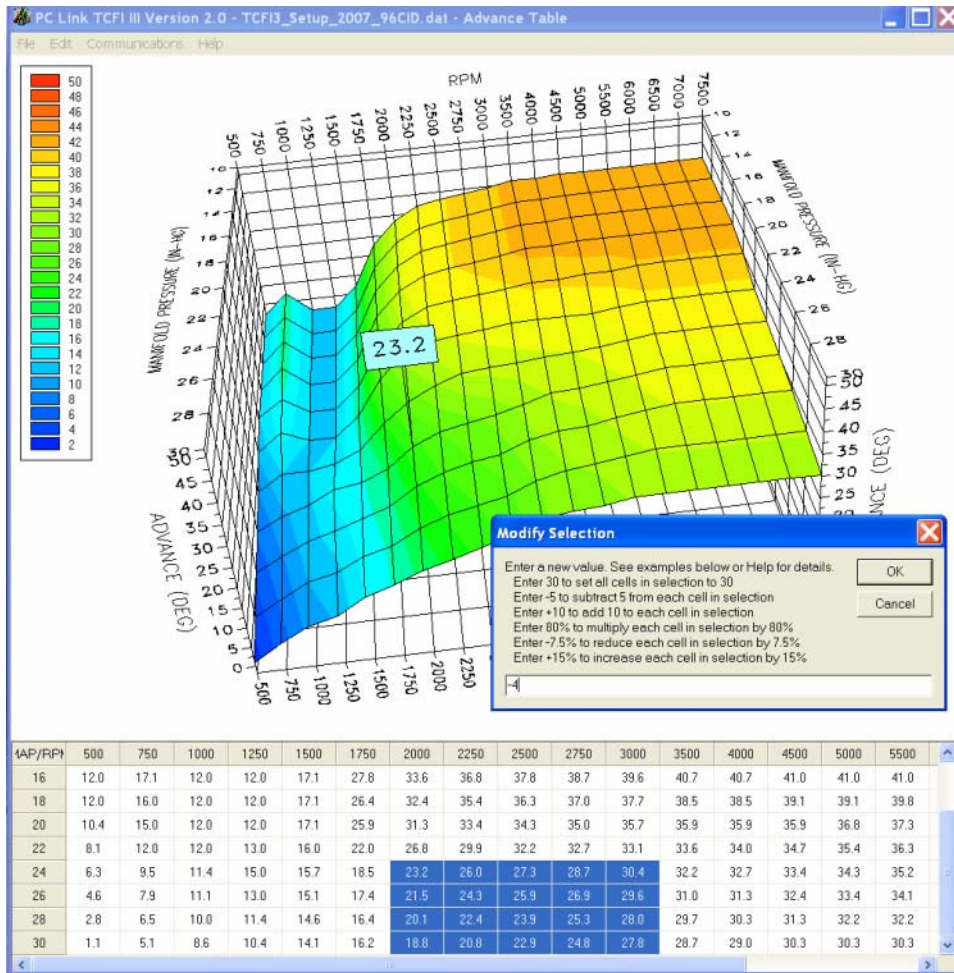


Figure 3 – Editing Advance Table in PC Link

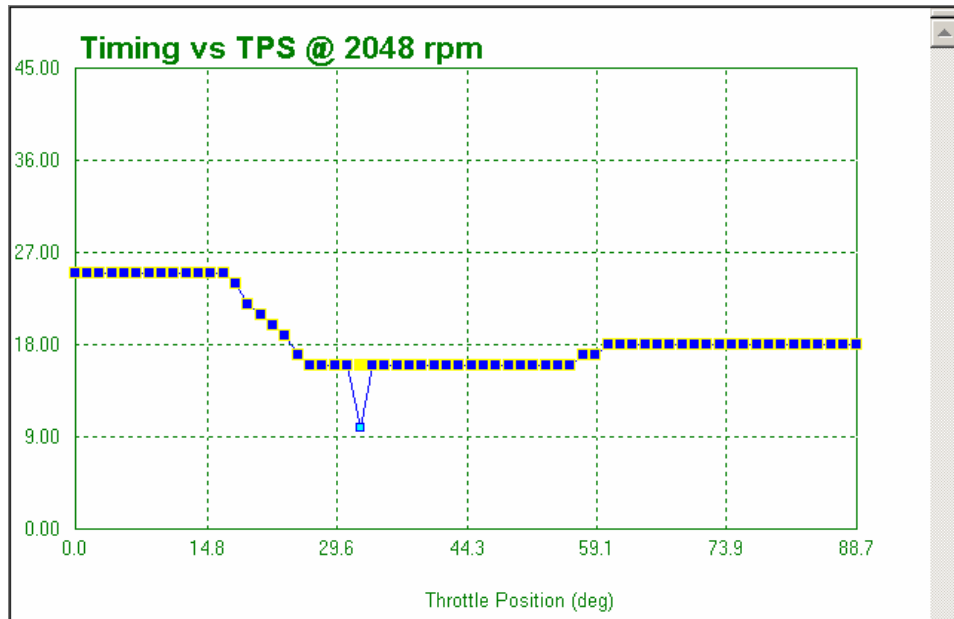


Figure 4 – Editing Advance Table in Smart Link

The PC Link software uses 250 or 500 RPM steps and 2 In-Hg manifold pressure (MAP) steps. You can select a range of cells with the mouse, right click to bring up the Modify dialog box, and enter a value such as -4 in the example shown in Figure 3 to take out 4 degrees in the selected cells. The Smart Link software has 32 individual advance tables for 256 RPM steps. Each table has 64 throttle position steps given in odd degree values from zero to 88.7 (corresponding to wide open throttle). The same editing operation would require **dozens** of mouse clicks to select individual points and **hundreds** of keyboard strokes (down arrow) to make the required changes. A simple editing task that would take 15 seconds in PC Link might require 15 minutes in Smart Link. We have never seen any other engine management system software, automotive or motorcycle, that had such cumbersome editing.

The PC Link software allows printing out tables with the printout showing both the 3D table and the spreadsheet values. Smart Link has no provision for printing tables. One would have to use third party screen capture software to accomplish this task.

SOFTWARE – DATA LOGGING

The Twin Tec TCFI III module has internal data logging that automatically stores data for the last hour of operation at 10 samples/second. Twin Tec TCFI Log software allows both real time display of all engine data on an instrument panel screen or chart display of downloaded data. On the chart display, you can easily select data to be displayed, scroll back and forth over the entire data, and print out the chart. The ThunderMax module has no internal data logging. Smart Link software allows basic display and logging of engine data while the PC is attached. Display is limited to relatively primitive bar graph gauges for data selected by the user. Smart Link has no provision for printing any logged data.

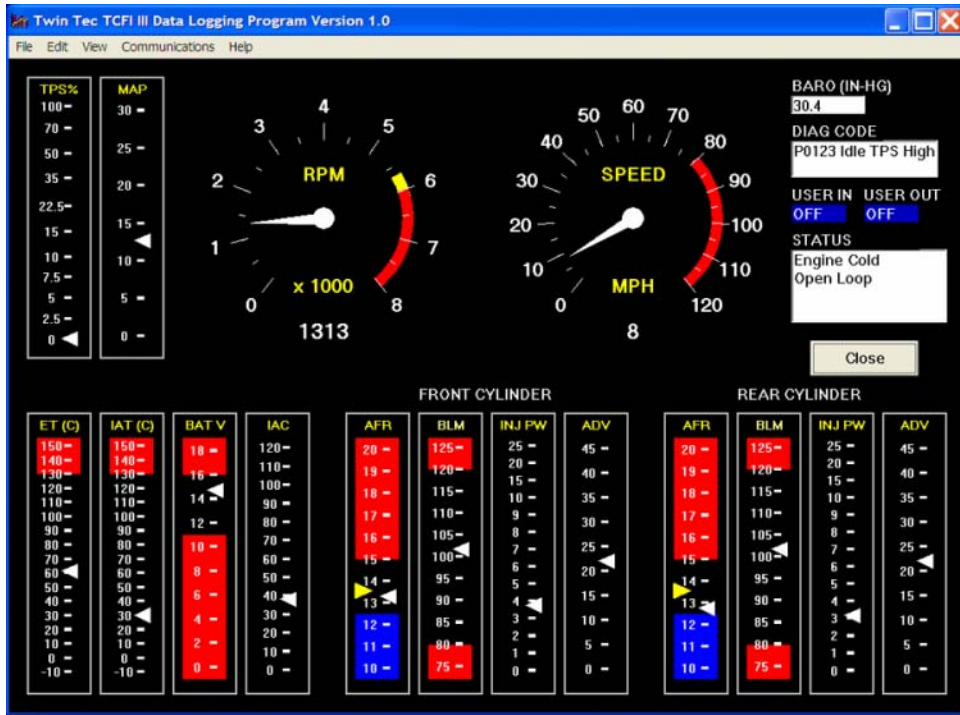


Figure 5 – TCFI III Log Real Time Display



Figure 6 – TCFI III Log Chart Display for Logged Data

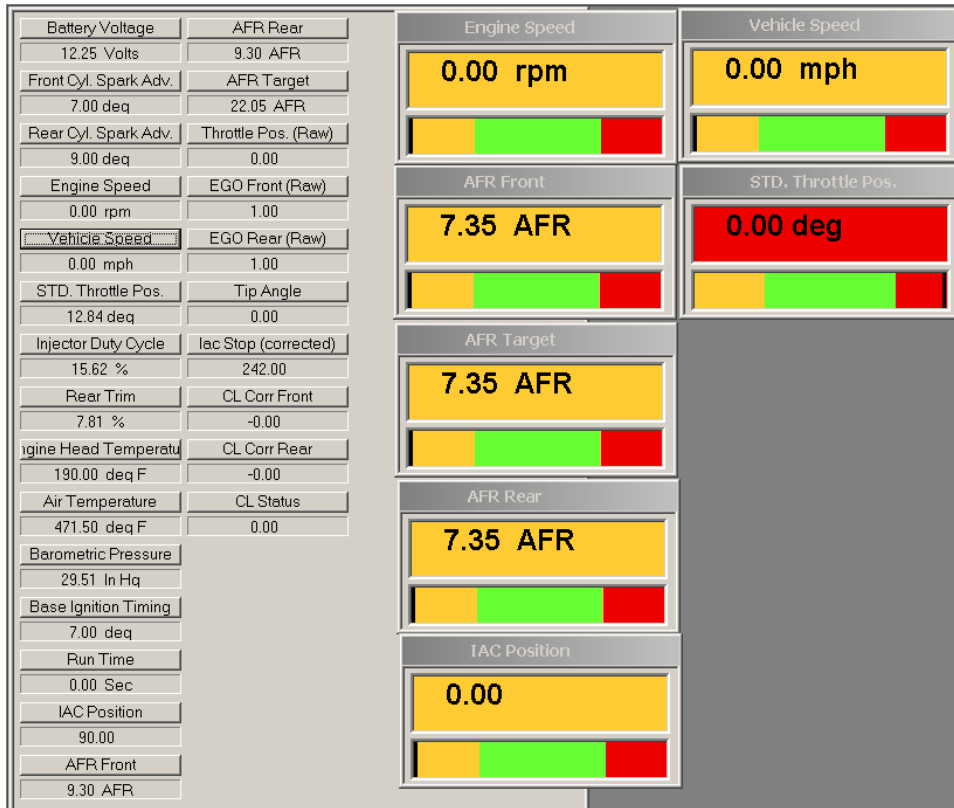


Figure 7 – Typical Smart Link Real Time Display

SOFTWARE – DIAGNOSTICS

The Twin Tec TCFI III system uses industry standard diagnostic codes that directly correspond to the Harley-Davidson® service manual flow charts. Historical diagnostic codes include “trips” – the number of engine start/stop cycles since the code was set. This helps to identify problems that rarely occur. The ThunderMax system also has diagnostic capability, but doesn’t use standard codes or report details on the number of trips since a historical code was set.

THUNDERMAX BATTERY DRAIN PROBLEM

Our ThunderMax test system exhibited a constant battery drain of about 0.1 amps, even with the run/stop switch and ignition key off. Other customers have reported the same problem. It appears that the ThunderMax unit does not always complete the power-down sequence when the ignition is turned off. It is not known if this problem affects all ThunderMax units. After about 4 days, the battery is sufficiently drained that it is impossible to start the engine.

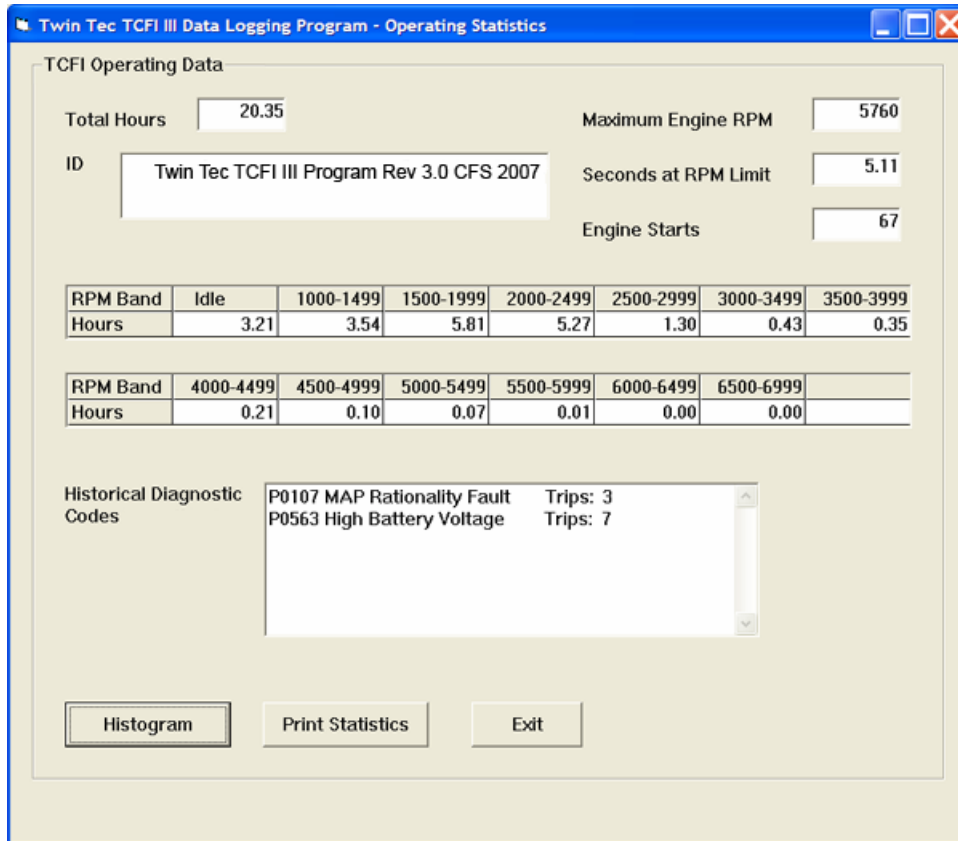


Figure 8 – TCFI Log Diagnostic Codes Display

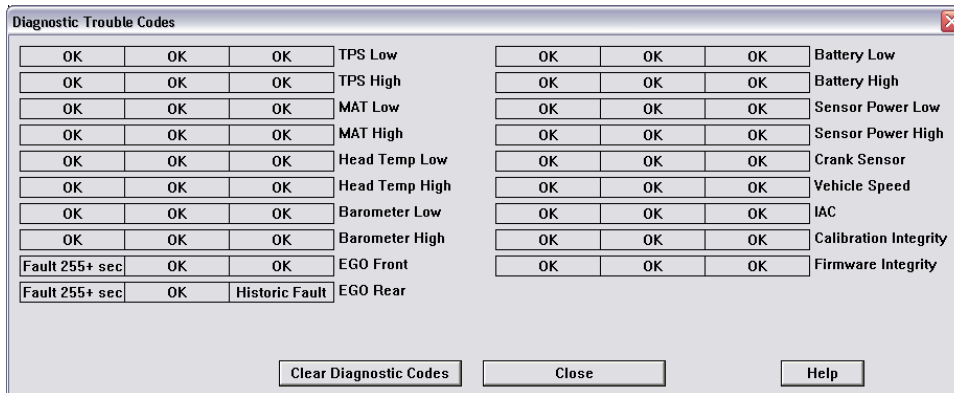


Figure 9 – Smart Link Diagnostic Codes Display

WIDE-BAND OXYGEN SENSOR CONSIDERATIONS

The WEGO IIID wide-band oxygen sensor interface module used with TCFI III system has provision for checking and recalibrating the Bosch LSU 4.2 wide-band sensors by means of diagnostic LEDS and adjustment trimpots. This is referred to as free air calibration as it is done with the sensors in free air. Accuracy of the sensors can be maintained as the sensors age or if they start to degrade from exposure to leaded racing gas or other fuel additives. The ThunderMax Auto-Tune module has no such capability. Without using some type of calibration gas, the user has no means of checking the sensor output or recalibrating the sensors. If sensor errors are suspected, the only approach is hit-or-miss replacement. In all fairness, the Bosch sensors are very reliable and capable of many thousands of miles of operation without significant degradation when used with unleaded pump gas.