



We Give You Gas

WARNING

Working with fuel is dangerous. If fuel is handled improperly it can lead to fires and death. It is imperative above anything else that all appropriate safety measures be used to control the fuel and any ignition sources, including static electricity, heat, sparks, and any other sources. Proper high-pressure fuel lines and connections must be used in accordance to the manufacturer's specifications and routed away from any potential sources of heat, ignition, and protected from mechanical damage. If you are unsure about your work or safety, stop work immediately and consult with a qualified automotive technician and/or safety official.

VaporWorx PressureWorx Dual Fuel Module Installation Instructions.

Thank you for your purchase of the VaporWorx fuel module speed control system. These "Smart" systems are designed to work with the GM 5th-generation Camaro LS3/L99 (P/N19208719 and 13585454), ZL1 (P/N 13579899 and 19260557) or the Cadillac CTS-V dual pump (P/N 19207950) fuel modules. They are also compatible with many Ford fuel pumps that utilize a returnless pulse width modulated factory fuel control system (check with VaporWorx for compatibility.) These are stand-alone systems and require minimal ECM commands: Only a 12+ turn on signal is needed. Hence, it will work with any EFI control system.

The purpose of the VaporWorx fuel module control system is to allow the fuel module pump(s) to adjust their speed based on the fuel demand. As fuel demand increases, the VaporWorx pulse width modulation control will also increase the fuel pump speed. As fuel demand decreases, so will the pump speed. This allows a large pumping system like the CTS-V to run reliably with significantly reduced heat generation. It effectively makes a very large pump seem much smaller during cruise/low fuel demand conditions.

The FlowWorx system will provide a 30-80psi constant pressure at idle after user adjustments are made. It is recommended that 58-60psi be used for most applications. During maximum fuel pump output the fuel pressure will drop approximately 3-4psi. This is similar to the Corvette C5 fuel filter/pressure regulator or any other non-manifold referenced system. This is normal for a non-manifold referenced fuel pressure regulation system. In most cases the full 3-4psi pressure drop does not occur since the pump is not at maximum capacity.

Lower fuel pressure settings can be used. The ZL1 fuel modules can be used at an initial fuel pressure of 42-65psi, CTS-V 42-62psi. For the LS3 fuel module it is recommended to use this module at an initial fuel pressure setting of 58-60psi. The LS3 venturi pumps are not strong enough to keep the module full under certain conditions at pressures lower than 50psi.

In most cases vehicles that are using the C5 fuel pressure regulator, or similar fuel pressure regulating systems, engine re-tuning will not be required. The FlowWorx system is an excellent choice for naturally aspirated engines and many supercharged applications.

The PressureWorx system will provide a 1:1 rate of fuel pressure change with manifold pressure. For these systems initial fuel pressure can be as low as 32psi. Maximum fuel pressure at wide open throttle should be limited to: ZL1 = 65psi, CTS-V = 63psi. Wiring connections to the engine MAP sensor are required, and the VaporWorx kits are specific to each MAP sensor, so ordering must be done accordingly (1bar, 2bar or 3bar.) To use a PressureWorx system in constant fuel pressure mode, just disconnect the MAP wiring to the VaporWorx controller and adjust the fuel pressure accordingly.

Unless otherwise specified the PressureWorx kits are tuned for 3-bar MAP sensors. Typical 3-bar sensors such as GM P/N 12592525 used on the LSA and ZR1 crate engines are a good choice.

The VaporWorx CTS-V FlowWorx kit is an excellent choice for the GM LSA engine package. Most all of the aftermarket ECM tuning packages are set up for 60psi constant, so matching the LSA to the VaporWorx CTS-V FlowWorx kit is a natural fit.

The choice between the constant pressure FlowWorx or the manifold referenced PressureWorx systems should be decided between you and your engine tuner. The tuner is key to getting the engine running correctly, and his/her input in this matter is critical to making both of your jobs easier.

Fuel Module Guidelines:

Under 600hp @ 60psi, and naturally aspirated: Gen5 Camaro LS3 fuel module.

Under 775hp @ 60psi, and naturally aspirated: Gen5 Camaro ZL1 fuel module.

Under 1000hp @ 60psi, and naturally aspirated: Cadillac CTS-V fuel module.

Under 650hp @ 60psi, supercharged: Gen5 Camaro ZL1 fuel module.

Under 810hp @ 60psi, supercharged: Cadillac CTS-V fuel module.

Over 810hp @ 60psi, supercharged: Twin fuel modules (custom controller required.)

When using the VaporWorx fuel module control system the idea of having a pump that is too big is no longer a concern. Yes, the LS3 pump is less expensive than the CTS-V, but if there is a chance that additional engine power is in the future, then buying the pump to suit those needs now will be less expensive, in both money and labor, in the long term.

As of 12-01-2013 the VaporWorx electronic kits have been changed. The new kits have one 2" x 3" control box.

These instructions are a general guideline. For example, your application may have a different fuel level sensor wiring callout, or be a modern OE plastic tank vs. the photos show. So, some of the instructions may not be needed for your application.

VaporWorx was founded on Customer Satisfaction and Service. We strive to treat people and our products the way we would want others to treat us and the products we purchase. That is why our electronics products are tested thoroughly before they are packaged and shipped. VaporWorx stands behind our products for one full year after purchase with a well-stocked repair facility and quick turnaround times. VaporWorx does not want to be the reason you cannot enjoy your car. The Terms of Warranty and Service are as follows:

Limited Warranty

VaporWorx warrants its products to be free from defects in material and workmanship under normal use and if properly installed for a period of one year from date of purchase. If found to be defective as mentioned above, it will be replaced or repaired if returned along with proof of date of purchase. This shall constitute the sole remedy of the purchaser and the sole liability of VaporWorx to the extent permitted by law, the foregoing is exclusive and in lieu of all other warranties or representations whether expressed or implied, including any implied warranty of merchantability or fitness. In no event shall VaporWorx be liable for special or consequential damages. This warranty is only valid on products purchased from VaporWorx or their Authorized Dealers.

Service

In case of malfunction, your VaporWorx component will be repaired free of charges according to the terms of the warranty. When returning VaporWorx components for warranty service, Proof of Purchase must be supplied for warranty verification. After the warranty period has expired, repair service is charged based on a minimum and maximum charge rate. (Contact VaporWorx for current rates).

VaporWorx

carlc@vaporworx.com

(805)498-3791

NOTE: The following instructions are for twin fuel module applications only.

The following steps will help to ensure good fuel module operation and long life. Careful attention to wire routing, protection, strain relief, connectors, crimps, etc. will lead to a longer lasting and more reliable installation.

- 1) Find a suitable place to mount the VaporWorx pulse width modulation controller (black box) near the vehicle battery. It is imperative that the box be mounted as close and **directly to the battery** as practical. If not connected directly to the battery an excessive amount of electrical noise may be generated, causing radio noise. Do not mount the controllers near sources of heat such as exhaust systems. The cooler the electronics are during operation, the longer their expected life will be. Screws are provided for mounting.
- 2) Install the fuel pressure sensor into a 1/8"-NPT female fitting that is tapped into the fuel line after the fuel module outlet. The sensor must be mounted near the fuel module outlet so that pressure fluctuations due to fuel injector operation are minimized. If the sensor is mounted in the engine fuel rail rapid pressure fluctuations may occur. Use a small amount of Teflon paste to seal **just the threads** of the sensor.
- 3) If desired the supplied braided loom can be installed over the fuel pressure sensor wiring. If so, slip a 1" piece of heat shrink tubing on the wiring first, then install the loom. The heat shrink will secure the ends of the loom to the wiring. The blue ECM fuel-enable wiring may also be integrated into this harness if desired. A short piece of blue wire with crimped terminal is also provided if needed.
- 4) Plug the three-cavity fuel pressure sensor plug into the fuel pressure sensor.
- 5) Route and secure the fuel pressure sensor wiring harness toward the VaporWorx controller. Be sure to leave sufficient wire length so that there is no strain on the wiring near the connectors. Secure the harness to the vehicle away from where it may become damaged from road hazards and verify that the cable will not be chaffed or cut on sharp edges.
- 6) The VaporWorx controller GT150 four-pin connector provides both fuel pressure sensor and fuel pump enable circuit connections. Using the terminals and seals provided as seen in Photo 1, crimp the terminals to the wires like that shown in Photo 2. Solder the terminals to the wires if needed. There will be a total of four wires to crimp:
 - a. Grey 20ga from the fuel pressure sensor
 - b. Black 20ga from the fuel pressure sensor
 - c. Brown 20ga from the fuel pressure sensor
 - d. Blue 20ga from ECM fuel pump + enable circuit.
 - e. White 20ga from MAP - (PressureWorx only)
 - f. Violet 20ga from MAP + (PressureWorx only)

For constant (non-manifold referenced) fuel pressure, simply leave the white and violet wires disconnected.



Photo 1: The GT150 connector body, terminals, seals, and terminal positional assurance clip. Photo 2: The terminal is crimped to the wire and seal. The part number for the Delphi terminal is 12191818. The seal is 15366022.

- 7) Insert the wires into the Delphi GT150 female connector body as shown in Photo 3. The pinout schedule is listed below for the connector body. A capital "A" and "F" can be found on the connector body. Just align to the colors from the VaporWorx GT150 connector.
 - a. Pin A: Grey
 - b. Pin B: Black
 - c. Pin C: Brown
 - d. Pin D: Blue NOTE: **For Pontiac G8 applications, connect Pin D: Blue wire to OE Fuel Pump + Grey wire.**
 - e. Pin E: White
 - f. Pin F: Violet

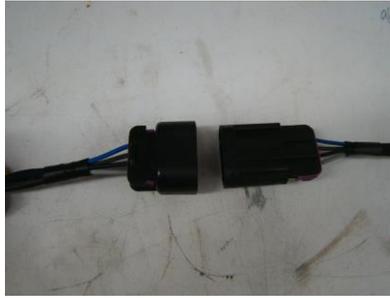


Photo 3: Delphi GT150 female connector (LH). Note that the colors align to each other on both plugs.

- 8) Re-verify that the wires have been properly placed in the connector and that the colors align. If the wiring is incorrect then the terminals will need to be removed and placed in the proper cavity. This can be done by removing the purple cap on the inside of the connector body face using a small screwdriver to pry up on the sides. The terminal can then be released by very gently prying back on the locking tab that secures the terminal to the body. Once corrected re-install the purple connector body cap. NOTE: The cap acts as a terminal locking device. Once the cap is fully seated removal and installation of the terminals is very difficult. The cap has a pre-terminal installation position where it is located in the body but not fully seated. Seat the cap once terminal installation is completed.
- 9) Once the correct wiring has been confirmed, install the terminal position assurance clip as shown in Photo 4.



Photo 4: The purple terminal position assurance clip is installed. Six cavity plug similar.

- 10) Connect the blue wire to the ECM fuel system enable circuit. The VaporWorx controller requires a 12v positive signal to operate. If a negative signal is used the system will not function.
- 11) See Diagram 1 for Steps 12-18

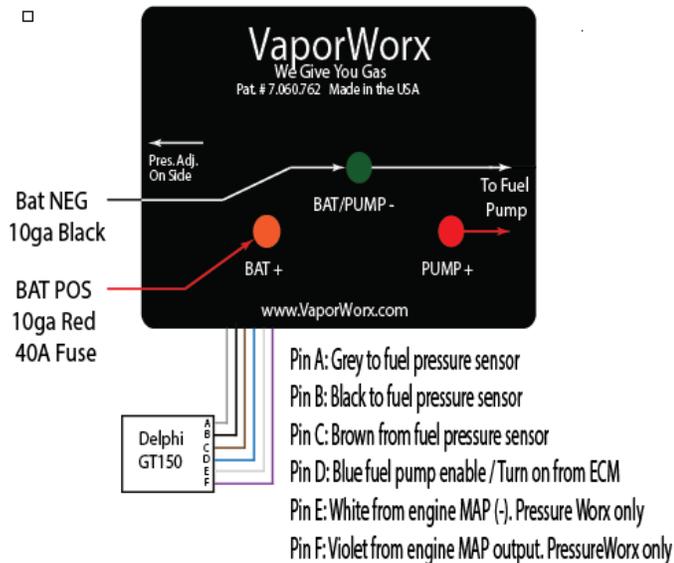


Diagram 1. Battery connections come from the left, the output to the fuel pump to the right. The fuel pressure adjustment is on the left-hand side wall of the controller as noted by the arrow on the lid. ZL1 wiring similar but only the top two connections on the plug are used.

- 12) Plan the routing of your power input and output harnesses. Woven braid should be installed before terminals are crimped on the ends of the wires. The ends of the braid can be sealed with a soldering iron and to the wire bundle using heat shrink tubing.
- 13) Unbundle the main power harness. Mount the fuse holder in a secure location so that one end can be connected to the battery.
- 14) The label on the top of the VaporWorx controller shows the input (BAT +) and output (PUMP +) of the positive side of the controller. Attach one end of the fuse holder to the battery positive terminal. Route the other end of the fuse holder to the VaporWorx controller BAT + terminal. Yellow insulated ring terminals are provided in the kit. Extending the wire from the fuse holder to the VaporWorx controller can be done by using the 10ga wire and yellow insulated butt connectors provided in the kit. *Do not over-tighten the brass nuts on the VaporWorx controller.* Though there is excessive wire length, keep the wire lengths as short as practical. Do not bundle or coil excess wiring. Keeping these lengths below 24" is good practice.
- 15) Route the 10ga black wire from the battery negative terminal to the VaporWorx controller negative input. Yellow insulated ring terminals are provided in the kit. Do not tighten the brass nut on the VaporWorx controller at this time.
- 16) Install the short harness that plugs into the fuel modules on the fuel tank. The VaporWorx controller is usually mounted in the trunk with a trunk mounted battery, so route the long wiring harness such that the disconnect plug is easily accessible. For example, on F-body applications the harness lengths are such that the plug is located just under the trunk floor near where the original fuel level sensor wiring is routed/behind the license plate. See Photo 6. Since the interconnecting plug is pre-installed the long harness will need to be inserted from underneath through the trunk floor. Use a suitably sized hole and rubber grommet as needed.

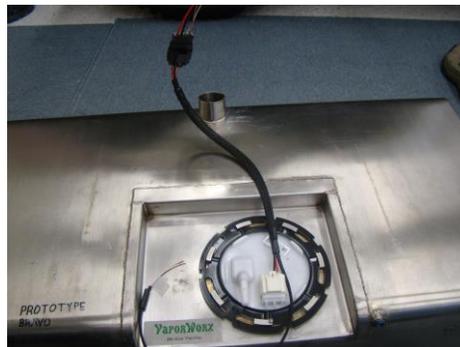


Photo 6. Note the black GT280 four-pin connector. Route the harness along the top of the tank to a convenient location, such as behind the license plate.

- 17) Fuel level sensor wiring is included in the kit. The black or white wire is for gauge ground, the tan routes to the fuel gauge. Route the wire(s) to tie into the tank fuel gauge wiring. The colors of these wires may not match the wiring color of your sensor. Verify that the sensor ground is connected to the VaporWorx black/white, and the output connected to the VaporWorx tan wire.
- See wiring diagram for the following steps.**
- 18) Attach one of the 12ga red wires from the fuel module wiring harness to the PUMP + on the VaporWorx controller. Ring terminals are provided. Do not tighten the brass nuts at this time.
- 19) Attach the 10ga black wire from fuel module wiring harness to the negative terminal on the VaporWorx controller. *Secure, but do not over tighten, the brass nuts.*
- 20) Unbundle the relay harness. Route a 12ga red wire in the Pin 30 plug to the PUMP + of the VaporWorx controller. Relay terminal numbers can be found on the bottom of the relay body. Ring terminals are provided as well as a relay plug and terminal kit. *Secure, but do not over tighten, the brass nuts.*
- 21) Route the other 12ga red wire from the fuel module wiring harness to the relay Pin 87 output. Relay terminals are provided. Crimp the terminals as required for a secure connection and insert into the relay plug body.

- 22) Install the 4psi Hobb's switch on to the engine using the 1/8" NPT fitting. The switch must be installed after the supercharger outlet. This is typically where the engine MAP sensor is located, and where an auxiliary in-cabin boost gauge would be connected. Due to many unknowns, adapters may be needed to make this connection.
- 23) From the relay harness, route the green wire to one of the terminals of the Hobb's switch. Red insulated ring terminals are provided. Wiring loom is also provided if desired. It does not matter which terminal is used on the Hobb's switch. The other end of the green wire goes to Pin 85 on the relay.
- 24) A 20ga black wire is provided for grounding the other terminal of the Hobb's switch. One end of this wire goes to chassis or engine ground, the other to the second terminal on the Hobb's switch. Red insulated ring terminals are provided in the kit.
- 25) The 20ga orange wire in the relay harness should be routed to a fused IGN + source and connected to relay terminal Pin 86. Red insulated ring terminals are provided in the kit. This orange wire may also be tied into the blue fuel enable wire on the VaporWorx controller.
- 26) Connect the tan wire in the VaporWorx long power harness to your fuel gauge wire.
- 27) Connect the black or white wire for the fuel level sensor ground to a suitable chassis ground.
- 28) Re-check and secure all connections and verify that all wiring is routed away from sources of potential damage and is not pinched.
- 29) Insert the 40A fuse into the fuse holder.
- 30) *NOTE:* For Pontiac G8 owners using twin Walbro or other non-OE fuel modules, extra lengths of brown and violet wire are included in the kit to allow extending the OE harness to the new fuel hangar/hat.

Preparation Required Prior to Engine Startup

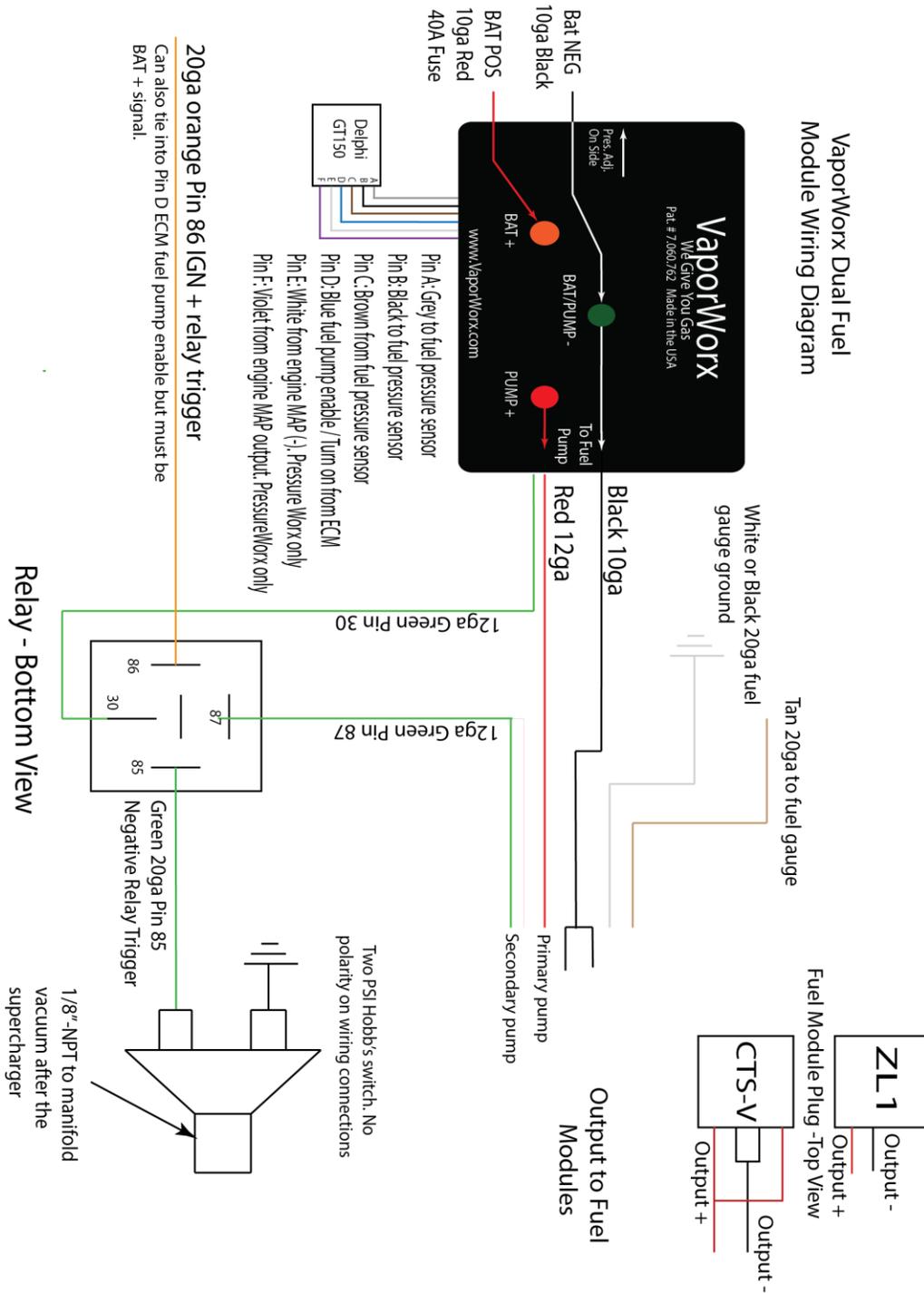
- 1) Fill the fuel tank to 3/4-full minimum so that the fuel in the tank can flow into the top of the reservoir. For initial fill-up and line flushing the lower reservoir must be fully submerged in fuel. Check for any leaks.
- 2) Disconnect the fuel line from the engine fuel rail. Route or extend this line to a fuel-rated and approved container. Secure the line to the container so that it will remain in place when fuel is pumped through the line. High-pressure fuel flow will cause a flexible line to whip if not secured.
- 3) Turn on the ignition switch. Fuel should begin to flow in several seconds. If the ECM controls the fuel turn-on circuit (blue wire) then it may take several cycles to flush the system. Most ECM's have a safety feature that turns off the fuel pump after 2-3 seconds if it does not sense that the engine is running. Do not run the pump for more than five seconds with the fuel line removed from the rail. After five seconds, allow at least one minute before repeating the turn-on cycle so that the fuel module reservoir can refill. *NOTE:* The fuel module venturi pumps do not work unless there is high fuel pressure. With the fuel line disconnected, no fuel pressure is available to power the venturi pumps. The pause between flushing cycles is to allow time for the module reservoir to refill with fuel. Fuel pump damage may result if insufficient fuel is available during flushing and initial priming.

In some cases, after several cycles the ECM may not turn the fuel circuit on until it senses engine rotation. In this case, if needed, 12v+ can be applied to the VaporWorx controller blue wire for a few seconds. The pump should begin to run. The fuel pressure sensor wiring must remain in place and not be disconnected.

- 4) Reconnect the fuel line to the engine fuel rail and attach a fuel pressure gauge to the engine fuel rail.
- 5) Turn on the ignition switch but do not start the engine. The fuel pressure gauge should rise and settle near its pre-set value. Turn off the ignition key and inspect the fuel system and engine fuel rails for leaks. It is normal that the fuel pressure will spike after fuel system shutdown. Fuel pressure should return to normal after engine start-up. The two-second priming rule is still in effect, so use the procedure in Step 3 to turn on the controller using the blue wire if needed.
- 6) Re-connect the blue wire to the ECM if it was removed. If no leaks are found, start the engine. Fuel pressure may increase 2-3psi higher than what was observed during engine-off due to system voltage increases. Again, check for leaks.

- 7) On the side of the controller near the sensor input wiring is a small hole. This hole will be on the centerline of the controller between the BAT + and BAT - input terminals. Inside the hole is a brass potentiometer screw that is used to adjust the fuel pressure. Adjust the fuel pressure for the FlowWorx systems to 58psi/4bar.
- 8) Shut down the engine as soon as practical and check the fuel system for leaks. Repair any leaks before continuing.
- 9) Restart the engine. Quickly depress and release the throttle pedal. The fuel pressure should remain constant with perhaps a 2psi drop-off for constant pressure applications. Manifold referenced systems will change the same amount as the manifold pressure.

VaporWorx Dual Fuel Module Wiring Diagram



Troubleshooting

- 1) Fuel pump runs at full speed when the engine is on:
 - a. Adjust the fuel pressure via the small screw on the side of the box.
 - b. Check fuel pressure sensor wiring connections. On the fuel pressure sensor plug Pin 1 = Brown, Pin 2 = Black, Pin 3 = Grey. Confirm that these wires align with the same wires on the controller GT150 plug. It is possible to crimp across the insulation of the wire and not obtain a good circuit pathway, hence, causing a controller malfunction.
 - c. Confirm that the input and output main power wires from the battery and to the fuel module are correct/not reversed.
 - d. Confirm the controller is connected directly to battery power. No chassis grounds.

- 2) Fuel pump does not run:
 - a. Check the input fuse. A 20A fuse has shown to be adequate in most situations for single module with no voltage increasing devices (Boost a Pump).
 - b. Check fuel pressure sensor wiring connections. On the fuel pressure sensor plug Pin 1 = Brown, Pin 2 = Black, Pin 3 = Grey. Confirm that these wires align with the same wires on the controller GT150 plug. It is possible to crimp across the insulation of the wire and not obtain a good circuit pathway, hence causing a controller malfunction.
 - c. Confirm that a minimum of 10v is available to the VaporWorx blue wire Pin D. 12v + can be applied directly to the GT150 Pin D blue wire for testing only.
 - d. Check that the brass nuts for the battery and fuel module power wiring terminals are properly tightened and free of contamination and corrosion.
 - e. Check the brass nuts that are under the 12ga battery and fuel module ring terminals. These may loosen over time. Retighten them and test the system.
 - f. Excessive fuel pressure due to engine shutoff. After ignition shutoff the injectors shut but the pump still spins, causing a pressure spike. This is normal, but until the pressure drops below the set pressure, the controller will not send power to the fuel module.
 - g. Check the temperature of the VaporWorx controller black aluminum lid. If the lid is over 225°F the controller will shut down.
 - h. Confirm that the battery and butt-joint connections are good. Use a volt-ohm meter to check connections.
 - i. Confirm that the input and output main power wires from the battery and to the fuel module are correct/not reversed.
 - j. Confirm the controller is connected directly to battery power. No chassis grounds.

- 3) The fuel pressure rapidly fluctuates, especially at idle:
 - a. The fuel pressure sensor is too close to the fuel rail. The VaporWorx system can react fast enough to chase individual injector pulses at idle, hence causing rapid fuel pressure gauge readings. Once engine speeds increase this tendency reduces. Move the fuel pressure to as close to the fuel module as practical. In some case where a very short primary fuel line is used, a longer line from a "T" may be needed to install the fuel pressure sensor into. This extra head length acts a damping system for the injector pulses.

- 4) Fuel pump does not have adequate pressure:
 - a. Turn the fuel pressure adjustment screw inside the hole on the side of the controller. A small eyeglass screwdriver can be used, as well as the tool supplied in the kit.
 - b. Remove the power wiring from the brass terminals on the top of the controller. Confirm that the lower brass nuts are tight.
 - c. Check that the connections from the VaporWorx controller to the fuel module are good.
 - d. For the CTS-V fuel module, there are four wires entering the plug (Pontiac G8 disregard.) The two outboard wires should be red, the two middle black. If these are incorrect, remove the terminals/wires from the plug body and re-orient. Gen 5 LS3 and ZL1 have BAT + on the far left of the plug body, BAT - is next to BAT +. See Photo 5 for LS3/ZL1, Photo 5A for CTS-V.
 - e. Using a heavy gauge jumper wire, connect the BAT+ to the PUMP+ on the VaporWorx controller. If the fuse is good the pump should run. If the pump is running but little or no fuel pressure exists, then either the fuel module is internally damage (broken plastics), the fuel pump(s) have been damaged, or there is a massive leak. The most common cause of fuel pump damage is running the pumps dry.

Fuel is the life blood for pumps. If the pump does not run then there is a problem with the electrical wiring at the module connection.

Fuel Module Output Testing

One question that often arises is how to monitor pump output. This is good to know in order to determine if the pump is adequate for the power produced. To test this, connect one voltmeter to the inputs of the VaporWorx controller (BAT+ and BAT-) and the other to the output (PUMP+ and BAT-). These connections must be made on the controller terminals. In a safe and legal way, have an assistant watch the meters as the car is driven at wide open throttle/maximum fuel demand. Once the output of the controller is 0.2volts less than the input, the controller is effectively sending maximum power to the pump(s). After this point is reached fuel pressure will begin to fall due to a pump over-capacity condition.

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