



# INSTRUCTION MANUAL

## Ultimate LS Systems - Kits 70001, 70002, 70003, 70004, 70011, 70012, 70013 and 70014

This instruction manual is designed to get you up and running with your Ultimate LS Induction System. This system is ready to go with everything needed to complete the induction system of your LS engine and get you on the road easier and faster than any other system

on the market today. Suitable for your new or pull-out LS engines to ensure you are up and running in a flash. For technical assistance with your Ultimate LS System, call 951-340-2624 or go online to [www.fitechefi.com](http://www.fitechefi.com) under "tech center."

**Warning:** Caution must be observed when installing any product involving fuel system parts or gas tank modifications. Work in a well ventilated area with an approved fire extinguisher readily available. Eye protection and other safety apparel should be worn to protect against debris and sprayed gasoline. Be sure to disconnect the negative terminal of the battery before beginning. We recommend having this installation performed by an experienced, qualified, and

FiTech approved automotive technician. The finished installation must be thoroughly checked for any fuel system leaks. All safety precautions must be observed when working with fuel. Lastly, ensure the engine has had sufficient time to cool! The coolant may still be hot. Disregarding any of this information can result in serious injury or death.

### Emissions Status:

FiTech's Ultimate LS System is not CARB (California Air Resources Board) approved for use on emission controlled vehicles. This system is designed to control the EFI and ignition on LS based engines being retrofit into older vehicles that do not require emission controls (pre-1976).

### Dimensions and Hood Clearance

- Intake manifold is 6.5" tall as measured from the top surface of the block.
- The throttle body will clear any stock truck accessories depending on the type of water pump, if there is truck water pump accessory clearance interference you will need to get a new LS1 water pump and accessory bracket.
- The throttle body sits at a downward angle of 7 degrees.
- Before installing your FiTech Intake manifold it is recommended to check hood clearance. This can be done in a few simple steps as follows:
  - First, using modeling clay or putty, (not included), make several small cones about 2-3 inches high. Position the cones on the various areas where you think clearance might be tight.
  - Close the hood to locked position and re-open. The height of the cone indicates the space between the hood and the air cleaner. Record these measurements. We recommend 1" of clearance.
  - Modification of the hood might be necessary to ensure there is no damage to any components.

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### Parts not included in the kit:

1. Coil Packs
2. Fuel Delivery System suitable to support required HP.
3. Optional Throttle Cable Bracket (FiTech #70160)
4. CAM Extension Cable is not included in 70001 or 70051.
5. Coil Pack Sub-harnesses are not included.

**Figure 1**



## 500 HP Kit Contents



### Contents for 500 HP Ultimate LS Kit

92MM Billet Aluminum Throttle Body

HandHeld Controller and cable

Windshield mount for HandHeld controller

(8) 36 lb/hr Injectors

LS ECU

Fabricated Aluminum Intake Manifold and bolts

Plug and Play Primary Wiring Harness

3 BAR MAP Sensor

Throttle Position Sensor (TPS)

Idle Air Control Motor (IAC)

Inlet Air Temperature Sensor (IAT)

Wide band Oxygen Sensor

Stainless Steel Oxygen Sensor Bung Kit

High Volume Fuel Rails including:

Mounting brackets

-6 AN fittings

(2) Fuel Rails

Screws for Mounting Brackets

AN fittings and Fuel Crossover Hose Assembly

**Figure 2**



## 750 HP Kit Contents



### Contents for 750 HP Ultimate LS Kit

102MM Billet Aluminum Throttle Body

HandHeld Controller with color touch screen

Windshield Mount for HandHeld Controller

(8) 55 lb/hr Injectors

(1) LS ECU

Fabricated Aluminum Intake Manifold and bolts

Plug and Play Wiring Harness

3-BAR MAP Sensor

Throttle Position Sensor (TPS)

Idle Air Control Motor (IAC)

Idle Air Temperature Sensor (IAT)

(2) Wide band Oxygen Sensor

(2) Stainless Steel Oxygen Sensor Bung Kits

High Volume Fuel Rails including:

Mounting brackets

-6 AN fittings

(2) Fuel Rails

Screws for Mount Brackets

AN fittings and Fuel Crossover Hose Assembly

## Modified Engines

The Ultimate LS intake manifolds are designed to provide maximum performance for street/performance engine applications. The intake manifold will have the best fitment when the engine block and cylinder heads are machined to standard OE dimensions. If the engine block or cylinder head deck surfaces have been milled significantly, the alignment of the mounting bolt holes and the port flange openings to the cylinder head may be shifted and not match up satisfactorily. If your engine has had the cylinder heads or engine block deck surfaces milled, the following may be necessary for proper intake manifold installation. The bolt holes in the intake manifold would have to be slotted to allow the fastener to properly pass through the manifold mounting holes. The mounting fasteners must freely thread into the cylinder head while passing through the mounting holes or

the manifold may not seat properly onto the cylinder head surfaces when the fasteners are tightened. As the o-ring grooves are located in the intake manifold mounting flanges, material may not be removed from the intake manifold mounting flanges without jeopardizing the sealing of the manifold. Any material removal required to align the port flange openings should be removed from the cylinder head not the intake manifold. When port matching the intake manifold port openings to the cylinder head openings, care should be taken not to break into or damage the o-ring groove or o-ring seal will not be effective. The intake manifold mounting surfaces on the cylinder heads should be in good condition, and free of nicks or scratches, where the sealing o-rings will seat on the heads to ensure proper sealing.

## Features

FiTech Ultimate LS Induction System is designed for street and performance engine applications with a 1500-6500 rpm power-band. The Ultimate LS kits are designed to support either 500 hp or 750 hp to the flywheel and all kits include a 3 BAR MAP sensor for power adder applications that support up to 30 PSI of boost (3 BAR). It has a high-flow cable operated 92mm or 102MM inlet throttle body and 36 lb or 55 lb flow-matched injectors. The 92mm and the 102 mm throttle bodies have parabolic inlet machining for smooth throttle transitions which is the same as OE throttle bodies. The throttle body features a progressive linkage pulley with a double return spring and an adjustable stop. The 500 hp and the 750 hp kits are both available with a transmission control option. The manifolds are designed with a 3mm thick construction that is TIG welded, black anodized with embossed FiTech logo and CNC machined with o-ring gasket and either cathedral or square port applications. The kit comes with a self learning ECU with touch screen controller for easy setup and con-

figuration. The programmable color touch screen HandHeld Controller includes a data logging feature. The Ultimate LS kit has a sequential fuel and spark control with individual cylinder trim.

The system also comes with stainless steel oxygen sensor bung(s), target AFR and timing control if desired, two fan control outputs, 5V tach output driver for most tachometers and a speedometer output driver for most electric speedometers. The system is compatible with 24X and 58X crank sensors, LS1-LS3 cam sensors, and compatible with car and truck coils.

Wiring the system is made easy with a custom wiring harness that uses existing factory coil packs and sub harnesses. FiTech's Ultimate LS kit comes with a knock sensor control and is custom cam friendly. Included are several timing curves that are each tailored for different camshafts, final drive gearing, and vehicle weight. The Ultimate LS system will allow for both EV1, EV6, and truck injectors with interchangeable injector harnesses. (Not included)

## Engine Protection Feature

The FiTech Ultimate LS Induction System is programmed with a limp home mode. Our features differ from competitors because the FiTech unit will not shut down your system. Instead the ECU will compensate if a sensor fails. This means, that if for any reason a sensor fails, that sensor will receive either a default value or a simulated value. This is to ensure that the engine remains running in a safe and controlled manner so that you can get to a repair facility, or to your home to resolve the issue. Due to the compensation features of the ECU, the way to check if something is going wrong with your system is

by the fault codes option on the main menu of your hand-held controller. The fault code comes up under OBD-II, diagnostic standard, to the right of the code it will state which sensor is having the problem. Check our troubleshooting guide to solve the fault codes errors. A new feature programmed into our hand-held is a rev offset. This feature will protect the engine because it lowers your built in rev limiter to prevent over rev and possible engine damage during warm up. It will automatically turn the feature off once your engine reaches operating temperature.

## Special Instructions

- We recommend using either the FiTech Force Fuel, or the FiTech Go-Fuel In-tank Retrofit Kit setup for optimum fuel delivery for all installations. A submerged pump is quieter and lasts longer.
- If using the Frame Mount Inline Fuel Pump, it should be mounted at, or below, the bottom level of the fuel tank and as close to the tank as possible. No more than 3-feet away from the tank. This type of pump is designed to pump, not draw. Works best when gravity fed.
- Only use hard fuel lines when using proper EFI rated flared fittings.
- Do not use solid core ignition wires.
- Make sure that you remove ALL low pressure flex joints on factory fuel lines and replace them with EFI rated fuel hose and use proper flared connections and clamps. Be careful not to mix 45° and 37° AN fittings. They look similar but will not work together. 45° fittings usually come from a hardware store or auto parts store while 37° AN fittings are what is supplied by FiTech and most speed shops.

- Only the steady state fuel "learns". Cranking and hard throttle hits will not learn, but they can be tuned in Go-EFI Tuning. Selecting the right "cam" and engine CID (cubic inch) will get the learning closer. The Accel Pump will often need tuning for your particular engine combination.
- Your system needs to run at 58 PSI so consult a FiTech approved professional if you are not certain about this portion of your installation.
- FiTech does not recommend aluminum fuel lines EVER!
- Use the supplied push lock style hose ends only with the supplied hose and vice versa. Interchanging hose ends and hose with other brands could cause leaks.
- The Ultimate LS systems are intended for use with unleaded pump gas with up to 15% ethanol content.

*Continued next page*

### Special Instructions (Continued):

- Tach output driver provides a 5V output signal.
- The fuel rails are machined to receive the supplied adapter fittings for -6 ORB to -6 AN male o-ring port.
- It is recommended to use unleaded fuel to ensure a longer lasting oxygen sensor. Leaded fuel will lead to improper exhaust gas oxygen readings. Before starting the install, ensure any RTV silicone sealer used is sensor compatible. This information can be found on the RTV package.
- When installing the fuel rails hardware and brackets, it is important

to only hand tighten a couple of threads in place, then once all bolts and hardware are in place, tighten the brackets to the rail before tightening the rail to the manifold.

- Be sure the engine has had sufficient time to cool before starting work on the installation.
- Be sure to disconnect the negative terminal of the battery before beginning.

**Very important note: Your fuel tank must have a vent to prevent pressure building up inside the tank.**

### Installing the Intake Manifold

1. Before starting the installation, disconnect the negative battery terminal (ground).
2. Before installing the intake manifold, set the intake on the cylinder heads to test fit the intake manifold without the o-rings installed. Make sure that the mounting bolts supplied can thread freely into the cylinder heads through the intake manifold mounting holes and that the mounting flange seats properly. Check the port opening alignment and test fit the throttle body, fuel and vacuum plumbing, throttle linkage, wiring, etc to ensure there are not any fit issues before performing the final intake manifold installation.



3. Install the MAP Sensor to back of manifold as shown in the photo at right. Then thread the Air Temperature Sensor into the front of the manifold and tighten securely. See Figure 7 on next page.

**Note: Torque specs are in inch pounds, not foot pounds.**

### TORQUE SPECIFICATIONS FOR LS ENGINES



Make first pass, following sequence shown here, torquing to 44 lb.in. Then make second pass torquing in sequence to 89 lb.in. Retorque after the engine reaches operating temperature, in sequence, to 89 lb.in.



4. Now install the eight o-rings provided in the mounting flange o-ring grooves. Apply a small amount of grease to the o-rings to ensure proper seal and help hold them in position during installation.
5. Next, place the intake manifold onto the cylinder heads, being careful that the o-rings remain in the grooves and are not being crushed between the manifold and the cylinder heads.

6. Apply a small amount of engine oil to the threads of the bolts before installing them into the intake.

7. Then install the bolts and washers and tighten following the torque sequence shown in the chart at left.



## Installing the Throttle Body

1. If optional Throttle Cable Bracket (FiTech #70063) is used, position it between the manifold and throttle body with gasket on the front face and the supplied o-ring in the groove on the manifold. See Figure 7.
2. Attach the Idle Air Control (IAC) and Throttle Position Sensor (TPS) to the new throttle body. Make sure each o-ring is in the groove and does not slip out while installing.
3. Tighten the screws holding the IAC and TPS to the throttle body.
4. Make certain the gasket mating surface on the intake manifold is clean and free of debris.
5. Using the included bolts, attach the throttle body to the intake manifold. Tighten bolts securely.
6. Slip the throttle cable on the linkage arm.
7. Observe the throttle body (while an assistant presses and releases the gas pedal) to ensure that the throttle blade opens and closes while also operating smoothly.

## Installing the Fuel Rails

1. Before installing the fuel rails, apply light grease to the o-ring on both ends of the fuel injectors (Figure 9) and insert the fuel injectors into the ports in the fuel rail (Figure 10).
2. To insert the injector without tearing the o-ring, gently rock the injector in the inlet of the port while applying pressure to insert the injector.
3. Insert the injector with its connector facing towards the outside of engine into the fuel rail.
4. Continue with the other three injectors. With the injectors installed, it is time to install the fuel rail assembly to the engine.
5. Position the rail assembly over the intake manifold with the injectors aligning with their mounting pockets on the intake.
6. With the injectors lined up, lightly press down on the fuel rail using caution not to bind any of the injectors or connectors. See Figure 11. The fuel rail assembly should come close to contacting the manifold brackets with very little pressure. Use caution not to bind or tear any injector o-rings. Check and ensure the injector is floating on the o-rings; rotate the injector back and forth to confirm that there is no bind on the injector body.
7. Attach the fuel inlet fittings to the front ports of the fuel rails. Make sure o-ring is on the end of the fitting that threads into the fuel rail. See Figure 12. Now install the crossover hose.

## Fuel System Requirements

1. System must have 30 microns or better fuel filtration.
2. Must be capable of supplying 58 PSI of fuel pressure to the injectors under full load.
3. Must use 37° flare fittings on all fuel line connections.

Figure 7

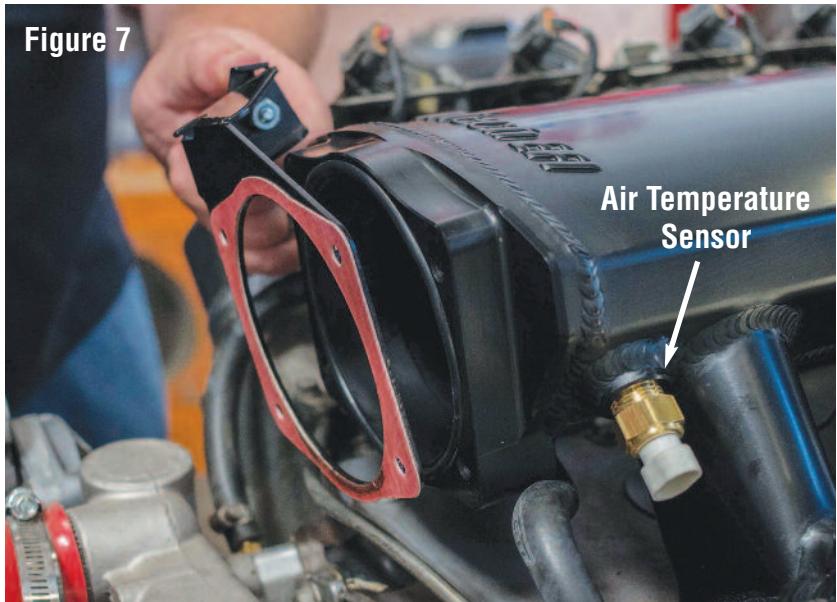


Figure 8



Figure 9

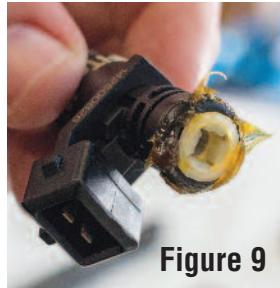


Figure 10

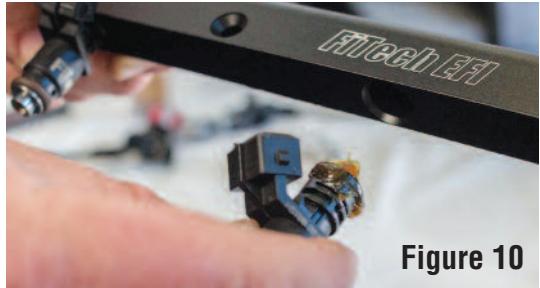


Figure 12

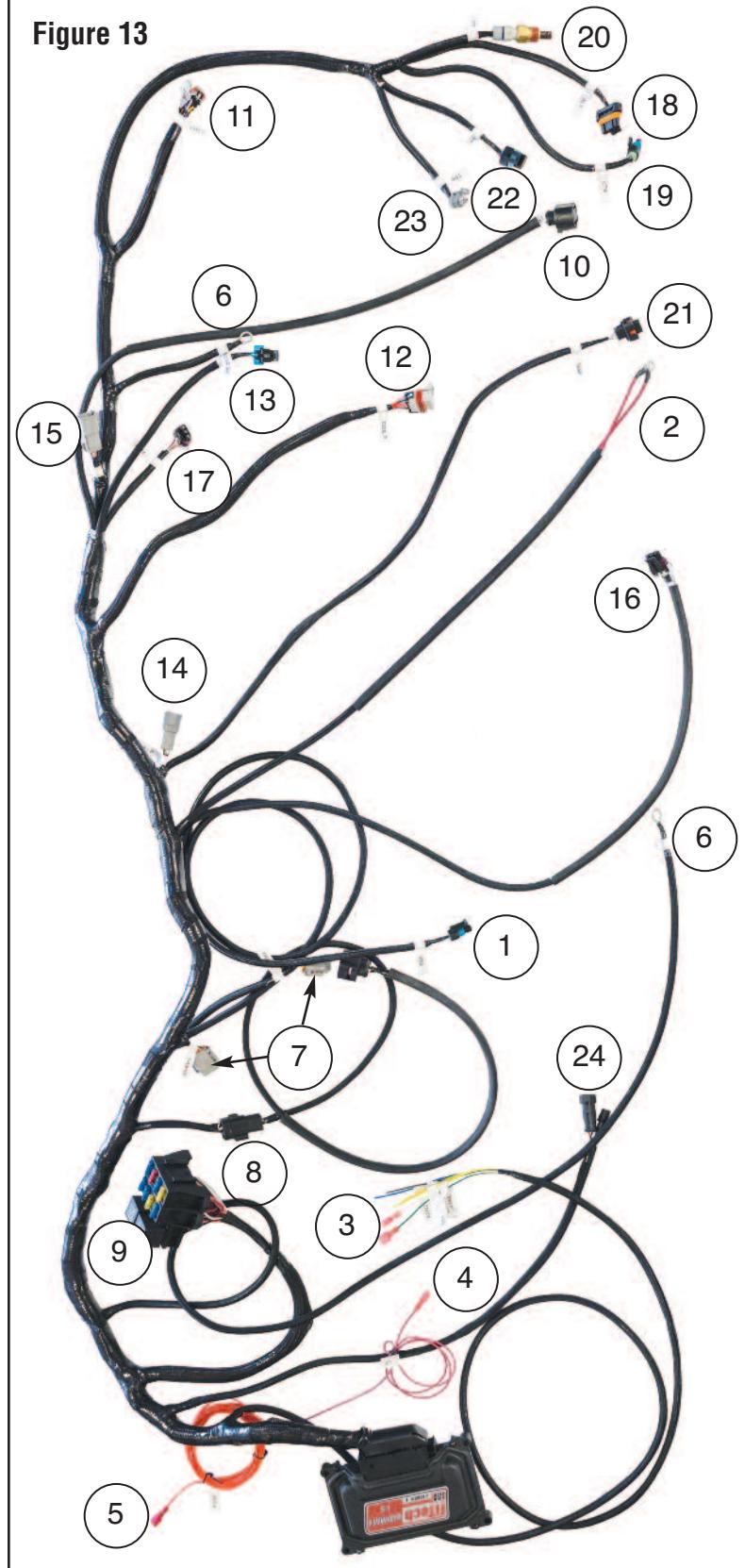


## Wiring the System

The Ultimate LS kit makes wiring the harness very simple. Every connection in the harness is labeled for where it goes. The various wires will need to be extended to make required connections. See the wire chart below which lists each wire used in the system and what it connects to. It is strongly suggested that any wire extensions are made with the same gauge and color wire as is used in the supplied har-

ness. Make connections as a soldered joint rather than a crimped connection. Utilize a shrink wrapped sleeve covering all connections. All modifications to wiring must be made on Item 3 "Accessory Wires," (the vehicle side wiring) such as extensions or cuts. Any modification of the ECU side harness will result in a VOIDED warranty.

**Figure 13**



Connector	Location
1	Vehicle speed sensor connects to back of transmission output.
VSS	
2	Main Power: Positive 12V goes to starter. Needs to be live even with power off.
POS (Red)	
3	These wires go to Fan, Tach Out, A/C Kickup, Speedometer, & Torque Converter Brake Switch
4	On/Off - Connect to switched 12V circuit. Must be on during "Key On" and "Cranking."
Red Wire (Key)	
5	Fuel Pump circuit. Wire provides 12V to fuel pump. Connect to (+) terminal on pump.
Orange Wire	
6	One grounds the ignition and one grounds to the engine block..
Grounds	
7	Only used when using transmission control.
Two Trans Connectors	
8	Optional second O <sub>2</sub> on passenger side. Yellow 6-pin.
O <sub>2</sub> Harness connector.	
9	Fuse Box with Relays.
Fuse Box	
10	O <sub>2</sub> Sensor on driver's side.
DRV.02	
11	Passenger side coil pack connection. Coils and coil pack sub harnesses not supplied.
Coil P	
12	Driver side coil pack connection. Connects to universal connector on O.E. coil pack.
Coil D	
13	Use sub-harness extension to reach to LS2, LS3 on side of block. LS1 is on back of block.
Knock	
14	Passenger side injector harness.
INJ P	
15	Driver side injector harness.
INJ D	
16	Crank position sensor. Located between starter and engine block.
CKP	
17	Use extension for LS2, LS3 where cam connects to front. LS1 connects to back.
CAM	
18	Connects directly to the alternator.
ALT	
19	Connects to engine coolant temperature sensor on driver's side front of cylinder head.
CTS	
20	Intake air temperature. Connects to front driver side of manifold. Threads into manifold.
IAT	
21	Connects to MAP sensor on back of the manifold.
MAP	
22	Idle Air Control. Connects to IAC mounted on the throttle body.
IAC	
23	Connects to throttle position sensor mounted on the throttle body.
TPS	
24	Connect the two female connectors to the two male connectors on the Handheld harness.
Handheld Controller	

## Main Wiring Harness Connection Details

**VSS:** Vehicle speed sensor connects to back of trans output.

**POS (Large Red Wire) Main Power:** Positive 12V goes to starter. This circuit needs to be live even when the switch is off so that the self-learning files are saved. This is fused with a 25 amp fuse.

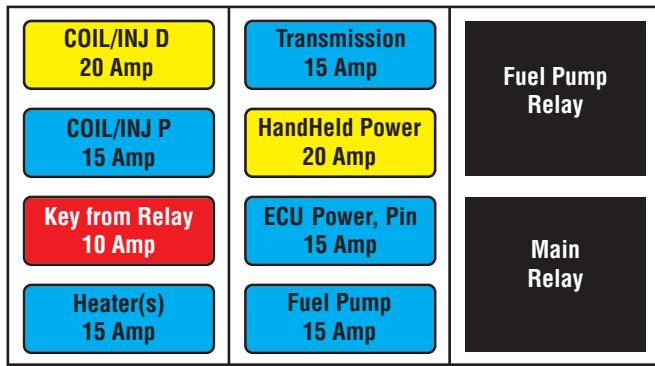
**Small Red Wire:** Key cranking power. On/Off - Connect this wire to a switched 12V circuit. Must be on during both "Key On" and "Cranking." DO NOT connect to the coil terminal when using an external CDI box such as an MSD 6A or any other CD ignition.

**Orange Wire Fuel Pump Circuit:** This wire provides 12V to the fuel pump and connects to the positive (+) terminal on the pump. No relay is required as one is included in the harness..

**Two Trans Connectors:** These two connectors plug into the sub-harness provided in the Transmission Control Optioned Kit and then the other end of the harness is connected to the plug on your transmission. (See Figure 14) NOTE: These are not connected unless you are using the FiTech optional Transmission Control.

**Accessory Wires:** These wires are labeled and go to Fans, the Tach Out, the A/C Kickup, the Speedometer, and the Brake Switch for the torque converter. The Brake Switch for the converter needs 12V when the brake is not pressed, and no voltage when the brake is pressed. See Figure 15 for how to achieve these connections.

Figure 17



**Fuse Box:** Above is a graphic showing the location of the various fuses in the supplied Fuse Box which is item 9 in Figure 13.

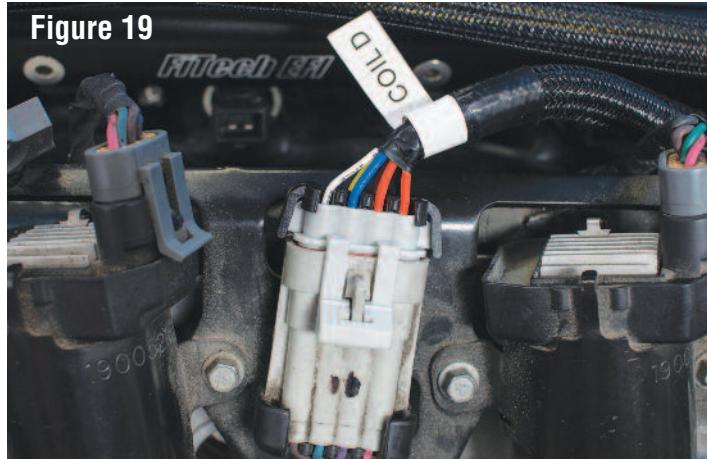


Figure 19

**Ground:** The wiring harness contains two ground wires (Ignition and ECU low current). They can be attached to existing threaded holes in the back end of both cylinder heads. One ground to the driver's side and one to the passenger's side. Scrape head clean of paint if needed.

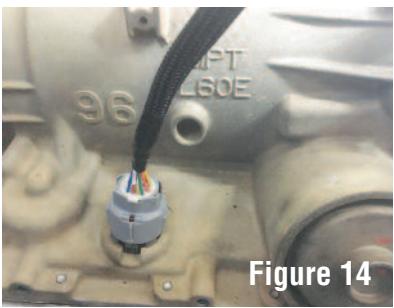


Figure 14

Figure 15

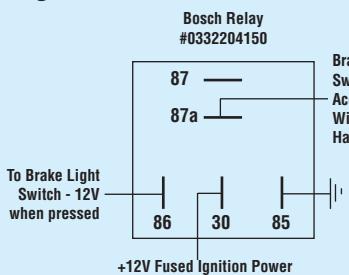


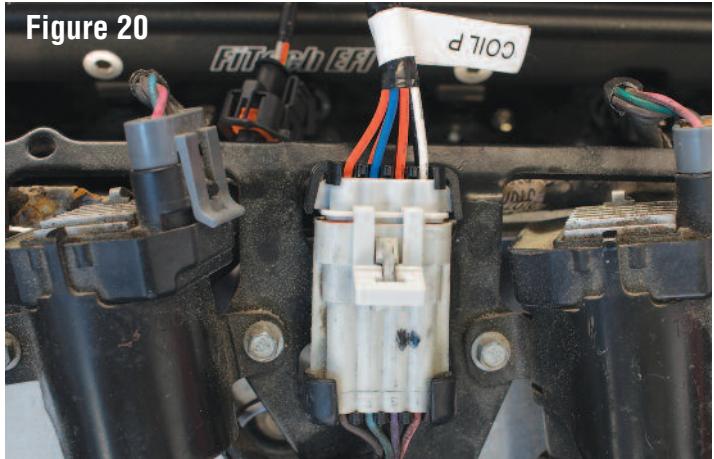
Figure 16

Figure 18



**O<sub>2</sub> Sensor Harness:** Yellow 6-pin connector. Note that the 500 HP kit uses one O<sub>2</sub> Sensor on driver's side headpipe. The 750 HP kit uses a second O<sub>2</sub> Sensor on the passenger's side. See Figure 33 on page 11 for sensor installation instructions.

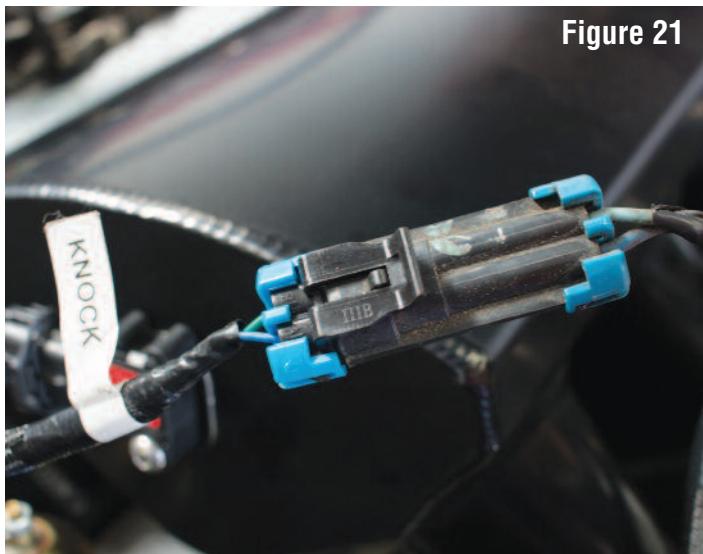
Figure 20



**Coil D:** The Coil D connector is connected to the existing connector on the driver's side coil pack. Note coils and coil sub harnesses are not included in kit.

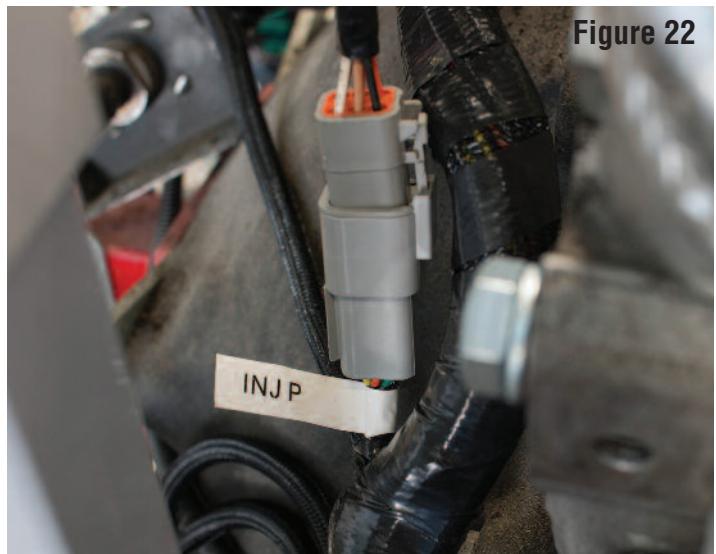
**Coil P:** The Coil P connector is connected to the existing connector on the passenger's side coil pack. Note coils and coil sub harnesses are not included in kit.

Figure 21



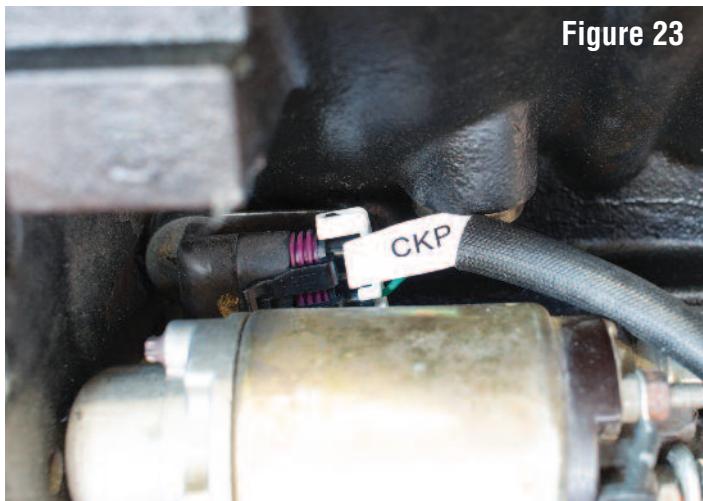
**KNOCK:** This sub-harness attaches to the Knock Sensor connector located on the side of the block on the LS2, LS3, and on the back of the block on the LS1, LS6.

Figure 22



**Injector P:** This connector mates with the injector harness on the passenger side of the intake manifold.

Figure 23



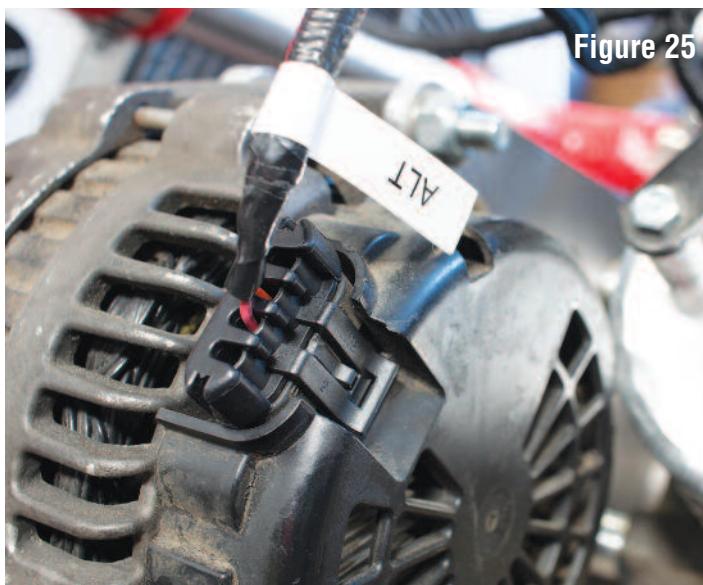
**CKP:** This connector mates with crank position sensor connector found between the starter and the block.

Figure 24



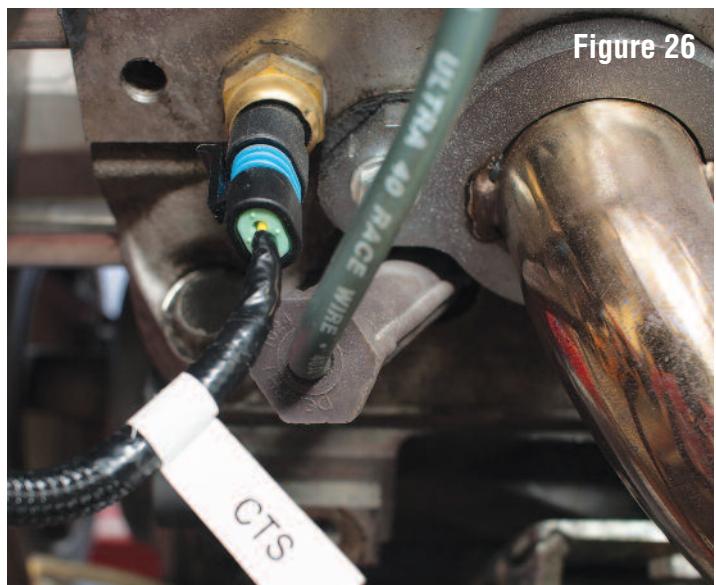
**CAM:** Connect to mating connector on back of engine on LS1, LS6. Available extension harness (#00000) to connect to mating connector on front of LS2, LS3. See page ?? for details.

Figure 25



**ALT:** This wire directly connects to the alternator.

Figure 26



**CTS:** This wire connects to the coolant temperature sensor located in the front side of the driver's side cylinder head.



Figure 27

**IAT:** Inlet air temperature: Connects to the front driver side of the manifold and threads into the manifold. This sensor is supplied and must be inserted in the manifold.



Figure 28

**MAP:** Connects to the manifold absolute pressure (MAP) sensor mounted on the back of the manifold. Sensor is attached to manifold with supplied machine screw.

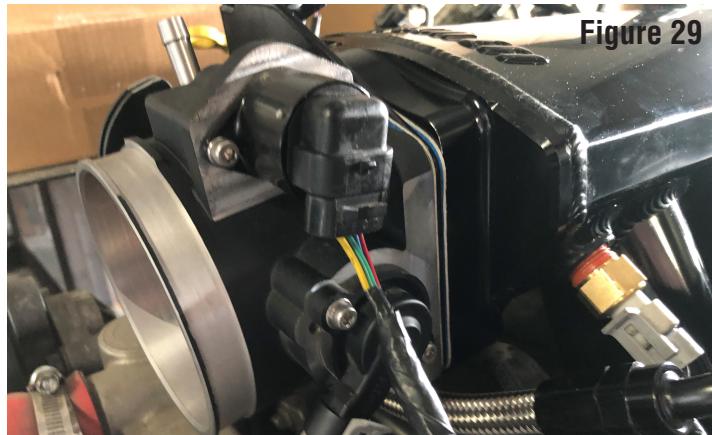


Figure 29

**IAC:** This harness connects to the idle air control motor that is mounted on the driver's side of the throttle body.

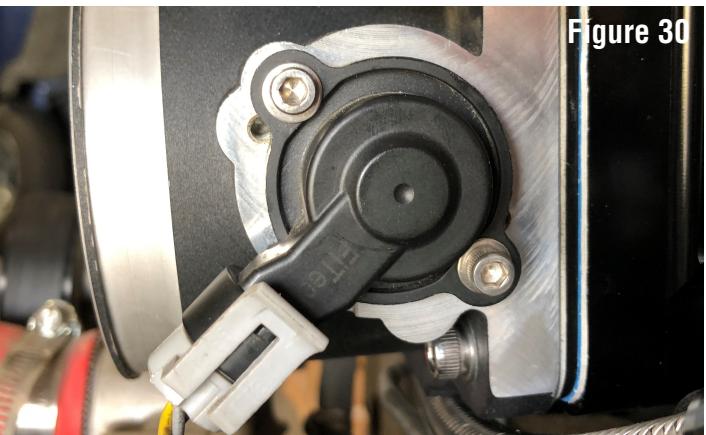


Figure 30

**TPS:** This connector connects onto the throttle position sensor mounted on the driver's side of the throttle body.

### Wide Band O<sub>2</sub> Sensor Bung Installation

Perform this installation at this stage. For complete details on this installation, see Page 11. Then go to "Final Steps" below.

### Final Steps

1. Attach the air inlet tube, all vacuum hoses, and electrical connectors on the new throttle body.
2. Reconnect the negative battery terminal.
3. Turn the key to "On" but do not crank, allow fuel system to pressurize and then check for any fuel leaks. Do this several times.
4. With engine turned off, perform the steps below outlined in the

"Initial Programming" section.

4. Start the engine and check for loose connections or vacuum leaks, fuel leaks, etc.
5. After the engine is warmed up, check the idle speed. Double-check all fasteners, clamps, and electrical connections to ensure they are all secure.
6. Re-torque intake manifold per specifications given on Page 4.

### Initial Programming

This simple procedure is performed using the HandHeld Controller. A laptop computer is not required.

1. The HandHeld Controller plugs into the harness at connector 24. See Figure 13. Turn key on.

- a. Go to write cal to ecu and click "in" on the joystick. Select the crank tooth option and transmission (if applicable) and click "in" on the joystick.
- b. Wait for it to finish loading, then turn key off, wait 15 seconds and then turn key back on.
2. In initial setup -> engine setup: Input your engine's cubic inch displacement, cam size, target idle speed warm, maximum RPM limit, ignition selection (varying on unit), crankshaft sensor, and injector flow rate. Make sure to click down on the joystick after every selection to save the parameter.
3. Go to transmission control:

- a. Enter your rear tire diameter and rear gear ration. (Note: Click

down on the joy-stick after each entry to save your selection.)

- b. Option 3: Forces an upshift if rpm is too high.
- c. If you are running an electronically controlled automatic transmission such as a 4L60 or 4L80, go to transmission option number 4: "Option 4LX0e trans" and select 4LX0e. If you are not using one of the listed transmissions, select "other" and click the joy-stick to send to ECU.
- d. If running an electronically controlled automatic transmission such as a 4L60 or 4L80, go to option 5: "4L6xe 4L8xe" and select your transmission, click the joy-stick to send to ECU.
- e. Option 6: Resets the learned rpm offset to avoid forced upshifts.
- f. Option 7: Enable/Disable learns to shift earlier to avoid RPM going above the forced upshift rpm.
4. The HandHeld Controller can be removed or left connected. When connected, there is a dashboard and gauges screen that will show engine parameters in real time.

## HandHeld Controller

There are two ways to navigate the HandHeld Controller; you can use the touchscreen with your finger or move the joystick up, down, left, right, or in. The joystick is the black button on the right hand side of your Controller. It can be used to view the displays on the controller by moving the button up and down or side to side, pressing the joystick in to save changes.

1. When making changes to the ECU through the HandHeld make sure that the ignition key is on.
2. Once the changes are made turn the key off, wait 15-20 seconds until the values disappear under the "dashboard" feature. Doing this will ensure that your changes have received a hard save.
3. Once the hard save is completed, if desired, the battery can be disconnected without interference with the calibrations. For HandHeld Controller definitions visit: [www.fitechfi.com](http://www.fitechfi.com) under "tech center" sub-tab HandHeld Controller. These definitions are also available on the HandHeld Controller when plugged in.

## Timing Control

The Ultimate LS System has a preset timing curve based on the engine calibration selected. If you desire to change timing control it is in advanced setting, under Go EFI tuning. The spark map can be adjusted based on engine RPM, throttle position, and vacuum reading. Use caution. Too much timing (total advance) can cause engine damage.

## Rev Limiter

The Ultimate LS System provides a fuel controlled rev limiter. When the engine attains the programmed RPM limit, fuel will be cut off to maintain the desired limit. Any external ignition related RPM limiter is independent of the Ultimate LS System and you should set the EFI related RPM limiter higher than your external rev limiter to prevent a crossover of the two happening at the same time.

## On-Engine Adjustments

Start the engine and observe idle. If idle is high, confirm the throttle cable is adjusted to allow the lever arm to rest on the blade idle screw and the cable is not holding the blade open. If idle is acceptable, bring the engine to running temperature and check the idle again. If idle is not desirable, turn the key to the off position for 30 seconds. This allows the ECU to learn the IAC's new position. Restart engine and re-evaluate idle.

**IMPORTANT!** The ECU takes time to learn after engine components have been changed. It is recommended that the vehicle be driven for one to two hours to allow the computer to adjust before moving to the following adjustments. Making adjustments before the computer has gone through a learn cycle can yield inconclusive and inconsistent results. If idle is low or rough, adjust the bleed screw (Figure 33 on page 11) clockwise. This will increase idle RPM.



Figure 31

## Crank Sensor

The LS engine platform has used two different crank position sensors through the years. There is a 24-tooth wheel or a 58-tooth wheel on the crankshaft. The sensor has always been located behind the starter. The 24-tooth sensor has a black connector whereas the 58-tooth sensor has a gray connector. The master kits are supplied with connectors for both the 24x and 58x trigger sensors. Connect the sensor in between the block and the starter by matching the connector colors.



Figure 32

## Cam Sensor

The cam sensor of LS engines has changed throughout the years. Not only it's location, but its wiring as well. Early models have the cam sensor located at the back of the block near the deck surface. During 2005, as a running change, the location changed to the front of the block between the cam and crank-shaft.

**Note:** The Ultimate LS System can function with either design.

### Wide Band O<sub>2</sub> Sensor

This is the key component of any EFI system. Only one sensor is required for the 500 HP kit, but on the 750 Hp kit we have included two, or a second can be purchased upon request. This sensor continuously monitors the exhaust gas mixture and sends the information to the ECU where adjustments are constantly made to maintain the air/fuel targets. The benefits of having the wide band O<sub>2</sub> sensor is that it provides real time accurate feedback of the amount of fuel the motor needs to reach desired air/fuel ratio directly to the ECU. The O<sub>2</sub> sensor connector will connect to the sensor on the headers. Caution must be taken before touching the headers. Make sure the engine is fully cooled!

1. The supplied O<sub>2</sub> Sensor should be installed in the driver's side exhaust bank.
2. The O<sub>2</sub> Sensor cable connects to one of the cables coming out of the ECU on the throttle body. See Figure 34.

- a. The ideal location for the Sensor is in the exhaust collector or within 8-inches of the collector itself. It must always be at least 18-inches from the exhaust tip, to prevent reversion and false lean conditions.
3. The sensor should be between 10° to 90° above horizontal (see figure 33) to allow condensation to run off. If this is not adhered to, the sensor is susceptible to water damage.
4. Never position the sensor on the outside of a bend in the exhaust tubing.
5. The sensor must always be mounted ahead of any catalytic converter if so equipped.
6. Drill a 7/8" diameter hole in the desired location.
7. The supplied bung kit can either be welded in place or clamped onto the pipe. The clamp-on style works well and will not leak. If welded, make sure the bung is welded completely all the way around and does not leak. Do not weld with sensor in place.
8. Install the sensor into the bung.

Note: It will not work on "Zoomie" style headers.

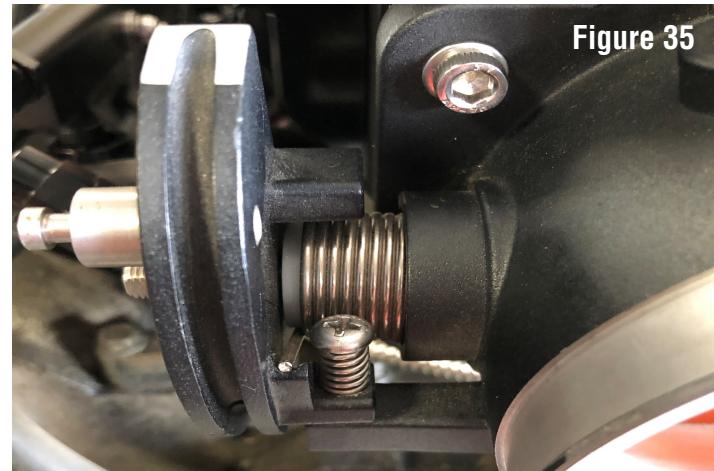
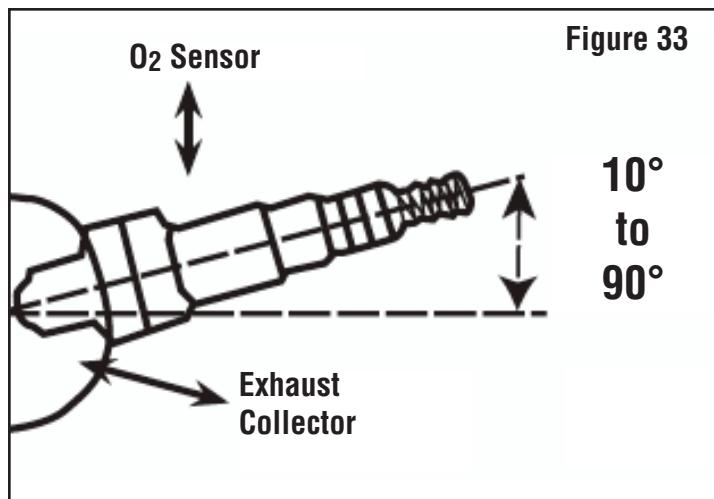
**WARNING:** Do not start the engine without the sensor cable connected to the wire harness and the EFI system is fully operational or damage will occur to the sensor.

### Transmission Control

The FiTech LS kit is available with electronic transmission control. This option is used when operating a GM electrotonically controlled automatic transmission. The Ultimate LS ECU has the ability to control the shift point, shift firmness, when to downshift properly, and all other features involved when controlling the transmission. This feature is suitable for 4L60, 4L65, 4L80 or 4L85 GM transmissions. This feature can be purchased with the kit or as an addition at a later time. If using transmission control, connect the two sides of the trans connector to the sub-harness and connect this to the connector on the transmission. Once connected to the transmission, you are ready. If not using transmission control leave the connectors untouched.

### Air Fuel Ratio (AFR)

An approximate value for gasoline's "stoichiometric" value is 14.7. A value of 12.5-13.0 is a "rich" value for near best power. For boost conditions (superchargers and turbochargers) 11.8 is a little richer than best power to keep combustion chambers a little cooler. Settings of 14.7-15.5 are lean and can sometimes be used for better cruise fuel economy. Idle AFR should be set to give a decently stable idle. Many engines prefer between 13.2 and 14.0 stoichiometric value.



# FiTech Warranty

**Limited Warranty:** FiTech EFI warranty is limited to repair or replacement (at our discretion) of any FiTech part that fails because of a defect in workmanship or materials.

**Implied warranty:** Any warranties implied by law are limited to the duration of this warranty (except in those states where prohibited by law).

**How Long It Is Covered:** All FiTech products are warranted for a period of one year from date of original retail purchase with an original receipt showing proof of purchase. Certain components of the EFI systems are limited to a 90 day warranty period. See separate complete Limited Warranty document for a list of specific components.

**Who We Cover:** All FiTech warranties apply to the original purchasing consumer.

**What We Do Not Cover:** Failure of a product due to misapplication, improper installation or maintenance, misuse, abuse, unauthorized repairs, accidents, or modifications to the original design. Removal or replacement costs, shipping costs, damage to related components, and costs incurred due to downtime of vehicle. Any product used in marine applications unless specifically stated for marine usage. Any parts used in racing applications or subject to excessive wear.

**Warranty Service Procedure:** In the event a problem develops with one of our products, contact our customer service department at 951-340-2624 or fax to

951-340-2648. It may be determined that the product will have to be returned for inspection and/or repair. A Repair Merchandise Authorization (RMA) number will be assigned to you. This number must be on the box shipped back to FiTech Customer Service. The product must be returned via freight prepaid. It must be accompanied by a clear description of what the problem is with the product. If the product is determined to be defective within the warranty period, FiTech will repair, replace, or issue credit to the original consumer at our discretion. Any repaired or replaced product will be returned to the sender via prepaid FedEx or other ground carrier.

**Return Policy:** FiTech guarantees its parts and is confident that our products will meet with your complete satisfaction. If the product does not meet your expectations, return it within 60 days for a refund or exchange. You can return the new, unused part within 60 days from the purchase date. To make a return, call our Customer Service Dept. at 951-340-2624 to receive a Return Merchandise Authorization (RMA) number. You must include the RMA number and a copy of the product purchase receipt with the return. The product must be sent back freight prepaid, in the original manufacturer's box to FiTech Customer Service/ 12370 Doherty St. Suite A, Riverside, CA 92503. Returns may be subject to a 15% restocking fee. No refunds will be issued without a copy of the receipt.



**California Proposition 65 Warning:** This product may contain one or more substances or chemicals known to the state of California to cause cancer, birth defects, or other reproductive harm.

LS Instructions - 9-12-17



12370 Doherty Street • Suite A • Riverside, CA 92503

Phone: 951-340-2624 • Email: [sales@FiTechEFI.com](mailto:sales@FiTechEFI.com) • Website: [www.FiTechEFI.com](http://www.FiTechEFI.com)