

Energy and Water Solutions

902 West 2010 South, Syracuse, Utah 84075

Voice: 801-825-5580 Fax: 801-825-5428

Website: www.ewsews.com Email: sales@ewsews.com

EWS

Model CNGE4 and CNGE8

CNG Conversion Kit Instructions and Owner's Manual For all EFI (Electronic Fuel Injected) Engines

These instructions are not the complete instructions that come with your kit. Some of our information is confidential and is only provided with your kit.

CNG Conversion Kit Parts List – Check to make sure your kit is complete before beginning.

Closed Loop Feed Back Controller with Wire Harness and Parts Bag
Pressure Gauge
Stepper Motor
Change-Over Switch and Fuel Indicator with Wire Harness and Parts Bag
Fuel Injector Controller and Parts Bag (10 cylinders will have two)
Injector Controller Harness (10 cylinders will have two)
Plastic Mixer
Foam Rubber Spacer for Mixer (if needed)
Regulator with Bracket and Hardware
Filling Nozzle
Filling Nozzle Bracket
Full Roll of 6mm HP Tubing
6 ft of 5/16" Heater Hose
3 ft of 3/8" Fuel Hose
Model CNGE8 comes with 2 regulators, 2 pressure gauges and extra hoses and hardware.
Instructions and Owner's Manual
CNG Sticker

1 Bag of the Parts Below:

3 High Pressure 6 mm Compression Fittings
5 High Pressure 6 mm Ferrules
6 High Pressure Tubing Straps
Aluminum Fitting for Mixer
4 Small Heater Hose Clamps
8 Large Hose Clamps
3" of 3/8" Heater Hose
2 Reducing Heater Hose Tees
8 Wire Ties
2 ft Heat Shrink Tubing
6 Small Self Tapping Screws for Tubing Straps
4 Large Self Tapping Screws for Mounting filling Nozzle and Regulator

Disclaimer

1. No Refunds on Used or Opened CNG (Compressed Natural Gas) Conversion Kits, CNG Parts, or CNG Cylinders.
2. Refunds are only with Return Authorization and have a 20% restocking fee.
3. Shipping Is Non-Refundable on all our products sold.
4. Our CNG Conversion Kits are not EPA or DOT certified.
5. Some of our CNG Cylinders are not DOT Certified, but are ISO Certified.
6. All CNG Conversion Kits, CNG Parts, or CNG Cylinders Installed or not Installed are considered Do It Yourself and are installed at your own risk.

7. Installation of CNG Conversion Kits, CNG Parts, or CNG Cylinders is Buyers Responsibility to Obtain, Perform, and Maintain.
8. By purchasing any of our products you agree To Forever Hold Harmless, Indemnify, and Covenant Not to Sue Energy and Water Solutions or anyone affiliated with Energy and Water Solutions.
9. The One-Year Warranty Provided by Energy and Water Solutions is only for Workmanship and Quality of the CNG Conversion Kits, CNG Parts, or CNG Cylinders.
10. We do not guarantee that you will not get a "Check Engine" light after installing our CNG Conversion Kits.
11. You agree to these terms and conditions by Viewing, Sharing, or Purchasing our information and products.
12. Individual Results May Vary In All Aspects and Respects Not Limited.
13. We reserve the right to change these terms at anytime for any reason without notice.

BEFORE YOU BEGIN INSTALLATION

Make sure your engine is running properly on gasoline before installing this kit. An engine that is not running properly or has low compression, may run worse on CNG.

Make sure all maintenance needed is performed before installing.

Install the conversion kit while the engine is cool.

Completely read these instructions before proceeding. Use www.alldatadiy.com to purchase the service manuals for your vehicle, if needed, to locate parts and wires on your vehicle.

Verify the Oxygen Sensor Voltage

1. Locate any oxygen sensor before any catalytic converters to connect to. The oxygen sensor wire is critical for proper operation. If the oxygen sensor is not the proper type with voltages below 1 volt DC or is defective the engine will not run properly on CNG. This is how the oxygen sensor operates. If the oxygen sensor voltage is below .5 volts (500 mv) the engine is running lean. If the voltage is above .5 volts the engine is running rich. The oxygen sensor voltage must go above and below .5 volts every few seconds on both fuels when the engine is running. If it doesn't, the sensor is the wrong type, defective, has a bad ground, or the engine's wiring is shorting the voltage. At this time you can only check the voltage while the engine is running on gasoline. See the trouble guide if the voltage is not correct.
2. See Locating and Connecting the Oxygen Sensor. Just verify that the sensor is working properly at this time and connect to it later as instructed. Note which wire is the correct wire so you can connect to it later.

Regulator Installation

1. Find a location to install the regulator as close as possible to the air intake hose where the mixer will be installed. If possible, the regulator should be installed so that it is perpendicular to the radiator or front of the vehicle. Mount using the bracket and hardware provided. The bracket is fastened to the bolt on the front center of the regulator with a locking washer and nut. It can be installed using the large self tapping screws, the bolt provided, or welding it to the fire wall or side wall or anywhere to hold it securely in place. You may need to place the bracket in a vice to bend it to fit and you may need to fabricate a bracket if the bracket provided will not work. You can rotate the regulator to make installation of the gas in, gas out, coolant lines, and pressure gauge as easy as possible. Model CNGM8 will come with 2 regulators, mounting bracket and hardware. Mount the two regulators next to each other. See the steps below for connecting these items.
2. There is a large black knob on the back edge of the regulator to adjust the idle. Do not adjust the small black knob as this is a drain to flush the regulator if needed. Do not adjust the brass screw as it is set at the factory.

Mixer Installation

1. Make sure there are no hoses that may be sucking intake air between the throttle body and where the mixer is installed. For proper operation the hoses may need to be relocated in front of the mixer if they are sucking air from the intake.
2. Make sure the mixer is installed at least 3 inches away from the mass air flow sensor. It can be installed in front or behind the mass air flow sensor. There are a few engines that may require the mixer to be installed before the mass air flow sensor for proper operation. After complete installation it may be necessary to relocate the mixer, but is uncommon.
3. Completely remove the air intake hose from the engine.
4. Check the mixer for proper fit into the intake hose. The mixer should be installed between the air filter and the throttle body where it is easiest to install and where the hose is easiest to connect to the regulator. If your engine has a turbo charger the mixer must be installed between the air filter and the turbo charger and not after the turbo charger. The end of the mixer that has the slope and the raised ribs must be the upstream side of the mixer where the air will flow into the mixer. It will not work if installed backwards. A 60% to 70% reduction of the air intake through the mixer is normal. All air must flow through the center of the mixer and no air should flow around the mixer.

5. Remove the aluminum fitting from the mixer. Place the mixer in the intake hose. If it is a loose fit, it must be sealed so no air will leak around the mixer and so the mixer is held in place firmly so it will not move. You must use a method of holding the mixer in place so that it cannot move by using a clamp around the intake hose and mixer if it is flexible, a silicone, RTV, or similar sealant, or screws.
6. Drill, or cut a hole in the intake hose so the aluminum fitting can be threaded into the mixer. If the intake hose is flexible, drill a 1/2" hole into the air intake for the fitting and the hose will make a tight seal.
7. Thread the hose fitting through the hole in the intake hose and into the mixer. Do not over tighten. Make sure the mixer is installed so the intake hose will still fit onto the throttle body and so the hose fitting on the mixer will be in the best location to install the gas hose from the regulator to it. Make sure you clean any shavings from the hose so nothing will get into the engine.
8. Seal any leaks around the aluminum hose fitting so no air can leak into the intake hose.
9. Reinstall the air intake to the engine and make sure all hoses and wire connectors are reinstalled.

Low Pressure Gas Hose and Stepper Motor Installation

1. Locate the stepper motor as close to the mixer as possible. It can be installed in any position. Install the 3/4" ID hose using hose clamps to the regulator gas out fitting, stepper motor, and mixer fitting. Cut the hose as needed. Place the clamps about 3" onto the hose before inserting the fittings to the hose. The black gas out fitting can be rotated to the desired position. Make sure the hose does not kink. 90 degree 1/2" barb fittings can be used if needed, but if used, you will need additional hose clamps. If you have model CNGE8, you will need to install the gray plastic tee fitting before the stepper motor so that the CNG from both regulators can be regulated by the stepper motor.
2. Tighten the hose clamps, but do not over tighten them. If any hose clamp should slip or strip replace it with another hose clamp.

Coolant Hose Connection

1. Slide a hose clamp onto both ends of the 5/16" hose.
2. Install the 5/16" hoses to the small center fittings of the reducing tees. This will help leakage while installing as the center fittings will already be sealed.
3. Locate the 2 heater hoses going to the heater core. Make sure they are not air conditioning lines. Do not install with the engine hot. Cut each hose at the most convenient location to install a reducing tee into each hose. The 5/8" reducing tee can be installed on most 1/2", 5/8", or 3/4" heater hose. If only one heater hose is accessible you can connect both tees to one hose with at least 5 inches of hose between the tees. If the tees are installed on the same hose, install a hose clamp between the 2 tees to close off the hose slightly to restrict the flow so some coolant will flow through the regulator, but most will flow through the larger hose.
4. Cut the heater hose. Slide a hose clamp onto each end of the heater hose before inserting the reducing tee onto the hose. Check the 5/16" heater hose to see if it is long enough to connect from the tees to the fittings on the regulator. It should be long enough for most installations. If it is not long enough, purchase enough hose for the shortest connection.
5. Install the two heater hoses to the two heater fittings on the regulator. It makes no difference which hose connects to each fitting.
6. If you have model CNGE8, connect a 5/16" hose from one tee fitting to one regulator. Connect the other 5/16" hose from the other tee to the other regulator. Connect a length of the 5/16" hose from one regulator to the other regulator so the hoses are installed in series. The coolant will flow from one tee fitting, through one regulator, through the other regulator, and then back to the other tee fitting.
7. Tighten all the hose clamps tight, but do not over tighten. If any hose clamp should slip or strip replace it with another hose clamp.
8. Check for leaks after installing your kit and after you start your engine.

How to Safely Install HP (High Pressure) Tubing and Fittings

1. Use only extreme pressure fittings and tubing rated for at least 3,000 psi. All tubing and fittings included in your conversion kit are extreme pressure fittings rated at 3,000 psi or higher.
2. Make all bends by hand slowly and carefully bending only slightly along its length.
3. If needed use a 1/4" tubing bender if you need to bend any small radius bends.
4. Do not use any tubing that has been kinked or damaged from improper bending or damaged while installing.
5. Use a helper to run the long length of tubing from the cylinder to the engine area to avoid damaging the tubing by kinking it or scrapping it.
6. If the end of the tubing is not sealed, tape the end while installing so nothing gets into the tubing.
7. Slide the nut and then the ferrule onto the tubing before threading the nut onto the fitting. Make sure at least 2 inches of the end of the tubing is straight, and the white rubber coating removed so the fittings will slide onto the tubing. Be careful to not drop and lose the nuts or ferrules. Three extra ferrules are included in the kit in case they are dropped or need to be redone. Do not replace any parts with lower pressure parts available at your local hardware or plumbing store.

8. Insert the tubing all the way into the fitting and make sure it does not slide out while tightening the nut.
9. Always use two wrenches so one wrench is opposing the force of the wrench on the nut when tightening any fittings, and tighten tight, but do not over tighten. Tighten only 1½ turns after the fitting begins to compress the ferrule. If there is any doubt that the tubing has slipped out while tightening, remove the fitting and inspect the ferrule. The ferrule must be completely on the tubing with some tubing extending beyond the ferrule. If the fitting is ever removed after it has been tightened, tighten only ¼ to ½ turn after the fitting starts to compress the ferrule.
10. Do not twist or bend the tubing while installing fittings.
11. You do not need to use thread sealant on compression fittings.
12. After tightening any fittings make sure the tubing does not move when pulling or twisting. If the tubing can be moved at all you did something wrong. Remove the nut and make sure the ferrule is firmly attached to the tubing and not on the very end of the tubing. If not, you will need to cut off the ferrule and use a new high pressure ferrule of the same type and start again.
13. Use 6 to 8 wraps of Teflon tape to all male pipe thread fittings and wrap in the same direction as when tightening.
14. Build a 3 to 4 inch loop in all tubing runs near the connection to any device to allow for expansion and contraction.
15. Only cut the HP tubing with a tubing cutter. Cut slowly only cutting a little with each rotation of the tubing cutter. The tubing is hard steel and cutting fast will damage the tubing cutter and the tubing. Ream out the tubing after it is cut making sure to not get anything in the tubing. If you do not ream out the tubing it will take longer to fill with CNG and the flow may be restricted and the vehicle may not run properly. Make sure no shavings are left in the tubing that could damage the regulator or your engine. Blow the tubing out with compressed air, if needed.

Installing the HP (High Pressure) Tubing and Fittings

1. We have 3 fill nozzle options. You will be provided with a nozzle with a ¼ turn valve unless you have requested one of our other fill nozzle options. If you have the standard fill nozzle with a ¼ turn valve go to step 3. If you have the strait nozzle without the ¼ turn valve you will run tubing from one port of the cylinder valve to the fill nozzle and from the other port of the cylinder valve to the regulator. You will be provided with an extra half roll of tubing an extra ¼" adaptor fitting with this option. If you have the cylinder valve with the fill nozzle on it, you just run the tubing from the remaining port of the cylinder valve directly to the regulator. This option should only be used where the cylinder is installed outside the vehicle such as in a truck bed.
2. Install the CNG cylinder to the vehicle following the cylinder installation instructions.
3. If the cylinder is installed in the vehicle or in the truck, the cylinder valve and all fittings should be vented to the outside using at least an 8 mil thick bag or a hose. We have vent bags and vent fittings available if needed.
4. Drill 1/2" holes where needed to rout the tubing from the cylinder area to the engine area. If installing the optional vent fitting, drill a 1 1/8" hole where the tubing will exit the vehicle and fasten the fitting with 3 screws. The angled end of the fitting should be to the outside with the longest end to the front.
5. Use the 3" length of 3/8" heater hose to slide over the tubing and half way into the hole to protect the tubing if not using the vent fitting.
6. Install the pressure gauge included with your kit to the shorter port of the gas in tee fitting of the regulator. If you have model CNGE8, install a pressure gauge to each regulator. Do not tighten the pressure gauge by turning the gauge. Tighten only by using a wrench on the square head fitting. Use the thick aluminum washer taped to the back of the pressure gauge to make the seal. Place it on the end before threading it onto the regulator. If the pressure gauge ends up where you cannot see it by turning the tee on the regulator, remove the pressure gauge and add the other thinner aluminum washer and install again.
7. Mount the fill nozzle under the gasoline flap next the fill cap, if possible. Make every effort, even if it is difficult, to install it there if there is room as this will make filling very easy. Install using the 6" bracket provided using 2 large self tapping screws, or bolt, or weld the bracket in place. You may need to install the tubing to the nozzle before installing to make installation easier as you may not be able to tighten the fittings after it is installed. Do not install the fill nozzle in the trunk or in the vehicle. You may also install the fill nozzle near the cylinder in the back of a truck, under the hood, or any other place where it can be safely installed. The fill nozzle must be located so the filling station nozzle can easily be connected to it. The filling station nozzle and valve bracket is large so make sure there is room to connect it to your nozzle.
8. Go to your nearest CNG filling station and check out the nozzle and how it operates, and how the gas is purchased. Try to closely watch at least one vehicle fuel while you are there. Try to do this before you begin the installation of your conversion kit.
9. There are two output ports on all cylinder valves. We do not supply the adaptor fittings to connect to your cylinder valve if you did not buy the cylinder or cylinder valve from us. We have most adaptor fittings for most cylinder valves available on our website on the PRICES page. Our tubing is 6mm steel and only the proper fitting should be used. Install the HP tubing from one port on the cylinder valve to the filling nozzle center port closest to the red handle with the mounting nut on it.

10. Install tubing from the filling nozzle port opposite of the filling nozzle to the longer high pressure port on the regulator. If you have model CNGE8, install tubing from both high pressure ports of both regulators to the high pressure tee fitting. Locate the tee fitting as close as possible to the regulators. Install tubing from the filling nozzle to the high pressure tee fitting near the regulators. Do not locate the tubing near any moving parts, hot exhaust, or engine parts. When running the tubing under the vehicle, keep the tubing above other car parts when possible to keep it up as high as possible where it is better protected from damage. The tubing must not be installed so that it is below the frame of the vehicle where it is in a crush zone where it can be crushed.
11. Strap the HP tubing in place every 18" using the small self-tapping screws provided and the thin flat metal straps provided. Just simply bend them to make a strap.
12. Tighten the nut that the pressure gauge is threaded into after you have the fitting in the desired position. It has o-rings so do not over tighten it.

Electronics

Installing the Controllers

1. Decide where you will install the FBS and Injector controllers. They can be installed under the hood or under the dash.
2. If installed under the hood they must be installed upright and so the connector is located at the bottom to keep moisture out of the controller. It must not be installed where it is lying horizontally.
3. Locate where all the wires will be connected and routed and organize the wires and cut to the desired lengths so that you will have a neat organized installation.
4. Purchase the black wire sleeves to protect and organize the wires if desired.

Read the above wiring tips and use them for all the following steps. Below is wiring information for each wire connection. Also see and study the wiring diagrams on the following pages

COS (Change-Over Switch) Installation

1. Plug the COS wire harness into the COS. The screws on the plug will be facing up when plugged in.
2. Mount the COS on, in, or under the dash near the driver where it is in view of the driver. If you have a small compartment it will fit into and can be mounted in, this is the best location.
3. Run the COS wire harness through the fire wall from inside the vehicle.
4. Tie the wire harness up out of the way inside the vehicle with wire ties.

Locating and Connecting the 12-volt Battery Wire

1. Connect the red wire from the FBS Controller to the fuse holder and then from the fuse holder to the 12-volt battery wire. This can be at the battery or any other wire that always has 12-volt battery. You will need to cut a 6" length of the red wire first. Make sure the fuse is not installed at this time.

Locating and Connecting the 12-volt Ignition Wire

2. Locate a 12-volt ignition wire. Use your service manual to help locate a wire. Make sure the wire turns off and on with the ignition. Do not use a wire that turns on with just accessories on. Connect the red wire from the COS (Change-Over Switch) to the fuse holder and then from the fuse holder to the 12-volt ignition wire. You will need to cut a 6" length of the red wire first. Make sure the fuse is not installed at this time.

Locating and Connecting the Chassis Ground

1. Connect all ground wires from all controllers, pressure gauge, and emulators to a good chassis ground and to the mounting bolt on the regulator. Be care as some grounds are black and some are brown. While locating the TSP wire you will also find a chassis ground wire at the same connector and is a good location to connect to the chassis ground wire.

Connecting the Wires to the Regulator Solenoid Valve

Do not connect any electric cylinder valves to the blue wires or to the solenoid on the regulator. This will damage the system and void the warranty. They must be connected to a 12 VDC ignition wire.

1. Connect the blue wire from the FBS controller, COS controller, and from all the fuel injector emulators together and then one blue wire to the positive terminal of the solenoid coil using a spade connector. Use the extra length from one of the blue wires from one of the controllers to connect to the solenoid coil. Do not connect any blue wires that are to be connected to fuel injectors. Crimp and then solder the wire to the connector. If any of the blue wires are not connected the system will not operate properly.

2. Connect a ground wire to the negative terminal of the solenoid coil using a spade connector. Use the extra length from one of the ground wires from one of the controllers to connect to the solenoid coil. Crimp and then solder the wire to the connector. If any of the ground wires are not connected to a good ground the system will not operate properly.
3. If you have model CNGE8 you will connect to the solenoids on both regulators.

Locating and Connecting the TPS (Throttle Position Sensor)

This connection is optional but is recommended. Disconnect this wire if the engine goes into limp mode which may happen on a few engines when this wire is connected.

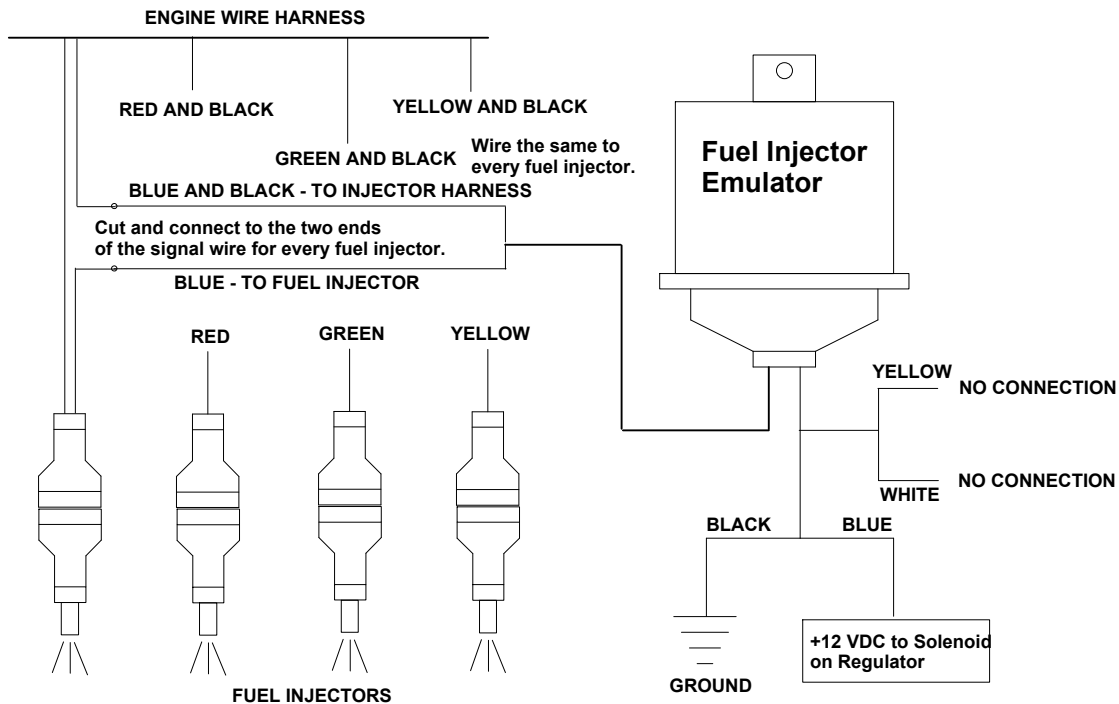
The Throttle Position Sensor is mechanically connected to the butterfly and the gas pedal. It sends a variable signal to the ECU that is proportional the opening angle of the butterfly. In the latest generation of vehicles where the opening of the butterfly is achieved through an electromechanical device as opposed to linkage, the TPS signal can be taken at the sensor which reads the position of the gas pedal.

1. The TPS connector is located at the throttle body on most engines. See your wiring diagram for your engine.
2. Most TPS connectors will have 4 to 7 wires. There will be a chassis ground, 12 volts battery voltage, 5 Volts, and the TPS voltage wire. Some engines have dual TPS wires. You can connect to either one. Turn the ignition on but do not start the engine to check the voltage.
3. The TPS voltage with the throttle closed will be .7 to .9 volts. After locating the TPS, have someone press on the gas pedal to open the throttle and the voltage will increase to over 3 volts with full throttle. If your voltage is above 4 volts at idle and decreases when the throttle is pushed the TPS type will need to be changed to an inverted TPS voltage using the software provided.
4. Connect the purple wire from the FBS controller to the TPS sensor wire.

Connecting the Fuel Injector Emulator Wire Harness

1. The fuel injector emulator and wire harness is used to disconnect the fuel injectors when using CNG and then to reconnect the fuel injectors when using gasoline. We do not use the emulator function to emulate any signals to the engine's ECU.
2. There are three ways to connect to the fuel injectors. We will try to supply the correct connectors for your engine so that you can connect the injector connectors supplied to your injector connectors by connecting the male and female connectors together for each fuel injector. If the connectors do not match or you are supplied a harness without connectors and if you have a common wire to all fuel injectors that you can positively locate, cut 4 pairs of connectors off and wire the wires to the common wire similar to the wire diagram below. You will cut the common wire and connect all the wires with the black stripe to one end of the common wire and all the solid color wires to the other end of the common wire. This will give a better connection using more than one set of wires. If a common wire is not available, you will connect the wires of the fuel injector wire harness supplied to the fuel injector wires as shown in the diagram below. You may be supplied with more than one injector emulator and wire harness for 10 cylinder engines. You may have extra wires or connectors that you will not need to connect. For example, you may get an 8 cylinder harness for a 6 cylinder engine. If you cut the connectors off and wire the connections, do not use the black wires. If you cut the insulation back a few inches you will see that the black wires are just a loop and can be removed. Many GM Vortech engines have a pot with all the injector wires where you will wire the harness. You may want to cut all the wires to the same length when wiring to a pot or throttle body.
3. If you are wiring to each fuel injector each injector will have 2 wires. One wire will usually be the same color on all injectors. Do not connect to these wires. The other wire will be a different color on each injector and this is the wire you will use. Cut the wire from each fuel injector and connect a wire from the harness to each end of the cut wire. You must use the sets of wires of the same color from the new wire harness. Do not reconnect the 2 ends of the original injector wire to each other as this will not allow you to turn off the fuel injectors when using CNG. See the drawing below.
4. Continue until you have connected every connector. V6, V8, and V10 cylinder engines will have connectors on both sides of the engine.
5. Connect the black wire from all emulators to ground.
6. Connect the blue wire from all emulators to all other blue wires from all controllers.
7. Plug the wire harnesses to your Fuel Injector Emulators.
8. There are 2 switches on the emulator. You do not need to be concerned about their setting as this function is not used. There is a trimmer adjustment. Midway is where it is set and we recommend that you do not change the setting as it is usually set at the best setting.

Connect the blue set of wires to the fuel injector that is the furthest from the Emulator and then the red, green, and yellow sets.



Locating and Connecting the Oxygen Sensor Wire

1. The oxygen sensor is located on or after the exhaust manifold. The proper connection to the proper oxygen sensor is critical for the proper operation when using CNG. This is how it works. If the oxygen sensor voltage is below .5 volts (500 ma) the engine is running lean and the FBS controller drives the stepper motor, which is a valve, open. If the voltage is above .5 volts, the engine is running rich and the FBS controller drives the stepper motor closed. If the regulator is adjusted properly, the voltage and stepper motor will go up and down every few seconds maintaining the proper fuel ratio without reaching the maximum or minimum settings. The settings are automatically adjusted by the FBS as you drive providing the perfect fuel ratio. Use this information when troubleshooting if you have any problems.
2. Most Oxygen Sensor connectors will have 4 wires. A chassis ground, two 12 volts battery voltage, and the Oxygen Sensor wire.
3. Use a meter to check for the proper voltage on each wire. The oxygen sensor voltage will be about .5 volts with the ignition on and the engine not running on most engines. The engine may need to be running to read the voltage. Use your service manual to locate the wire so you can wire to it without starting the engine. Some late model engines have higher voltage air fuel ratio sensors that have 2 to 3 volts. Do not connect to these sensors or any sensor with a voltage over 1 volt. If you do not have an oxygen sensor before the catalytic converter, you will need to have a universal, low cost, unheated oxygen sensor installed before the catalytic converter and connect to the new oxygen sensor wire. An oxygen sensor and bung can be purchased from us or your dealer. You can have the bung welded on to the exhaust and the sensor threaded into the bung. A bung installed will cost \$50 to \$100 at a muffler shop. The muffler shop may tell you that installing CNG on your engine will damage your catalytic converter. Our kits will not damage your engine or your catalytic converter. Most sequential injection conversion kits, including EPA certified kits, will damage engines and parts as they do not adjust the fuel properly because these kits do not use the oxygen sensor to adjust the fuel ratio like all our kits do.
4. Many engines will have multiple oxygen sensors. If you have more than one sensor, connect to the easiest sensor to connect to before the catalytic converter.
5. Connect the white wire from the FBS controller to the oxygen sensor. Some sensor wires have an outer ground shield with the sensor wire inside so make sure that you connect to the inside wire. The ground shields should be reconnected to each other if cut.
6. The oxygen sensor signal is only monitored so the wire must still be connected to the engine's ECU.

Locating and Connecting the Ignition Pulse (Coil) or RPM Wire

1. Connect the black wire from the COS controller to the ignition pulse wire. Most late model engines will have individual coils for each cylinder with a connector with 3 or 4 wires. You will have a chassis ground, 12 volts battery voltage, and the pulse wire to turn on the coil to fire the spark plug. You will only need to connect to one coil pulse wire if you have more than one coil. You may have a coil for each cylinder or you may have a coil for every two cylinders. You may have two coils per cylinder. It does not matter, just

connect to one. Older engines will have a single coil located in or near the distributor and the coil pulse wire will be connected to the primary side of the coil. Do not connect directly to any high-tension coil or spark plug wires. If you are not able to locate a coil wire, connect to the RPM wire. You may be able to connect to a camshaft or crankshaft wire, but only as a last resort.

2. When ready to locate the wire, start the engine. The wire that causes the voltage to vary around 10 to 12 volts is the ignition pulse wire. The voltage will be lower than the battery voltage. The battery voltage will be a steady voltage. Your meter will not respond fast enough to see the voltage changes but the voltage will vary enough to see it the correct wire. Do not connect directly to any high-tension coil or spark plug wires.

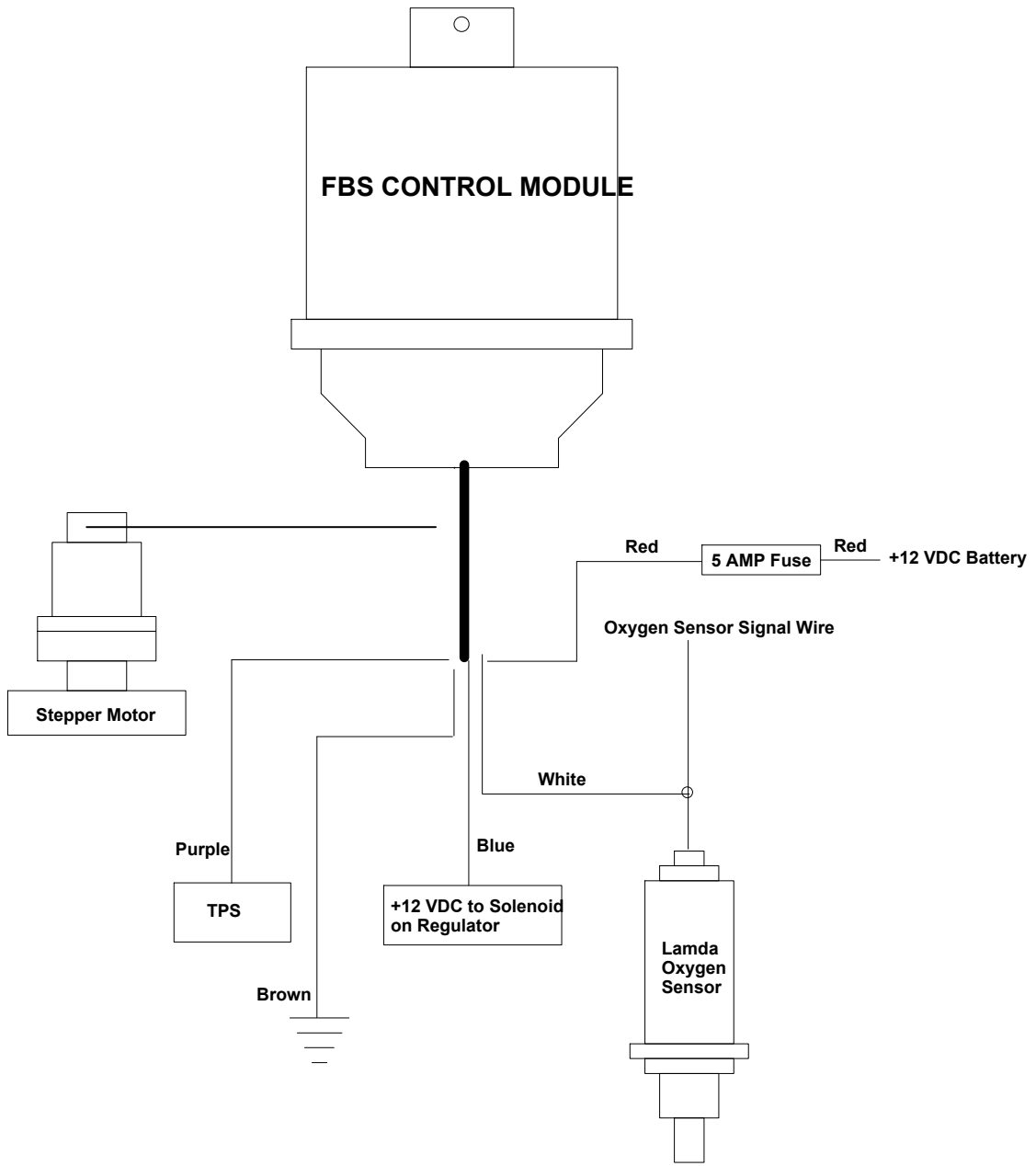
Connecting to the Pressure Gauge Level Sensor

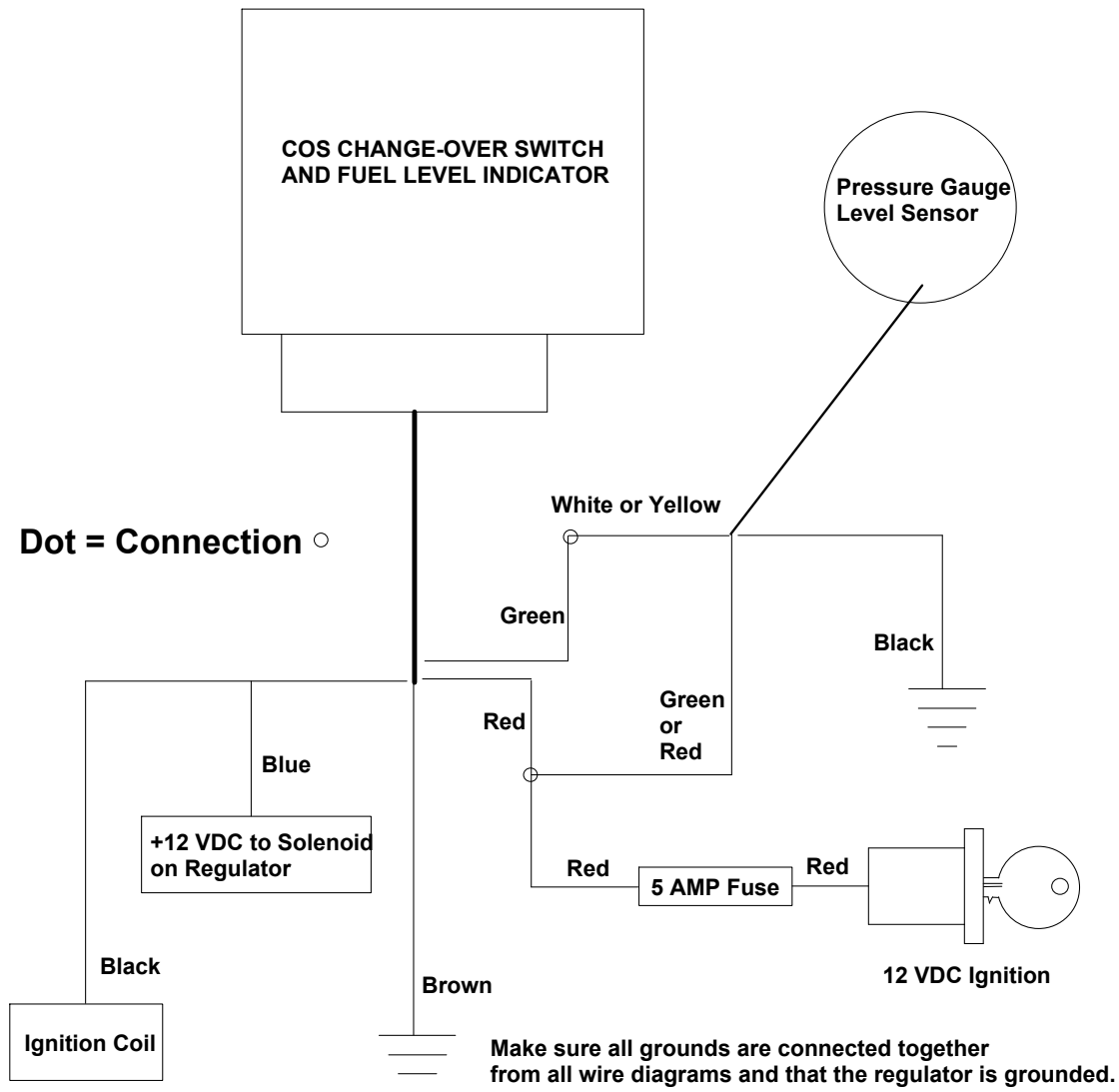
1. Connect the connector and wires supplied to the pressure gauge.
2. Connect the black wire from the gauge to ground. Cut the ring connector off if not needed.
3. Connect the white or yellow wire from the gauge to the green wire from the COS.
4. Connect the green or red wire from the gauge to the red 12-volt ignition wire after the fuse.

If you have model CNGE8, you will connect to only one pressure gauge. The other gauge can be used if one should ever fail. Connect the spare gauge wire harness to the unused gauge connector and insulate the spare wires.

Final Wiring

1. Plug all wire connectors into the proper controllers, emulators, stepper motor, and fuel level sensor (pressure gauge).
2. Install the controllers, and emulators to the back firewall or wherever the best location is to mount them to your vehicle. They should be installed upright with the connector at the bottom with the rubber boot over the connectors to keep the connections clean and dry.
3. Insulate all wires not used. Do not connect any spare wires that are not shown connected in the wire diagrams!
4. Use the wire ties provided to organize and support all the wires.
5. Make sure all wires are away from any moving parts, hot exhaust or engine parts, or high-tension spark plug wires.
6. Install the CNG sticker to the back of the car on the right side.





Installing an Oxygen Sensor and Bung to the Exhaust if needed

1. The bung must be installed before the catalytic converter. Metal shavings must not be allowed in the exhaust system where they can get into the engine or catalytic converter. Remove the exhaust pipe or exhaust manifold if necessary.
2. Wire the oxygen sensor as shown in the wire diagram.

How to Fill the CNG Cylinder

1. After completing all the steps above, you are ready to fill your CNG cylinder. Do not fill it before then.
2. Double check that all high-pressure connections are tight, the cylinder is secure, and the tubing is secure and will not be damaged while operating the vehicle.
3. Leave all fuses out until you return home and are ready to run the engine on CNG.
4. Drive to your local CNG filling station.
5. Bring the wrenches needed to tighten any fittings if there is a leak.
6. Bring your soap test leak towel. All you need is several drops of dish soap on a couple of very wet paper towels. Rub the towels vigorously on all fittings to create suds and watch for any air bubbles, which indicate a leak.
7. Do not fill the cylinder with anyone in or near the vehicle during the first filling, and until the cylinder and the entire CNG system is filled to capacity and you are sure there are no leaks by testing for leaks.
8. Open the cylinder valve and filling nozzle valves before filling.
9. Read and follow the filling station instructions.
10. Connect the filling station nozzle to your filling nozzle.

11. Before filling be ready to check for leaks as soon as the gas is turned on. Fill only to 500 psi and test for leaks. Turn the CNG gas off and the cylinder valve off if you hear or see any leaks. Repair all leaks and then turn on your cylinder and filling nozzle valve. Check for leaks again.
12. If there are no leaks continue to fill the cylinder to 200 bar or 3,000 psi. Test for leaks again. Repair any leaks. If the filling station pressure is low you may not be able to reach the desired pressure. Do not overfill your cylinder.
13. Disconnect the filling nozzle.
14. It is normal for the cylinder to get warm when filling, and for the pressure of the cylinder to drop slightly after it cools.
15. Always when opening the cylinder valve just open it slightly and slowly until the pressure equalizes. Then open it all the way.
16. Drive home to make adjustments before driving on CNG.
17. Do not part the vehicle inside a garage or enclosed area for 24 hours after the cylinder is filled to 3,000 psi and there is no smell of CNG and no more leaks found.

Start up and Adjustment

1. Make sure you have completely read and understand all of these instructions before proceeding.
2. Check the cylinder pressure gauge again. If the pressure is still reading about the same pressure, proceed to step 2. If the pressure has dropped, check for leaks again.
3. Turn on the cylinder valve and filling nozzle valves.
4. Raise the hood and leave it open.
5. Install the fuses into the fuse holders.
6. Your FBS controller comes programmed with our program that works on all engines. You do not need to program the controller. All you need to do is adjust the idle screw on the regulator as instructed below, and your engine will run properly if all wiring is installed properly and the mixer is installed properly. Your FBS controller is self adjusting and continuously adjusts itself for optimum performance. Once adjusted properly it will always run at peak performance.
7. Switch the COS black switch to the left auto position.
8. Start the engine. It will start on gasoline. The orange light indicating gasoline should come on. The green arrow light just to the left should be on indicating it is waiting for the proper RPMs to convert to CNG. After 30 seconds accelerate the engine to 3,500 rpm and then lower to 2,000 rpm. The engine should change to CNG. The engine may stall the first time. If the engine stalls, start the engine again and repeat. If the engine does not convert to CNG, adjust the COS to lower the RPMs the engine converts at by turning the screw with the small black plastic screwdriver provided in the direction indicated to lower the RPMs. If the engine still does not change to CNG, run the engine to 3,000 rpm and push the red switch and it will change to CNG. If now it does not switch, there is something not wired properly. Check all the wiring to find the problem. See the trouble shooting section below. When the engine converts to CNG, the green CNG light will come on and the 4 green fuel level lights will come on if the cylinder is full. The 4 green lights will go out one at a time as the pressure in the cylinder drops. When it is near empty the red light will come on.
9. Let the engine run on CNG for 3 minutes varying the engine speed from idle to 3,000 RPMs.
10. Let the engine idle.
11. Observe the lights of the FBS controller. They can be seen through the cover from the top or end. They should change equally from green to red every 5 to 15 seconds. This is normal and indicates the oxygen sensor is connected and working properly. Green indicates lean fuel and red indicates rich fuel. If the green or orange light only lights the idle screw will need turned out counter clockwise to run richer. If the red light only is on the screw will need turned in clockwise. Turn the idle screw on the regulator ½ rotation at a time and wait at least 30 seconds to see what the lights do before making any other adjustments. If it is running lean or rich adjust until the red and green lights alternate on. The idle screw on the regulator is the hex head brass knob near the heater hose fittings and is turned by hand. Be careful not to unscrew it all the way.
12. Continue to adjust the idle screw in clockwise (lean) ½ turn at a time until the red light does not come on.
13. Turn the idle screw out counter clockwise ½ turn. Wait and make sure the red light comes on. If it does not turn ½ turn counter clockwise again. The red light and green light should start alternating. When they do you are done and the engine should run great. Adjusting the idle near lean keeps the stepper motor near full open while idling so when the gas pedal is pressed the stepper motor is open and the engine will accelerate at peak performance. If the idle is slow or ruff, turning the idle screw ½ to 1 full turn may be needed. If it does not idle smoothly adjust the knob out more until the idle is the smoothest but make sure the red and green lights still alternate on. Run the engine from idle to 3,500 rpm a few times and see that it runs properly and idles properly.
14. If the engine runs properly, take a test drive in a low traffic area for several blocks making several complete stops making sure it idles properly. If it is running well, take a test drive at highway speeds and see that it is running properly. You may notice a slight decrease in power. This is normal and is to be expected. You may get a check engine light on occasion. If you do, you should get a code reader and check and clear the code. It is usually a lean or rich code and is nothing to worry about. If you wait to convert to CNG after

the engine is warm, most engines will not get an engine code. Try it a few times to see after you have driven the vehicle for a couple of weeks. Make sure you clear any codes first.

15. If the engine does not run or idle properly adjust the idle screw again as described above. The test drive should have given the controller time to self-adjust and adjusting the idle screw again should fix any problems you may experience.

Operation

1. The black switch on the COS should be set to the left position. When the switch is in this position, your engine will start on gasoline and switch to CNG on deceleration after reaching 2,000 to 3,000 rpm. The engine will continue to run on CNG until the engine is turned off, or the black switch is pushed to the right position. In the right position the engine will only run on gasoline.
2. If the red switch is pushed while the engine is running, the engine will immediately switch to CNG. Do not switch fuels while the engine is below 1,500 rpm or the engine may stall. You may if you desire, switch fuels manually before driving. This is done before putting the car in gear. Push the throttle to at least 2,000 RPMs and push the red button and you switch to CNG.
3. If the red switch is pushed while starting the engine, the engine will start on CNG. Do this anytime you need to run on CNG only. Do not push the throttle while starting on CNG or the engine will backfire!
4. If you run out of CNG or gasoline, you can change the fuel while you are driving by pushing the proper switch as described above. You will notice a slight hesitation as the fuel changes. It is wise to not run out of either fuel when fuel is available.
5. Watch the fuel indicator lights and fill the cylinder with gas when needed. Do not run out of CNG. This system does not automatically switch to gasoline if you run out of CNG.
6. Keep at least $\frac{1}{4}$ tank of gasoline in your vehicle and when filling with gasoline only fill to $\frac{1}{2}$ tank unless you will need more gas for a long driving range.
7. Turn the cylinder valve off if the vehicle is not going to be used for several days. If the cylinder has been turned off, make sure you turn it on carefully before starting your engine.
8. Never run out of either gas, and never start your engine with the cylinder valve off, or you may get warning lights and the engine may not operate properly and your vehicle may be unsafe to drive. Operate only on gasoline with the black switch pushed to the right position until you have filled the cylinder with CNG and all warning lights have been cleared. You may also need to disconnect the negative battery terminal for several minutes to reset your engines ECU.
9. Visually check your system for leaks or damage each time you fill the cylinder with CNG.
10. If you smell or hear a gas leak, do not start the engine and turn the cylinder valve off and have the leak repaired.
11. It is common for many engines to get a "Check Engine" light while running on CNG and it does not mean your system is not installed and running properly. We recommend purchasing a low cost scanner to read the code and clear it. There are some good buys on www.ebay.com. A lean fuel code is the most common and is nothing to be concerned about.

Maintenance

1. Check your system for proper operation and damage each time you fill with CNG.
2. Check for leaks monthly using the soap test.
3. Check hoses and pressure lines for damage or wear monthly.
4. Keep the dust cover on the filling nozzle.
5. Monthly check the indicator lights on the FBS controller for proper operation while idling and when the engine is warm. Adjust if needed as described in the Start up and adjusting section above.
6. Monthly check the cylinder to be sure it is secure and does not have any damage. If your cylinder has any damage have it inspected by a certified tank inspector.

Troubleshooting

This section is only provided with your kit.

Do not call your dealer or EWS with installation questions unless you are sure there is a problem with your conversion kit. It is your responsibility to install your kit. Study the instructions and drawings carefully. Call a friend for help or take your car to a repair shop for help if needed.