

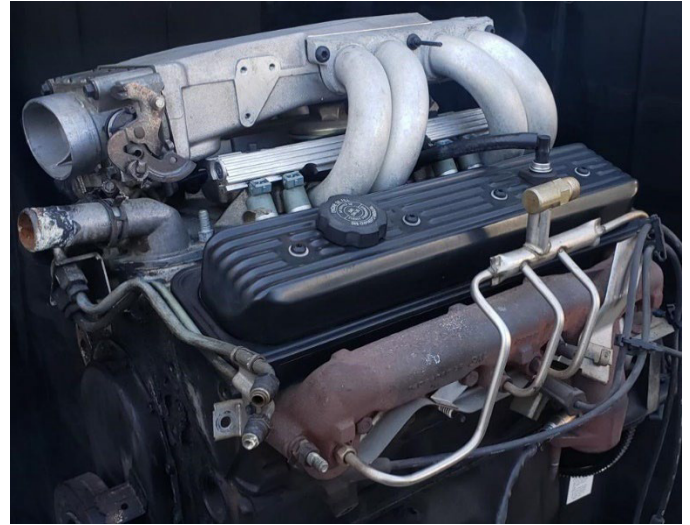
FiTech

Fuel Injection

INSTRUCTION MANUAL FiTech

Ultimate TPI Kits **38350, 38351,**

38352, 38353



This instruction manual is designed to get you up and running with the FiTech Ultimate TPI System. This system has almost everything needed to complete the installation of the ECU, wire harness, and sensors for your 305 (LB9), 350 (L98), or modified TPI engine.

For technical assistance with FiTech Systems, call 951-340-2624 or go to <https://fitechefi.com/resources-and-support/>

Warning: Caution must be observed when installing any product. 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 battery before beginning. We recommend this installation be performed

by experienced, qualified, and FiTech approved automotive technician. The finished installation must be thoroughly checked for fuel system leaks. All precautions must be observed when working with fuel. Ensure the engine has had sufficient time to cool as coolant may still be hot. Disregarding any of this can result in injury or death.

Emissions Status:

The FiTech Ultimate TPI System is not C.A.R.B. (California Air Resources Board) approved for use on emission-controlled vehicles. This system is designed to control TPI based engines being retrofit into older vehicles that do not require emission controls (typically pre-1965 vehicles). Check your local regulations. The Ultimate TPI System eliminates the Check Engine Light, Mass Airflow Sensor, Cold Start Injector, EGR valve, AIR Injection, and Canister Purge valve.

Parts NOT included in the kit:

- Intake Manifold
- Throttle Body (uses OEM style throttle body)
- Ignition Coil (uses OEM external coil)
- Distributor to Coil Sub-harness (uses OEM harness)
- Distributor (uses OEM **Small Cap** computer controlled TPI HEI distributor needed)
- Fuel Injectors to support engine power
- Coolant Temperature Sensor (uses OEM sensor)
- Intake Air Temperature Sensor (uses OEM IAT or MAT sensor)
- Fuel Delivery System suitable to support engine power.

Parts INCLUDED in some OR all kits:

- Ultimate TPI ECU
- Engine wire harness
- Handheld controller and harness and windshield mount and USB cable
- Wideband Oxygen Sensor and bung kit
- 3 Bar MAP sensor
- Instruction manual (this document)
- 700R4/200R4 transmission connector for torque converter lockup control (38350, 38351)
- 4L60E/4L80E transmission control harness (38352, 38353)
- Second Wideband Oxygen Sensor and harness (38351, 38353)

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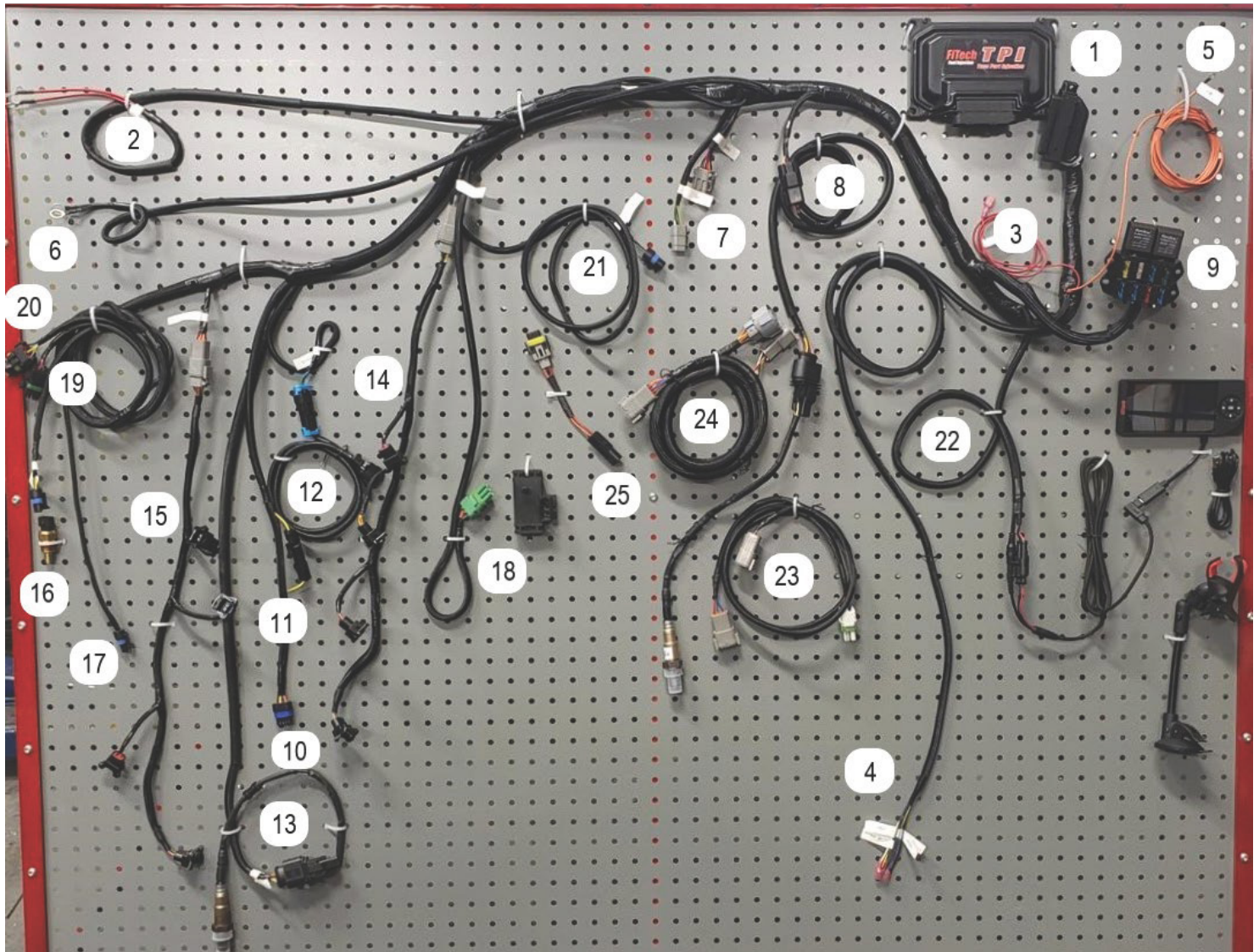
Important Notes for Wiring the System

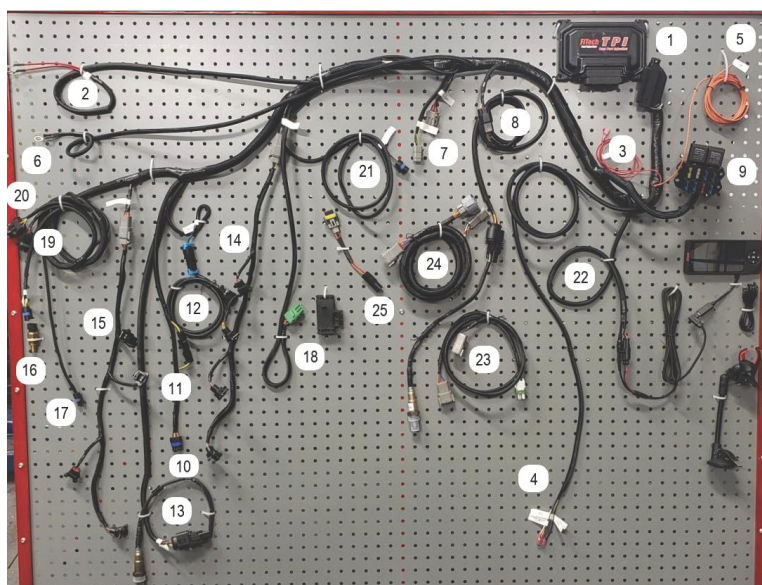
The Ultimate TPI kit makes wiring the engine simple. Most connections in the harness are labeled or only fit one sensor. The accessory wires (Branch 4 in picture) (Fans, AC-input, Brake Switch Input, Speedometer Output, Tach Output) may need to be extended and/or removed from the sheathing to make required connections.

The wire chart below lists each wire used in the system.

It is suggested that wire extensions are made with the same gauge and color wire as is used in the supplied harness. Make connections with a soldered joint or a properly crimped connection with heat shrink. Modification to wire harness are only permitted on the "Accessory Wires" (Branch 4 in picture) such as extensions or cuts.

Modification of the ECU side harness may result in a **VOIDED** warranty.





	Connector	Function and Connection Point
1	ECU Connector	Connects to the ECU – make sure all pins insert properly and slide lock is fully engaged
2	POS (Red)	Main Power: Positive 12V goes to starter. Needs to be live even with power off
3	Red Wire (Key)	On/Off - Connect to switched 12V circuit. MUST be 12V during "Key On" and "Cranking"
4	Accessory Wires	Wires go to Fan Relay, Tachometer, A/C Clutch, Speedometer, Brake Switch
5	Orange (Fuel Pump)	Fuel Pump circuit. Wire provides 12V to fuel pump. Connect to (+) terminal on pump
6	Grounds	Ground to the engine block or cylinder head
7	Trans Connectors	Only used when using transmission control
8	O2 Harness	Optional second O ₂ on passenger side
9	Fusebox	Fuse Box with Relays
10	Distributor	Plugs into the small cap computer-controlled HEI that is on later model TPI engines
11	EST Bypass	When disconnected, the computer-controlled HEI will spark only at base timing
12	Knock	Connects to the knock sub-harness which connects to the knock sensor
13	DRV O2	O ₂ Sensor on driver's side
14	INJ P	Passenger side injector harness
15	INJ D	Driver side injector harness
16	CTS	Connects to engine coolant temperature sensor on front of intake manifold base
17	IAT	Intake air temperature is typically located in the plenum of the intake manifold
18	MAP	Connects to MAP sensor on back of the manifold
19	IAC	Idle Air Control. Connects to IAC mounted on the throttle body
20	TPS	Connects to throttle position sensor mounted on the throttle body
21	VSS	Vehicle speed sensor connects to back of transmission output
22	Handheld	Connect the two female connectors to the two male connectors on the Handheld harness
23	700R4/200R4	Connect to the 200R4 or 700R4 transmission connector on 38350, 38351 kits.
24	4L60E/4L80E	Connect to the 4L60E or 4L80E connector.
25	Old Style VSS	Adapts the VSS connector to older style VSS connectors on the transmission tailshaft

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ECU & Main Connector (81 pins): The slide lock of the harness connector must be slightly open before inserting the connector into the ECU connector. Make sure all pins slide in properly without bending any over. The slide lock will begin to engage, and the connector will need to be pushed into the ECU while also pressing the slide lock into the fully closed and locked position. When mounting the ECU, make sure the connector of the ECU is pointed downward to avoid collecting water. Ensure the ECU is mounted in a location that is away from water, heat and vibration.



POS (2 - 12-gauge Red Wires) Main Power: Positive 12V goes to battery. This circuit needs to be live even when the ignition switch is off so that the self-learning files are saved. The EFI self-learn values are saved permanently after the key is off for about 15 seconds, after which the battery can be disconnected (for vehicle storage).

If the voltage of this wire drops below 9.5 Volts while cranking, the engine may fail to start, as the injectors require around 9 volts to open against the fuel pressure.

If the battery is in the trunk, these wires need to be extended to reach the battery, as the voltage drop from the battery to the front of the vehicle can still be excessive when cranking.

If the battery is disconnected while the ECU is still powering down, the ECU may corrupt the calibration, causing issues, requiring re-writing the calibration from ECU, or other problems. Always ensure that the ECU has fully powered off before disconnecting the battery.



KEY (1 - 18-gauge Red Wire): Key Ignition, with power during cranking. On/Off - Connect this wire to the ignition switched 12V circuit. On TPI systems with an external ignition coil, the large pink wire is properly switched by the ignition switch and can be used to connect this wire.

The most important part is that this circuit must be ON during both "Key On" and "Cranking." Failure to connect to the proper ignition switch circuit is the #1 cause of no-starts on new installations.

****DO NOT** connect to the ignition coil terminal when using a Capacitive Discharge Ignition (CDI) box such as an MSD or any other CDI ignition – this will damage the ECU immediately and void the warranty.



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Accessory Wires (multiple 20-gauge wires):

The **Tach Out** (12 volt square wave output) can be used to send an RPM signal to the tachometer if desired. **A/C In** (connect to the wire that turns on the AC Compressor Clutch) which will help maintain a proper idle if AC is used on the vehicle and will turn on Fan 1 if electric fans are used – AC requires the use of a fan while on to cool the condenser to avoid rapid over-pressure of the system.

Speedo(meter) Out is only for speedometers that can use a square wave 12volt speed signal. The handheld can be used to adjust the output rate to suit most speedometers. **Brake** switch input for the torque converter needs 12V when the brake is not pressed, and no voltage when the brake is pressed. This option can be disabled in Initial Setup.

The **Fan 1** and **Fan 2** wires are relay control wires – they should be connected to Pin 85 of the relay(s) that power(s) the fan(s). Pin 86 should be connected to a KEY Switched ignition source so that the fans turn off with the ignition key. Relay Pin 30 should be fuse or circuit breaker connected to the battery. Pin 87 should go to the cooling fans, and the other wire of the cooling fan should be grounded – ensure the fan blows towards the engine. Each fan will require a relay.

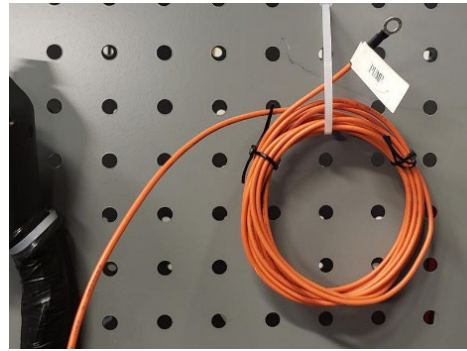


PUMP (1 – 16-gauge Orange Wire) Fuel Pump Circuit:

This wire provides 12V to the fuel pump and connects to the positive (+) terminal on the pump.

The negative terminal of the fuel pump should be grounded to the chassis.

No external relay is required as one is included in the harness in the fuse block. If multiple fuel pumps are used, this wire can be used to send voltage to a remote relay's signal input.

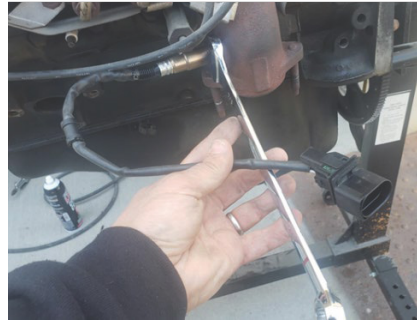


Grounds (2 Ring-terminal Black wires): These two terminals should be connected to one of the cylinder heads, ideally. The point of connection should be cleaned of paint, rust, or other barriers to electrical current connection. The engine block or heads must also be grounded to the vehicle chassis and battery with very large cables. Improper grounding will cause malfunctions in the EFI system.



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DRIVER SIDE WIDEBAND SENSOR HARNESS: This harness attaches to the Wideband Oxygen Sensor installed in the Driver side exhaust bank. Be careful to ensure connection to the proper side of the engine as one injector bank will trend towards full rich and one injector bank towards full lean trim if the wideband oxygen sensors are connected to the opposite banks of the exhaust, or if both sensors are in the same exhaust bank.



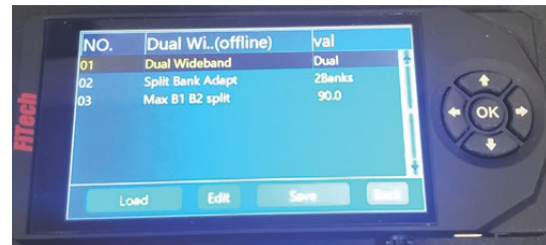
PASSENGER SIDE WIDEBAND SENSOR SUBHARNESS:

This dual O2 sub-harness (P/N 38351 & 38353) attaches to the Wideband Oxygen Sensor installed in the Passenger side exhaust bank. The other end is connected the main harness. Be careful to ensure connection to the proper side of the engine as one injector bank will tend towards full rich and one injector bank towards full lean trim if the wideband oxygen sensors are connected to the opposite banks of the exhaust, or if both sensors are in the same exhaust bank.



****TURN ON DUAL WIDEBAND MODE for 38351 & 38353:**

Initial Setup: Dual Wideband Mode: set to Dual, Split Bank Adapt: 2Banks. This allows independent trim and learning for both cylinder banks of the engine.



Wide Band O₂ Sensor Bungs

Install one Wideband oxygen sensor in the driver's side exhaust collector – in the factory provided bung if available – the OEM 1-wire Oxygen Sensor is no longer needed with the Ultimate TPI system. If installing a dual wideband system (38351, 38353), you may need to add a bung to the passenger side exhaust. The included oxygen sensor bung kits may be used to add the bung to the exhaust – follow the instructions on page 17 to properly position and install the bungs.



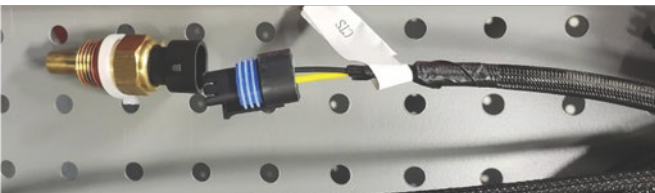
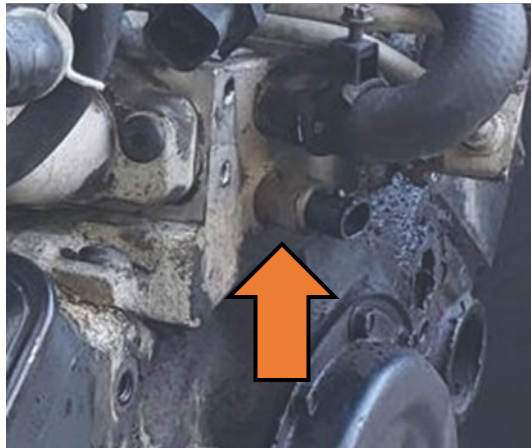
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IAC: This harness connects to the OEM Idle Air Control (IAC) motor that is mounted on the bottom side of the throttle body. Take care when connecting to the IAC to ensure the pins are inserting properly in the connector. The IAC controls the amount of air that is allowed to bypass the throttle blades for idle speed control and cold starting. See the additional information in the instruction manual.



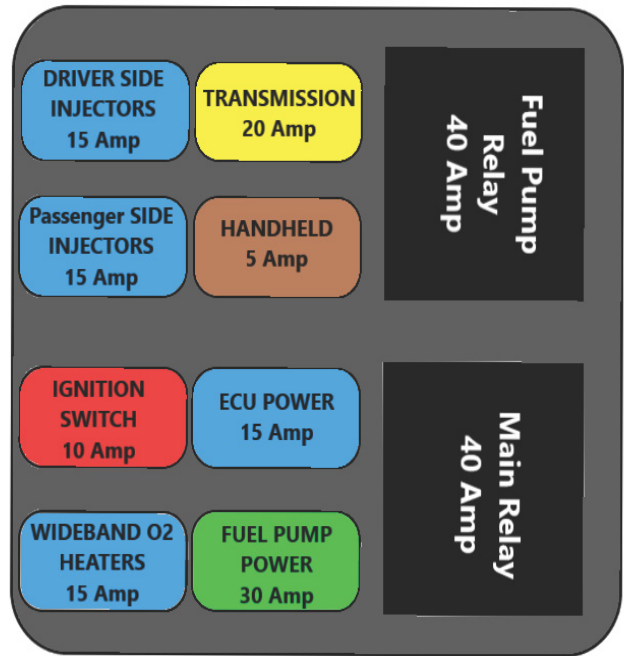
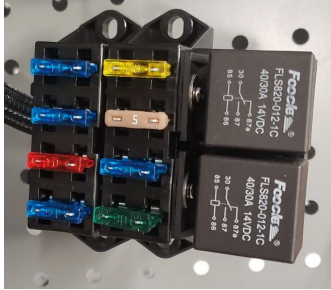
TPS: This connector connects onto the Throttle Position Sensor mounted on the passenger's side of the throttle body. The FiTech EFI system can remember the closed position of the TPS, which removes the need to ever adjust the position of the throttle position sensor on the throttle body.

CTS: This wire connects to the supplied Coolant Temperature Sensor, or the original coolant temperature sensor located in the front of the lower intake manifold. If a replacement sensor is needed, you may buy the original replacement sensor for a TPI engine from a local parts store or order one from FiTech (part# 60021.) The wires for the CTS CANNOT be shared with anything such as a temperature gauge. Either use an Autometer iCAN gauge, FiTech ONE-GAUGE, FiTech Handheld, or use another stand-alone gauge and sensor for your dashboard.



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Fuse Box: To right is a graphic showing the location of the various fuses in the supplied Fuse Box. If replacing a fuse, it's important to use at least the shown amperage rating to avoid voltage drops to the supplied circuits and avoid premature fuse or relay failure. A failed fuse typically is caused by a short to ground in the wire harness circuit – however a failed actuator (such as an internal short circuit on a fuel pump or solenoid) may also cause the fuse to fail. It's important to note that most of the fuses are supplied power by the relays, which are supplied power by the large red POS wires that are connected to the battery.



Distributor Connectors: The FiTech Ultimate TPI uses the OEM small cap TPI distributor with integrated computer-controlled HEI module for ignition timing control. If your engine is using a LARGE cap computer-controlled HEI, it is required that a small cap distributor be acquired and installed.

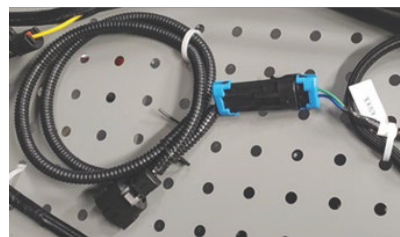
original system harness connection for this should be reused or purchased new.

The FiTech Ultimate TPI system doesn't include the connector from the distributor to the ignition coil. The



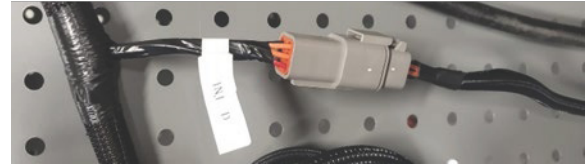
KNOCK: This sub-harness attaches to the Knock Sensor directly – typically located in the passenger side of the engine block. The external OEM knock module is no longer needed, if equipped. If no knock sensor is to be used – possibly from space constraints or solid valvetrain, be sure to disable knock control in the Initial Setup.

****Knock control is not a substitute for setting the proper timing – it is only an attempt to reduce the risk of engine damage when knock occurs unexpectedly. If knocking is audible, reduce the ignition timing in the system.**

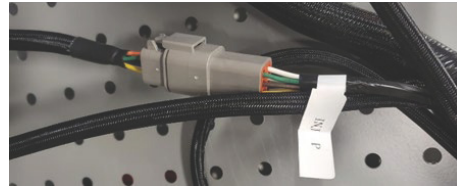
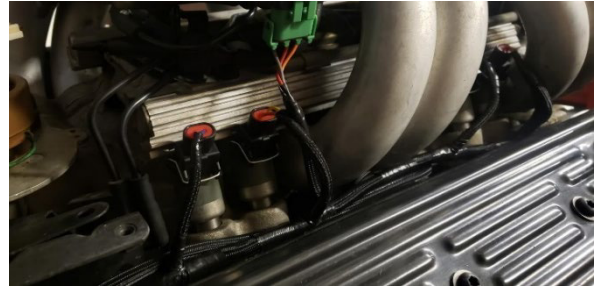


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INJECTOR D: This connects to the injector sub-harness on the Driver's side of the intake manifold. It is important to make sure the injector harnesses are connected to the proper bank of injectors. If the banks are swapped when using a dual wideband sensor system (38351, or 38353), one bank will tend towards full rich and one bank towards full lean trim (the same symptom can be found if the wideband oxygen sensors are installed in the opposite banks of the exhaust, or if both sensors are in the same exhaust bank).



INJECTOR P: This connects to the injector sub-harness on the passenger side of the intake manifold. It is important to make sure the injector harnesses are connected to the proper bank of injectors. If the banks are swapped when using a dual wideband sensor system (38351, or 38353), one bank will tend towards full rich and one bank towards full lean trim (the same symptom can be found if the wideband oxygen sensors are installed in the opposite banks of the exhaust, or if both sensors are in the same exhaust bank).



HOW ULTIMATE TPI INJECTION WORKS: The injection method of the FiTech Ultimate TPI system is NOT sequential with reference to the engine – as there is not a cam synchronization signal that would indicate which cylinder is actually cylinder #1 compression from the distributor. However, the injection method differs from the stock TPI injection method in that the injectors do fire in a sequential-but-not-synchronized-to-engine-position order. This means it will inject 1 pulse per 2 revolutions, in the firing order of 1-8-4-3-6-5-7-2 but the injection will not be timed to inject, for example, on the closed intake valve.

The stock TPI computer injects in a different manner of injecting all injectors once per revolution, and all at once or all in each bank at once. This double injection requires halving the injection pulsewidth, which causes issues at low loads and large injectors and inconsistent fuel delivery. With the sequential injection method, the pulsewidth is larger and more controllable with respect to the injector's ability to deliver consistent fueling and more equal cylinder-to-cylinder, delivering a more stable operation.

Fuel Injectors: Larger flow fuel injectors will be needed if increasing the engine power through much larger camshafts or supercharging or turbocharging or using fuels such as E85.

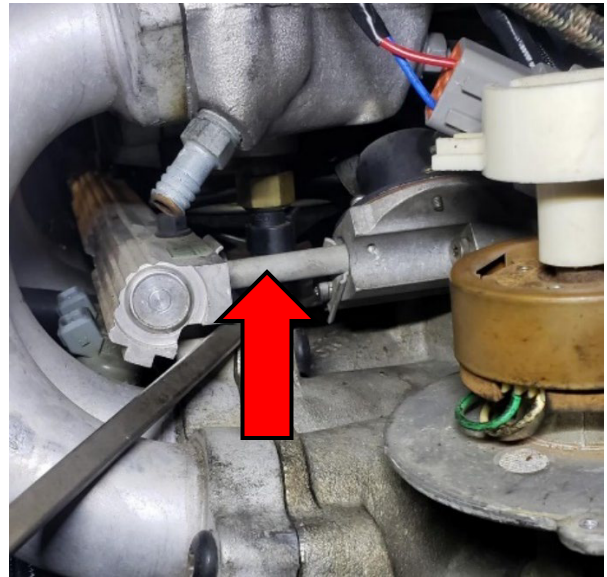
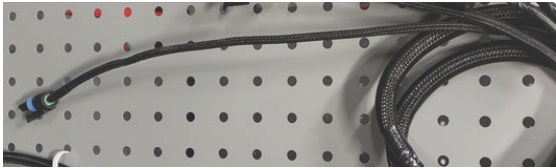
The FiTech Ultimate TPI system is compatible ONLY with HIGH-IMPEDANCE injectors – meaning they have 10-15 Ohms resistance. The supplied Injector harness has EV1 connectors. EV6 sub-harnesses are available from FiTech.

Fuel Pumps: When power is increased over stock, the EFI fuel pump typically will need to be upgraded to be able to supply fuel at the rated fuel pressure (typically 43 psi) without dropping when at maximum power.

The voltage and pressure will affect fuel flow from a pump. If E85 is used, the fuel pump capacity also will need to be increase. ONLY EFI pumps can be used.

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IAT: Intake Air Temperature (sometimes referred to as MAT or Manifold Air Temperature): Connects to the intake air temperature sensor – typically located under the plenum towards the rear driver side of the top plenum. This may be difficult to reach and requires care when installing. If desired, an inlet air temperature sensor may be used in the air filter ducting instead – be sure to use a sensor with the factory coefficients.

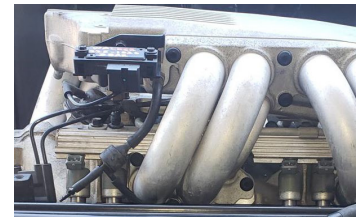


MAP: Connects to the Manifold Absolute Pressure (MAP) sensor. The MAP sensor is supplied in the kit and is typically mounted on the rear passenger side of the intake manifold plenum – it must be connected to a port that has full manifold vacuum, and that there are no other vacuum connections on the same port.

The supplied sensor is a 3 Bar (boost capable!) sensor that corresponds to the parameters pre-programmed into the ECU. The FiTech Ultimate TPI system utilizes a “Speed Density” algorithm, which senses load based on the MAP sensor.

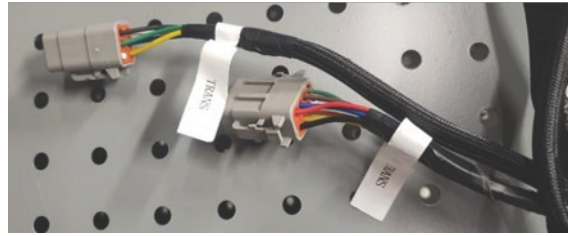
The 1985-1989 TPI systems did not include a MAP sensor from the factory, so it is VERY important to install and use the FiTech supplied sensor for proper operation. Make sure the nipple points downward to avoid collecting fuel vapors in the sensor.

The factory Mass Air Flow sensor in the inlet ducting is no longer needed by the FiTech Ultimate TPI system. This allows you to change and possibly improve the inlet ducting without fear of causing issues.



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Trans Deutsch Connectors (1 – 6-pin, 1 – 8-pin): 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 for manual transmission applications (such as T5 and T56), and non-computer-controlled transmissions (such as TH350, TH400).



VSS: Vehicle Speed Sensor (VSS) connects to back of trans output. On 700R4, 200R4, some 4L60 and some older 4L60E and 4L80E, the included adapter harness (Labeled 25 in harness picture) may be needed to connect to the transmission vehicle speed sensor.



On 4L80E transmissions, the REAR-most sensor is the output sensor and should be the only sensor used – the front sensor (input shaft speed sensor) should be left unconnected to the FiTech Ultimate TPI harness.

It is not recommended to splice these wires with an aftermarket speedometer – instead use the speedometer output of the Ultimate TPI harness to send a signal to the speedometer.

700R4 / 200R4 Transmission Harness: Harness to 700R4 or 200R4 Transmission. This harness only controls the Torque Converter Lockup Clutch (only). It does not control shift points – those are still managed by TV Cable and internal governor settings. Follow factory procedures for setting up the TV Cable (transmission damage can occur from improper setup).



4LX0E Transmission Harness: Harness to 4L60E or 4L80E transmissions (and 4L65E, 4L85E and most 4L70E transmissions). See additional information for setup and tuning 4LX0E transmissions.

****REMEMBER TO TURN ON 4LX0E** select the proper transmission type in Initial Setup on the handheld. ****Be sure the connector is installed with the proper orientation – it's possible to force the connector on in the wrong way, resulting in many transmission faults. **4L80E must use the REAR VSS.**



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Handheld Controller Connection: Connects the ECU to the Handheld. The 2-wire connection on the harness supplies constant battery 12 Volts and ground to the Handheld. The stereo jack connector has the K-Line communication line.

The USB-C connection of the handheld harness can be inserted into either the bottom of the handheld or handheld dongle.

For retrieving data-logs, using FiTech ProCal Laptop Software, or for other handheld modifications such as software upgrades, a USB to USB-C cable is supplied for connecting to a laptop or PC.

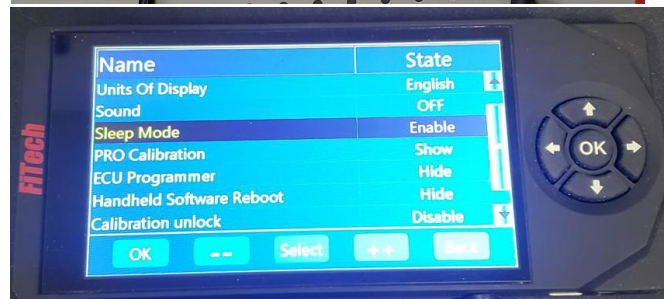
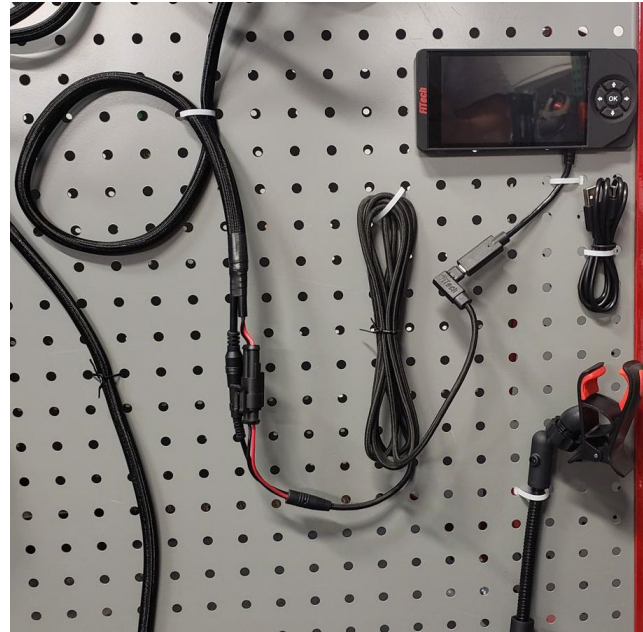
A windshield mount for the handheld is also supplied for convenient viewing of the handheld controller.

The Handheld controller is necessary for initial setup and for making changes to the settings. It is also useful for monitoring the engine. It is NOT needed for normal operation and can be disconnected if desired. Keep it with the vehicle for easy access to the system.

The Handheld controller has a small current draw that may drain a battery over the course of a few weeks. Either disconnect the handheld, or battery, or keep the vehicle battery on a maintenance charger when parking for extended periods.

The Handheld controller has a SLEEP mode that can be activated or deactivated in the Display Settings menu of the Handheld. It is highly recommended to keep SLEEP mode activated – this allows the Handheld screen to turn off after 90 seconds of inactivity (other than active Dashboard or Data Logging). If the screen is left on, the vehicle battery will drain faster when the engine is off.

***Keep a Backup Calibration recorded into the Handheld controller for simple recovery – do this after setting up the system – use “Read Cal from ECU” and select one of the backup calibrations to overwrite. If recovery becomes necessary, use “Write Cal to ECU” to restore the calibration from the saved backup file.



INITIAL SETUP

This simple procedure is performed using the Handheld Controller. The Handheld Controller plugs into the wire harness with the supplied handheld cable. A laptop computer is not required.

Turn the key on. Ensure the battery of the vehicle is fully charged.

1 INITIAL SETUP -> Engine Setup: Input your Engine CID (cubic inch displacement), Cam size (Mild-Wild 1-4), maximum RPM limit (Rev Limit RPM), target Idle RPM Warm. Make sure to click on the OK button after every selection to save the parameter.

- a. The **Injector Flowrate** is in pounds per hour “Lb/hr” of injector flow at the fuel pressure being used (typically 39-45 psi when no vacuum is applied to the fuel pressure regulator – though the vacuum reference should be used when in normal operation).
- b. The “**Cam Mild-Wild 1-4**” is choosing a preset volumetric efficiency table. The following guidelines should be used as a starting point.
 1. Stock cam,
 2. 212-224 @0.050 intake duration camshafts.
 3. 224-236 @0.050 intake duration camshafts
 4. 236-248 @0.050 intake duration camshafts
 - i Larger camshafts should start at cam 4 but will likely need custom tuning in the “Pro Tuning” menu in the CAM4 FUEL TABLE.

2 INITIAL SETUP -> Fan and AC Setup, make sure the electric cooling fans that are being controlled by the FiTech ECU are enabled, and that the ON and OFF temperatures are set to reasonable temperatures for your engine – it is always recommended to have the ON temperature HIGHER than the OFF temperature (the fans will turn ON if the temperature goes above the ON temperature and will cool the engine until the temperature is BELOW the OFF temperature.

3 INITIAL SETUP -> Transmission menus: Use the menu for the transmission that you have installed. If you are using a TH350 or other NON-computer controlled transmission, make sure the “700R4 200R4” option is set to “OFF”, and the 4LXOe Trans Option is “Other,” and “Option T56” is set to “Other.”

Enter your rear tire diameter and rear gear ratio. (Note: Click down on the OK button after each entry to save your selection.)

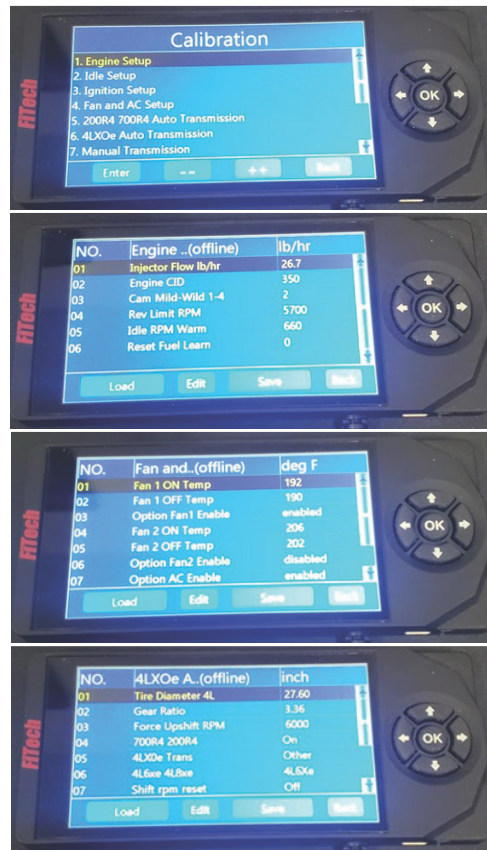
ii Option 3: Forces an upshift if rpm is too high.

ii if you are running an electronically controlled automatic transmission such as a 4L60 or 4L80, go to transmission option: "Option 4LXOe trans" and select 4LXOe. If you are not using one of the listed transmissions, select "other" and click the OK button to send to ECU.

When running an electronically controlled automatic transmission such as a 4L60E or 4L80E, go to option 5: "4L6xe 4L8xe" and select your transmission, click the OK button to send to ECU **v** Option 6: Resets the learned rpm offset to clear the forced upshifts learning offsets.

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.



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Final Steps Before & After First Starting:

1. Attach the air inlet tube, all vacuum hoses, and electrical connectors on the 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 key-on & engine off, perform the steps below outlined in the "Initial Setup" section. 14 seconds.
5. Start the engine and check for loose connections or vacuum leaks, fuel leaks, etc.
6. If the distributor was moved or changed, be ready with a timing light to help first startup. Set timing referring to "Ignition Timing Control" instructions.
7. After the engine is warmed up, check the idle speed. Doublecheck all fasteners, clamps, and electrical connections to ensure they are all secure.
8. MAKE SURE COOLING FANS COME ON if electric fans.
9. MAKE SURE NOTHING IS MELTING on the exhaust.
10. MAKE SURE ALL PLUG WIRES ARE NOT BURNING.
11. MAKE SURE NO FAULTS and ALL SENSORS have reasonable readings.
12. MAKE SURE ALL CYLINDERS WORK (IR TEMP GUN).

Handheld Controller

There are two ways to navigate the Handheld Controller; you can use the touchscreen with your finger or move the Direction Pad up, down, left, right, or in. The Direction Pad are the black buttons 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 OK button in to save changes.

When making changes to the ECU through the Handheld make sure that the ignition key is on.

EVERY change that is made to a tuning item needs to be "Sent" to the ECU, by pressing the "OK" button. If multiple items are changed in a Tuning Menu, each item must have the OK button pressed when it's highlighted. This is to prevent accidental changes to tuning items when scrolling through the items. Changes can ONLY be made when the ignition key is ON. If the Handheld asks if you'd like to work Offline – the correct answer is NO – it means that there is no connection with the ECU – either the key is not on, or the harness is not connected, or some other issue is preventing connection to the ECU.

Most changes can be made while the engine is running and will have an immediate effect. Some settings are critical to the startup and cannot be changed while running.

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 full and permanent save – these changes will not be affected by disconnecting the battery from now on.

Once the hard save is completed, if desired, the battery can be disconnected without interference with the calibrations. For Handheld Controller definitions visit: www.fitechefi.com under "tech center" sub-tab Handheld Controller. These definitions are also available on the Handheld Controller when plugged in.



FiTech Ultimate TPI Instruction Manual

Ignition Timing Control

The Ultimate TPI System will control ignition timing based on a proper setting of the distributor to the base timing. The “Distr Base Timing” is the value that the ECU will reference for calculating the amount of time to wait to deliver what it assumes is the desired spark advance. IF the distributor is not properly set up, the ACTUAL spark advance will not be correct – and will result in engine damage or bad efficiency.

Setting up the distributor with a timing light is a very important step in ensuring proper engine operation. A “Dial-Back” style timing light is recommended, but if the balancer on the engine has enough timing marks, a basic flash timing light will suffice.

There are 2 ways to set up the distributor – do EITHER of these methods (not both methods). Both methods should deliver the same results.

- A. Disconnecting the EST Bypass wire (yellow wire with 1 pin Weather-pack connector) and setting the distributor timing to the “Distr Base Timing” in the Handheld (typically 6 to 9 degrees – make sure it matches the Handheld value). Then reconnecting the wire.
- B. Or by turning on the “Lock Timing to Set” to “Locked” mode in the handheld and setting the distributor to the “Locked Spark Adjust To” timing value of typically 30 degrees.

The ignition timing will spark at the “Distr Base Timing” advance during cranking and any RPM below 400. If the engine “kicks back on the starter” it may need less base timing, but this adjustment requires BOTH the “Distr Base Timing” to be reduced, AND timing light be used to adjust the position of the distributor.

A preset timing curve based on typical TPI engine requirements is supplied in the default calibration. If you desire to change timing under “Go EFI Tuning.” The spark map can be adjusted based on engine RPM and MAP reading. Use caution. Too much timing (total advance) can cause engine damage, and too little timing can cause excessive exhaust temperatures and poor fuel economy.



TUNING – IGNITION TIMING: The spark advance delivered to the engine is very important to have correct. The timing shown is the delivered timing if the distributor base timing matches the Initial Setup base timing.

Idle Timing: 10-20 degrees is fine. Lower idle timing allows more Idle Stability spark control range, at the expense of idle fuel economy.

Low Load (~40kPa): 40+ degrees is fine at higher RPM. **Full**

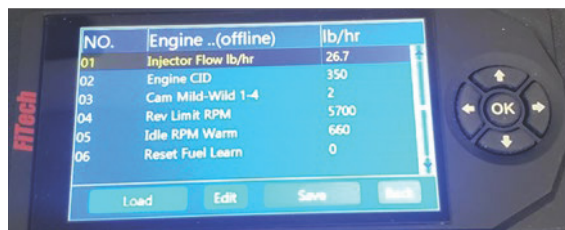
Load (~100kPa MAP): low RPM may need to be in the low teens to avoid knock. High RPM usually needs over 30 degrees for maximum power, but may be knock limited,

depending on the compression ratio, chamber, fuel octane, and temperature.



Rev Limiter

The Ultimate TPI System provides a fuel and spark 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 TPI System. Undesired side effects may occur when using external rev limiters, such as 2-step limiters.



FiTech Ultimate TPI Instruction Manual

Engine Dependent Adjustment – Idle speed

Start the engine and observe idle when warm. Different camshafts will idle better at different speeds. Stock or small camshafts may idle fine at 620 RPM. A very high overlap camshaft may need 900 RPM. The “In Gear Idle RPM warm” value is for 4Lx0E transmissions that can determine when the transmission is in gear – and having a slightly lower RPM can help avoid the engine lugging hard against the torque

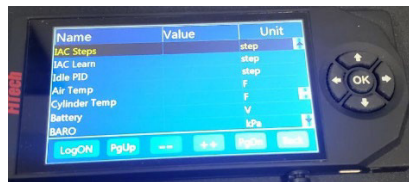
converter as it attempts to maintain a higher idle speed than the torque converter wants to allow.



On-Engine Adjustments – IAC Steps

If the “IAC steps: are above about 30 steps with a fully warm idle in PARK (as can be seen in the Handheld Dashboard by scrolling down a few rows), it may be necessary to adjust the screw that holds the throttle arm slightly open (see pictures). This screw may possibly be blocked from adjustment by a plug that would need to be removed prior to adjustments. The main idea is to open the throttle enough to allow the IAC to be nearly closed (below 10 steps, above 0 steps) when the engine is at idle and fully warmed up.

**If this step is skipped and the throttle is opened with the screw, the ECU may consider the throttle to be open, and will add IAC steps in preparation for a closing throttle.



When adjusting the idle screw on the throttle body, set the “Idle screw set TPS 0” mode in Initial Setup, Idle Setup to “All Zero.” This will reset the TPS to 0 which is considered the closed position.



TUNING - Air Fuel Ratio (AFR): An approximate value for gasoline’s “stoichiometric” value is 14.7. A value of 12.512.8 is a “rich” value for near best power for the 90-100kPa region. For boost (MAP much greater than 100kPa - superchargers and turbochargers) around 11.8 is a little richer than best power to keep combustion chambers a little cooler. 14.7-15.2 is lean and can sometimes be used for better cruise fuel economy. Idle AFR should be set to give a stable idle. Many engines prefer between 13.0 and 14.0 at idle, but much larger camshafts may prefer as lean as 15.5:1.



TUNING – ACCEL PUMP: When hitting the gas hard, extra fuel is needed to wet the intake ports properly so that the correct amount of fuel is reaching the cylinder. Different manifolds, injectors, fuels, and temperatures will have a significant effect on this and may require tuning for acceptable performance.



TUNING - CRANK FUEL: Engine starting takes a large amount of fuel to first wet the runners and deliver enough fuel to the cylinders for rapid starting. This is VERY temperature dependent and can need adjustment for your engine combination for optimal performance.



FiTech Ultimate TPI Instruction Manual

Wide Band Oxygen Sensor Installation

The LSU 4.2 Wideband Oxygen Sensor is a key component of the FiTech EFI system. Only one sensor is required for the 38350 and 38352 kit, but on the 38351 and 38353 kit we have included two sensors (along with the necessary extension harness for the second wideband oxygen sensor), 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 benefit of having the wide band oxygen 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 Oxygen sensor connector will connect to the sensor in the exhaust. Caution must be taken before touching the headers. Make sure the engine is fully cooled!

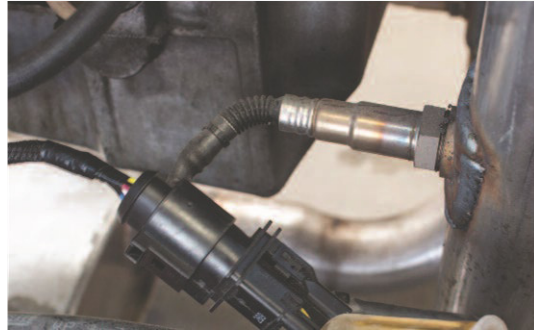
1. The supplied Oxygen Sensor should be installed in the driver's side exhaust bank.
2. The Oxygen Sensor cable connects to one of the cables coming out of the harness.
3. The ideal location for the sensor is in the exhaust collector or within 8-inches of the collector itself. It must always be at least 18-inches from the exhaust tip, to prevent reversion and false lean conditions. Any exhaust leaks before or near the oxygen sensor **MUST** be repaired – leaks will cause the system to over-fuel the engine.
4. 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.
5. Never position the sensor on the outside of a bend in the exhaust tubing. 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. Do not weld with the gasket.

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.



4L60E & 4L80E Transmission Control

The FiTech TPI kit is available with electronic transmission control. This option is used when operating GM electrotronically controlled 4L60E or 4L80E automatic transmissions.

The Ultimate TPI ECU can control the upshift points, shift firmness, when to downshift properly, and all other features involved when controlling the transmission. This feature is suitable for 4L60, 4L65, 4L70E, 4L80 or 4L85 GM transmissions.

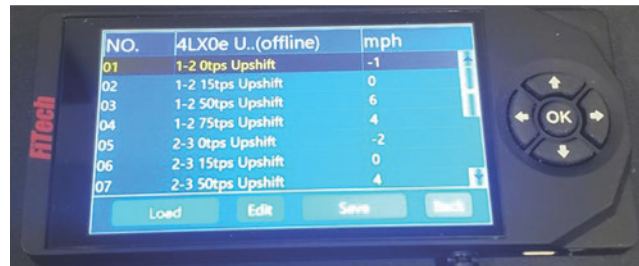
This feature can be purchased with the kit or as an addition later. The ECU has the transmission control built in.

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 and turning on 4LX0E in Initial Setup and selecting your transmission type, you are ready for testing. If not using transmission control. the connectors are unused.

Upshift, Downshift and Line Pressure are based on vehicle speed and have a table “behind-the-scenes” that is preset for a typical transmission. The 4LX0e Upshift OFFSET, DOWNshift OFFET, and LINE PRESSURE tables allow for making small changes to the baseline – this means that if the values are 0, the transmission will operate fairly normally. If numbers are increased, the speed at which the shift occurs will go up accordingly, or the shift firmness will go up.

****Line pressure changes are very unlikely to cure existing transmission slippage, although if the line pressure is reduced from the baseline, slippage may occur, and transmission damage may occur.**

FiTech is not liable for any transmission or engine damage – EVER. It is important to be aware of this and be aware of your engine and transmission performance – continued operation with malfunctioning controls is for you to notice and stop for repair.



FiTech Ultimate TPI Instruction Manual

Data Logging: The FiTech Handheld has a data-logging feature that will record the data in the dashboard or in any of the “Data Logging” menu groups. This feature is enabled by clicking the OK button when in one of those menus and will record all of the data delivered by the ECU into a *.csv file



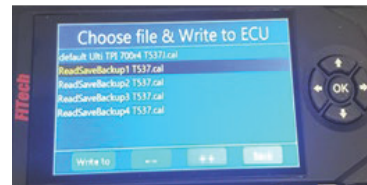
that can be found in the memory of the handheld. This information can be useful for diagnosing problems or for tuning. The data can be retrieved to a laptop for viewing by using the USB cable and selecting the “Open USB Mass Storage” mode in the “Handheld Software mode Selection” menu.



Long Term Storage – IMPORTANT NOTES:

If storing the vehicle, it is important to disconnect the battery or keep a maintenance charger connected to the battery. When the battery is disconnected, no settings are lost in the ECU. However, the handheld “gauges” that were selected will not be saved. If the battery of is allowed to die, or the engine is cranked with a very low battery, there is a chance that the calibration gets corrupted, causing a no-start situation, requiring re-loading of the calibration. To do this requires having had priorly saved a calibration into the handheld by utilizing the “READ CAL FROM ECU” function and

every so often, especially after any changes are made. Then, when needing to restore the calibration for whatever reason, utilize the “WRITE CAL TO ECU” function, to fully restore the ECU to the prior configuration.



saving your customized and learned calibration from the ECU into one or more of the “Backup” calibrations in the handheld memory – it is recommended to make a backup

3-Year Limited Warranty on FiTech EFI Systems

WARRANTY ON THIS EFI SYSTEM IS SOLELY HANDLED BY FITECH FUEL INJECTION. DO NOT CONTACT THE SELLER.

FiTech extends the following limited warranty to the original purchaser of a FiTech EFI system purchased after November 1, 2022. FiTech warrants its products against defects in materials and workmanship, under normal use and service for 3 years from the date of original purchase. This applies only to the original purchaser and the parts must remain installed on the original vehicle for which they were purchased. This warranty is void if the product was improperly installed, was installed on a vehicle for which it was not designed, if it was modified in any manner, or was removed from the original vehicle and reinstalled on another vehicle. Coolant temperature sensors and oxygen sensors are not covered under this warranty.

This warranty shall not apply to any product installed improperly, or contrary to FiTech's instructions, altered, misused, repaired, or damaged from an accident, collision, or willful or negligent act. To make a claim under the terms of this Warranty, the original purchaser must contact FiTech tech support. If FiTech tech support deems the product in need of warranty service, proof of original purchase will be required. Purchaser must call FiTech Technical Support (951-340-2624) option 2 or email: Techmail@fitechefi.com, to obtain a Returned Material Authorization (RMA). Proof of purchase must clearly show the place of purchase, purchase price, product purchased, and date of purchase. Purchaser needs to register their product here: <https://fitechefi.com/warranty-registration> or using the mail-in registration form found in the product box.

FiTech's 3-Year Limited Warranty does not cover factory refurbished parts, this warranty is only valid for new purchases from an authorized dealer.

FiTech's liability is expressly limited to replacing or repairing the defective part or parts (refunds are not covered under FiTech's 3-year Limited Warranty). FiTech will have no liability for the cost of installation or removal of the defective product or for the cost of labor or any additional parts required to complete the installation of the replacement product. FiTech is not responsible for any shipping charges accrued during the warranty process/claim.

In no event will FiTech be liable for any indirect, special, incidental, or consequential losses or damages (including but not limited to interruption of business or loss of business or profit) resulting from the use or inability to use the product, any breach of warranty, or any defect in the product, even if FiTech shall have been advised of the possibility of such potential damages or losses. Some states do not allow the exclusion or limitations of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

If the product is in the FiTech facility for repair, the amount of time the product is in repair will be added to the existing warranty period.

In the event that your EFI System that is under warranty is in for repair and FiTech has authorized a replacement, and if that EFI System has been discontinued, FiTech will replace it with a similar product for the same application. The replacement EFI System will maintain the existing warranty period of the original EFI System.