



## **Wire Harness Installation Instructions**

### **For Installing:**

**Part # 65140 – '91-'98 Jeep 4.0L Engines**

**Part # 65141 – '91-'98 Jeep 4.0L Engines w/HI TORQUE Camshaft**



**Manual # 90554**

**Perfect Performance Products, LLC**

**Painless Performance Products Division**

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We have attempted to provide you with as accurate instructions as possible, and are always concerned about corrections or improvements that can be made. If you have found any errors or omissions, or if you simply have comments or suggestions concerning these instructions, please write us at the address on the cover and let us know. Or, better yet, send us a fax at (817) 244-4024

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# PLEASE READ ALL INSTRUCTIONS PRIOR TO INSTALLATION

## 1.0 Introduction

Congratulations on purchasing the most up-to-date and easiest-to-install engine management system on the market. It has been designed for easy installation, even with little or no electrical experience.

This kit is a complete fuel injection system for the Jeep Multi Point Injection 4.0L L6 engines. This kit includes all the wiring needed by the MEFI computer to control the fuel injection system. It is designed to use the parts listed in **Table 4.1**. Use of any other parts may cause the system to function improperly.

This system will work on Jeep 4.0L engines from 1991-1998 with the appropriate sensors. See **Table 4.1** below for sensor, distributor, coil and fuel injector requirements.

This system is weatherproof; which means all of the connectors on this harness, that can be, are the weather pack type of design. So, if mounting the ECM and Relays in the engine compartment is desired, it can be done with limited corrosion/moisture problems. The computer and dash group can also be easily mounted under the dash for a cleaner installation.

Most of the wiring in the harness has been pre-terminated to proper connector and all wire has been color-coded. All wiring is 600 volt, 275° F, TXL.

This harness is divided into three major groups:

Engine Group	Includes wiring for the fuel injectors, distributor and sensors.
Dash Group	Includes ignition feed wires, assembly line diagnostic link (ALDL) connector, check engine light, computer connectors, tachometer wiring, relays and fuse block.
Tail Group	Includes power wire for the fuel pump.

## **2.0 About these instructions**

These instructions provide the information needed to install the 65140 PERFECT '91-'98 **Jeep 4.0L Engine Jeep 4.0L** fuel injection harness kit. These instructions are divided into major **Sections**, as follows:

- 1.0 Introduction
- 2.0 About These Instructions
- 3.0 Tools Needed
- 4.0 Contents of the 65140 Wiring Harness Kit
- 5.0 Pre-Installation and Harness Routing Guidelines
- 6.0 General Installation Instructions
- 7.0 Wire Harness Installation
- 8.0 Trouble Shooting Instructions

**Sections** are further divided into **Paragraphs** and **Steps**. Throughout, the **Figure** numbers refer to illustrations and the **Table** numbers refer to information in table form. These are located in or near the sections or paragraphs to which they correspond. Please pay special attention to any **Notes** or any labeled **CAUTION**.

## **3.0 TOOLS NEEDED**

In addition to everyday mechanics tools; the following will also be needed:

**Crimping Tool** - Always use a quality tool, such as a Thomas & Betts to ensure superior crimps.

**Wire Stripper** – Be sure to only strip 1/4" of the insulation off for all crimps made during the installation of the harness.

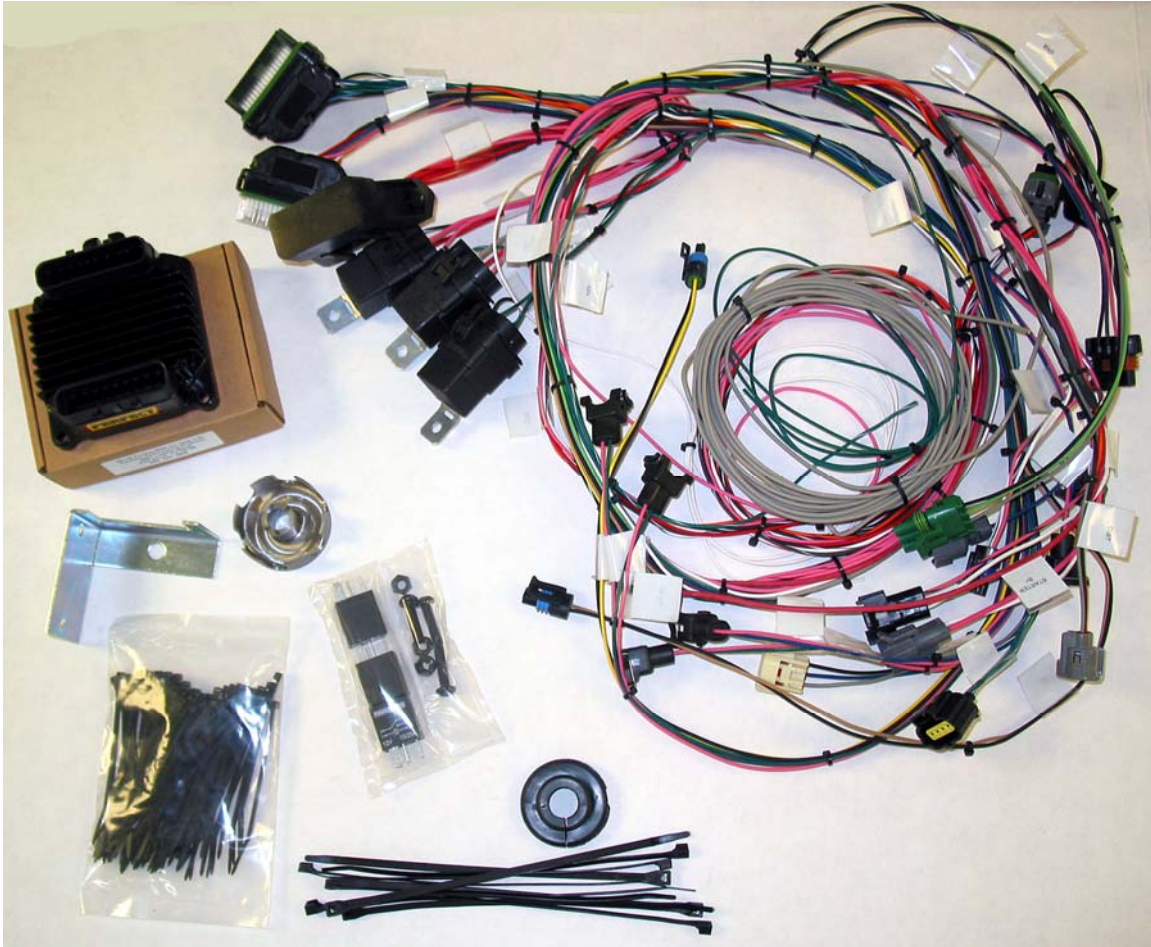
**Continuity Tester** – ONLY use this device when the battery is disconnected.  
**CAUTION:** Do not use a test light to test the computer or sensor wiring or damage to the computer may result.

**Electric Drill & 1 3/8" Hole Saw** – Use this to drill the hole into the firewall for the main pass through location of the fuel injection harness.

**Digital Voltmeter** – Use this to verify the battery is fully charged (11.9 – 12.7 volts) and once the engine is running, the alternator is charging the battery (13 – 14.5 volts).

#### **4.0 CONTENTS OF THE 65140 WIRE HARNESS KIT**

Take inventory to see that you have everything you are supposed to have in this kit. If anything is missing go to your dealer where you purchased the kit or contact Painless Performance at (800) 423-9696. This kit should contain the following items:



- **The main wiring harness with required connectors installed.**
- **PERFECT ECM 65140**
- **Installation Manual (this booklet)**
- **Coil/Ignition Module Bracket**
- **Distributor Shutter Wheel**

## 5.0 PRE-INSTALLATION AND HARNESS ROUTING GUIDELINES

The installation of your harness kit will consist of two (2) steps

- \* The physical routing, positioning and securing of the harness, wire groups and individual wires and connectors.
- \* The proper electrical connection of the individual circuits.

We cannot tell you how to route the harness in your vehicle. That depends a great deal upon the particular make of the vehicle and what extent you want to secure and conceal the harness. We do offer some general guidelines and routing practices starting in **Paragraph 5.1.3**, general installation instructions in **Section 6.0** and precise instructions concerning the electrical connections you will have to make beginning in **Section 7.0**.

To begin the installation of the wire harness, read the following sections:

### 5.1 Understanding the Jeep 4.0L engine

- 5.1.1 The 1991-1998 Jeep 4.0L L6 engines came with several different sensor/component packages. Distributors, injectors, Idle Air Control, and the Throttle Position Sensor all changed throughout the years. This made it very difficult to build one fuel injection harness to control them all. So, through the purchase of specific components based on what year engine needs to be controlled, this kit can control the 1991-1998 Jeep 4.0L L6 engines.
- 5.1.2 **The PERFECT system for the Jeep 4.0L requires the use of the following parts in Table 4.1.** These parts meet or exceed all requirements of the PERFECT Performance Products harness and controller.

<b><u>1991 – 1998 Jeep 4.0L Sensor Requirements</u></b>		
GM MAP Sensor	Delco # 16137039	NAPA # 21961 CRB
GM Ignition Coil	Delco # <u>D-573</u>	NAPA # IC29
GM Coolant Temp	Delco # <u>25036979</u>	NAPA # TS4015
GM Intake AirTemp	Delco # <u>25036979</u>	NAPA # TS4015
GM Oxygen Sensor	Delco # <u>AFS-105</u>	Bosch # 15703
GM Knock Sensor	Delco # <u>10456126</u>	NAPA # DKS206
GM Ignition Module	Delco # <u>D-1986-A</u>	NAPA # TP12
*Distributor	Mopar # 56027028	NAPA # 48-4694 NRD <b>Must Use with MP847</b>
*Distributor Pickup (1997-1998 4.0L )	Mopar # 56041030	NAPA # MP847 ECH
Throttle Position Sensor (1997-1998 4.0L's)	Mopar # 4874371	NAPA # 220161 CRB
Fuel Injectors (1996-1998) (48-50psi fuel pressure at the rail)	Mopar # 53030778	NAPA # 218313 CRB
Fuel Injectors (1994-1995) (39psi fuel pressure at the rail)	Mopar # 53030343	NAPA # 218669 CRB
Fuel Injectors (1991-1993) (39psi fuel pressure at the rail)	Mopar # 33007127	NAPA # 218689 CRB
<b>*Note: All of the listed injectors will work with this Fuel Injection Kit. Be sure to regulate the fuel pressure to the specified pressures. Any slight change of the fuel pressure will affect the performance of these systems.</b>		
Idle Air Control Motor (IAC)	Mopar # 4874373 AB	NAPA # 2-29571 CRB

**Table 4.1 – Sensor Requirements**

**\* Most 1997-1998 Jeep Wranglers and Cherokees came with the correct distributors. 1997 Grand Cherokees did not come with the correct distributors. Due to the lack of information available, depending on the year of Jeep engine and what model of Jeep it was removed from will determine if the correct distributor is present. Best choice is to compare it to the pictures on page 24 of this manual.**

**Note: This harness does not have wiring for emission devices.**

5.1.3 Familiarize yourself with the harness by locating each of the harness labels and by looking at the connectors on the wire ends.

- 5.1.4 Decide on the mounting location for the computer and relays. This PERFECT Fuel Injection harness kit is designed to mount the computer and relays either under the hood or under the dash of the vehicle.

**NOTE: This harness is weatherproof to provide efficient and trouble free operation in the off-road environment. Painless does not recommend washing our harness with a pressure washer. In the event where the engine and harnessing needs a good wash, use a light detergent first to loosen the dirt and then carefully wash the engine and harness with a garden hose. Be sure to cover any exposed wire connections with plastic bags beforehand.**

- 5.1.5 A good exercise is to lay out the harness on a workbench beside your vehicle and identify all the connectors and wires.

- 5.1.6 When routing the harness, be sure to avoid exhaust manifolds, accessory belts, hood hinges and any other objects on the engine or under the hood that may damage the harness. Whenever possible, be sure to use the provided zip ties to help secure the harness.

**NOTE: Jeep 4.0L engines naturally make the exhaust manifold/headers glow red during long periods at higher rpm operation. With this in mind, it is recommended to wrap the knock sensor, knock sensor connector and wire to avoid it being burnt. Header wrap can significantly reduce under hood temperatures and prevent this problem.**

- 5.1.7 Plan where harness supports will be located. Many times the OEM harness supports can be used. **The harness brackets located near the fuel injector rail are a prime example of a good harness support to use.**

- 5.1.8 Allow enough slack in the harness at places where movement could possibly occur such as engine to body and engine to frame.

## **6.0 GENERAL INSTALLATION INSTRUCTIONS**

### **CAUTION:**

- **Never disconnect the battery or the computer connectors with the ignition on.**
- **Separate the two ground wires by connecting them to two different locations. This will aid in noise suppression throughout the harness and especially on the clean sensor ground.**
- **Giving or Receiving a “Jump Start” may cause damage to the computer .**
- **Using a test light to test any of the sensor circuits, will result in computer damage.**
- **A test light may be used to check for 12 volts at the coil and the injectors.**

### **Notes:**

- **There is normally a small amount of current drain on the battery with this fuel injection system.**

- Each connector in this harness is different and will only fit in its appropriate sensor. Never Force any Connectors.
- When connecting the plugs to the computer use extra care to ensure none of the pins on the computer are bent.
- The fuel pump you are using MUST be rated at a minimum of **60 PSI** (lbs. per square inch). It will be necessary to purchase an external fuel pressure regulator in most instances. The two specific fuel pressures needed for these systems are 49psi or 39psi. This is determined by the specific fuel injectors used. See Table 4.1 for the fuel injector part number.

## 6.1 GROUNDING THE VEHICLE AND ENGINE

A **PERFECT**ly wired vehicle will only have problems if the chassis harness components and the fuel injection system aren't properly grounded. Don't go to the effort of installing a quality fuel injection system only to neglect proper grounding.

- 6.1.1 Connect a ground strap or cable (minimum of a 4 GA. wire) from the negative battery terminal to the frame. Be sure to clean the place of connection on the frame with a wire wheel to remove any grease or dirt. For the best connection, use a star type lock washer to fasten the ground cable to the frame.
- 6.1.2 Connect a ground strap (minimum of a 4 GA. wire) from the engine to the same point on the frame in step 6.1.1. This is best accomplished with a braided ground strap which is available from an auto parts store. **DO NOT RELY ON THE MOTOR MOUNTS TO MAKE THE CONNECTION FROM THE ENGINE TO THE FRAME, THEY'RE MADE OF RUBBER AND RUBBER DOESN'T CONDUCT.**
- 6.1.3 Connect a ground strap from the engine to the body. This will ensure your vehicle has the proper grounds for most all circuits both for the engine and separate from the engine.

## 6.2 ROUGH INSTALLATION

**CAUTION: DISCONNECT THE POWER FROM YOUR VEHICLE BY REMOVING THE NEGATIVE BATTERY CABLE FROM THE BATTERY.**

- 6.2.1 Position the computer, fuse block and relay bases in their desired mounting location. This location should be either under the dash or on the firewall in the engine compartment.
- 6.2.2 If mounting the computer under the dash, drill a 1 3/8" hole in the firewall for the pass thru grommet.
- 6.2.3 Route the engine connectors and the gray fuel pump wire though the hole. Push the grommet (already installed on the harness) into the hole until it is seated. Be sure the split on the grommet is at the top of the hole in the firewall.
- 6.2.4 Route the fuse block and relay bases to their desired mounting location.

- 6.2.5 Mounting screws for the computer have been included. Be sure not to over tighten these screws to avoid warping the computer housing. An effort also needs to be made to mount the computer onto a relatively flat surface. Otherwise, damage can result to the steel cover on the rear of the computer, which will damage the internals of the computer.

### **6.3 HARNESS ATTACHMENT**

**Note:** Harness routing doesn't necessarily need to be a time-consuming task, but some caution must be taken to ensure isolation of the harness from hot and sharp parts on the engine. A good way to protect the harness is to use the factory harness mounting points as often as possible. Most 4.0L engines had a plastic housing along side the valve cover to hold the injector, TPS, IAC and IAT sensor wiring. Some 4.0L engines also had a thermal blanket on top of the intake manifold as a thermal barrier for both the harness and the injectors. If your engine doesn't have this thermal barrier, purchasing one from a Mopar dealer is advisable.

- 6.3.1 Permanently mount the computer, fuse block and relays. Be sure to use the appropriate 1/4" bolt holes in the computer housing to fasten it to a bracket under the dash or flat against the firewall.
- 6.3.2 Attach harness groups to your vehicle with clips or ties starting at the computer and working outward.
- 6.3.3 Rubberized clamps from your local auto parts supplier make for a very professional method of fastening the engine section of the harness onto the engine.
- 6.3.4 Call your local Painless Wiring dealer for a price on the PowerBraid Fuel Injection Kit P/N 70921. This kit comes with all the high performance braid needed to make your new harness look fantastic under the hood of your vehicle.

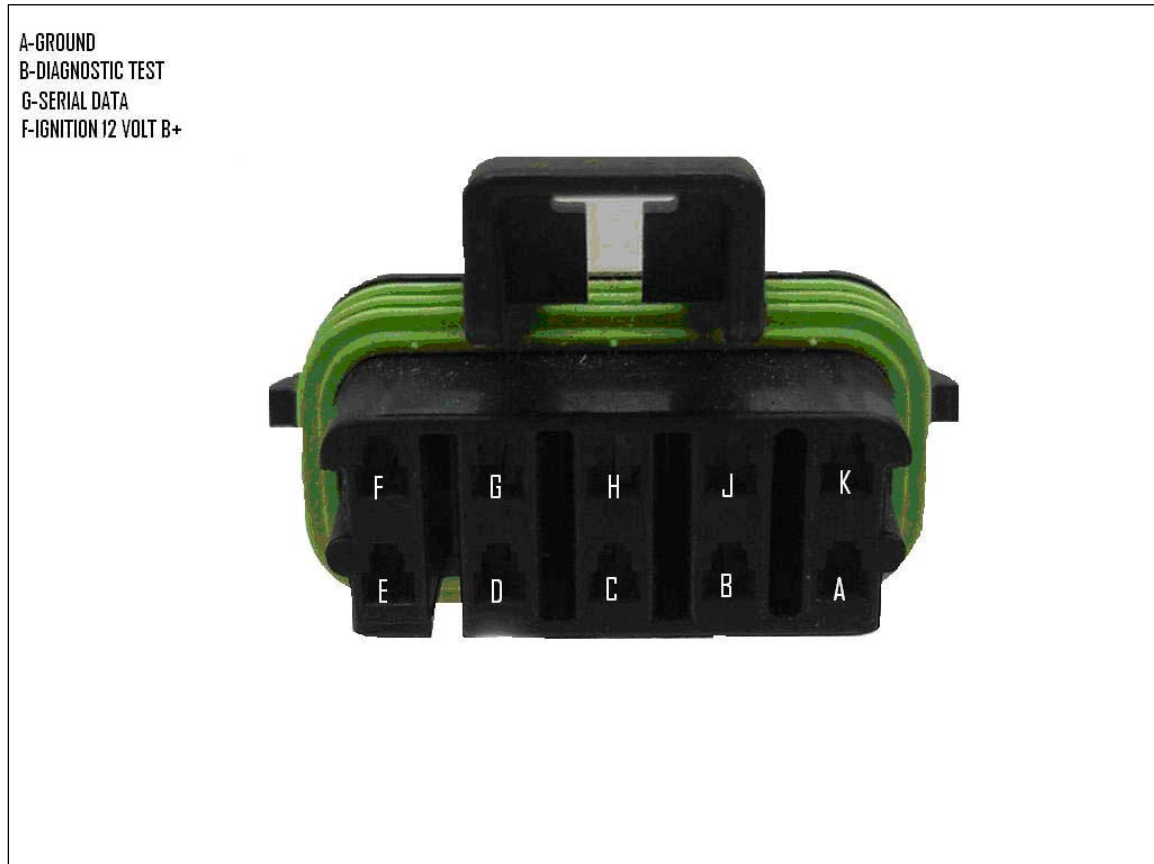
## **7.0 1991-1998 JEEP 4.0L SYSTEM WIRE HARNESS INSTALLATION**

### **7.1 SPECIFIC CIRCUIT CONNECTION**

**Note:** If you have not already done so, read sections 5.0 and 6.0 of these instructions and think through the installation of the harness before securing or cutting any wires.

## 7.2 DASH SECTION INSTALLATION

The wires in this group consist of the Diagnostic Link Connector (DLC) (SEE **FIGURE 7.1**), the check engine light (pre-mounted into a bracket) and three (3) other wires.

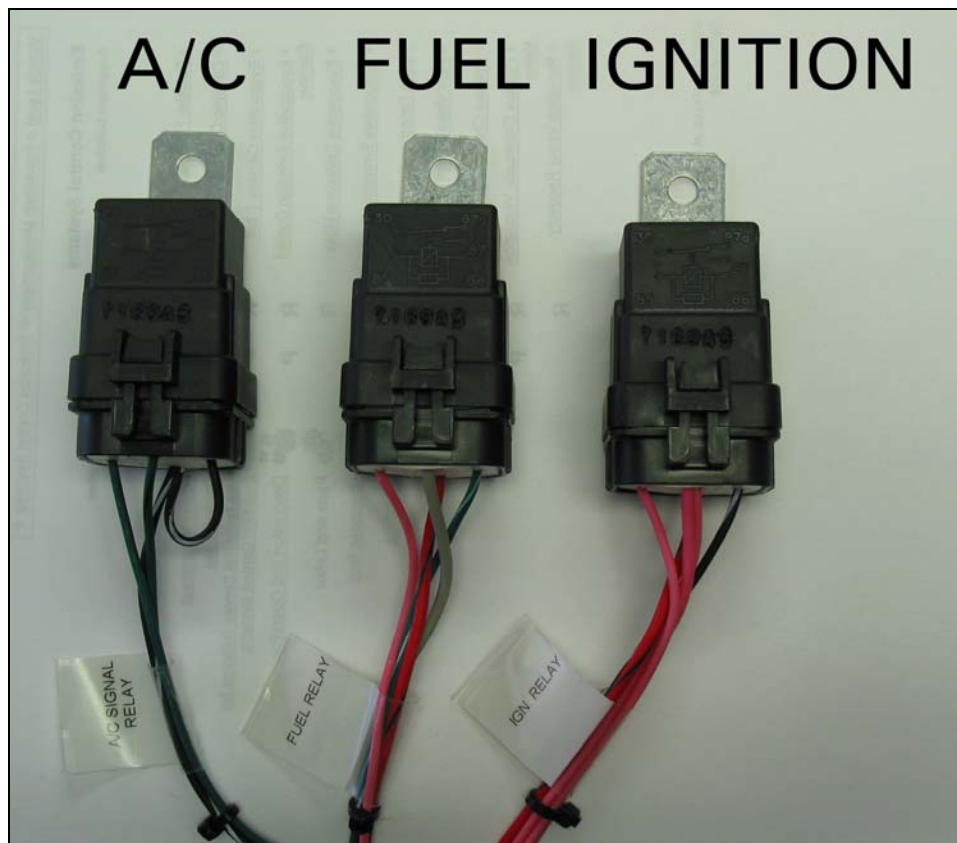


**FIGURE 7.1 Diagnostic Link Connector (DLC)**

- A. Find a easily accessible and visible location to mount the Check Engine Light and the DLC connector. Note: The Check Engine Light wires are pre-terminated and their colors are Pink and Brown/White. Do not apply 12V switched power to the pink wire in this section; it supplies power to the Check Engine Light.
- B. Mount the DLC connector and the check engine light in the place selected.
- C. Locate the PINK ignition hot activation wire, labeled “IGN” and attach it to a 12V **fused** power source **WHEN THE KEY IS IN THE RUN AND START POSITIONS ONLY**. This is the ignition power signal wire for the harness and computer. It allows the computer to power up and enables the main harness relay to power up the sensors, injectors, and ignition system. With the pink wire correctly wired, the check engine light will come on when the ignition switch is in the “ON” position and when the engine is not running.

### The three relays supplied in the kit:

- **Fuel Pump Relay** - Supplies the 12V power to your fuel pump. It will run for 3 seconds after the ignition is turned to the on position to prime the fuel rail to prepare the engine to start.
- **A/C Signal Relay** – Supplies the computer a ground signal to slightly increase engine RPM to compensate for the load on the engine from the A/C compressor.
- **Ignition Relay** – Supplies 12V power to the O2 sensor heater, Ignition System, Check Engine Light and Computer when the key is in the Run or Start position.



**FIGURE 7.2 Relays and Function**

**Note:** All three relays are identical.

### 7.3 ENGINE GROUP INSTALLATION

The engine group is designed to be separated into left side (driver) and right side (passenger) sections. Each side is tie-wrapped separately, **but not labeled**. The right side of the harness has connectors for the distributor, ignition module, and ignition coil. The left side of the harness has connectors for the idle air control motor, throttle position sensor, injectors, oxygen sensor, knock sensor and MAP sensor. When you begin routing, separate the engine group into left and right sections and place them accordingly.

- 7.3.1 Before you connect any wires, separate the fuel pump wire from the engine group and place it out of the way.
- 7.3.2 Locate the Ground #1 and Ground #2 breakouts on the harness. Attach each of them to their own separate bolts. By separating them, as opposed to connecting both of them to the same bolt, aids in noisy signal dissipation.
- 7.3.3 Using **Figure 7.1** thru **7.11** and the **Table 7.1**, plug in each harness connector to its appropriate sensor or device.
- 7.3.4 Check to make sure your distributor has the correct distributor connector. See **Table 4.1** for the correct cam sensor information. This PERFECT System uses the original cam sensor signal **specifically** from the 1997 Wrangler and Cherokee and the 1998 Wrangler, Cherokee and Grand Cherokee 4.0L distributors.
- 7.3.5 Check to make sure the 65140 wire harness has the correct Throttle Position Sensor connector. This PERFECT System uses the TPS from the 1997 and 1998 Wrangler and Cherokees. Most if not all of the Grand Cherokees have the incorrect TPS. See **Table 4.1** for the specific part number.
- 7.3.6 Check to make sure the 65140 wire harness has the correct Idle Air Control Motor Connector. This PERFECT System uses the IAC Motor from the 1997 Grand Cherokees and the 1998 Wrangler, Cherokee and Grand Cherokee. See **Table 4.1** for the specific part numbers.
- 7.3.7 The Pink wire labeled IGNITION needs to be connected to the original coil wire from the original engine or connected to a fused ignition switched 12V power source.
- 7.3.8 The Green wire tagged A/C SIGNAL needs to be connected to the A/C compressor clutch power wire; if the vehicle is equipped with A/C. This will enable an increase in the engines RPMs when the A/C is turned on to compensate for the additional load of the A/C compressor and the additional electrical load on the alternator.

## 7.4 TERMINAL INSTALLATION INSTRUCTIONS

- 7.4.1 Have all tools and connectors handy.
- 7.4.2 Select the correct terminal for the wire. The wires to be connected with crimp on terminals are 18ga. (Red – 22-18ga/ Blue – 16-14ga/Yellow – 12-10ga)
- 7.4.3 Determine the correct wire length and cut the wire. Remember to allow enough slack in the harness and wires at places where movement will occur. **Double-check your calculations.**
- 7.4.4 Strip insulation away from the wire. Strip only enough length necessary for the type of terminal lug you are using. (1/4” will be appropriate for most crimp on terminals.)

**Note:** In the following steps, be sure each terminal is crimped with the proper die in the crimping tool. An improper crimp will not make good enough of a connection. **DO NOT OVER CRIMP.**

- 7.4.5 Crimp the terminal onto the wire.
- 7.4.6 Connecting the wires and connectors throughout the harness is a repeating process. Make sure that each wire is properly routed and then terminated.
- 7.4.7 When all the wires are terminated, tighten the mounts and ties to secure the harness permanently.
- 7.4.8 Attach the connectors to the computer. **Be careful not to bend any pins.**
- 7.4.9 After all the connections have been made throughout the harness, connect the battery to the vehicle.

**CAUTION:** BE SURE THE IGNITION IS OFF WHEN YOU CONNECT THE BATTERY OR DAMAGE TO THE COMPUTER MAY RESULT.

## 7.5 TAIL SECTION INSTALLATION

- 7.5.1 Locate the Gray Fuel Pump wire which was separated earlier from the engine group. Cautiously route it towards the rear of the vehicle. Be sure to avoid all sharp edges, moving or hot parts that may damage the wire.
- 7.5.2 Take this gray wire and connect it to the fuel pump positive terminal. This is the 12V ignition hot power wire for the fuel pump. It is supplied through the Fuel Pump relay, which is controlled by the computer.
- 7.5.3 **See the Tables 7.1 and 7.12 for harness connections.**

<b>Label on Harness</b>	<b>Connects to:</b>	<b># of Wires</b>	<b>Wire Colors</b>
DIST	Distributor	3	Org/Red, Blk, Gry
ICM	Ignition Control Module	4	Pnk, Wht(18), Blk/Wht, Wht(16)
COIL(Black)	Ignition Coil	2	Pnk/Blk, Wht
COIL(Gray)	Ignition Coil	2	Pnk, Wht
OXY	Oxygen Sensor	4	Blk/Wht, Pnk, Pur, Blk
INJ #1 – INJ #6	Injectors	2	Blu, Pnk OR Grn, Pnk
GROUND #1	Engine Block	2	Blk/Wht, Blk/Wht
GROUND #2	Engine Block	1	Blk/Wht
STARTER B+	Large Battery Post on Starter	1	Red
FUEL PUMP	Positive Post on Fuel Pump	1	Gry
A/C SIGNAL	A/C Compressor Clutch B+	1	Dark Green
MAP	MAP Sensor	3	Gry, Lt Grn, Blk
KNOCK	Knock Sensor	1	Dark Blue
IAT	Intake Air Temp Sensor	2	Tan, Blk
IAC	Idle Air Control Motor	4	Dk Grn/Wht, Blu/Wht, Blu/Blk, LtGrn/Blk
TPS	Throttle Position Sensor	3	Gry, DkBlu, Blk
ECT	Coolant Temp Sensor	2	Ylw, Blk

**Table 7.1 Engine Side of Harness Connections**

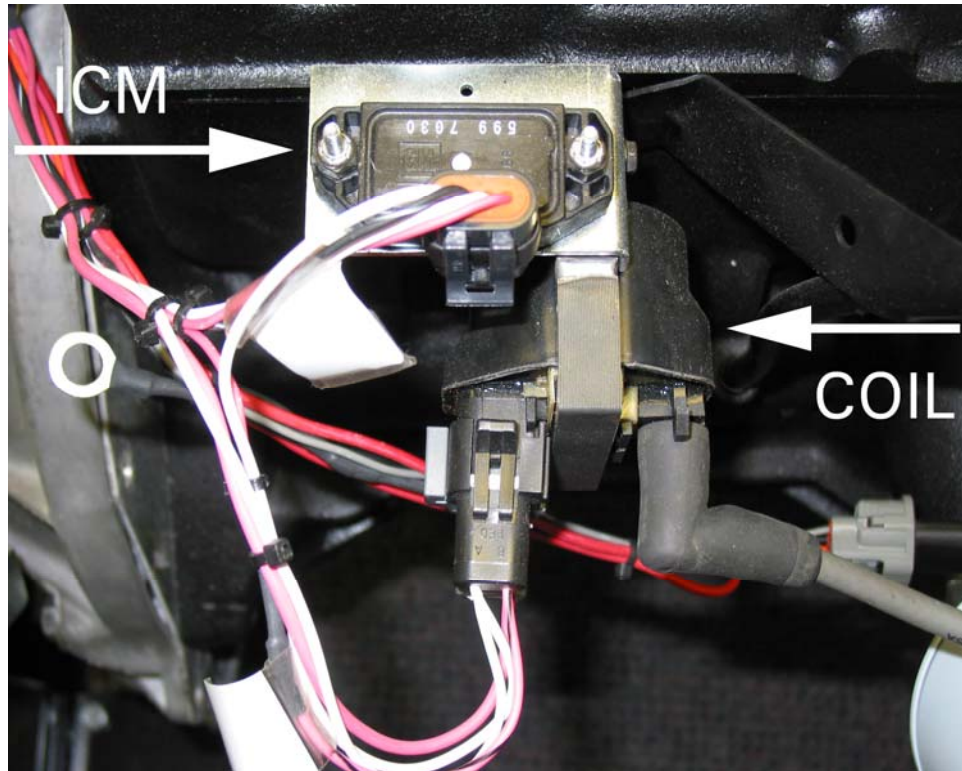
<b>Label on Harness</b>	<b>Connects to:</b>	<b># of Wires</b>	<b>Wire Colors</b>
IGN	Switched B+ Power	1	Pink
TACH	Tachometer Signal Input	1	White
FAN RELAY	Ground Activation of Fan Relay for Automatic Operation	1	Grn/Wht
J1	Computer	-	-
J2	Computer	-	-
DLC	Diagnostic Connector	4	Red, Org/Blk, Wht/Blk, Blk/Wht
DLC	Check Engine Light	2	Brn/Wht, Pnk
IGN RELAY	Ignition Relay	5	(3)Pnk, Red/Blk, Blk/Wht
FUEL RELAY	Fuel Pump Relay	4	Red/Blk, Pnk, Gry, Grn/Wht
A/C SIGNAL RELAY	Computer & A/C Clutch	4	Blk/Wht, Grn, Grn/Blk



**Table 7.2 Computer Side of Harness Connections**

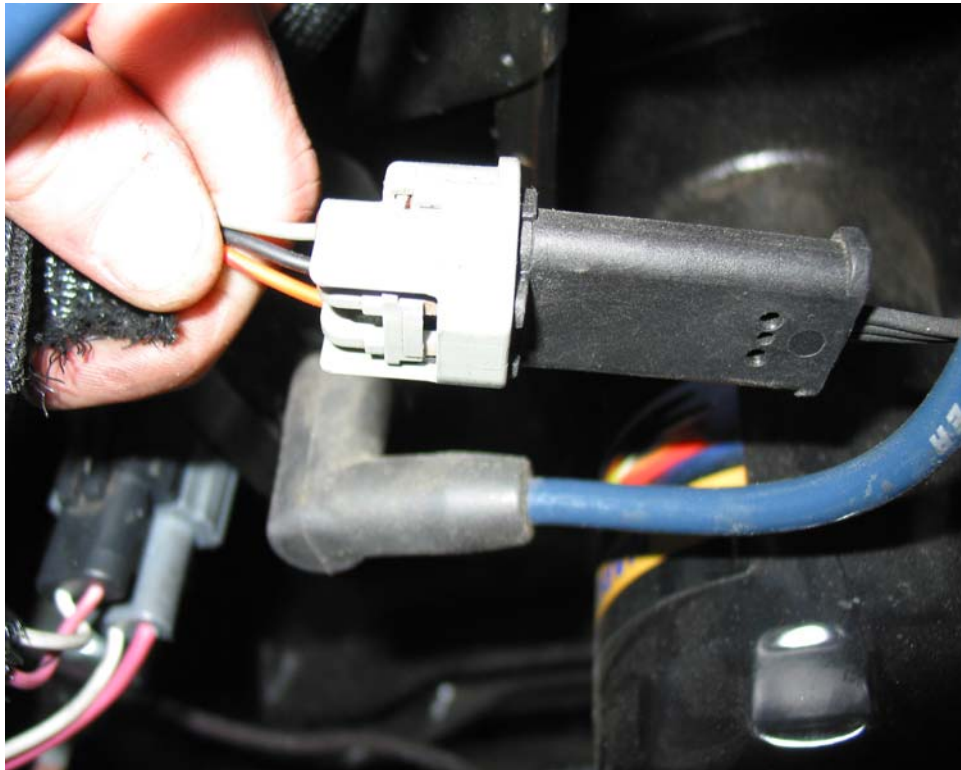
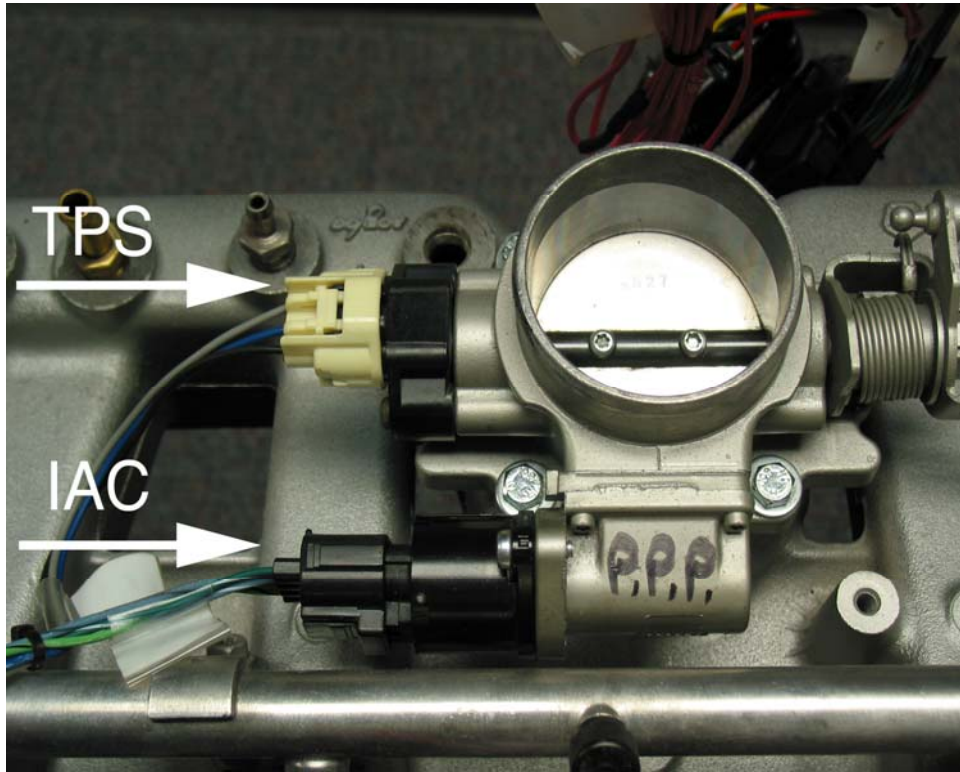
**Figure 7.3 Knock Sensor (Below Intake Manifold)**





**Figure 7.4 Oxygen Sensor**

**Figure 7.5 Ignition Module and Coil with PERFECT Bracket**

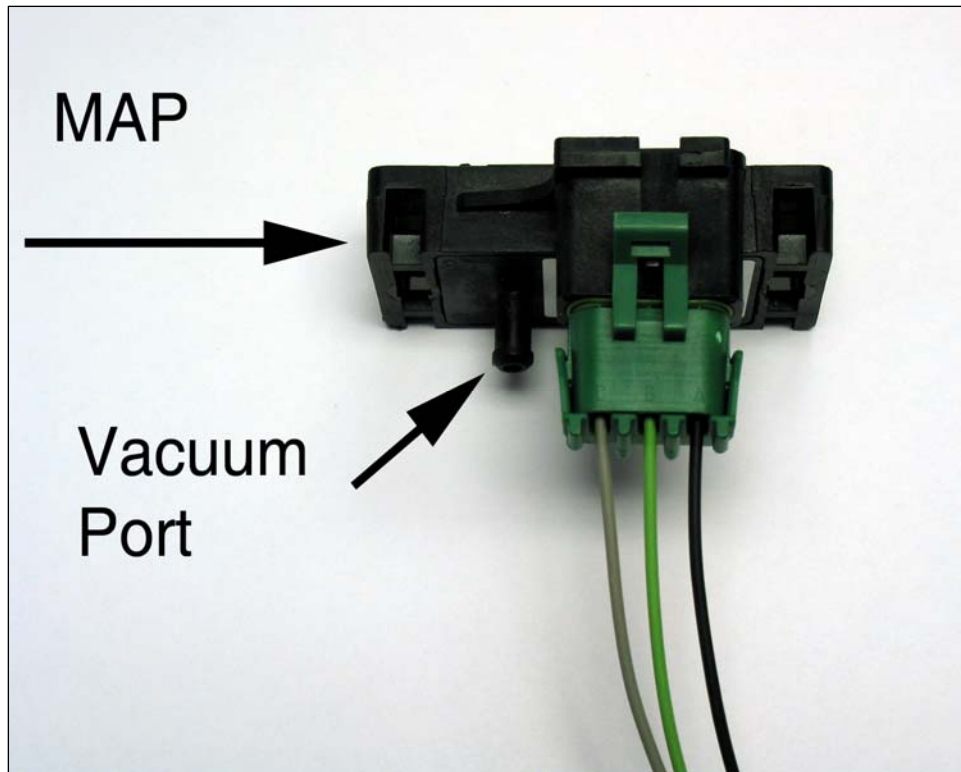


**Figure 7.6 Throttle Position Sensor (TPS) and Idle Air Control (IAC)**

**Figure 7.7 Distributor Connection**



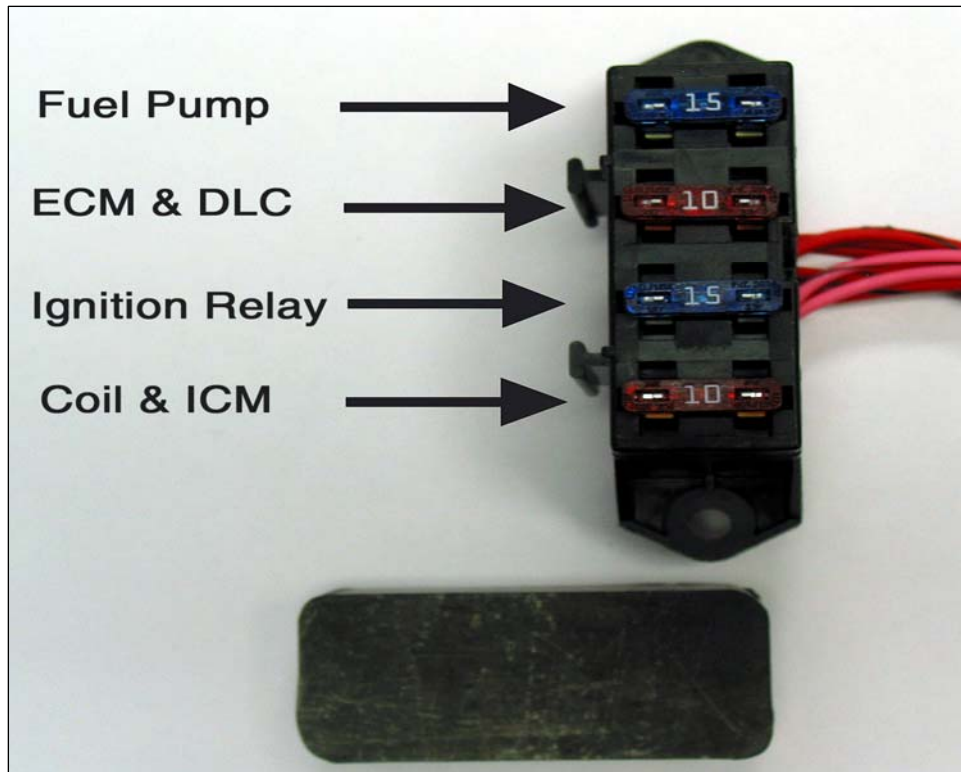
**Figure 7.8 Coolant Temperature Sensor (CTS)**



**Figure 7.9 Manifold Absolute Pressure Sensor (MAP)**



**Figure 7.10 Intake Air Temperature Sensor (IAT)**



**Figure 7.11 PERFECT FUSE BLOCK**

**Note: ECM (Engine Control Module), DLC (Diagnostic Link Connector),  
ICM (Ignition Control Module)**



**Figure 7.12 PERFECT ECM**

## **Distributor Modifications**

The Jeep 4.0L engines, from the factory, use both a crankshaft sensor and a camshaft sensor. The crankshaft sensor is located on the bell housing and the camshaft sensor inside the distributor. This PERFECT Engine Management System **only** uses the camshaft sensor. Inside this kit a new shutter wheel has been included and will need to be installed into the correct stock distributor. See Table 4.1 for the specific years of distributors supported with this system. The following photos illustrate the installation of the shutter wheel and the removal of the stock mounting tab.

### **Steps 1 – 9 illustrate how to disassemble the Distributor.**



**STEP #1 Carefully knock the roll pin out of the drive gear. Be sure not to squeeze the fragile aluminum housing in a vise.**



**Step #2 Do not lose any of these pieces as they will all be reused.**



**Step #3 Carefully, remove the original shutter wheel, shaft and thrust washer all the while twisting the parts back and forth. (The thrust washer is below the original white plastic shutter wheel.)**



**Step #4 Now; remove the roll pin holding the original shutter wheel on the shaft. Be sure to keep the original roll pin and don't forget the thrust washer on the bottom of the shutter wheel.**



**Step #5 Be sure to keep the roll pin and don't forget the thrust washer on the bottom of the shutter wheel.**



**Step #6 Remove the original shutter wheel from the shaft.**



**Step #7 In order for the timing to be adjustable on this system the original lock down tab on the distributor must be cut off. The photo above shows the tab being cut off with a pneumatic cut off wheel.**



**Step #8 The tab may also be cut off using a band saw.**



**Step #9 Depending on the quality of job done on cutting off the lock down tab, the distributor may only need a bit of a touching up. An engine lathe works quite nicely for this step, but a flat file can do the job as well. Just be sure to make the flange as round as possible.**

**Steps 10 – 9 illustrate how to reassemble the Distributor.**



**Step #10 Take Note of all the parts needed for a complete reassembly.**

- 1. Distributor Housing(Aluminum)**
- 2. Thrust Washer**
- 3. Thrust Washer with three fingers**
- 4. Distributor Drive Gear**
- 5. Distributor Drive Gear Roll Pin(The larger of the two pins)**
- 6. PERFECT Shutter wheel**
- 7. Original Shutter Wheel Roll Pin**
- 8. Distributor Shaft**
- 9. Distributor Gasket**

**\*Be sure to thoroughly clean all of these parts and lightly coat the shaft and drive gear with engine oil before installing Distributor Assembly into the engine.**



**Step #11 Install new PERFECT shutter wheel onto the rotor side of the distributor shaft.**



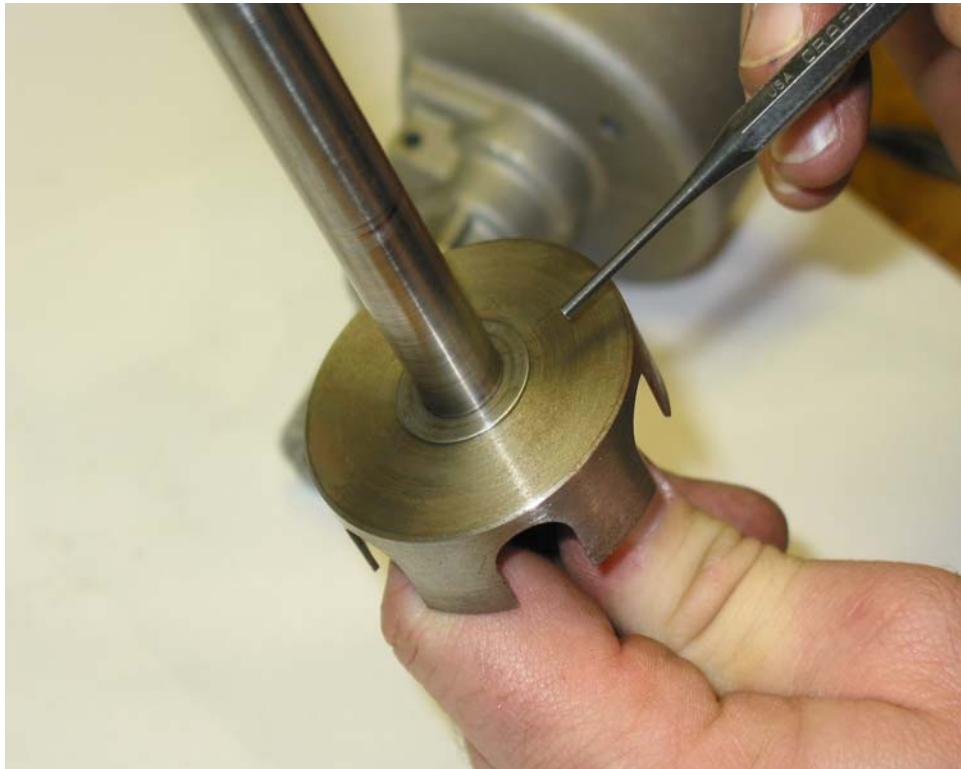
**Step #12 Verify the holes line up for the roll pin. It may be necessary to chase the hole with a 1/8" drill bit. Remember to keep the drill as square to the hole as possible and don't wobble the drill back and forth while drilling.**



**Step #13 Install the smaller original shutter wheel roll pin into the PERFECT shutter wheel.**



**Steps #14 Carefully, drive the roll pin into the shutter wheel and shaft by using a hammer and metal punch until it's flush. DO NOT PUT ANY PRESSURE ON THE SHUTTER WHEEL SHUTTERS AS IT MAY BEND OR BREAK THEM OFF.**



**Step #15 Install the original thrust washer onto the now assembled shutter wheel and distributor shaft. DO NOT SKIP THIS STEP; IT IS REQUIRED FOR THE PROPER DISTRIBUTOR SHAFT END-PLAY.**



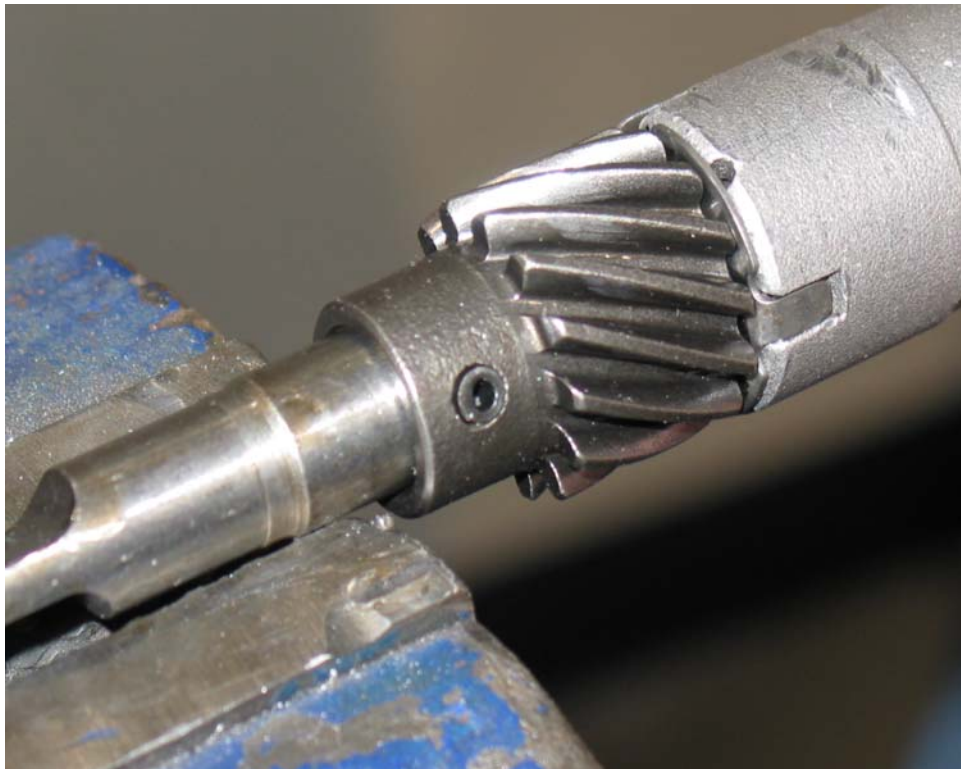
**Step #16 Apply a small amount of engine oil on the distributor shaft assembly and insert it into the distributor housing. Be sure to wipe off any excess oil afterwards.**



**Step #17 Install the Thrust Washer with three fingers onto the engine end of the distributor.**



**Step #18 Install the Distributor Drive Gear onto the engine side of the distributor shaft and housing.**



**Step #19 Install the larger Distributor Drive Gear Roll Pin using a hammer and metal punch until its flush.**



**Step #19 Install either the old or a new distributor housing gasket.**



**Final Step #20 Install the cam sensor onto the distributor housing.**

**The Distributor is now ready to be installed into the engine. Either an earlier model distributor hold down will need to be purchased or a Small Block Chevrolet hold down can be used. Be sure in whichever choice is made the distributor is firmly held in place in the engine.**

**Once all of the above has been completed, including harness installation, computer mounting and distributor modification and install. It will be necessary to set the base timing on the system by following these next instructions.**

- 1. Place a jumper between the A and B terminals on the Diagnostic Link Connector with the engine running. This tells the computer to request the timing to be at 10 degrees.**
- 2. Hold the throttle open far enough to rev the engine up to 1000rpms.**
- 3. Measure the base timing with timing light and set it to 10 degrees.**
- 4. Lock down the distributor and remove the jumper wire from the DLC connector.**

**At this point the engines timing has been synchronized with the computer. Providing this system has been installed on a relatively healthy engine with clean injectors, the correct fuel pressure and a fresh tune up; the throttle response will be crisp and the engine will run smoothly.**

## 8.0 TROUBLE SHOOTING INSTRUCTIONS

**Note: Only scanners with marine cartridges and marine cable plugs will communicate with the PERFECT computer.**

If you are having trouble with your engine running badly or not running at all, first perform basic trouble shooting (checking for faulty connections, spark, fuel pressure, etc.) then see if the computer has stored any trouble codes in its memory.

### 8.1 THE CHECK ENGINE LIGHT

Normally, the “check engine” light should come on when ignition is initially turned on, and then go out few moments after the engine starts running. If the computer has detected a problem and a fault code has been set the light will come back on.

8.1.1 The computer identifies particular trouble codes by flashing the “check engine” light in a certain way. The codes are read by counting flashes:

- A: The first digit (the “tens” digit) of the code is flashed quickly, followed by a brief pause, then the second digit (or “ones” digit) is flashed, followed by a longer pause. For example, three (3) quick flashes followed by a brief pause followed by two (2) flashes indicate a code 32.
- B: The code will repeat itself. The next code, if any, will be displayed in the same manner.

**Note: When you access the codes from the computer a code 12 (one flash followed by two flashes) will first be displayed. THIS DOES NOT INDICATE A PROBLEM. Code 12 will be flashed 2 times, followed by the particular trouble codes, if any. If the computer merely flashes code 12 there are no trouble codes stored. Code 12 means the engine is not running.**

### 8.2 RETRIEVING TROUBLE CODES FROM THE COMPUTER

- 8.2.1 In order to retrieve the trouble codes stored in the computer, locate the ALDL plug installed in **Section 7.2**. Turn the ignition on, BUT DO NOT START THE ENGINE. Connect a jumper wire from the ALDL terminal “A” to terminal “B” see **Figure 7.1** and observe the check engine light.
- 8.2.2 If you have read any codes (remember the normal code 12), write them down for reference Remove the jumper wire from the ALDL connector.
- 8.2.3 Take the codes one at a time and match them to the codes in **Table 8.1**. This will tell you in which circuit the computer has detected a problem.

**Note: A code indicates there is a problem with a specific circuit, NOT NECESSARILY THAT A PARTICULAR PART IS BAD.**

8.2.4 Before taking more extensive corrective actions for any trouble codes, make sure that all connections on the indicated circuit, INCLUDING the computer, are clean and tight. Inspect the wiring in the circuits for any broken, shorted, or exposed wires. Finally, insure all ground wires are clean and secure.

8.2.5 If you are getting a code from your computer and need to clear the code, other than 12, after you have replaced a part, readjusted a part, etc. You can do this by making the following steps.

- A: Install a jumper wire from terminal A to terminal B
- B: Ignition ON engine OFF
- C: Move throttle from 0% (idle) to 100% (WOT) and back to 0%.
- D: Remove the jumper wire.
- E: Turn ignition OFF for at least 20 seconds.
- F: Ignition ON engine OFF
- G: Recheck for codes.

<b>Code #</b>	<b>Circuit affected</b>
13	Oxygen Sensor
14	Coolant Temp. High Voltage (COLD)
15	Coolant Temp. Low Voltage (HOT)
21	Throttle Position Sensor (high voltage)
22	Throttle Position Sensor (low voltage)
23	Intake Air Temp. Low Voltage (HOT)
25	Intake Air Temp. High Voltage (COLD)
33	MAP Sensor Circuit (high voltage)
34	MAP Sensor Circuit (low voltage)
41	Ignition Control Circuit (open IC circuit)
42	Ignition Control Circuit (grounded IC)
44	Knock Sensor Inactive
54	Heated Oxygen Low Voltage (lean)
55	Heated Oxygen High Voltage (rich)

**Table 8.1** Diagnostic Trouble Code Chart

## **8.4 WHEN TO CALL PERFECT PERFORMANCE PRODUCTS TECH LINE**

- 8.4.1 These harness kits have been built with the highest regard to strict quality control and tested before shipment. Before calling use please double check all connections and perform basic trouble shooting (fuel pressure, spark, injector pulse, etc.).
- 8.4.2 If you have any questions concerning the installation of this harness or are having trouble in general; please call the Painless Performance tech line at (800) 423-9696. All calls are answered from 8 AM to 5 PM CST, Monday-Friday, except holidays. Please leave a message if you are unable to reach us and we will return your call as soon as possible.

**Note: HELPFUL INFORMATION ON THE PERFECT ECM CALIBRATIONS.**

The PERFECT ECM has been specifically calibrated for your particular engine. This computer will NOT work with any other type of engine. The computer has been programmed with a REV. limit set @5,000 RPM. If your computer was to detect an engine malfunction it will set the “check engine” light and store a code. The computer will also place itself into a “safe mode” if the engine temperature reaches 250°. Once the engine cools down the computer will reset itself out of “safe mode” and return to normal running operation. Safe mode will still allow you to drive your vehicle, but will not allow the engine to rev over 1,300 RPM.

E-mail: [tech@painlessperformance.com](mailto:tech@painlessperformance.com)

WEB: [www.painlessperformance.com](http://www.painlessperformance.com)

## **Painless Performance Limited Warranty and Return Policy**

Chassis harnesses, fuel injection harnesses, and Striker ColdShot units are covered under a lifetime warranty.

All other products manufactured and/or sold by Painless Performance are warranted to the original purchaser to be free from defects in material and workmanship under normal use. Painless Performance will repair or replace defective products without charge during the first 12 months from the purchase date. No products will be considered for warranty without a copy of the purchase receipt showing the sellers name, address and date of purchase. You must return the product to the dealer you purchased it from to initiate warranty procedures.

# **PERFECT**

## **ENGINE MANAGEMENT SYSTEM<sup>®</sup>**

### **PERFECTION CalTool**

**P/N: 65245**

**Manual #90549**



**Perfect Performance Products, LLC**

**Painless Performance Products Division**

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If you have any questions concerning use of this software or having trouble in general, please feel free to call Painless Performance Products' tech line at 1-800-423-9696. Calls are answered from 8am to 5pm central time, Monday thru Friday, except holidays.

We have provided as accurate instructions as possible, and are always concerned about improvements to be made. Any comments or suggestions concerning these instructions please send a fax to (817)244-4024 or e-mail is always welcome at [painless@painlessperformance.com](mailto:painless@painlessperformance.com). We appreciate your business.

**Perfect Performance Products, LLC** shall in no event be liable in contract or tort (including negligence) for special, indirect, incidental, or consequential damages, such as but not limited to, loss of property damage, or any other damages, costs or expenses which might be claimed as the result of the use or failure of the goods sold hereby, except only the cost of repair or replacement.

P/N 90549

December 06, 2007  
Revision #3 07/10

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Congratulations, on the purchase of the **Perfect Engine Management** fully tunable fuel-injection system. This booklet is designed as a guide through the tuning process. Tuning an injection system can be tricky and at times very complex, but with patience and some general guidelines, a superb running engine can be accomplished.

## **This kit contains the following parts:**



- Instruction Manual #90549
- USB Key
- Software CD w/Case
- Gray communication cable
- NGK Wide Band Interface Cable

**NOTICE: This kit is ONLY compatible with Windows XP. It will not work with Windows Vista or Windows 7.**

**This kit does not include a USB to Serial adaptor. Keyspan® company ([www.keyspan.com](http://www.keyspan.com)) makes a very easy to use unit P/N USA-19HS. This is the ONLY adaptor which is compatible with this kit. This adaptor must be purchased for this kit and is available from most electronics suppliers.**

# **Installing the Software**

1. Start by placing the Software CD into the CD/DVD drive on the desired computer and close the drive door. The software will automatically start an installation wizard and walk you through the installation process.
2. Follow each step in the wizard and finish the software installation process. At the end when it asks if you would like to start the software, remove the check from the box and close the window.
3. Now that the software has been installed onto your computer; there is an icon on your computer titled, "InGenius Perfect v2.2."
4. **Now insert your purple USB key into a port on your computer.**
5. Double click on the InGenius Perfect v2.2 icon on the desktop or go to START>All Programs>Painless Performance>Ingenius Perfect v2.2>Ingenius Perfect v2.2.
6. Now you can navigate through the software as explained in these instructions. Please read about each section and what changes it allows.
7. If you are ready to connect to your car with the Perfect System installed (it won't work sitting on a workbench disconnected from your engine), place the CD that was included with your new KeySpan USB to Serial adaptor (P/N USA-19HS) and install the software as per the KeySpan software wizard.
8. Now connect the USB to Serial adaptor to the computer, connect the gray communication cable to the USB to Serial adaptor and then, with the ignition **OFF** plug the communication cable into the PERFECT engine harness.
9. After the software opens, turn the ignition to the **ON** position and watch for the red icon on the lower right hand corner of the screen to turn yellow and then green.  
  
*\*If the icon did not change colors, the ECM and laptop are not communicating. Click the Run button on the top of the screen one time, wait three seconds and then click it again. If the icon on the bottom of the screen still does not change, go to OPTIONS>Settings>Communication>and pick a different COM port. If it was set to COM 1 then try COM 3. Try each different Com Port until the icon on the bottom of the screen turns green. Each time a different Com Port is tried, the RUN button on the top of the screen will need to be toggled on and then off.*
10. **IMPORTANT/IMPORTANT/IMPORTANT: ALWAYS CLICK RECEIVE FOR THE FIRST TIME WHEN THE SOFTWARE CONNECTS TO THE ECM. If you send a blank calibration to the ECM it will erase the ECM and it will be necessary to send it back to Painless to be recalibrated. THIS IS A VERY IMPORTANT DETAIL TO NOT MISS.**

11. On part numbers 65140, 65141, 65252, and 65253 it is necessary to save the calibration onto your computer once you have received it. These calibrations are not in the software package where they can be retrieved once they are modified.
12. In order to load a calibration into the ECM, go to Calibration>Open>Calibrations>  
**And then pick the appropriate calibration for your PERFECT SYSTEM. For example, A GM Tuned-Port Engine uses the L98 calibration.**
13. Click on the desired calibration, open it and now click<SEND>. Do not turn off the ignition or try to start the vehicle until it's completed downloading the cal to the ECM.
14. Now cycle the ignition off, wait seven seconds and then turn it to the On position.
15. **Providing the engine, fuel system, and wiring installation is complete, turning the key to the start position should fire up the engine. Be sure to check the fuel pressure is at the specific pressures for your engine.**

## Section 1: General Tuning Guidelines

**The adjustments available in this software have the potential to seriously damage the engine, if** not done in the proper way. If a leaner than required mixture or too much spark timing is programmed into the engine ECM, detonation leading to a damaged engine will most likely occur. The calibrations provided for each engine are a good base to start programming from. Most of the time the spark tables for each engine combo will not need to be changed from the ones provided. When larger than stock camshafts are installed into an engine the idle and just off idle spark timing may need to be slightly advanced. The fuel tables and idle setup are most often in need of tuning. However, if the fuel/air mixture is too lean engine damage is imminent under sustained heavy loads. A rich condition will usually just produce clouds of black smoke from the exhaust pipe or even foul spark plugs.

## Section 2: Dashboard

This screen serves as a "Scan Tool" for the PERFECT systems. The Dashboard shows live sensor data, (RPM, TPS, MAP, O2, and ECT), etc, when the engine is running or the key is in the ON position. This sensor data is used to analyze engine performance, sensor functionality and monitor critical sequences of events. For example, with the key on engine off, if the accelerator is not being pressed at all, the TPS gauge should read "0%". Then with the accelerator pressed to the floor, the TPS gauge should read "99.6%". The throttle adjustment is explained in more detail in Section 3: Idle.

The Dashboard can be customized by adding different gauges with each displaying different parameters and controlling how each parameter is displayed. Simply right click the mouse, choose "Design mode", then right click the mouse again and select "New Gauge". A window displaying all of the available features for each gauge will popup. Simply click on each tab and make decisions based on the appearance and function of the gauge desired. Many of the most important gauges come preset in this software package and can be modified at anytime. Once any design changes have been made, simply go to File-Save Workspace and save any changes that have been made.

## Section 3: Fuel

These screens contain the main Base Fuel Table with the fuel injector pulse width values. The values are in milliseconds of injector firing time or in other words, "How long the injector is open and allowing fuel to be sprayed into the engine". Other adjustments in this section are simply a multiplier being applied to the values in the Base Fuel Table to increase or decrease the amount of fuel under specific conditions. It is critical the base fuel table values are as accurate as possible.

See below for a description of how each adjustment is made in the Fuel screen:

## 1. Main – Base Fuel Table

- RPM (Revolution per Minute) vs. MAP (Manifold Absolute Pressure) Sensor values in KPA (Kilopascals) These are the “X” and “Y” coordinates of the table.
- How much fuel will the engine efficiently burn at a specific RPM? If the engine was held at a constant RPM and MAP(Load) listed on the Base Fuel Table, then the amount of fuel the injector will deliver is directly proportional to how many milliseconds the injector is command to be open.
- It is crucial, when making adjustments to these values; the Coolant and Intake Air Temperature Compensation multipliers are set to 1.00 and the Transient Fuel multipliers must be set to 0. Only then will the engine be running solely on off the Base Fuel Table numbers. The O2 sensor selection in the **Setup menu** must be set to either “No Fuel Trim” or when present “Wideband Monitor”. This is to prevent any Closed Loop O2 fuel trim. This fuel injection system is **only** compatible with the NGK AFX wideband system. Call your local Painless Performance dealer for more details.
- Painless has provided base calibrations for each engine supported, so be sure and start with the correct engine base calibration.

## 2. Compensation – Coolant Temperature and Intake Air Temperature

- Coolant Temperature – These values are multiplied to the Base Fuel Table values to richen the mixture when the engine coolant, hence the engine, is cold. Or another way of looking at it is, it leans out the mixture as the engine warms up. Generally speaking, the values warmer than 176deg F should be 1.00. This would mean there is no enrichment due to the engine not being at running temperature.
- Intake Air Temperature – These values are multiplied to the Base Fuel Table values to richen the mixture when the intake air is cool and to lean out the mixture when the intake air is hot. It’s best to use the Coolant Temperature to do most of the cold enrichment when the engine is cold and the Intake Air enrichment to fine tune fueling via air temperature.

## 3. Crank Fuel

- Crank Fuel Prime – This is the initial shot of fuel from the injectors, comparable to throttling a cold carbureted engine before startup. The amount of fuel needed will vary with each different engine combination. Generally, more fuel is needed for quicker starts on engines with larger lift and duration camshafts. Watch for an overly large puff of black smoke out of the tailpipe during startup for an indication if the values in these fields are too large.
- Crank Fuel – This is the amount of fuel sprayed into the engine from 0 rpm to 300 rpm. Colder temperatures require more fuel. Watch for an overly large puff of black smoke from the tailpipe for an indication of too much fuel during startup.
- Crank to Base Fuel Compensation – These values are multiplied to the Base Fuel Table values and are used to gradually pull out the overly rich mixture during cranking. Once the engine speed is greater than 300 rpm, these values will start tapering off the amount of fuel being injected into the engine. Think of this as the transition to the Base Fuel Table while the engine is firing up. It’s equivalent to the choke pull-off on a carburetor.

- Blend Time – This is the time it takes to transition from Crank Fuel to the Base Fuel Tables. Larger times here will slow down the transition and keep the fuel mixture rich longer. Smaller times here will speed up the transition and shorten the amount of time the mixture is richer. If the engine acts like it's about to die after it first fires up, this value may need to be increased dependent upon if the Air/Fuel ratio measured in the exhaust goes lean and the engine stumbles.

#### 4. Transient Fuel

- MAP Acceleration Enrichment - These values are multiplied to the Base Fuel Table values to richen the mixture when there's a change in the amount of engine vacuum. Engine vacuum can be directly translated into the amount of load being applied to an engine. With increased load, the engine will need more fuel to continue to do the same amount of work. Only with a change in the engine vacuum (load) will these fuel multipliers be applied to the mixture.

##### **Fuel Multiplier based on Delta Manifold Pressure (0 to 31.13 msec)**

- "**Delta**" – means "**change in**"

- TPS Acceleration Enrichment – These values are multiplied to the Base Fuel Table values to richen the mixture when there's an increase in the amount of throttle being applied to the engine. Only on an increase in throttle will this adjustment be used by the ECM to richen the mixture. In carburetor terms, this adjustment would be the "accelerator pump". If under a hard stomp of the throttle the engine stumbles, slightly increasing these values may help to fix the problem. Watching the Air/Fuel ratio in the exhaust with a wide band O2 sensor, see if the mixture goes too lean. Under a hard acceleration, it would be normal to possibly see the AFR goes as far rich as 10 to 1.

##### **Fuel Multiplier based on Delta Throttle Position (0 to 31.13 msec)**

- "**Delta**" – means "**change in**"

#### 5. Decel Fuel Cut-off

- This enables or disables the fuel to be cut-off during a deceleration. It helps prevent and control back-firing when decelerating. It also prevents the engine from loading up with fuel during a high rpm throttle release. In most street applications, it is recommended to enable this feature for best drivability.

#### 6. Oxygen Sensor

- Idle Target A/F Ratio – This is the Air/Fuel Ratio the ECM will trim or add fuel to when in closed loop and the engine is idling. The ECM only has the authority for 20% more or less fuel. Before any closed loop fuel trim is used the Base Fuel table must be as accurate as possible.
- Target A/F Ratio – This is the Air/Fuel Ratio the ECM will learn to for each engine load (MAP) and engine rpm. The desired Air/Fuel Ratio entered in each box is where the fuel trim adjustment in the software will adjust the Air/Fuel Ratio to be. Weather conditions and Barometric pressure have an effect on how much fuel will need to be added or subtracted from the base fuel table. Understand these values are a "Target" for the ECM to reach with Fuel Correction. This is displayed on the Main

Dashboard under the O2 Sensor gauges. Fuel Correction is the percentage of fuel being added or subtracted by the ECM from the Base Fuel Table. The less fuel being added or subtracted from the Base Fuel Table the closer the values are to being correct for a given calibration.

- Enable RPM – This is the engine speed in which Closed Loop O2 Fuel control becomes active. Most stock, smooth idle engine combinations will want to enable the Closed Loop O2 control at around 600 rpm. Larger profile camshafts may require the enable rpm to be around 1500-2000 rpm.
- Disable RPM – This is the engine speed in which the Closed Loop O2 Fuel control becomes inactive.
- Coolant Temp Enable – This is the coolant temperature the engine must be up to in order to enter Closed Loop O2 control. It's best to enter Closed Loop O2 control after the engine is at operating temperature. Generally about 10-15 degrees before the thermostat opening temperature will cover most engine combos.
- Minimum Run Time – This is the minimum time the engine must be running before entering Closed Loop O2 control. The main purpose of this is for hot starts were the engine is still warmed up, but the O2 Sensor is not. If the O2 sensor is not warmed up it will not function properly and will most likely send the incorrect signal to the ECM.

## Section 4: Spark

The Base Spark Tables are developed in these screens. The sky's the limit when configuring a spark table for ignition timing, so great care must be taken when modifying these tables. If too much spark advance is calibrated into the system, severe detonation will occur. Detonation will not only hinder engine performance, but can also severely damage the engine. Engine damage will result from too much spark advance and continual detonation.

The values in these tables are in degrees of spark advance before top dead center. In other words, "The number of degrees of crankshaft rotation the spark plug fires before each piston reaches Top Dead Center." It is critical the Base Spark Table values are as accurate as possible. If the engine has detonation under a load or hard acceleration, be sure to retard the spark appropriately. Knock detection can be enabled or disabled in this section. Knock detection is useful in determining if the Base Spark Table has too much advance calibrated in it. Spark compensation based on coolant temperature and engine load can be adjusted here as well.

### 1. Main – Base Spark Table

- RPM (Revolution per Minute) vs. MAP (Manifold Absolute Pressure) Sensor values in KPA (Kilopascals) These are the "X" and "Y" coordinates of the table.
- The MAP values are a direct translation to the amount of engine load. The higher the MAP value reading indicates a larger engine load.
- Base Spark Table values should only be calibrated when the engine is fully warmed up.
- Painless has provided base calibrations for each engine platform supported, so be sure and start with the correct engine base calibration.

- When the Knock System is enabled, a gauge showing the amount of Knock Retard on the Mini Dashboard can be used to determine if the Base Spark Table needs to be calibrated.
- Generally speaking, the specific spark table provided for each engine platform supported will not need to be adjusted. Some examples of when the timing will need to be advanced more would be when a very large duration/lobe separation camshaft has been installed. The advance from idle and up to about 1500rpm would be the area to slightly increase, so a more stable idle speed can be achieved.

## **2. Compensation – Altitude and Coolant Temp and MAP**

- Altitude - This is used to add or subtract spark advance based on atmospheric pressure. The amount of atmospheric pressure is a measurement taken by the ECM every time the ignition is turned on. This directly relates to the amount of oxygen available to the engine to support combustion. Higher elevations have less atmospheric pressure; hence less air will be pushed into the engine with each piston stroke. SO, to maintain close to the same performance as in lower altitudes; advancing the timing slightly is one option.
- It is always a good idea to monitor the knock system while tuning the spark tables. If the engine is knocking/has detonation/pinging and more spark timing is added, severe engine damage will eventually occur.
- Coolant Temp and MAP – This table is designed to remove spark when both engine load and temperature are both at higher levels. As the engine is loaded and the engine speed decreases knock may occur. This is because the fuel sprayed into the cylinders is given a longer time to heat up before combustion. The amount of spark to be removed will depend on the engine combination, efficiency of the cooling system, and size/weight/gearing of the vehicle it is in. The base calibrations provided in this software package do not have values in this table.
- Knock – All systems supported with this software from Painless Performance use the knock system. It is highly recommended to leave the knock system enabled to prevent severe engine damage. The maximum amount of spark retard the knock system is allowed to enable is 10 degrees.

## **Section 5: Idle**

### **1. Idle Speed – Desired Idle Speed and Vehicle Speed Enable**

- Desired Idle Speed – This is where the idle speed of the engine is set based on coolant temperature. Higher idle speeds are recommended when the engine is cold to quicken the amount of time a cold engine takes to reach operating temperature. On the Dashboard there is an indicator called “Idle in Control of RPM” which tells if the ECM is in control of the idle speed. The throttle must be fully closed for this to occur.
- Vehicle Speed Enable – Where applicable, this tells the ECM when to go into loop idle control in relation to MPH. A good place to start is 25mph.

## 2. Throttle Setup – Throttle Zero and Throttle Scaler

- Throttle Zero – This is used to synchronize the throttle position sensor signal and what the ECM considers closed throttle. The calibration procedure for this is outlined on this screen. If this number is incorrect, Closed Loop Idle Air Control, Idle Spark Stabilizer and Stall Saver will not work properly.
- Throttle Scaler – This multiplier is used to scale up or down the TPS reading to achieve the correct throttle position percentage at WOT(wide open throttle). With the throttle fully depressed, adjust this value until the percentage at WOT is 99.6%. On this system 99.6% is wide open throttle. Always be sure to check the Throttle Zero value by using the procedure in the software after adjusting the Throttle Scaler.

## 3. Advanced Idle Calibrations

- Throttle Follower Intro – This value represents the number of steps per percentage of throttle opening the IAC (Idle Air Control) valve will open as the throttle is opened. This acts as a buffer when under a quick deceleration to help the transition from open throttle to closed throttle. Some carbureted applications had a dashpot to dampen a quick snap of the throttle. This adjustment does the same thing, only with the IAC. A value of 1 will cause the ECM to open the IAC one count per 1% of throttle position.
- Vehicle Speed Follower Intro – This value represents the number of steps per vehicle speed (MPH) the IAC valve will open. This is especially useful on a long deceleration down a hill where the throttle is closed and the engine is still above the Desired Idle Speed. Without the Vehicle Speed Follower, the ECM will try to bring the idle down to the set Desired Idle Speed and fully close the IAC. Once the vehicle came to a stop, the engine speed would droop below the Desired Idle Speed and almost die because of the time it takes to open the IAC from its fully closed position.
- Follower Decay – This is the rate in which the Throttle Follower is decayed out. How many seconds it takes to bring the IAC back to its Idle Speed Position. If the engines idle hangs or stays higher than normal, increase this value. If the engine idle droops and almost dies, decrease this value.
- Stall Saver – This is a multiplier used to set a RPM below the Desire Idle Speed in which the Stall Saver goes into effect. So if the idle speed is 750 rpm and the value in this field is set at 0.7500, then the Stall Saver will enable at 562 rpm. Stall Saver adds IAC counts (opens) and advances the ignition timing to keep the engine from stalling.
- Stall Steps – This is the number of IAC steps added by the ECM when in Stall Saver mode. This number will be added every .125 seconds or 8 times per second. The more steps added, the more aggressive the ECM will try to recover the engine from stalling.
- Crank IAC Position – This is the IAC cranking position based on coolant temperature. When the ignition is turned to the on position the ECM will move the IAC to this position to give the engine the correct amount of air to start. The larger the number the higher the engine speed will flare when it first fires up. This is why it is not necessary to hold the throttle open while cranking a fuel injected engine, as it most likely would be on a carbureted engine.
- IAC Max Position – This value is the upper limit for how many counts the IAC can open to. These values are setup at the factory and the Perfect System Calibrations

already have them. Under normal circumstances this value will not need to be changed.

- IAC Max Base Position – This is the maximum IAC position without throttle follower, stall saver or load anticipation added. These values are setup at the factory and the Perfect System Calibrations already have them. Under normal circumstances this value will not need to be changed.

## Section 6: Setup

### 1. Sensors – IAT Sensor

- IAT Sensor – This is where the Intake Air Temperature Sensor input to the computer is enabled or disabled. If an IAT Sensor is present, enable this input. Calibration of the fuel via air temperature must be entered under the Fuel Screen. The IAT sensor calibration is useful to remove a slight amount of fuel as the air temperature increases or to add a slight amount of fuel as the air temperature decreases. On a really cold day, 32deg F and below, this adjustment can be used to enrich the fuel slightly.

### 2. Oxygen Sensor – Enable/Disable

- No Fuel Trim - This is exactly what it says, "No Fuel Trim" meaning the engine will run directly off of the Base Fuel Table values only. This means the O2 system has been completely disabled. When using an external wide band O2 sensor to monitor the exhaust air/fuel ratio, this will need to be selected.
- Stock Closed Loop – This is only used with a stock narrow band O2 sensor. All PERFECT systems use this type of sensor when no wide band O2 sensor is present.
- **These next two choices REQUIRE the use of a NGK AFX wide band Oxygen Sensor Kit P/N 91101.**

**NOTE: Included in this kit is a wideband interface harness with the purpose of connecting a NGK Wideband Sensor P/N 91101 into the main engine harness. Simply match and connect the wires based on their colors and plug into the O2 connector on the engine harness. Be sure and follow the instructions on the Wideband display module to do a free-air calibration before inserting the NGK O2 Sensor into the exhaust pipe.**

- Wideband Monitor – This is only used with the NGK AFX wide band kit. Its purpose is to accurately measure the oxygen content in the exhaust to indicate if the engine is receiving too much fuel or not enough fuel. More oxygen is lean and less oxygen is rich. The gauge on the Dashboard of the software that displays, "O2 Sensor" will indicate what the air/fuel ratio is in the exhaust. This gauge will not give an accurate measurement when a narrow band O2 sensor is being used.
- Wideband Closed Loop – This is to enable closed loop O2 fuel trim after the base fuel table has been thoroughly calibrated. The ECM will compare the Air/Fuel ratio value in the Target Air/Fuel ratio table to the actual value read in the exhaust. The ECM has the authority to change the amount of fuel plus or minus 20% of the

values in the Base Fuel table. This is why it is best to have the Base Fuel Table's values within at least 20% of the desired Air/Fuel ratio.

### **3. Fuel Pump – Prime Time at Keyup**

- Prime Time at Keyup – This is the amount of time the fuel pump will run when the ignition switch is initially turned to the on position. Its how the computer primes the fuel rail with pressurized fuel before the engine is being cranked to lessen the amount of time for fuel to be delivered and the engine to start. Three seconds is usually more than enough time to prime the system.

### **3. Rev Limit**

- Engine Speed Limit based on Coolant Temperature – This is the Rev Limiter on the Perfect System. Cold engines and overheating engines need to have a lower rev limit, than engines at normal operating temperature.

### **4. Aux Output – NOT SUPPORTED IN PERFECT APPLICATIONS**

### **5. Fan 1 – On Temperature/Off Temperature**

- On Temperature – On all PERFECT systems this is the temperature in which the ECM will provide a ground signal to an electric cooling fan relay. Set this temperature at approximately 20 degrees Fahrenheit lower than the normal engine operating temperature.
- Off Temperature – On all PERFECT systems this is the temperature in which the ECM will take away a ground signal to an electric cooling fan relay thus turning the fan off. Set this temperature at approximately 10 degrees Fahrenheit lower than the On Temperature set point in order for the fan to run continuously. In most cases, the electric cooling fan will not need to cycle on and off, but if such operation is desired the On and Off temperature set points will need to be adjusted.

### **6. Fan 2 - NOT SUPPORTED IN PERFECT APPLICATIONS**

### **7. Set Timing – Enable/Disable**

- By enabling the "Set Timing" mode, the ECM will force the spark advance to 10 degrees of base spark timing. At this point, adjust the distributor until the base timing tab is showing 10 degrees of advance. Lock down the distributor and then disable the Set Timing function. This function is used to synchronize the distributor advance to the ECM advance. In other words, the ECM and the Engine's distributor are now calibrated to each other. This function is only used on adjustable distributor ignitions engines.

**The PERFECTION software has been designed specifically for use with the Delphi MEFI-4 engine control module supplied by Painless in the PERFECT Engine Management System. This programming software is not compatible with any other MEFI ECM.**

Please note there are early and late versions of the PERFECT ECM. The early version only has the Delphi serial number on the label located on the back of the ECM. If you have this ECM you will need to send it in to Painless to have the latest base calibration flashed onto the ECM. Please contact Painless at 1-800-423-9696 for a return authorization and shipping instructions. There is no charge for this upgrade. **Be sure to send in the purple USB Key Number (as seen below) with your Purple USB key.**

The later version of the PERFECT ECM will have a USB key number in addition to the Delphi serial number. If you have this version of the ECM the USB dongle included in this software kit must be sent to Painless so it can be matched with the USB key number on the ECM. Again, please contact Painless for shipping instructions and make sure you send in the **purple USB Key Number (as seen below) with your Purple USB key.**

PERFECT software can only be used with the ECM and dongle for which each USB key number has been assigned.



**Perfect Performance Products, LLC** shall in no event be liable in contract or tort (including negligence) for special, indirect, incidental, or consequential damages, such as but not limited to, loss of property damage, or any other damages, costs or expenses which might be claimed as the result of the use or failure of the goods sold hereby, except only the cost of repair or replacement.