Technical Support Training Manual

E85 Conversion System Version 4.1

Xpertech Inc.

12730 Pacific Ave Ste. 14A , Los Angeles, California 90405

please contact Dan Lorenzo at info@whitelightning.net

Thank You, Dan Lorenzo

Chairman Xpertech Incorprated

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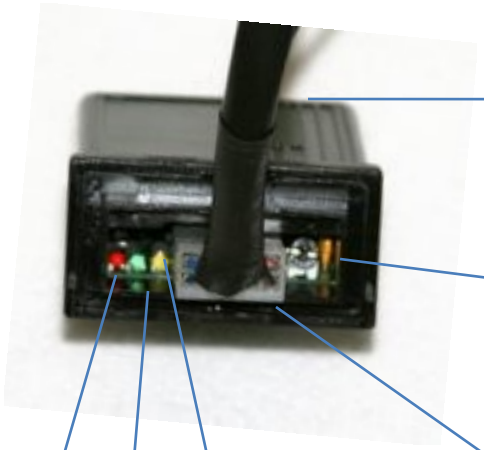
E85 Kit Components



Unit Enclosure

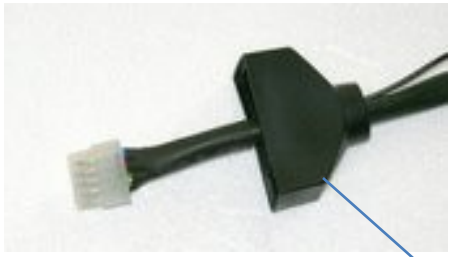
Potentiometer

LED Lights

White Harness Connector

"Multi Colored" = Signal ECU Ground pulse Male Jumper Wire

"BLACK" = Constant Power Male Input Jumper Wire



Waterproof Rubber seal

Circuit Board

White Circuit Board Connector

Diagram 1.1

Male Connector “All Except EV6”

Why Did My Kit Come With The Male Connectors Unattached ?

The Harness on your White Lightning Conversion Kit has been shipped to you with the male connector unattached. The reason for this is that there are many variations that the Vehicle Manufacturer has used to configure the polarity of the fuel injectors. We have seen these variations on same year, make and model vehicle's with the same V.I.N. and engine size.

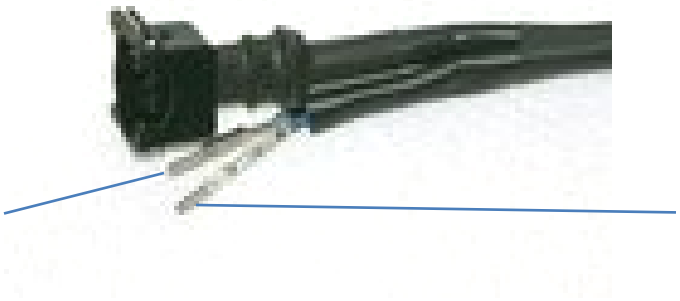
This is a very simple procedure and requires no mechanical skills or expensive equipment. You will notice that when you view all of your vehicle’s fuel injectors on your engine that there are two wires per fuel injector.

One wire is constant power that is delivered by the key on ignition switch power. This wire is always the same color as the power wire on all the other fuel injectors. Your first step is to find the common colored wire on your vehicle’s fuel injectors. All fuel injection systems use a common colored wire for power and a multi colored wire for ground pulse.

We then recommend that you plug the empty male connector into the Vehicle’s female connector with no wire attached. Follow the common colored fuel injector wire (power 12V+) through the connector and then mark the cavity in order to insert the black wire male terminal so it will then mate with the common colored wire of the fuel injector power source. After you have achieved this, you can then insert the multi-colored wires into the neighboring cavity in the male connector.

Black Wire :

Our Black wire on the E85 kit is to be inserted into the male connector cavity that matches the power wire on the vehicle’s original female harness. Remember the power wire is the common colored wire of the two wires seen on your vehicle's original fuel injector harness connector.



Multi-colored wire:

The Multi-colored wire is to be inserted into the male connector cavity that matches with the vehicle’s original ground pulse wire.

Diagram 1.2

Male Connector EV6

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We then recommend that you plug the empty male connector into the Vehicle's female connector with no wire attached. Follow the common colored fuel injector wire (power 12V+) through the connector and then mark the cavity in order to insert the Red wire male terminal so it will then mate with the common colored wire of the fuel injector power source. After you have achieved this, you can then insert the multi-colored wires into the neighboring cavity in the male connector.

Red Wire :

Our EV6 Red wire on the E85 kit is to be inserted into the male connector cavity that matches the power wire on the vehicle's original female harness. Remember the power wire is the common colored wire of the two wires seen on your vehicle's original fuel injector harness connector.

Multi-colored wire:

The Multi-colored wire is to be inserted into the male connector cavity that matches with the vehicle's original ground pulse wire.

Diagram 1.3

Potentiometer Adjustment

Diagram 1.4

Potentiometer:

This adjustment has the ability to control the extra amount of fuel delivered from our circuit board. Our device is shipped in position “0” which is fully counter clockwise in a horizontal position. In this position, the device will allow no additional increase and will use the OEM injector pulse from the car’s ECM . We have found that most vehicle's operate best at half or position 5. This can be seen when screwdriver slot is horizontal.

Circuit Board:

Allows O.E.M. signal to pass through unaltered and then delivers additional “pulse” or extra shot of fuel to the fuel injectors. The amount of extra fuel delivered depends on the setting of the potentiometer . Position 0 or full counter clockwise will deliver no addition pulse. Position 10 or full clockwise will deliver 27% additional pulse.

Diagram 1.5

After you have connected all connectors and installed unit to vehicle and are sure that the vehicle runs as it did before the installation, you can then move potentiometer from the fully counter clockwise (Horizontal position) the half-way vertical position #5.

Fuel Injector Schematic

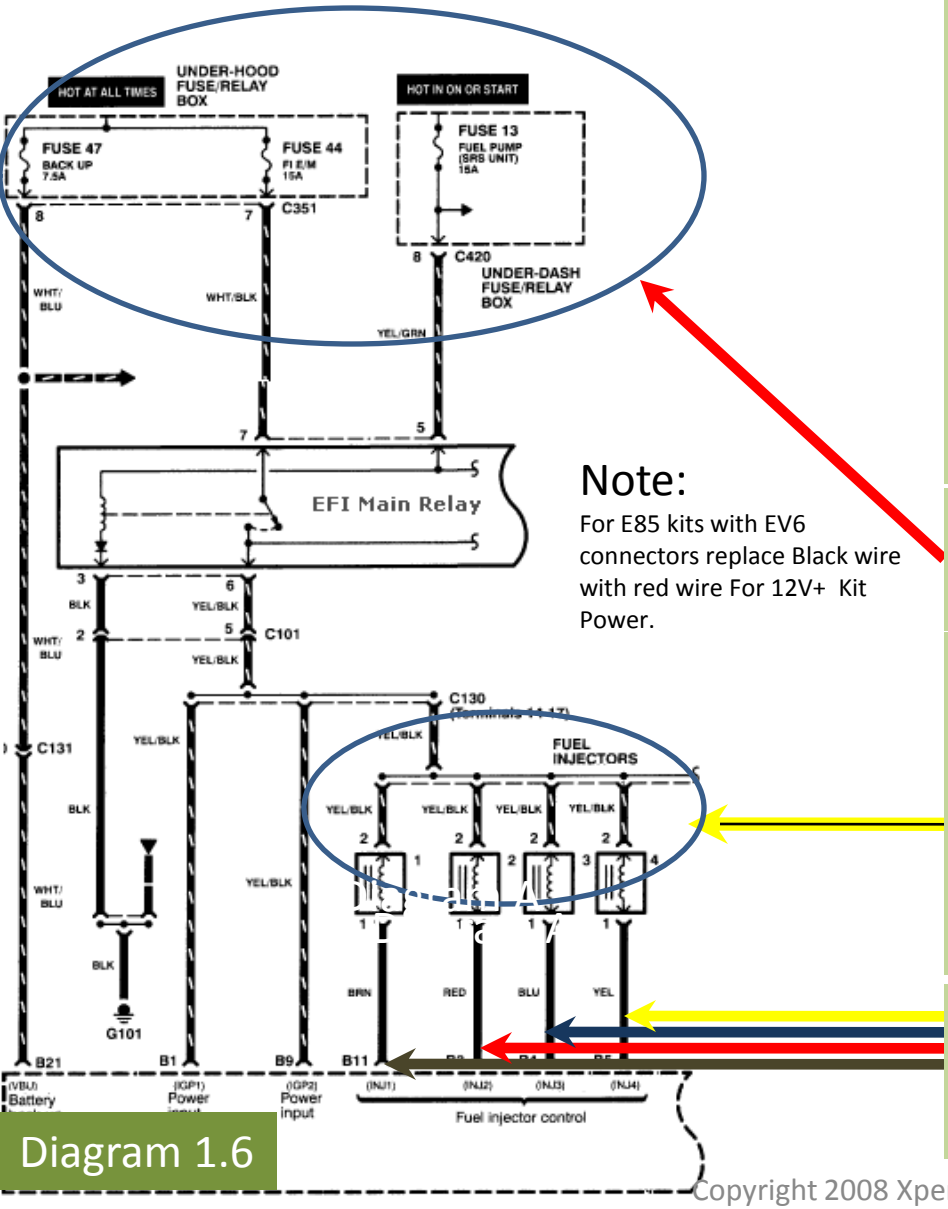


Diagram 1.6

Note:

For E85 kits with EV6 connectors replace Black wire with red wire For 12V+ Kit Power.

Male Connectors

All injectors have constant **12V+** power with key on engine running or not. It is imperative that the **BLACK** male (input) White Lightning connector matches the **12V+** power of the original vehicle's OEM Female Fuel Injector connector.

The Male White Lightning connector is ***critical***. This male connector delivers power from the injector circuit to the WL circuit board. And allows the E.C.M. ground signal to pass through the proper channels within the circuit board that delivers the extra pulse.

If this is installed improperly, the fuel injector will not operate resulting in a "check engine" light .

All WL **BLACK 12V+ male wire and Ground terminals must match the original OEM connector Wires.**

12V+ Source

Note: Key on engine off or key on engine running will supply power to the fuel injectors.

12V+ Source to Injectors

Note: All power wires on your injectors have the same color wires (**Yellow** with a Black Stripe). The **Black** wires of the White Lightning male connector must connect with the common colored wires as seen here, **Yellow** with black tracer. All vehicle's will have a common colored wire on all injectors this is the **12V+** power wire.

Pulse Source (E.C.M. Ground)

Note: All ground pulse wires are always different colors **Brown**, **Red**, **Blue**, **Yellow**. This is the ground signal that is re-routed through the circuit board and actually gives the secondary pulse.

Why Fuel Injection

For most of the existence of the internal combustion engine, the carburetor has been the device that supplied fuel to the engine. On many other machines, such as lawnmowers and chainsaws, it still is. But as the automobile evolved, the carburetor became more and more complicated trying to handle all of the operating requirements.

In order to meet emissions requirements, catalytic converters were introduced. Very careful control of the air-to-fuel ratio was required for the catalytic converter to be effective. Oxygen sensors monitor the amount of oxygen in the exhaust, and the **engine control unit** (ECU) uses this information to adjust the air-to-fuel ratio in real-time. This is called **closed loop control** -- it was not feasible to achieve this control with carburetors. There was a brief period of electrically controlled carburetors before fuel injection systems took over, but these electrical carb's were even more complicated than the purely mechanical ones.

At first, carburetors were replaced with **throttle body fuel injection systems** (also known as **single point** or **central fuel injection** systems) that incorporated electrically controlled fuel-injector valves into the throttle body. These were almost a bolt-in replacement for the carburetor, so the automakers didn't have to make any drastic changes to their engine designs.

Gradually, as new engines were designed, throttle body fuel injection was replaced by **multi-port fuel injection** (also known as **port**, **multi-point** or **sequential** fuel injection). These systems have a fuel injector for each cylinder, usually located so that they spray right at the intake valve. These systems provide more accurate fuel metering and quicker response.

The gas pedal in your car is connected to the **throttle valve** -- this is the valve that regulates how much air enters the engine. So the gas pedal is really the air pedal.

Spark Timing

Spark timing is controlled in the same fashion as is the mixture, except that the map entries control the spark timing. This allows for spark timing that varies with engine load and provides an extremely adjustable spark timing "curve."

- The White Lightning Kit can only be installed on fuel injected engines

Fuel Injection 101

Modern electronic fuel injection consists essentially of a pressurized fuel source (Fuel Pump), a solenoid valve (Fuel Injector) and an electronic controller (E.C.M.). The amount of fuel delivered to the engine is determined by the amount of time that the fuel injector is open. It is up to the electronic controller to determine the engine's fuel needs and tell the fuel injector when to open and when to close.

The amount of time that the injector is open is called the fuel pulse width or fuel duty cycle.

Fuel is picked up from the fuel tank through a supply line. The fuel is passed through a fuel filter and delivered to the fuel pump. A positive displacement electric fuel pump then pressurizes the fuel. The pressurized fuel circulates to the fuel injectors, then goes to the fuel pressure regulator. The pressure regulator returns fuel to the fuel tank via the fuel return line as required to maintain at a constant pressure the fuel supplied to the injectors. The constant flow of fuel provides cooling to the fuel pump and clears any tendency for vapor lock in the fuel system. The E.C.M. determines which cylinder is breathing, and fires the injectors to provide fuel to that cylinder. Since the E.C.M. knows which cylinder is breathing, the mixture for each cylinder can be individually adjusted. Injecting fuel only when the intake valve is open eliminates fuel puddling in the intake tract and provides crisp response and good fuel atomization.

Spark Timing

Spark timing is controlled in the same fashion as is the mixture, except that the map entries control the spark timing. This allows for spark timing that varies with engine load and provides an extremely adjustable spark timing "curve."

- With the White Lightning Kit installed the first ground signal from the E.C.M. is allowed to pass unaltered through the White Lightning circuit board. The circuit board then generates a second ground pulse firing the injector an additional time which in turns adds more fuel for proper engine performance on e85.

Fuel System components

Diagram 1.7

E85 performs in much the same way that gasoline does and actually surpasses gasoline in key performance categories. Your vehicle will run cleaner, cooler, and stronger on E85 and will increase the engine life and fuel system components on your vehicle.

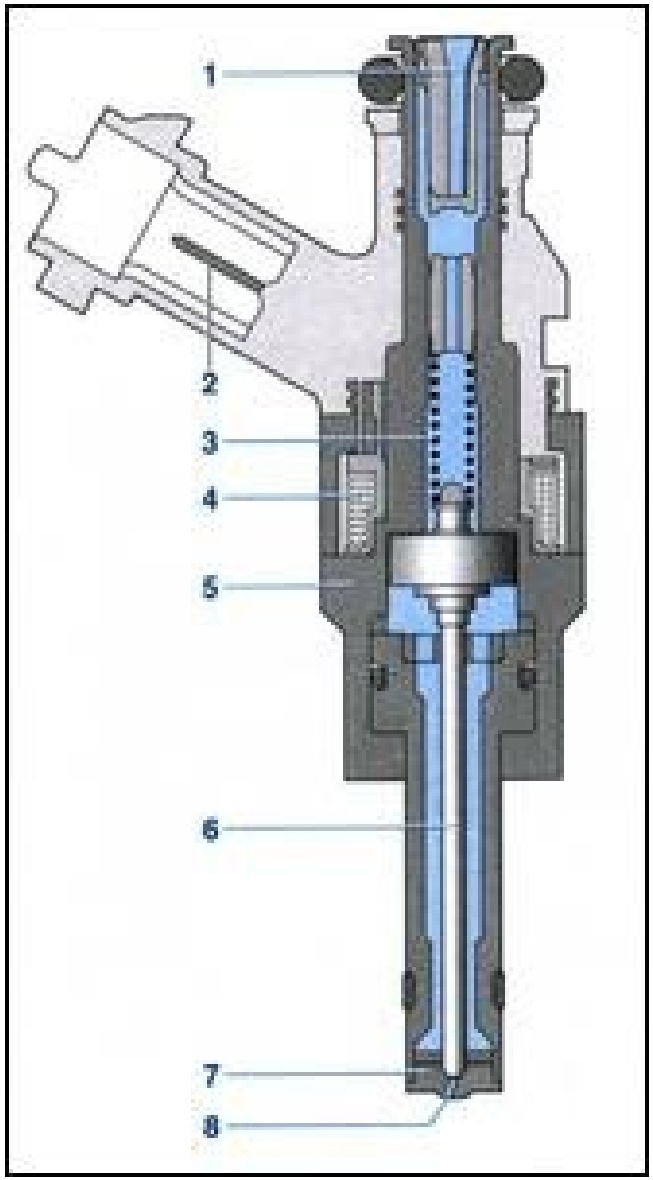
Fuel Injector Example

Diagram 1.8

1. Fuel Inlet
2. Terminal
3. Coil
4. Controller
5. Housing
6. Pintle
7. Pintle Seat
8. Nozzle

When a fuel injector is energized the coil becomes a magnet which pulls the Pintle off the seat and allows Pressurized fuel to Spray into the combustion Chamber.
“shown here in it’s open state”

The Fuel Pump supplies pressure to the Fuel Injectors. When a fuel injector is energized it will release the pressurized fuel into the combustion chamber.



Fuel Pumps

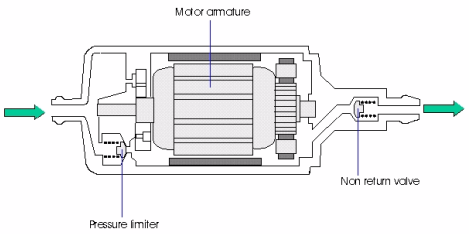


Diagram 1.9

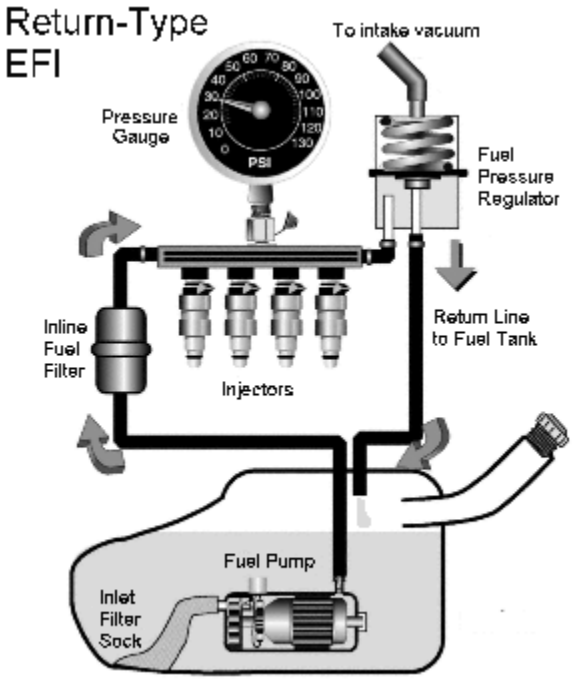


Diagram 2.0

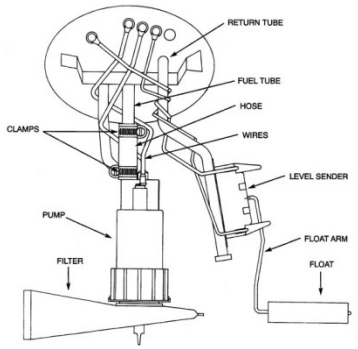


Diagram 2.1

Fuel Pump Operation

The Fuel Pump supplies pressure to the Fuel Injectors. When a fuel injector is energized, it will release the pressurized fuel into the combustion chamber.

Usually the Fuel Pump is located inside or near the fuel tank, the fuel pump's job is twofold:

1) To push fuel from the tank to the injectors.
2) To create sufficient pressure so the injectors will deliver the correct amount of fuel under all operating conditions.

The pressure developed by the pump, as well as the volume of fuel it flows, must meet the vehicle manufacturer's requirements for engine performance, economy or emissions will suffer.

The amount of fuel pressure required for a given application will vary depending on the type of injection system. The differences may not seem like much, but a few pounds of fuel pressure has a significant impact on engine performance and emissions.

Most Fuel Pumps have two fuel filters, a strainer filter at the bottom of the fuel pump module inside the fuel tank and one exterior filter before the Fuel Rail.

Both filters are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

We recommend a one time fuel filter change after the first 600 - 1000 miles of using E85, on vehicle's made before 1998.

Theory and Operation

A fuel injector has 12V + at all times when the vehicle's ignition is turned on . The vehicle's ECU (Electronic Control Module) then triggers ground pulse signals to actuate the internal magnetic coil which then lifts the pintle to be lifted off its seat allowing the pressurized fuel to spray into the intake chamber.

When we attach the device inline with the fuel injectors, what we are actually doing is allowing the first ground signal from the E.C.M. to pass through the circuit board to the fuel injectors, then in micro-seconds we tag that signal and give an additional pulse.

The amount of extra duty cycle or (fuel injector on time) that we give is controlled by the micro-chip on the circuit board. The circuit board actually triggers an additional ground signal that then actuates the fuel injector a second time. The waveform pattern would look the same, only smaller than the original signal.

An automotive engineer would see two inductive fuel injector waveform spikes on an oscilloscope. ***Waveform A*** in the photo below would be the original wave form pattern the original stock E.C.M. and the second waveform pattern would be ground pulse generated by the White Lightning Flex Fuel Conversion System. Every OBD 2 computer has the ability to adjust for rich conditions created by our device when using gasoline. ***Waveform B*** in the Photo below is an original unmodified example of a fuel injector without a Conversion system installed.

The second pulse would be a percentage of the first original signal. Our circuit board is essentially a ground signal generator triggered by the reference pulses from the ECU to the fuel injector. Our circuit board is a 4 channel board with one ground pulse input from vehicle's ECU and one ground pulse output to the fuel injector. Our power to the board is supplied by only one of the constant power wires to the first fuel injector. Our ground to the board is supplied from battery cable or engine ground. When vehicle's key is turned on, circuit board is supplied power from our wiring harness. With power supplied to circuit board our "ground pulse generator" (Circuit Board) is now activated.

The secondary ground signal we give depends on the amount of increase that we selected from the potentiometer on the circuit board. Our potentiometer has markings of 0 – 10; this range would give us a maximum in full clockwise position of 27% increase of the original computer signal and a minimum of "0" or no additional signal in full counter clockwise position.

Theory and operation Diagram

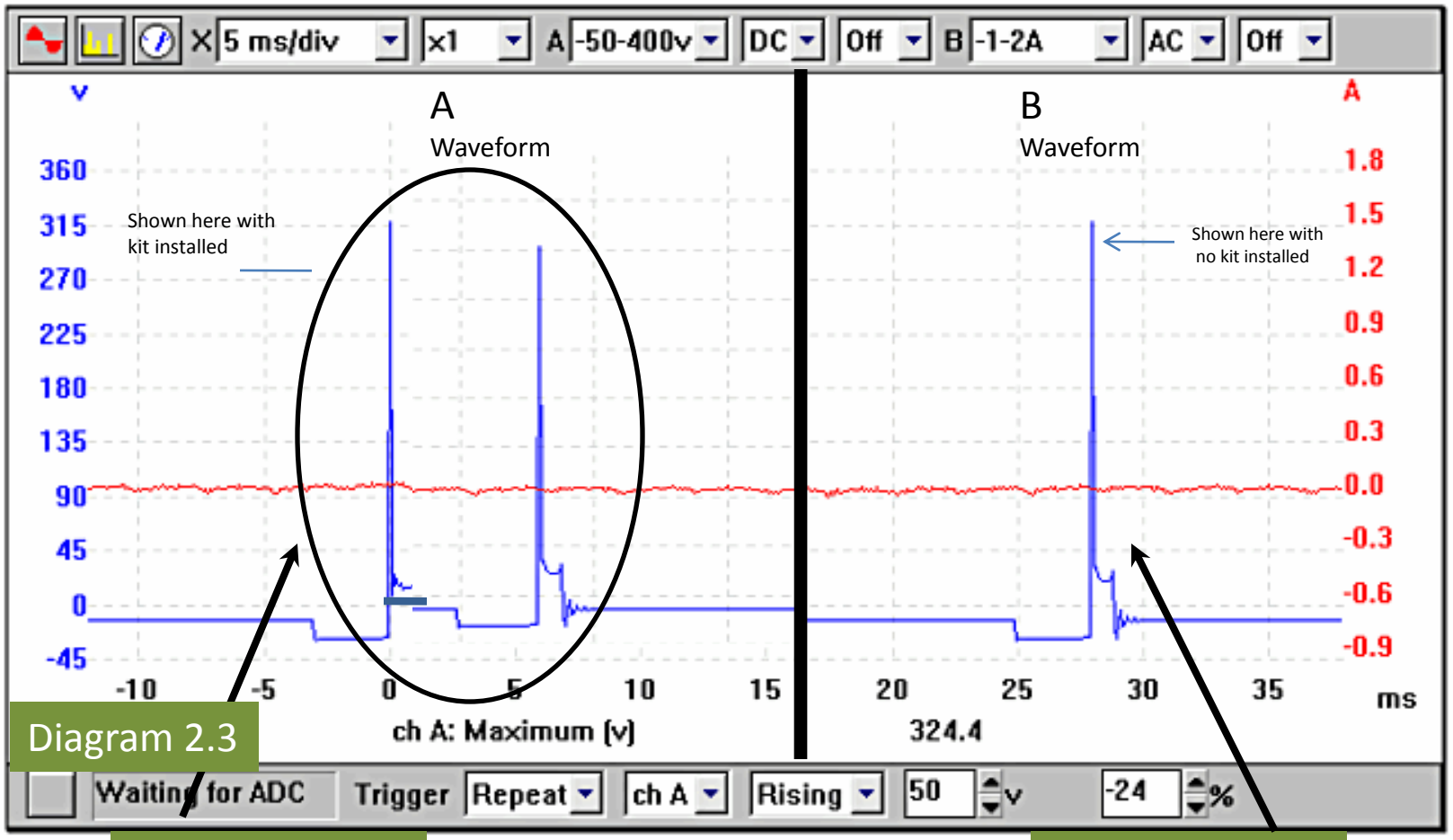


Diagram 2.3

Kit Installed with extra pulse

No Kit Installed

Trouble Shooting

Check Engine Light

Generic Scan Tool

Sensors and Controllers Inputs/outputs

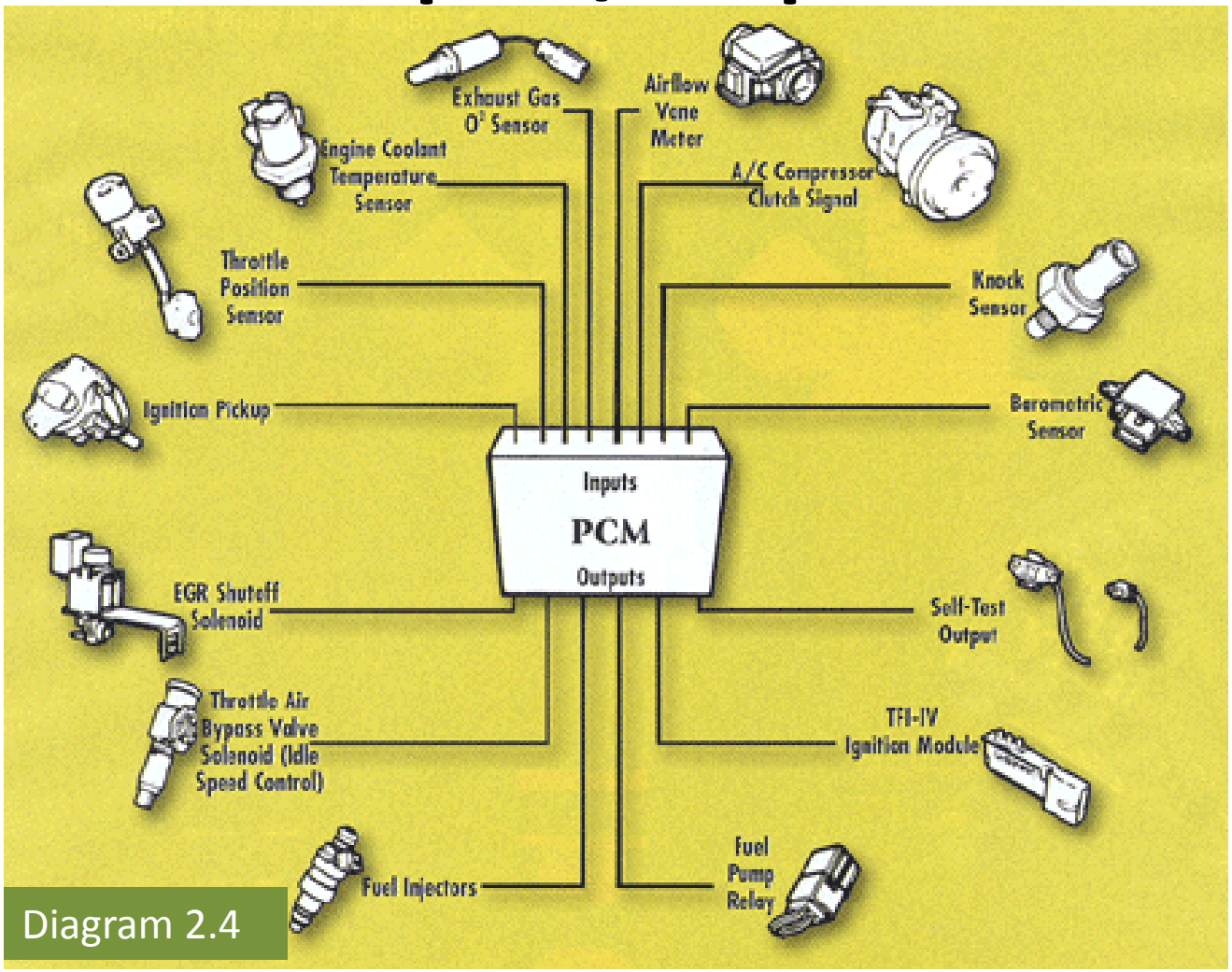


Diagram 2.4

The PCM's job is to manage the powertrain. This includes the engine's ignition system, fuel injection system and emission controls. The PCM receives input from a wide variety of sensors and switches.

OBD II

EMISSIONS AND OBD II

- With computerized engine control systems, it doesn't take much of a sensor input problem to adversely affect drive ability and emissions. A sluggish O2 sensor, a defective coolant sensor that always stays cold, a throttle position sensor that has a dead spot, an airflow sensor that isn't reading accurately, etc., can all hurt performance, fuel economy and emissions.

- In an attempt to ratchet up the self-diagnostic capability of PCMs, the California Air Resources Board developed a "next generation" onboard diagnostic system called OBD II. "OBD" is an acronym for "On Board Diagnostics." The "II" or "2" stands for "second-generation system." OBD II first appeared in 1994, and it has been required on all cars and light trucks since 1996. OBD II was then Federally mandated and adopted by the EPA .

- Unlike earlier onboard diagnostic systems that set a diagnostic trouble code only when a sensor failed or read out of range, OBD II monitors most engine functions while the vehicle is being driven. It is designed to detect almost any problem that can cause emissions to exceed the federal limit by 1.5 times.

- OBD II is extremely sensitive. Some say it is overly sensitive because the vehicle manufacturers have been overly cautious in setting trigger points below the 1.5 threshold to reduce the risk of expensive emission recalls. As a result, some vehicle's may not actually have an emissions problem when the Check Engine light is on. Nevertheless, the problem should always be investigated to determine the cause.

Our rule at White Lightning, LLC is to automatically assume that any "check engine" light seen after installation is directly related to the White Lightning Kit. These issues can be easily solved over the telephone and or this technical service manual.

Check Engine Light

The codes listed in this section could be set by other conditions, for this training manual they should be assumed that the vehicle was running properly before installation of the White Lightning Kit and the installation of the White Lightning Kit has caused them. These trouble codes can be easily repaired with a simple phone call. These are the only codes that we have recorded in our 5 years of business operations.

The “check engine” light is designed to alert the driver when an emissions or sensor problem occurs. Depending on how the system is configured and the nature of the problem, the lamp may come on and go off, remain on continuously or flash, all of which can be very confusing because you have no way of knowing what the light means. Is it a serious problem or not? Even if the engine seems to be running okay, *you should you never ignore the “check engine” light.*

To address this issue, AutoZone (auto parts stores) recently announced a nationwide "Check Engine Light Program" for its stores. When a motorist has a “Check Engine” light on, he can take his vehicle to an AutoZone store for a FREE DIAGNOSIS. A store employee plugs a code reader or basic scan tool into the vehicle's diagnostic connector and reads out the code. In theory, this provides a diagnosis so the appropriate part(s) can be replaced.

Unfortunately, it's not as simple as it sounds. A trouble code is only a starting place, It's not the final diagnosis. Somebody still has to check out the various components in the affected circuit to determine exactly what is causing the problem. Jumping to conclusions often results in a faulty diagnosis.

For example, let's say a vehicle has an OBD II code for: A MISFIRE CONDITION

code P0300 (more than one cylinder) or single codes P0301,P0302,P0303,P0304,P0305,P0306,

P0307,P0308,P0309,P0310,P0311,P0312. These codes will indicate a improperly wired “White Lightning” male connector, or it might indicate a loose connector or installation error.

OBD II Codes
P0300/P0310-P0312

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Harder to diagnose are misfire codes. OBD II can detect misfires in individual cylinders as well as random misfires. If it generates a misfire code for a single cylinder (say P0301 for the #1 cylinder), tells you the cylinder is misfiring - not why.

When we see these codes it is usually a connector not plugged in properly or that the male connector was assembled improperly.

A random misfire code (P0300) is even harder to diagnose. A random misfire means that there are more than one cylinder with a poor connection. This is usually due to improper assembly of the male connectors or more than one connectors are not seated on the fuel injector properly.

A “check engine” light that flashes will signify that there is a misfire condition on most vehicle's.

OBD II Codes
P0171/P0174

Technical Description

System Too Lean (Bank 1 and Bank 2)

What does that mean?

Basically this means that an oxygen sensor in bank 1 or bank 2 detected a lean condition (too much oxygen in the exhaust). On V6/V8/V10/V12 engines, Bank 1 is the side of the engine that has cylinder #1.

An inline 4 cylinder and 6 cylinder engine have only one bank. The E.C.M. will show code for Bank 1 only

Symptoms

You will more than likely not notice any drivability problems, although there may be symptoms such as a lack of power, detonation (spark knock), and/or a hesitation/surge on acceleration.

Causes

A code P0171/P0174 may mean that the following has happened:.

Not enough fuel: Potentiometer set too low

Solutions

Pull back waterproof boot and adjust the potentiometer to a higher setting. Using a one step increase from factory setting number 5 to setting number 6.

On vehicle's older than 1998 check for a dirty fuel filter and proper fuel pressure usually seen after 600 - 1000 miles of driving on E85. Ethanol can break loose debris in a vehicle's fuel system left from gasoline deposits.

There is a sweet spot for all vehicle's. 90% of all vehicle's run fine in position # 5

OBD II Codes
P0172/P0175

Technical Description

System Too Rich (Bank 1 Bank 2)

What does that mean?

Basically this means that an oxygen sensor in Bank 1 or Bank 2 detected a rich condition (too much fuel in the exhaust). On V6/V8/V10/V12 engines, Bank 1 is the side of the engine that has cylinder #1.

An inline 4 cylinder and 6 cylinder engine have only one bank. E.C.M. will show code for Bank 1 only.

Symptoms

You will more than likely not notice any drivability problems, although there may be symptoms such as a misfire.

Causes

A code P0172/P0175 means that the following has happened:

Too much fuel: Potentiometer set too high

Solutions

Adjust potentiometer from the factory setting of 5 to a lower position using one step down to position 4.

- There is a sweet spot for all vehicle's. 90% of all vehicle's run fine in position # 5