

**HOWELL**

**ENGINE DEVELOPMENTS, INC.  
FUEL INJECTION APPLICATIONS**

**INSTALLATION  
MANUAL**

**Tuned Port  
Or  
LT-1  
Fuel Injection Harness  
(1985-1992)**

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## TUNED PORT OR LT-1 FUEL INJECTION HARNESS

You have just acquired one of our premier electronic fuel injection wiring harnesses enabling you to easily install and wire up any 1985-1992 Tuned Port equipped small block Chevrolet or 1992-1997 LT-1 350 engine. It is designed to utilize the vehicle on-board computer (ECM) and all the GM preferred relays, sensors and other accessories to operate the fuel injection and ignition as originally designed by the factory. All systems that effect engine performance have been included and emission control connectors are in place for those harnesses specified for street legal and late model operation. (Most street rod and off-road harnesses do not require emission connectors.)

TPI engine designs varied from 1985-1992 as follows: 1985-1989 models were equipped with Mass Air Flow sensors and can be installed as designed with MAF sensor or run with the later design ECM eliminating the MAF in speed density configuration. 1990-1992 models were all speed density and can be run with the air cleaner mounted directly on the throttle body if so desired. MAF designs require the correct harness and ECM part #1227165. Speed density designs require a different harness and ECM #1227730. Modified engines should not be run with the speed density design unless you are sure you can get a calibration prom (Mem-Cal) to properly match the ECM to your engine.

LT-1 engines were introduced in 1992 in Corvettes and 93 in Camaro's and Firebirds. The engines were identical through 1997 except for exhaust manifolds and the arrangement of accessories at the front of the engine. Because of this, Corvette and Camaro/Firebird engines require different harness design layouts. LT-1's have used 3 different ECM's:

1. 92-93 models with removable Mem-cal.
2. 94-95 models with flash programming of the complete ECM.
3. 96-97 models with flash programmed OBD-II ECM.

For 92-93 models using ECM #16159278 we supply a modified Camaro Mem-cal that will bypass Vehicle Antitheft systems and allow proper operation. 94-95 models, with electronic 4L60E transmission, we re-program the ECM (Part #16188051) to match your engine and we have programs with and without the production MAF sensor. (All 92-93 LT-1's were speed density and did not use a MAF sensor.) 96-97 LT-1's must be run with the 94 or 95 ECM as there is no known source for re-programming the OBD-II ECM's. All LT-1 ECM's were underhood mounted in production and are weatherproof so they may be mounted inside the vehicle or underhood.

All LT-1's are equipped with 24 lb/hr flow rated injectors. 350 CID tuned ports came with 22 lb/hr injectors and 305's with 19 lb/hr injectors. If you are changing engine displacement or putting a TPI manifold on a different engine make sure injectors match the engine size closely and that the correct Mem-cal is used to match the injector size being used. If you need new or different sized injectors, Howell Engine Developments has a variety in stock

### INSTALLATION

If you intend to mount then ECM inside the vehicle you will need a hole in the firewall large enough to pass through the largest engine connector along with the harness, threading it through from the passenger side of the firewall.

Mount the ECM, fuse block, ALDL connector and check engine light on the passenger side of the firewall or dashboard. Make or buy a protective grommet to protect and seal the harness where it passes through the firewall.

In the engine compartment you will need to mount fuel pump relays, battery and fuel pump power fuses (ESC module in early TPI's) on the firewall or fenderwells. All other sensors are engine mounted. LT-1 ECM's may be underhood mounted. For street rods our harnesses are designed to mount all fuse blocks, relays and ESC module (if used) on the inside of the firewall with the ECM. Also, because of header clearance problems, you may need to relocate the knock sensor from the right block drain to the threaded hole above the oil filter pad on the left hand side. (Re-tap the hole to 1/4" pipe thread.) You also need to mount the Oxygen sensor in the left hand collector or exhaust pipe below the collector. (See also our later note about heated Oxygen sensors.) LT-1's use two Oxygen sensors and control each bank separately when operating in closed loop.

Connect the large ground terminals to the back of the right hand cylinder head and connect all other sensor, distributor and injector wires as labeled. LT-1 engines had some variation on distributor, coil and Oxygen sensor connectors from year to year and we need to know your model year to match things properly.

Connect a 14-gauge wire directly from the battery positive terminal, (or other major fulltime 12V source), to the batter feed terminal on the harness. A Weatherpack male terminal and female connector are supplied to connect this line to the harness. This battery power feed is color coded ORANGE and is protected by its own 20 Amp fuse and weather proof fuse block.

Connect a 14 or 16-gauge wire from the harness to your electric fuel pump. A Weatherpack connector is also supplied for this. This power feed from the harness is color coded RD and also has its own weatherproof fuse block and 15 Amp fuse.

Connect a 14 or 16-gauge wire from your ignition switch to the PINK power lead at the 3-fuse block close to the ECM. This supplies switched 12-volt power to the harness to run the ECM, Injectors and other powered sensors. THIS 12 VOLT LEAD MUST HAVE POWER DURING THE TIME THE ENGINE IS CRANKING AND RUNNING, so be careful where you tie into the vehicle power system to make sure that it does. This power feed must turn off when the ignition switch is off. The ECM and injectors are protected by three 5 Amp fuses. A Weatherpack connector is also supplied for this connection. (On street rod harnesses a single fuse block with 4 fuses is mounted near the ECM to handle battery, switched and fuel pump power.)

If you do not intend to use a light bulb already in your dashboard, you will need to purchase a suitable 12V bulb and socket for a "Check Engine" light. This will be connected permanently to the wires marked as such near the ECM connectors.

The "Check Engine" or "Service Engine Soon" light should be mounted where it is visible to the driver. It will come on whenever the ignition is turned on and STAY ON WHILE CRANKING THE ENGINE. It should go off when the engine starts. If it comes back on in a short time, it means one of the sensors or systems is malfunctioning and the ECM has stored a "trouble code" to tell you where to look. Our 109 page service manual sent with your harness will help you diagnose and correct trouble codes. If not, any Chevrolet or good tune up mechanic with a Camaro service manual should be able to trouble shoot it for you. Most, but not all, of the original wire color codes have been retained in this harness.

FUEL PUMP INSTRUCTIONS – Whatever electric fuel pump you use needs to supply filtered 45 PSI fuel at the fuel rail and maintain that pressure from idle to high

speed wide open throttle. A return line from the fuel rail takes excess, or bypass, fuel back to the vehicle tank. Your fuel pump should be mounted under the floor near the fuel tank or inside the fuel tank. Connected to harness power, the fuel pump will operate for 2 or 3 seconds when the ignition is turned on. It will resume operating when you start to crank the engine and continue running when the engine starts.

There are several sources for high-pressure fuel pumps. The Corvette, Camaro and Trans-Am use excellent in-tank pumps made by AC products. We stock and sell Air-Tex in-line fuel pumps with hose nipple ends and Bosch sells in-line pumps for most foreign and some domestic EFI vehicles. Rubber isolates the pump with mounts and flexible fuel lines or it will be noisy. A fuel pump that will supply 50 PSI or more is required. The fuel pressure is regulated in the intake manifold fuel rails to approximately 45 PSI.

**IGNITION SYSTEM** – You will need a 12 or 14-gauge ignition wire to the “Batt” terminal on the distributor cap or coil. This should come from your ignition switch and should be protected by a separate fuse for safety. Many times you can use the engine wiring harness originally installed in your vehicle to power up the ignition and other standard sensors and gauges on your TPI or LT-1 engine. **MAKE SURE YOUR IGNITION SUPPLY WIRE IS 12 VOLTS AND NOT A LOWER VOLTAGE AS USED IN EARLIER BREAKER POINT IGN SYSTEMS.** GM remote coil ignitions require a special gray molded connector to connect to ignition power. Howell can supply one of these if you do not have one.

**AIR CLEANER** – Depending on your installation or what you salvaged from the scrap yard with your engine, you may run the original vehicle air cleaner or a cleaner of your choice. When using a Mass Air Flow sensor you can put a right angle duct in front of the throttle body and install the airflow sensor perpendicular to the engine. Always operate your engine with a duct or air filter attached to the open end of a MAF sensor. Airflow blowing across the open end will seriously affect engine operation. Do not locate a MAF more than 12 to 14 inches from the throttle body or it will adversely affect the TBI or LT-1 calibration. Howell Engine Developments stocks and sells several varieties of K&N filters that will clamp directly to a MAF or the throttle body itself on speed density systems. We have been successful using 3” schedule 30 PVC plumbing pipe for inlet air ducts.

**OXYGEN SENSOR (S)** – Proper operation of GM TPI and LT-1 engines require an oxygen sensor (two on the LT-1) and unleaded fuel. The GM ECM’s are “smart” computers and will improve their driving calibration while operating in “closed Loop” and retain it as long as the battery power remains connected. Normally the engine will go “closed loop” after the oxygen sensor reaches 600 degrees F. Header equipped vehicles should be equipped with heated oxygen sensors due to the cooler operation of the sensor located further from the engine and the heat rejection of the header tubes. Howell can supply these if needed. Most LT-1’s are equipped with 2 heated oxygen sensors (one for each bank). Whenever the battery power feed is disconnected the ECM will lose its stored memory and may not drive as well for a while. Driving can restore the learned calibration. Our service manual tells you how to use the computer diagnostic system to find out when and if your engine is going into closed loop operation. **NOTE:** In the rare case that Oxygen sensors get reversed side to side on LT-1’s, they will drive OK with a clean memory ECM until they go into closed loop. In closed loop they will get confused signals and start to run terrible. If you have these symptoms, look for reversed oxygen sensor leads.

**START UP AND INITIAL DRIVING** – With all the previously discussed connections made, and 45 PSI of fuel pressure, your vehicle should start right up and smooth out as soon as the air is purged from the injector nozzles. Check for fuel leaks and make sure none of your altered wiring or fuel lines are in a position where the exhaust system heat can damage them. **MAKE SURE THE COOLING SYSTEM IS FULL.**

If the engine does not start immediately it may be because the fuel pump cannot displace air in the line and prime itself. Loosen the high-pressure line at the engine and cycle the pump by turning on the ignition key to displace the air. Wrap a rag around the fitting to prevent gas from spraying around the engine compartment. Look at your “SERVICE ENGINE SOON” light when attempting to start for the first time. The light should come on when the ignition is turned on, STAY ON during cranking and go off when the engine starts. **IF THE LIGHT GOES OFF DURING CRANKING IT MEANS YOU HAVE POWERED THE ECM AND INJECTORS FROM AN ACCESSORY FUSE BLOCK TERMINAL AND THE ENGINE WILL NOT START.** Your switched 12V power must come from a terminal that is hot with key on and during cranking and goes off when the ignition is turned off.

On ECM controlled spark timing systems set the initial spark timing to the factory recommended or your desired setting with the “EST Disconnect” unplugged. Re-connect this plug after setting the initial timing. **NOTE:** Running with the EST disconnect uncoupled will turn on the SES light and store a code 42 in the ECM memory. You may want to disconnect the battery power for 30 seconds to clear this code after setting the timing. In case it won't start and you get an immediate code 46 on your check engine light, it means you have a VATS protected Mem0cal or production programmed LT-1 ECM. Code 46 is the Vehicle Anti-theft System warning and you must use a Mem-cal or re-programmed ECM that does not have the anti-theft feature. Howell Engine Developments stocks and sells re-programmed mem0cals and LT-1 ECM's without the VATS feature. We can also reprogram your 94-95 LT-1 ECM to eliminate VATS and other unwanted features.

Because our wiring harnesses keep all essential engine functions operating they qualify as direct factory replacements for emission function in the eyes of the EPA and CARB. If you are doing an installation requiring emission controls we have instructions and special add-on emission harnesses and vehicle speed sensors that meet 49 states EPA standards as well as the rigorous California requirements. Contact us if you need additional help with your installation.

For older vehicles (without vehicle speed sensors and brake interrupt TCC wiring) we can supply lock-up kits using a vacuum switch and 4<sup>th</sup> gear pressure switch to work on all transmissions with lock-up converters (THM 350's, 200R4'S and 700R4's). LT-1 harnesses specified for use with 4L60E trans come with all the correct wiring to operate the transmission and lock-up converters.

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