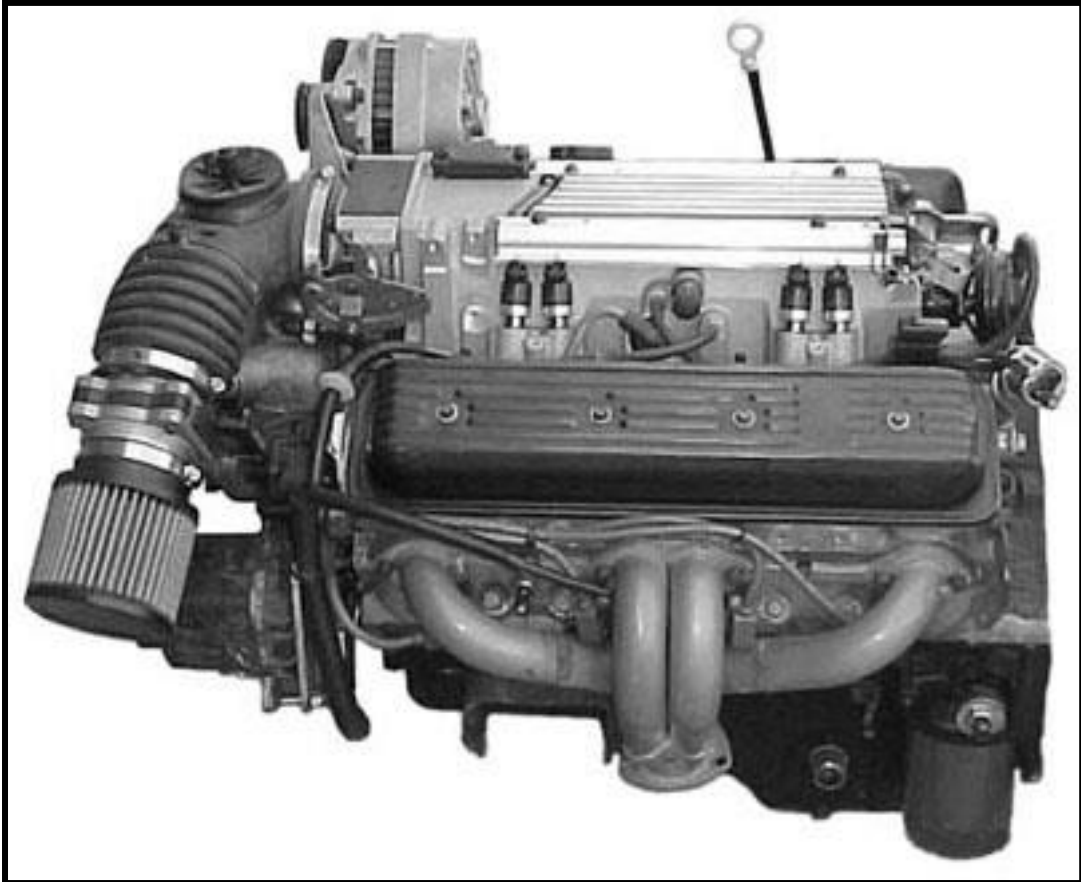


PAINLESS

PERFORMANCE PRODUCTS



Wire Harness Installation Instructions

For Installing Harness Numbers:

60502: 1992-97 GM LT1 Harness Std. Length

60505: 1992-97 GM LT1 Harness Extra Length

Manual P/N 90517

Painless Performance Products recommends you, the installer, read this installation manual from front to back before installing this harness.

Painless Performance Products, LLC
2501 Ludelle St.
Fort Worth, TX 76105-1036
PHONE: 800-423-9696 FAX: 817-244-4024
EMAIL: support@painlessperformance.com

If you have any questions concerning the installation of this harness, feel free to call Painless Performance Products' Tech Line at 1-800-423-9696. The Tech Line can be reached from 8 A.M. to 5 P.M. central time, Monday through Thursday, and 8 A.M. to 4:30 P.M. on Fridays.

We have attempted to provide you with as accurate of instructions as possible and are always concerned about corrections or improvements that can be made. If you have found any issues or omissions, or simply have comments or suggestions concerning these instructions, please write us at the above address, send us a fax at (817) 244-4024, or email us at support@painlessperformance.com. We sincerely appreciate your business.

Painless 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.

12th Edition: November 2019
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CAUTION: BEFORE THE REMOVAL OF YOUR ORIGINAL HARNESS AND/OR THE INSTALL OF YOUR NEW PAINLESS HARNESS, DISCONNECT THE POWER FROM YOUR VEHICLE BY REMOVING THE NEGATIVE OR POSITIVE BATTERY CABLE FROM THE BATTERY.

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1. INTRODUCTION

This harness is designed to be a complete wiring system for the fuel injection system on General Motors 1992 and newer LT1 injected engines and to control the 4L60E transmission. This harness includes all wiring that is needed by the computer to run and control the injection system and transmission. A module has been included to bypass the vehicle anti-theft system (VATS) incorporated in the computer. **When using this harness on a '96 or '97 engine you must replace the coil, coil output wire with the parts from a '92 - '95 engine.**

NOTE: The use of a 40 pulse Vehicle Speed Sensor, such as the one that comes standard in the 4L60E transmission, is required when using a 1994 or newer computer for operation of emission devices. If emission devices are required in your area, the use of any other style transmission, such as a 350 or 400 Turbo, which cannot operate a 40-pulse sensor, cannot be used. The use of a 4L60E will also require the use of an electronic speedometer because of the absence of a cable drive in the transmission.

Any 1994-1997 LT1 ECM will work with this harness. It will however be up to you, the installer, to verify you have the right combination of knock sensor module, knock sensor part number, and the number of knock sensors needed for your application. See **Section 4.3** for the correct knock sensor information.

Usually, the computer, relays and fuse block can easily be mounted under the dash. Most of the wiring in the harness has been pre-terminated to the proper connector and all wire has been GM color-coded.

This fuel injection system harness has been 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 (DLC) connector, check engine light, computer wiring and connectors, brake switch wiring, gear shift indicator wiring, tachometer wiring, air pump, canister purge, VATS and fuse block.

TAIL GROUP

Include VSS wiring, transmission wiring (if applicable) and power wire for fuel pump.

2. ABOUT THESE INSTRUCTIONS

These instructions provide information for the installation of the 60502 LT1 (92-97) Fuel Injection Harness Kit. The contents of these instructions are divided into major **Sections**, as follows:

- 1.0 INTRODUCTION
- 2.0 ABOUT THESE INSTRUCTIONS
- 3.0 TOOLS NEEDED
- 4.0 PRE-INSTALLATION AND HARNESS ROUTING GUIDELINES
- 5.0 GENERAL INSTALLATION INSTRUCTIONS
- 6.0 60502 LT1 (94 & 95) FUEL INJECTION HARNESS KIT
- 8.0 TROUBLE-SHOOTING INSTRUCTIONS AND TROUBLE CODES

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

3. TOOLS NEEDED

In addition to your regular tools, you will need, at least, the following:

- Crimping tool
 - Wire stripper
 - Continuity tester
 - Electric drill
 - 1 5/8" Hole saw (for the rubber grommet in the firewall)
- NOTE: USE A QUALITY TOOL TO AVOID OVER-CRIMPING.**
- CAUTION: DO NOT USE A TEST LIGHT TO TEST THE COMPUTER OR SENSOR WIRING OR YOU WILL DAMAGE THE COMPUTER.**

4. PRE-INSTALLATION AND HARNESS ROUTING GUIDELINES

The installation of your harness kit will consist of two parts:

- 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 automobile. That depends a great deal upon the particular make of the automobile and what extent you want to secure and conceal the harness. We do offer some general guidelines and routing practices starting in **Paragraph 5.3**, general installation instructions in **Section 5.0**, and precise instruction concerning the electrical connections you will have to make beginning in **Section 6.0**. To help you begin thinking through the installation of your wire harness, read the following sections:

4.1 TRANSMISSION FUNCTION

If you are not using the 4L60E transmission, read **Paragraph 4.1.1**, then skip to **Paragraph 4.1.3**. If you **ARE** going to use 4L60E, then skip **Paragraph 4.1.1**, and start at **paragraph 4.1.2**.

- 4.1.1** If you **ARE NOT** using a 4L60E transmission, tape off and store the light blue/black and pink (brake switch) wires in the dash group and the 13-position (transmission) round connector in the tail section.
- 4.1.2** If you **ARE** going to use a 4L60E transmission then you **MUST** have a two-position vehicle speed sensor (VSS), and the correct brake switch. These are necessary to make the transmission work correctly. The brake switch should be closed (electrically connected) when the brakes **ARE NOT** being applied and open (not electrically connected) when the brakes **ARE** being applied. This is the opposite of a standard brake light switch. If you are using a pressure brake switch, a **SPDT** relay must be installed to unlock the converter when the brakes are applied. The vehicle speed sensor lets the computer know how fast the wheels are turning.
- 4.1.3** Regardless of whether you use the 4L60E or not, the vehicle speed sensor (VSS) and park/neutral indicator switch must be used and is needed by the computer so it can command the emissions control devices on the engine. This part is necessary if you want your car to be street-legal.

NOTE; EMISSION DEVICES:

This harness has provisions for 3 emission devices, which are EGR solenoid, Air Pump relay and a Canister Purge solenoid. We have rolled up the canister purge solenoid wiring and air pump wiring in the dash section and may be left there if these items are not to be used. If you plan on using the canister purge solenoid and air pump you will need to route these wires out to the engine compartment and install an air pump relay. Secure the wires to the main harness using the tie wraps supplied.

To keep the check engine light from coming on you will need to plug in a canister purge solenoid and air pump relay to the wires in the dash section. (The computer looks for signals from these controls and does not care if the actual devices are installed.)

4.2 GET TO KNOW THE PARTICULAR ENGINE YOU ARE USING

4.2.1 Painless Performance recommends the use of the following parts. See **Table 4.1**. These will meet all requirements and are compatible with this Painless harness. The numbers given are GM and AC Delco part numbers.

LT1 Fuel Injection Harness Part # 60502 or 60505

Brake Switch	GM	25524845
Intake Air Temp	GM	12110319
Ign. Module	Delco	D-1986-A
Idle Air Control	GM	17113099
Coil	Delco	D-573
Oxygen Sensors	GM Delco	25312184 AFS75
TPS Sensor	GM	17106680
EGR Solenoid	Delco	214-396
Gear Switch Indicator	GM Delco	15705308 D2286A
MAP Sensor	GM	16137039
Coolant Temp Sensor	GM	25036979
Air Pump Relay	GM Delco	14100455 15-8426
MAF Sensor	Delco	213-252
Canister Purge Sol.	GM Delco	1997201 214-565

Table 4-1 Compatible Parts

NOTE: Components with part numbers other than the ones listed may plug into the 60502 or 60505 harness, but the part numbers **MUST** match the ones on this list for proper operation. An adapter is included to adapt the 4-pin square IAC connector to the '94 – '96 flat, 4-pin connector.

ECM Part #'s

88961150	1994-1995 Camaro
16188051	1994-1995
16181333	1994-1995
88963801	1996 Camaro
16242921	1996 Camaro
16214399	1996/1997

THIS HARNESS WILL NOT WORK WITH A FACTORY CORVETTE ECM. Communication and VATS error will occur.

- 4.2.2 Familiarize yourself with the harness by locating each of the harness groups and by looking at the connectors on the wire ends.
- 4.2.3 Decide where and how the computer, fuse block and relays will be mounted. Painless wire harness kits are designed to mount either under the dash or in the kick panel. They must be no further apart than the wiring will allow (approx. 16 inches).
- 4.2.4 A good exercise is to lay out the wire harness on the floor beside your vehicle and identify all the connectors and wires.
- 4.2.5 You will want to route the harness through and around open areas. Inside edges provide extra protection from hazards and also provide places for tie wraps, clips and other support.
- 4.2.6 Route the harness away from sharp edges, exhaust pipes, and the hood, trunk and door hinges.
- 4.2.7 Plan where harness supports will be located. Use a support approximately every 6 inches unless the harness routes under the floor carpet.
- 4.2.8 Allow enough slack in the harness at places where movement could possibly occur (body to frame, frame to engine, etc.).
- 4.2.9 The wires should be bundled into harness groups. Use tape, nylon ties or poly split loom.

4.3 KNOCK SENSORS

- 4.3.1 All LT1 engines utilize a sensor to detect combustion detonation and will adjust timing in the event pre-detonation occurs. All engines have one sensor mounted on the passenger side of the engine, just forward of the starter. Depending on the vehicle the engine came out of and/or the knock sensor module in the ECM you are using, some installs will require an addition knock sensor to be installed on the driver side of the engine.
- 4.3.2 Using the chart below verify you have the right combination of knock sensor module, knock sensor part number, and the number of knock sensors needed for your application. Using the wrong combination will result in error codes being stored in the ECM and/or poor ignition timing.

<u>KNOCK MODULE NUMBER</u>	<u>YEARS</u>	<u>BODY STYLE</u>	<u>ENGINE</u>	<u># OF SENSORS</u>	<u>KNOCK SENSOR PART #</u>
16214681	1996	Y	5.7/LT4	2	213298 / 10456222
16214661	1996-1997	F	5.7	1	213325 / 10456287
16214671	1996	B	5.7	2	
16214691	1996	B	4.3	2	
16177690	1994-1995	Y	5.7	2	21396 / 10456126
16177700	1994-1995	F	5.7	1	
16188309	1994-1995	B	5.7	2	
16188709	1994-1995	B	4.3	2	

F= Camaro/Firebird; Y= Corvette; B=CAPRICE, IMPALA, ROADMASTER

Table 4-2 Knock Sensor

- 4.3.3 The knock sensor module can be found on the ECM, under the sealed cover. The part number of the module will be printed on it.

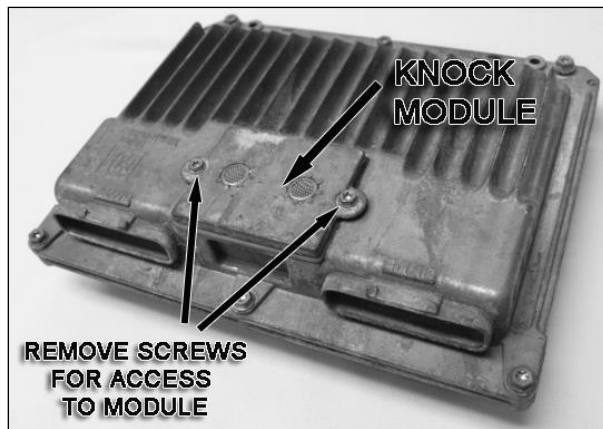


FIGURE 4.1 Knock Module Location

4.3.4 If you require 2 knock sensors, a knock sensor pigtail has been provided. The knock sensor will connect to the Painless chassis harness according to the ECM you are using, see the diagram on the next page. 1996-1997 ECMs require the knock sensor pigtail to be added to the BLUE ECM connector, the correct terminal has been pre-installed; instructions for this are on the next page. 1994 & 1995 ECMs will require you to splice the blue wire of the pigtail to the blue wire going to the knock sensor connector of the Painless harness. Splices and heat shrink have been provided. When splicing these wires, the pigtail will need to be cut to length. Both connectors should break out from the main harness about 34-36”.

1996-1997 ECMs Only

1. Locate the BLUE ECM connector. Undo the locking tangs of the connector, giving you access to the wire insertion side of the connector. Using a small screw driver, press the locking tang on one side of the blue terminal lock and pull the lock away from the connector. Once one side is done, do the other side as well to completely remove the lock from the connector.
2. Locate the knock sensor pigtail supplied with this kit. This pigtail will be a blue wire with a round gray connector pre-installed. Plug the terminal pre-installed on the blue wire into pin #21.
3. Route the pigtail down the harness to where the other knock sensor is. Use zip ties or tape to secure the wire to the harness.

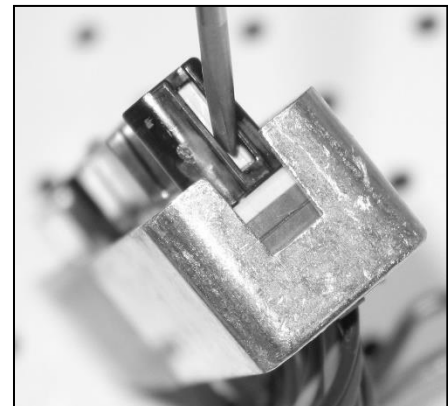


Figure 4.2
ECM Terminal Lock

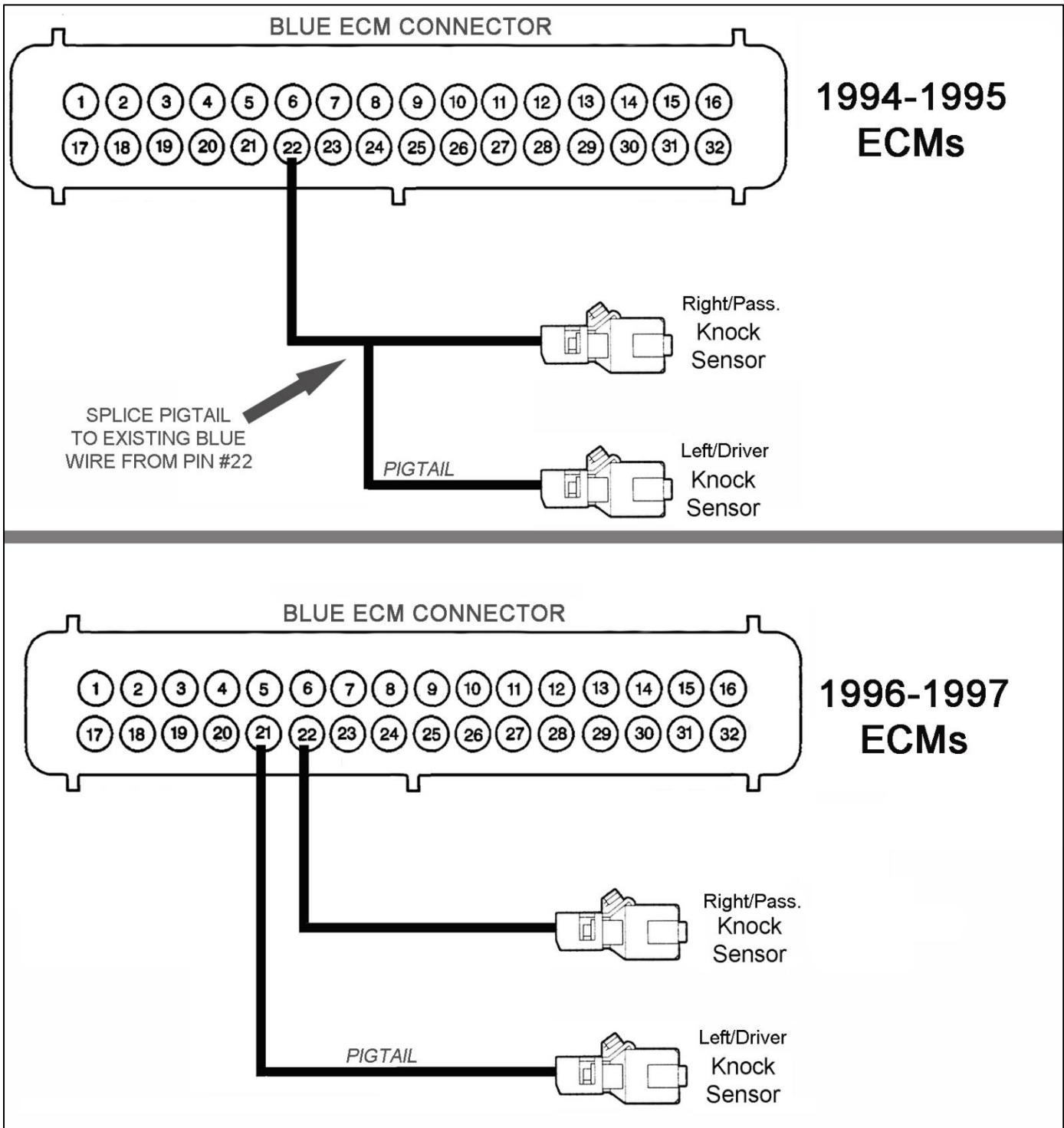


FIGURE 4.3
Knock Sensor Add On

5. GENERAL INSTALLATION INSTRUCTIONS

CAUTION:

- **DO NOT DISCONNECT THE BATTERY OR THE COMPUTER CONNECTORS WHILE THE IGNITION IS ON.**
- **DO NOT SHORT ANY WIRES IN THIS HARNESS TO GROUND (WITH THE EXCEPTION OF LABELED GROUND WIRES) OR DAMAGE TO THE COMPUTER WILL RESULT.**
- **GIVING OR RECEIVING A "JUMP START" MAY DAMAGE THE COMPUTER.**
- **DO NOT USE A TEST LIGHT WHEN TESTING COMPUTER SENSORS OR COMPUTER CIRCUITS. DAMAGE TO THE COMPUTER WILL RESULT!**
- **WHEN ROUTING THE WIRES FOR THE VEHICLE SPEED SENSOR (IF USED) MAKE CERTAIN THAT THEY ARE AT LEAST 12 INCHES AWAY FROM ANY IGNITION WIRING (SPARK PLUG WIRES, ETC.).**

NOTES:

- There is a normal, small current drain on these fuel injected systems.
- Each connector in this harness is different and will not fit in the wrong place. **NEVER FORCE ANY CONNECTOR.**
- When connecting the plugs to the computer **USE EXTREME CARE** to make sure none of the pins in the computer are or become bent.
- The fuel pump you are using **MUST** be rated at a minimum of **45 PSI** (pounds per square inch).

5.1 GROUNDING THE VEHICLE

A perfectly and beautifully wired automobile will nevertheless have problems if everything is not properly grounded. Don't go to the effort to installing a quality wire harness only to neglect proper grounding.

Note: The installer of this harness is responsible for all ground wires not provided with this part.

- 5.1.1** Connect a ground strap or cable (minimum of a 4 Ga. wire) from the negative battery terminal to the chassis (frame).
- 5.1.2** Connect a ground strap (minimum of a 4 Ga. wire) from the engine to the chassis (frame). **DO NOT RELY UPON THE MOTOR MOUNTS TO MAKE THIS CONNECTION.**
- 5.1.3** Connect a ground strap from the engine to the body.

5.2 ROUGH INSTALLATION

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

Note: Make no wire connections or permanent mounting of any kind at this time.

- 5.2.1** Position the computer and sensors in their intend locations.
- 5.2.2** Drill a 1-5/8" hole for the firewall grommet near the computer for the engine group and tail section to pass through.

- 5.2.3 Route the engine group and tail section through the hole. Push the grommet (already installed on the harness) into the hole until it is seated.
- 5.2.4 Route the dash group over to the driver's side of the car.
- 5.2.5 Route the fuse block and relays to the place they will be mounted.

5.3 HARNESS ATTACHMENT

Note: Harness routing and shaping will be a time-consuming task. Taking your time will enhance the beauty of your vehicle. Please take your time and be patient.

- 5.3.1 Permanently mount your computer. You should mount the fuse block and relays at this time.
- 5.3.2 Mold harness groups to the contour of the dash, engine, frame, etc. Remember to route harness away from sharp edges, exhaust pipes, hinges, and moving parts.
- 5.3.3 Attach harness groups to your automobile with clips or ties starting at the computer and working your way outward.

Note: Do not tighten tie wraps or mounting devices at this time. Make all harness attachments LOOSELY.

- 5.3.4 When used every 1-1/2" or so on the visible areas of the harness, colored plastic wire ties make a very attractive assembly. Otherwise, a tie installed in other areas every 6" or so will hold the wires in place securely. **REMEMBER TO TAKE YOUR TIME.**

5.4 TERMINAL INSTALLATION INSTRUCTION

Note: In the following steps you will be making the circuit connections. Before you start, you should carefully read Sections 6.0, and continually refer to the wire charts, DOUBLE CHECKING your length calculations before cutting any wire or making any connections. These directions are for the wires, which do not have a connector already, installed on them.

- 5.4.1 Have all tools and connectors handy.
- 5.4.2 Select the correct terminal for the wire and application.
- 5.4.3 Determine the correct wire length and cut the wire. Remember to allow enough slack in the harness and wires at places where movement could occur. **DOUBLE CHECK YOUR CALCULATIONS.**
- 5.4.4 Strip insulation away from wire. Only strip as much insulation off as necessary for the type of terminal lug you are using.

Note: In the following step, make sure that the terminal is crimped with proper die in the crimping tool. An improper crimp will not make a good connection. DO NOT OVER-CRIMP.

- 5.4.5 Crimp the terminal onto the wire.
- 5.4.6 Connecting the wires and connectors throughout the harness is a simple process. Make sure that each wire is properly routed and then attached. **DO NOT ATTACH THEN ROUTE AFTERWARD.**

- 5.4.7 When all the wires are attached, tighten the mounts and ties to secure the harness permanently.
- 5.4.8 Attach the connectors to the computer. **BEING VERY CAREFUL NOT TO BEND ANY PINS.**
- 5.4.9 After all connections have been made throughout the harness, connect the battery to the vehicle.

CAUTION: BE SURE THE IGNITION IS OFF WHEN YOU RECONNECT THE BATTERY OR YOU WILL DAMAGE THE COMPUTER.

6. INSTALLATION

Take inventory to see that you have everything you are supposed to have in this kit. If anything is missing, contact the dealer where you obtained the kit or contact Painless Performance at (817) 244-6898. The kit should contain the following items:

- The main wire harness with the connectors already on the ends of most of the wires.
- Fuel Injection Installation Instructions P/N 90517 (This Booklet).
- WH 427 ECM data wire (purple)

6.1 SPECIFIC CIRCUIT CONNECTIONS

Note: If you have not already done so, read sections 4.0 and 5.0 of these instructions and think through the installation of the harness before securing or cutting any wires.

6.1.1 DASH SECTION INSTALLATION

The wires in this group consist of the diagnostic link connector (DLC) (SEE **FIGURE 6.1**), the check engine light (pre-mounted into a mounting bracket), and 13 other wires.

Note: You may need to connect the check engine light wires to their mates in the wire harness.

CAUTION: DO NOT MAKE ANY CONNECTIONS WHILE THE COMPUTER IS PLUGGED INTO THE HARNESS.

Note: Wire color (Example: **BLK/WHI**) is one wire with a stripe. The second color (the stripe) may not be bold. Observe all two-color wires closely.

- A. Find a suitable location to mount the DLC connector (using the bracket that the light is mounted in) that will allow access to the front of the connector and still allow you to see the light while driving.

NOTE: If using a 1997 computer you will have to install the serial data wire provided in this kit. This wire connects into port number 7 in the Blue connector in your ECM, and to the number 2 port in the DLC connector.

- B. Mount the DLC connector using the bracket containing the check engine light in the place selected.

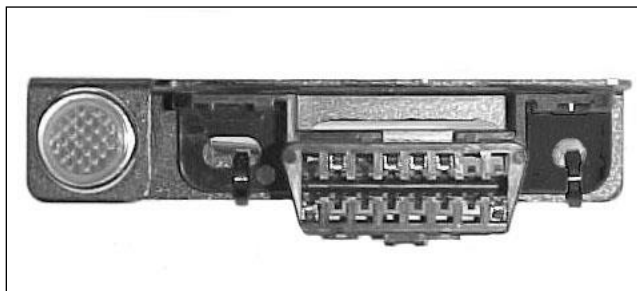


FIGURE 6.1 DLC Connector & Check Engine Light

- C. Locate the pink ignition hot activation wire, labeled "fuse block ignition B+ (18 Ga.)" for the fuse block and attach it to a 12V **fused** power source where there is power when the ignition switch is in the **START** and **ON/RUN** position

WHEN THE KEY IS IN THE START AND RUN POSITION. This is the power wire for the fuel injection harness. If the pink wire is connected correctly, the check engine light will come on when the ignition is "ON or START".

D. Locate the Orn/Blk and Blk/Wht wires in the dash group. These two wires are for the Park/Neutral **INDICATOR** Switch, **NOT** the Neutral Safety Switch. If you have a GM column then you can use the combination switch P/N 15679680 and wire it as described in paragraph 2 or 3 below. The ORN/BLK wire needs to be grounded in "Park and Neutral" and ungrounded in "Drive". This can also be done with a toggle switch or a switch on the parking brake.

CAUTION:DO NOT CONNECT THESE WIRES USING DIRECTIONS FROM DIFFERENT PARAGRAPHS. YOU MAY DAMAGE THE COMPUTER.

D.1. If you are **NOT** using a vehicle speed sensor (VSS) or Park/Neutral Indicator Switch then you will need to connect these two wires together.

Note: If you do this, the computer will stop controlling the exhaust gas recirculation (EGR) solenoid. THIS WILL PREVENT THE SYSTEM FROM BEING STREET-LEGAL.

D.2. If you are going to use the recommended switch for the computers benefit **ONLY**, then you will wire it as shown in **Illustration A**.

D.3. The recommended switch is a combination reverse light **AND** neutral safety switch. You may use it for these purposes **AND** the computer signal **IF** you wire it **EXACTLY** as shown in **Illustration B**.

D.4. You may want to install your own switch. This switch must connect the Orn/Blk wire to ground only when the car is in **PARK OR NEUTRAL**. You may or may not want to use the **BLK/WHT** wire. The other end of the **BLK/WHT** wire is already grounded throughout the harness.

E. The single light blue wire is the wire that lets the computer know when the brake is applied. If you **ARE NOT** using a 4L60E then you will tape off and store this wire. If you **ARE** using the 4L60E transmission then you will have to install an electrical switch described in **Paragraph 4.1.2**. The pink wire provides power for this switch.

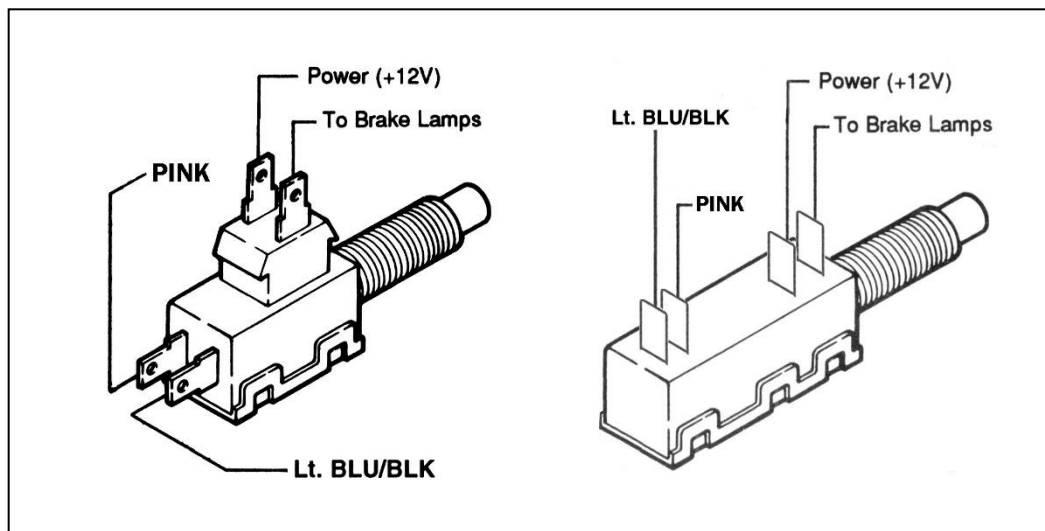


FIGURE 6.2 Brake Switch Connection

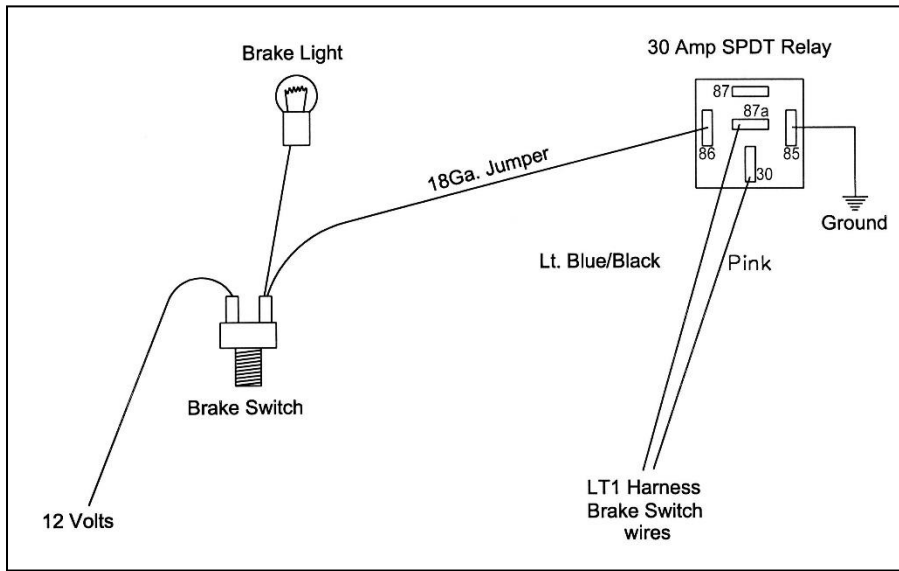


FIGURE 6.3 Brake Switch Relay

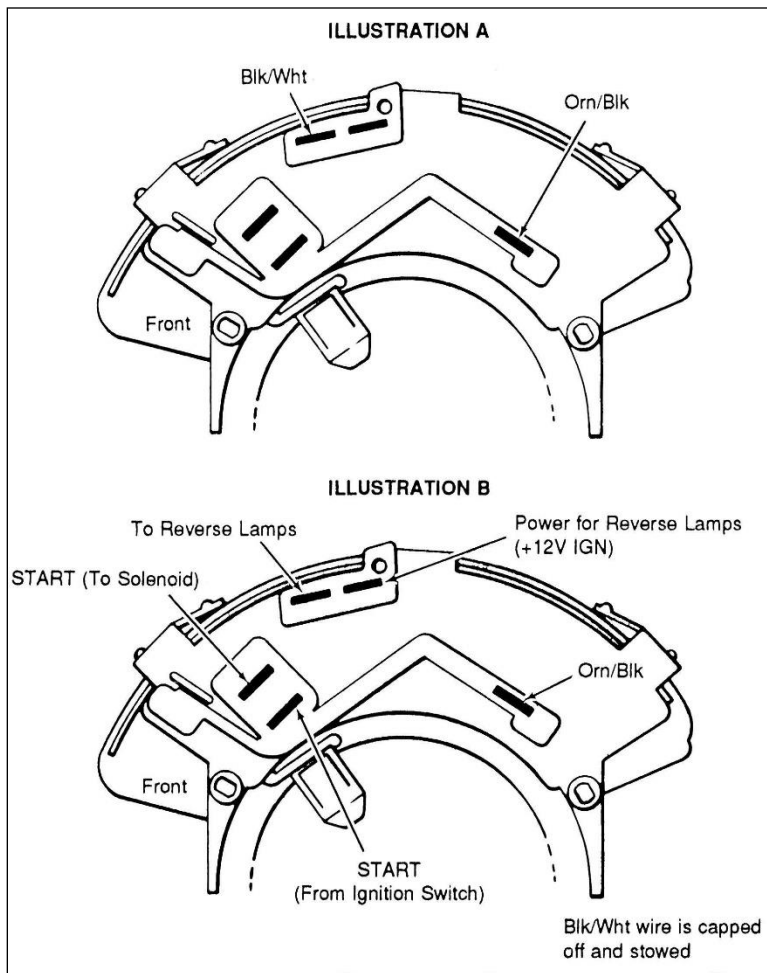


FIGURE 6.4 Gear Indicator Switch

F. If you are using the recommended brake switch then you will wire it according to **Figure 6.2**. The pink wire to the back of the switch in the illustration is the wire that has power on it whether or not the brake is being applied.

CAUTION:FAILURE TO WIRE THIS SWITCH CORRECTLY WILL RESULT IN A DANGEROUS SITUATION ON THE VEHICLE.

- G. If your vehicle has a pressure type brake switch, you may use a relay as shown in Figure 6.3. The relay must be a **SPDT Relay** and wired correctly or it could result in a dangerous situation with the vehicle. The torque **converter may not unlock**.

The fuel pump connector has a small gray wire at the bottom of it that terminates in a female connector. This wire is a test point for the fuel pump. After the vehicle has been wired and tested OK, tape off this wire and store it in the harness.

- H. The wires labeled VATS (lt. green, red and black) are to be connected to the matching wires on the VATS module supplied in the kit.
- I. Fan #1 relay wire (green) and fan #2 relay wire (blue) are relay ground wires activated by the computer.

NOTE: The green wire labeled A/C CLUTCH B+ splices (using the blue T-Tap in the parts bag) into the ignition hot wire going to the A/C compressor clutch. This is the A/C REQUEST wire.

- J. The wire labeled TACH (white) is the signal wire for a tachometer is used.
- K. The VSS output wire sends out a signal to operate the electronic cruise control or speedometer if so equipped.

6.1.2 Dash Section Connections

WIRE COLOR	# OF POSITIONS IN CONNECTOR	LABELED	CONNECT TO:
Brown (4) Red (2)	4	Air Pump Relay	Relay
Brown, Green/White	2	Canister Purge	Canister Purge Solenoid
Black, Red (2)	3	Air Pump	Air Pump
Gray, Green/White, Black/White, Pink	4	Fuel Relay	Fuel Pump Relay
Green/White		VSS Output	Speedometer/Cruise
White		Tach	Tachometer
Orange/Black, Black/White		P/N switch	Park/Neutral Switch
Pink, Light Blue/Black		Brake Switch	Brake Switch
Pink		Fuse Block B+	Ignition Power

TABLE 6.1 Dash Section Connections

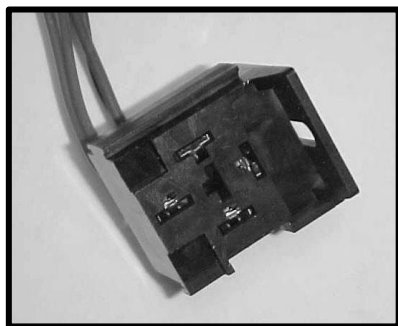


FIGURE 6.5 Air Pump Relay Connector

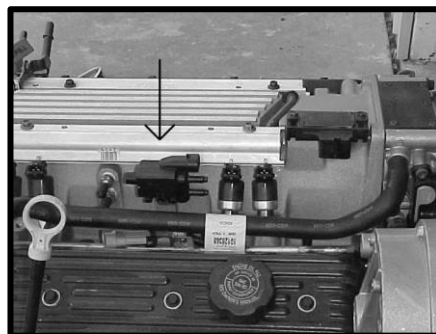


FIGURE 6.6 Canister Purge Solenoid

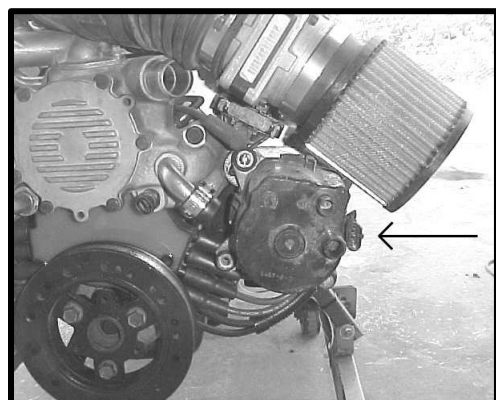


FIGURE 6.7
Air Pump
Connection

6.2 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 engine has the connectors for the idle air control, throttle position sensor, distributor, and map sensor, all of which **ARE** labeled. When you begin routing, **FIRST** separate the engine group into left and right sections and place them accordingly.

- 6.2.1 Before you connect any wires, separate the tail section from the engine group and place it out of the way.
- 6.2.2 Locate the two **BLK/WHI** wires in the harness that end in a single, large ring terminal and ground them to the engine.
- 6.2.3 Using **Figure 6.4 – 6.8**, and the specific connections indicated in **Table 6.1**, connect the wiring as directed.

NOTE: The air pump connector is rolled up in the dash section and must be routed out to the engine compartment if the air pump is to be operational. See section 4.1 Paragraph 4.1.3

- 6.2.4 Check to make sure that the 60502-wire harness has the correct distributor connector on it for your particular engine. There are two different connectors used on LT1 engines. The 92 & 93 engines used a short connector, 1" long and the 94 and up engines use a 2" connector. This 60502 harness has the 2" connector made on it. You may reuse the original connector or Painless offers part # 60114 as a solution.
- 6.2.5 The pink wire labeled coil power needs to be connected to the wire that powered the coil on the original engine.

6.2.6 Engine Section Connections

WIRE COLOR	# OF POSITIONS IN CONNECTOR	LABELED	CONNECT TO:
Brown, Gray	2	EGR	EGR Solenoid
Blue	1	Knock	Knock Sensor
Ylw, Pink/Black, Pink	3	CKP	Crank Position Sensor
Purple/White, Tan/White, Brown, Black	4	Driver Side Oxy	Left Oxygen Sensor
Purple, Tan, Brown, Black	4	Pass. Side Oxy	Right Oxygen Sensor
Red	Ring Terminal (2)	Starter B+	Starter Solenoid
Gray, Light Green, Black	3	MAP	Map Sensor
Pink, Black	2	Inj # 1	Drivers Side Front Inj
Pink, Light Green/Black	2	Inj # 2	Pass Side Front Inj
Pink, Pink/Black	2	Inj # 3	Drivers Side 2nd Inj
Pink, Light Blue/Black	2	Inj # 4	Pass Side 2nd Inj
Pink, Black/White	2	Inj # 5	Drivers Side 3rd Inj
Pink, Yellow/Black	2	Inj # 6	Pass Side 3rd Inj
Pink, Red/Black	2	Inj # 7	Drivers Side 4th Inj
Pink, Blue/White	2	Inj # 8	Pass Side 4th Inj
Gray, Black, Blue	3	TPS	Throttle Position Sensor
Light Green/Black, Light Green/WhiteLight Blue/Black, Light Blue/White	4	IAC	Idle Air Control Motor
Yellow, Black/White, Pink	3	MAF	Mass Airflow Sensor
Red/Black, Pink/Black, Red, Light Blue/Black	4	DIST	Distributor
White, Black, Pink/Black, White/Black	4	IGN MOD	Ignition Module
Pink, White	2	Coil	Ignition Coil
Pink/Black, White/Black	2	Coil	Ignition Coil
Black, Yellow	2	ECT	Engine Coolant Temp.Sensor

Black, Tan	2	IAT	Intake Air Temp Sensor
Black, Black/White (3) Pink	Ring Terminal (2)	Ground Coil Power	Engine Ground Power for Coil

TABLE 6.2 Engine Section Connections

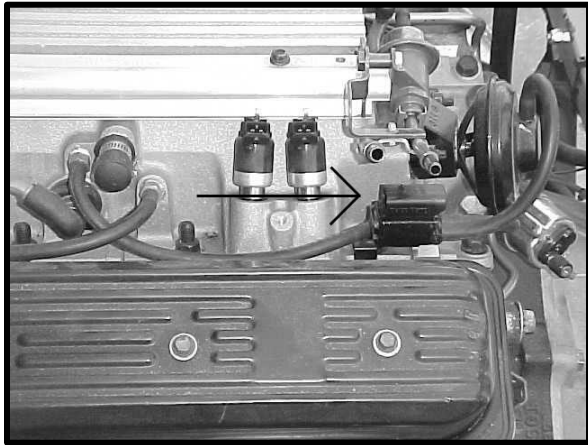


FIGURE 6.9 EGR Solenoid

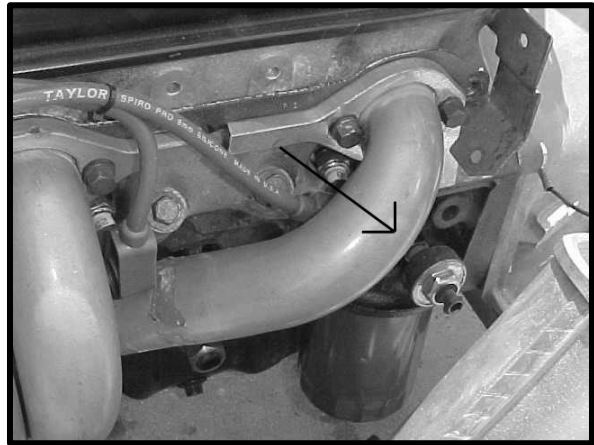


FIGURE 6.10 Knock Sensor



FIGURE 6.11 Oxygen Sensor

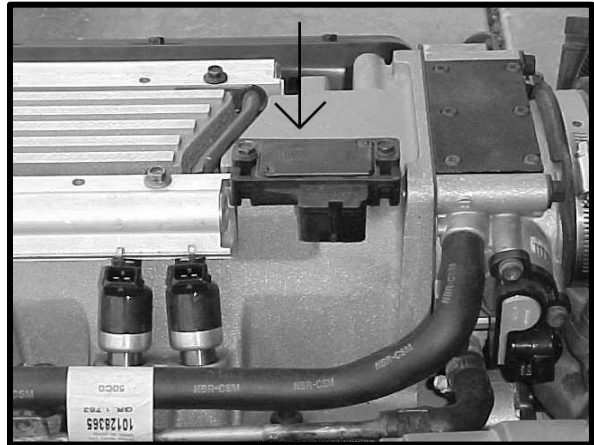


FIGURE 6.12 MAP Sensor

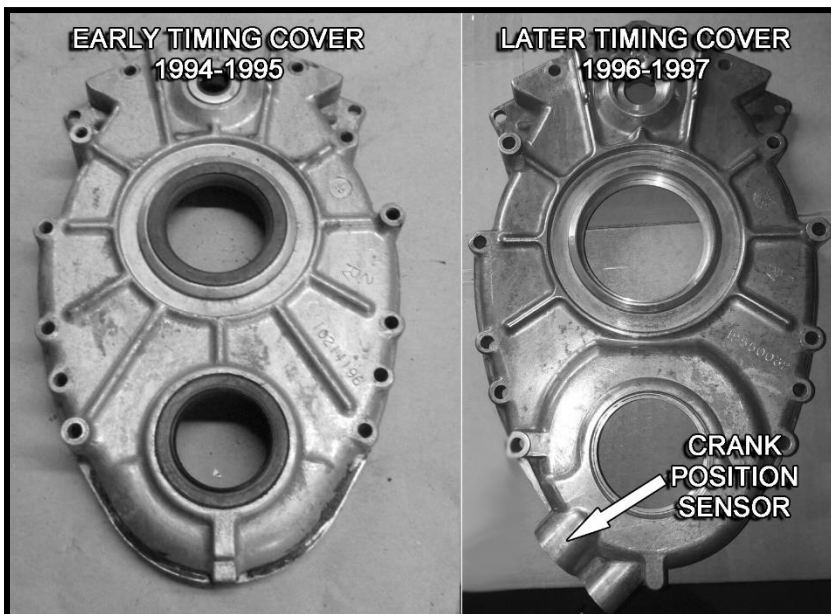


FIGURE 6.13 CKP Sensor –
The crank position sensor will only be found on 1996-1997 engines. Those using a 1996-1997 ECM must connect to a crank position sensor or have codes 335 & 336 turned off in the ECM. The crank position sensor simply detects engine misfires and has zero control over engine fueling or timing.

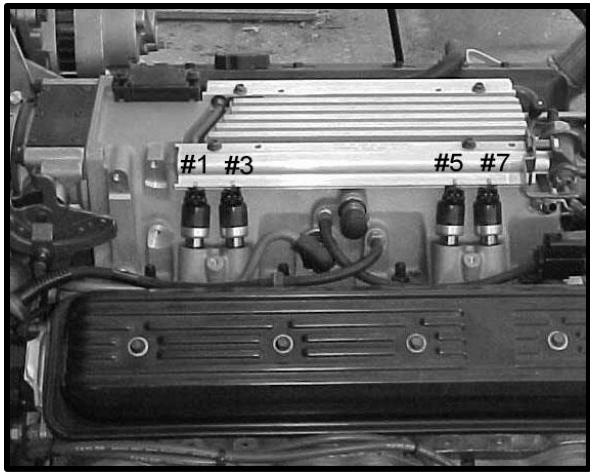


FIGURE 6.14 Injectors 1, 3, 5, 7

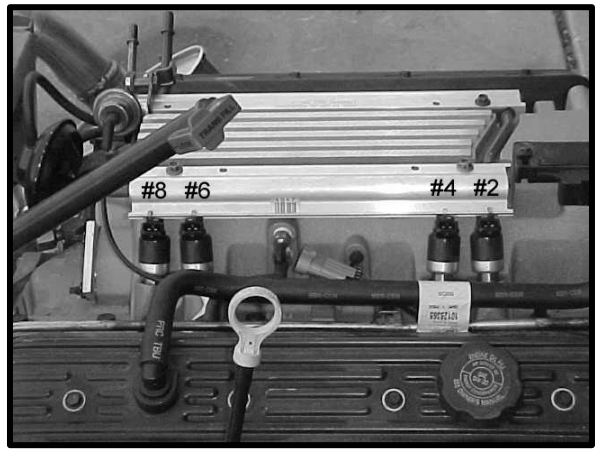


FIGURE 6.15 Injectors 2, 4, 6, 8

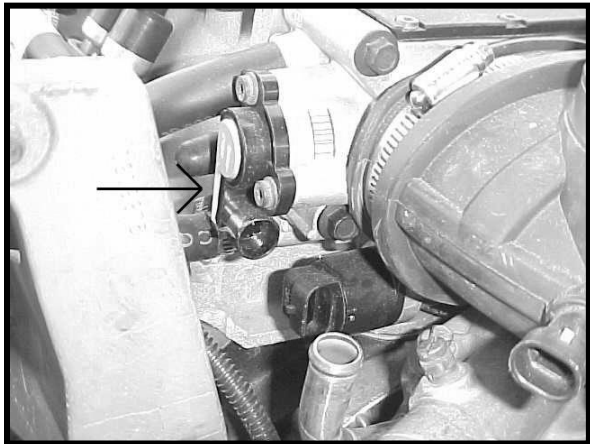


FIGURE 6.16 TPS Sensor

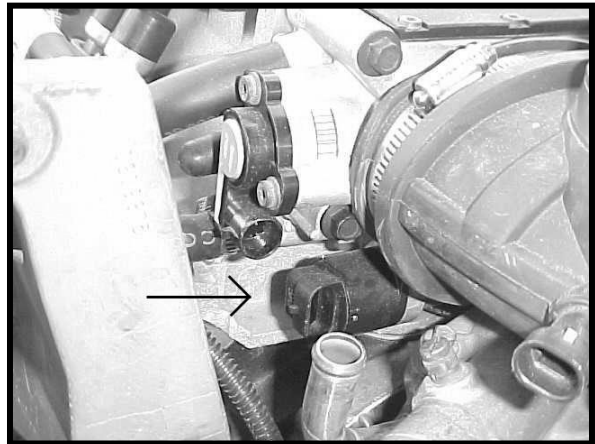


FIGURE 6.17 IAC

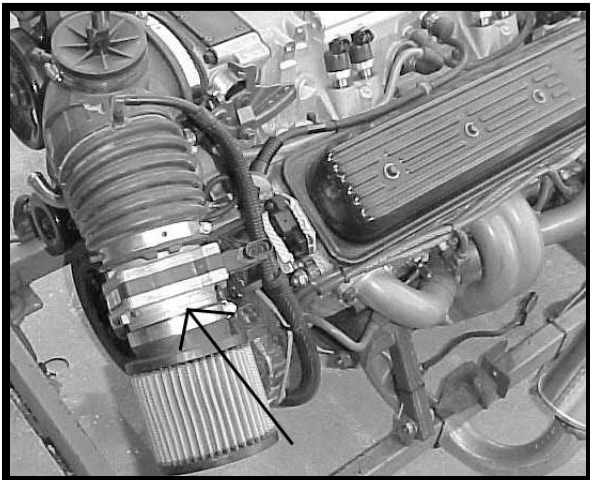


FIGURE 6.18 MAF Sensor

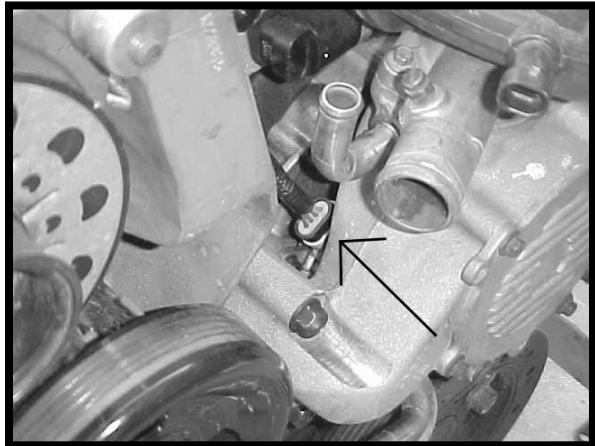


FIGURE 6.19 Distributor connection

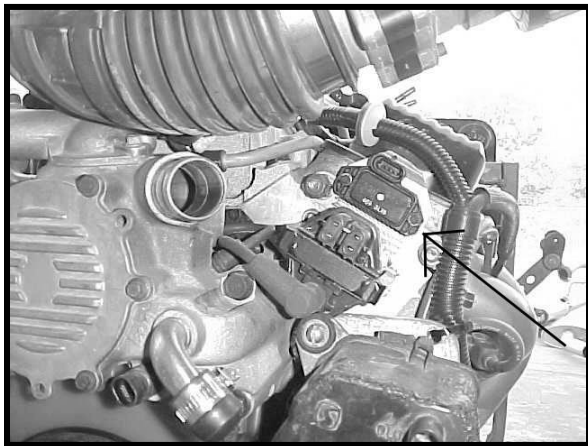


FIGURE 6.20 Ignition Module

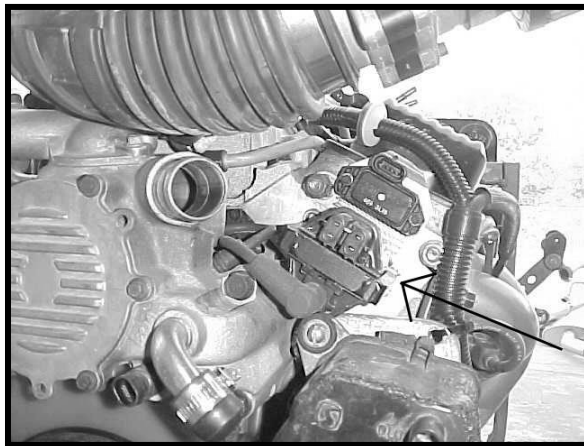


FIGURE 6.21 Coil

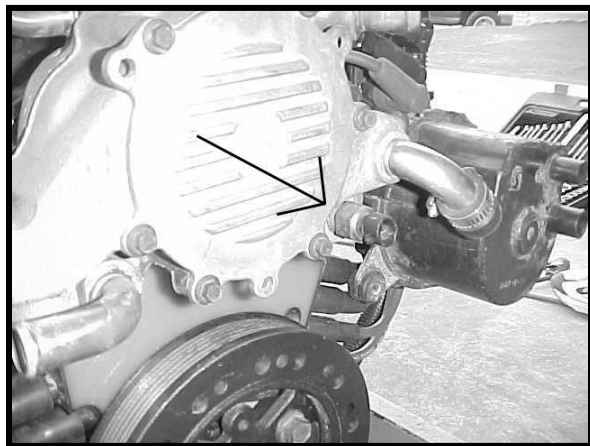


FIGURE 6.22 ECT Sensor

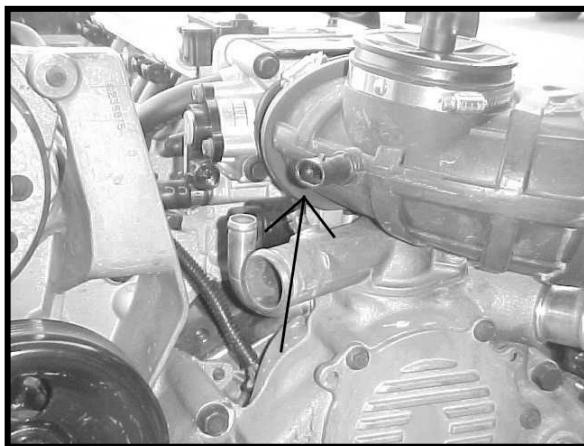


FIGURE 6.23 IAT Sensor

6.3 TAIL SECTION INSTALLATION

- 6.3.1** Locate the tail section that you earlier separated from the engine group. Begin routing it towards the rear of the vehicle. Be sure to avoid all sharp edges, moving or hot parts, or anything else that may damage the harness.
- 6.3.2** If you **ARE** using the 4L60E transmission, route the 13-position connector to the transmission and attach it.
- 6.3.3** If you **ARE NOT** using the 4L60E transmission, tape up the connector and store it in the harness.
- 6.3.4** Take the gray wire and route it to the fuel pump. This is the power wire for the fuel pump.
- 6.3.5** Take the connector for the Vehicle Speed Sensor (VSS) and connect to the Vehicle Speed Sensor.

6.3.6 Tail Section Connections

WIRE COLOR	# OF POSITIONS IN CONNECTOR	LABELED	CONNECT TO:
Purple, Yellow Gray	2	VSS Fuel Pump	Speed Sensor Fuel Pump
Light Green, White, Light Blue/White, Tan/Black, Brown, Pink, Yellow/Black, Red/Black, Pink/Black, Blue, Red, Yellow/White, Black	13	Trans	Transmission

TABLE 6.3 Tail Section Connections

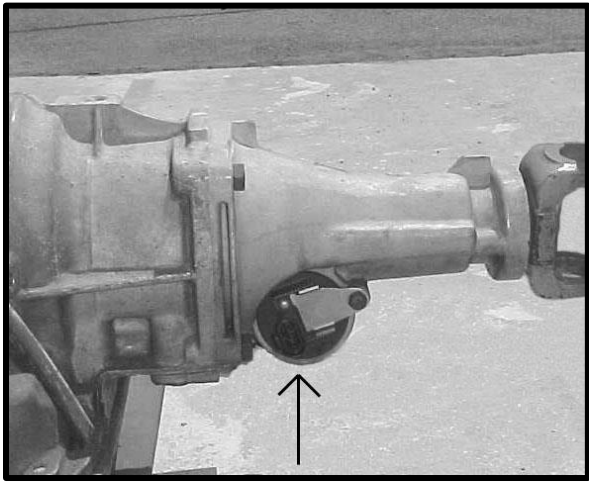


FIGURE 6.24 VSS

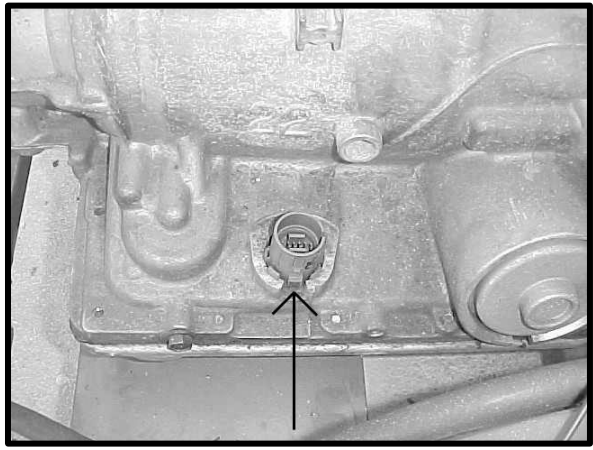


FIGURE 6.25 Transmission Connection

7. TROUBLE- SHOOTING INSTRUCTIONS

If you are having trouble with your engine running badly or not running at all, first perform basic trouble-shooting (ensure that you are using the correct parts (**Table 4.1**), check for faulty connections, blown fuses, connection of VATS module, spark, timing, fuel pressure, etc.), then see if the computer has stored a trouble code in its memory.

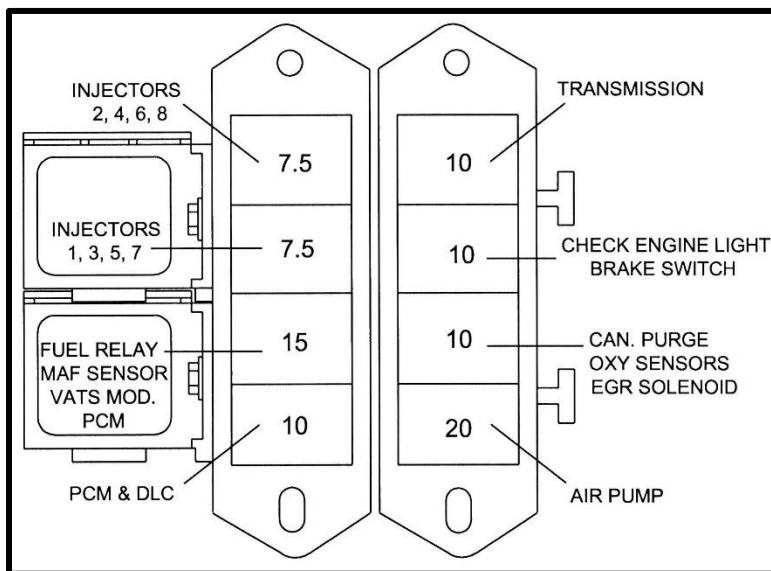


FIGURE 7.1 Fuse Identification

7.1 THE "CHECK ENGINE" LIGHT

Normally, the "check engine" light should come on when the ignition is turned on, then go out a few moments after the engine starts running. If it reappears, or stays on while the engine is running, the computer has detected a problem and a trouble code has been set.

7.2 RETRIEVING TROUBLE CODES FROM THE COMPUTER

The chart below shows the type of ALDL test connector each vehicle came with from the factory. If you are using a computer with '94 Camaro/Firebird, '94-'95 Caprice or '95 Impala programming you must install the **OBD 1** connector. **We have included this connector as a pig tail assembly.**

If you need to install the OBD 1 connector start by cutting the zip ties holding the OBD 11 connector to the check engine light bracket. After you disconnect the negative battery cable you can cut the 5 wires coming from the OBD 11 connector. The cut ends of Orange and Black wires should be insulated and zip tied so that they will not short. You can now use the supplied butt connectors to connect the Black/White, White/Black and Tan wires coming from the harness to the matching wires coming from the OBD 1 pig tail. Install the OBD 1 connector on the check engine light bracket where you removed the OBD 11 connector from, using the supplied zip ties. If you have any issues with this process please contact the Painless Performance Tech line at 1-800-423-9696.

	1994	1995	1996
Camaro	OBD 1	OBD 11	OBD 11
Firebird	OBD 1	OBD 11	OBD 11
Caprice	OBD 1	OBD 1	OBD 11
Impala	-----	OBD 1	OBD 11

- 7.2.1 In order to retrieve the trouble codes stored in the computer, a scanner must be connected to the Assembly Diagnostic Link (DLC) connector (installed and connected in **Paragraph 6.2.1**). Follow the instructions provided with the scanner to read the codes set in the computer.
- 7.2.2 After you have read any codes, write them down for reference. Remove the connector from the DLC connector.
- 7.2.3 Take the codes one at a time and match them to the codes in **Table 7.1**. This will tell you in which circuit the computer has detected a problem.

Note: A code indicates a problem in a specific circuit, NOT THAT A PARTICULAR PART IS BAD.

- 7.2.4 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 circuit for any broken, shorted, or exposed wires. Finally, insure all ground wires are clean and secure.
- 7.2.5 If a trouble code is detected and the problem has been fixed, clear the codes by first making sure the ignition is off then disconnecting the NEGATIVE battery cable for at least 3 minutes.
- 7.2.6 Trouble Code Chart, Diagnostic Trouble Code (DTC)

DTC 11 = Malfunction Indicator Lamp
DTC 13 = Bank 1 (left) Heated Oxygen Sensor (HO2S) Open Circuit
DTC 14 = Engine Coolant Temperature (ETC) Sensor Circuit (Signal Voltage Low) Overheated
DTC 15 = Engine Coolant Temperature (ETC) Sensor Circuit (Signal Voltage High) Engine cold
DTC 16 = Distributor Ignition System (Low Resolution Pulse)
DTC 18 = Injector Circuits
DTC 21 = Throttle Position (TP) Sensor Circuit (Signal Voltage High)
DTC 22 = Throttle Position (TP) Sensor Circuit (Signal Voltage Low)
DTC 23 = Intake Air Temperature (IAT) Sensor Circuit (Signal Voltage High) Cold Intake Air
DTC 24 = Vehicle Speed Sensor (VSS) Circuit
DTC 25 = Intake Air Temperature (IAT) Sensor Circuit (Signal Voltage Low) Hot Intake Air
DTC 26 = Evaporative Emission (EVAP) Canister Purge Solenoid Valve Circuit
DTC 27 = Exhaust Gas Recirculation (EGR) Vacuum Control Solenoid Valve Circuit
DTC 28 = Transmission Range (TR) Pressure Switch Assembly Fault
DTC 29 = Secondary Air Injection (AIR) Pump Circuit
DTC 32 = Exhaust Gas Recirculation (EGR)
DTC 33 = Manifold Absolute Pressure (MAP) Sensor Circuit (Signal Volts High, Low Vacuum)
DTC 34 = Manifold Absolute Pressure (MAP) Sensor Circuit (Signal Volts Low, High Vacuum)
DTC 36 = Distributor Ignition System (Faulty High or Extra Low Resolution Pulse Detected)
DTC 37 = Brake Switch Stuck "ON"
DTC 38 = Brake Switch Stuck "OFF"
DTC 41 = Ignition Control (IC) Circuit (Open Circuit)
DTC 42 = Ignition Control (IC) Circuit (Shorted or Grounded Circuit)
DTC 43 = Knock Sensor (KS) Circuit
DTC 44 = Bank 1 (Left) Heated Oxygen Sensor (HO2S) Circuit (Lean Exhaust Indicated)
DTC 45 = Bank 1 (Left) Heated Oxygen Sensor (HO2S) Circuit (Rich Exhaust Indicated)
DTC 46 = Pass-Key Circuit
DTC 47 = Knock Sensor (KS) Module Circuit or Module Missing
DTC 48 = Mass Air Flow (MAF) Sensor Circuit
DTC 50 = System Voltage Low
DTC 51 = EEPROM Programming Error
DTC 53 = System Voltage High
DTC 55 = Fuel Lean Monitor
DTC 58 = Transmission Fluid Temperature (TFT) Sensor Circuit Low (High Temp Indicated)
DTC 59 = Transmission Fluid Temperature (TFT) Sensor Circuit High (Low Temp Indicated)
DTC 61 = A/C System Performance
DTC 63 = Bank 2 (Right) Heated Oxygen Sensor (HO2S) Circuit (Open Circuit)

DTC 64 = Bank 2 (Right) Heated Oxygen Sensor (H02S) Circuit (Lean Exhaust Indicated)
DTC 65 = Bank 2 (Right) Heated Oxygen Sensor (H02S) Circuit (Rich Exhaust Indicated)
DTC 66 = A/C Refrigerant Pressure Sensor Circuit (Open or Shorted)
DTC 67 = A/C Refrigerant Pressure Sensor Circuit (Pressure Sensor or A/C Clutch Problem)
DTC 68 = A/C Relay Circuit (Shorted Circuit)
DTC 69 = A/C Clutch Circuit
DTC 70 = A/C Clutch Relay Driver Circuit
DTC 71 = A/C Evaporator Temperature Sensor Circuit (Open or Shorted)
DTC 72 = Vehicle Speed Sensor Loss (Automatic Transmissions Only)
DTC 73 = Pressure Control Solenoid (PCS) Circuit (Current Error)
DTC 74 = Traction Control Circuit (TCS) Circuit Low
DTC 75 = Transmission System Voltage Low
DTC 77 = Cooling Fan Relay Control Circuit
DTC 79 = Transmission Fluid Over-temp
DTC 81 = Transmission 2-3 Shift Solenoid Circuit
DTC 82 = Transmission 1-2 Shift Solenoid Circuit
DTC 83 = Reverse Inhibit System (Manual Transmission)
DTC 83 = TCC PWM Solenoid Circuit Fault (Automatic Transmission)
DTC 84 = Automatic Transmission 3-2 Control Solenoid Circuit
DTC 84 = Skip Shift Solenoid Circuit (Manual Transmission)
DTC 85 = Transmission TCC Stuck "ON"
DTC 90 = Transmission TCC Solenoid Circuit (Manual Transmission)
DTC 91 = Skip Shift Lamp Circuit
DTC 97 = VSS Output Circuit
DTC 99 = Tach Output Circuit

TABLE 7.1 Diagnostic Trouble Codes

7.3 Trouble Shooting guide for your Painless Performance Harness

If you have installed your harness, made all the connections as outlined in the installation manual, and utilized the correct components as shown in the compatible parts list, the engine should start and run. If you are experiencing difficulties in getting the engine started, this trouble shooting guide should help you in diagnosing the problem.

- 7.3.1 FIRST AND FOREMOST, DO NOT TRY AND START YOUR ENGINE WITHOUT INSTALLING AND CONNECTING ALL OF THE COMPONENTS.** Attempting to do so will result in a “no start” situation. This includes things like the O2 sensors, knock sensors, the “PRNDL” switch (if it applies to your harness), relays, and the ECT. It’s easy to try and skip connections just to see the engine fire up, but this could cause countless difficulties trying to diagnose the issue.
- 7.3.2** Before you attempt to start the engine, be sure that you have the correct ECM for your harness. The correct ECM is listed in the “compatible Parts List” on **page 7**. Also, make sure that the ECM and PROM you are using have been programmed by someone who is familiar with the programming procedures required for the ECM/PROM used in an engine transplant. There is more involved in programming for an engine transplant than just turning off the vehicle anti-theft. It is important to have someone who knows these tuning procedures so that you can be confident your ECM’s programming is correct for your application.
- 7.3.3** The first things to check if you are experiencing a “no start” situation, and your ECM has been programmed properly, are the battery (+) power to the harness and the grounds. Make sure the grounds are not stacked with each other. They can be on the same head or block area but should be bolted separately, not on top of each other. Also make sure that your vehicle is grounded properly, or your grounds will not do you any good. This means the negative battery cable should be bolted to the block or the frame using a star washer. The star washer allows your ground cable to cut through any paint and makes direct contact with the metal. Then, a ground strap (also using star washers) should be bolted from the block to the frame. Last, there should be a small ground strap from the block or head to the firewall. Only when these grounds are in place will the grounds for your harness be correct.

- 7.3.4** The battery (+) power to the harness should only come straight from one end of the positive battery cable, either at the battery or at the starter. The constant battery power is what provides power to the harness for the computer (ECM) memory. If it is not going to the positive battery cable, the ECM will have to relearn initial startup procedures every time you start it.
- 7.3.5** Last, make sure that the wire tagged “**12v IGN.**” and the “**Coil B+**” wires are both connected to an ignition hot source that has power **BOTH** in the ON/RUN position as well as the START position. An easy way to tell if you connected the wires to the correct power source is to look at the check engine light.
- 7.3.6** The check engine light has a direct correlation with the “**12v IGN.**” wire. If this wire is connected to the correct power source, the check engine light will come on when the key is turned to the ON/RUN position and will stay on when the key is turned all the way to the START position. If the light goes out in either of these ignition switch key positions, this means you are losing power to the “12v IGN” wire and must find another power source for it. The engine will never fire and start if this wire does not have the proper power source.
- 7.3.7** Also, make sure your check engine light is connected to the harness at the ALDL bracket. If you think you have connected the “**12v IGN.**” wire properly, and still do not have a check engine light when you turn the key on, check to see if the light is connected to the harness. Sometimes, the harnesses are not plugged into the light. The wires that connect to the light (**PINK** and **BROWN**) are tied together near the light. They are terminated so you can connect them to the 2 **BLACK** wires coming from the light.
- 7.3.8 FUEL PRESSURE:** If you have checked all of the constant/switched power and your grounds but still have a “no start” problem, move onto the fuel system. The fuel pump should come on for a few seconds when you turn the key on and then shut off. This is to pressurize the fuel system, prepping it for start. If you turn the key on and do not hear the fuel pump come on and cycle, you need to check the fuel pump relay.

Make sure (as mentioned earlier) that the relay is plugged into the base. If it is plugged in properly, check to see if the relay might be defective. To do this, put 12 volts to the short wire marked “Test” coming out of the relay base. This wire is the same color as the wire providing power to the fuel pump. This “Test” wire will bypass the relay and apply 12 volts directly to the pump. If the fuel pump comes on when the 12 volts is applied, this tells you the relay is defective and needs to be replaced.

If your fuel pump does cycle with the key on you should check the fuel pressure. The fuel pressure should be about 40 to 47lbs KOEO. If it is not, you need a fuel pump that will deliver enough pressure to the injectors and the engine to run.

- 7.3.9 INJECTORS:** GM injectors are susceptible to gumming up and sticking when the engine is left sitting for long periods of time (a year or more) with old fuel sitting in them. It is suggested that you clean the injectors if you do not know how long the engine has set.

If your injectors are clean and free, check to see if you have injector pulse. The best way to do this is to use a “NOID LIGHT” which can be found at any auto parts store. They are inexpensive and easy to use; you can buy a single light for the fuel injection system you are working on. Or you buy a set of 8 that will have a light for many different types of injectors. OEM offers singles (#25143 for the LS injectors) and Performance Tool offers a set of 6 (#W89500).



FIGURE 7.2 Noid Light

The light plugs into the injector connector. If you are getting an injector signal from the ECM, the light will flash. If the noid light does not flash, you are not getting the proper injector pulse signal from the ECM. This could be because the ECM is not getting the proper signal from the Opti-Spark unit, the ECM may have a bad driver, or one of the relays is either defective or not installed in the fuse block properly. These relays also control the coil power, and that is the next thing to check.

- 7.3.10 SPARK:** if you have checked and cleared all of the previously mentioned components and still have a “no start” condition, you need to check for spark at the coils. You will need to test for 12 volts at the **PINK** colored wire going to each coil. Another common failure in the LT1 engines is the Opti-Spark unit located inside the distributor at the front of the engine. This unit is responsible for pulsing the injectors and can often be the cause of a “no start” situation.

If all these things check out, you should be getting air/spark/fuel and that is what it takes to fire your engine. Remember, it does not pay to try and start your engine without everything installed and connected as it leads to undue frustrations.

7.4 WHEN TO CALL PAINLESS PERFORMANCE PRODUCTS' TECH LINE

- 7.3.1** These harness kits have been built with the highest regard to quality control. Before calling us please double check all connections and perform normal basic trouble-shooting (fuel pressure, timing, ignition system, etc.).
- 7.3.2** If you have any questions concerning the installation of this harness or having trouble in general, feel free to call Painless Performance Products' tech line at (817) 560-8324. Calls are answered from 8am to 5pm central time, Monday thru Friday, except holidays. Email questions to Tech@painlessperformance.com

Painless Performance Products, LLC **Limited Warranty and Return Policy**

Chassis harnesses, fuel injection harnesses, and Trail Rocker 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.