

INSTALLATION INSTRUCTIONS

Atomic LS EFI Master Kit LS2/LS3, PN 2950

ONLINE PRODUCT REGISTRATION: Register your MSD product online. Registering your product will help if there is ever a warranty issue with your product and helps the MSD R&D team create new products that you ask for! Go to www.msperformance.com/registration.

Thank you for selecting the Atomic LS EFI System! MSD's Atomic EFI systems are designed with two major goals; to simplify EFI and deliver better overall performance from your engine. Simplicity is achieved through wired-less technology to ease installation plus the Atomic is simple to program with no PC required! Performance is delivered through advanced control of the fuel and ignition, just as you'd expect from MSD.

Parts Included:

- | | |
|--|--|
| 2 - Integrated Fuel/ECU Rail Assemblies | 1 - TPS Sensor Harness |
| 1 - Power Module | 2 - 90° -6 AN fittings |
| 1 - Handheld Monitor | 4 - -6 AN fittings |
| 1 - Wideband O2 Sensor, Bung and Plug | 1 - 15" High Pressure Fuel Hose |
| 2 - MAP Sensor Adapter Harnesses | 2 - Fuel Hose Clamps |
| 2 - Camshaft Sensor Harnesses, 1x and 4x | 4 - Installation Brackets |
| 2 - Crankshaft Harnesses, 24x and 58x | 4 - Intake Manifold Bolts |
| 4 - Injector Harnesses | 8 - Injector Retainers |
| 1 - IAT Sensor and Grommet | 8 - 8/32" Socket Head Cap Screws |
| | 1 - 4G Micro SD Card |
| | 4 - Grommet, Sleeves and Mounting Screws |

Parts Required, Not Included:

- Injector O-Rings
- Fuel System: Fuel Pump, Regulator, Line
- **LS1 and LS6 Installation Kit** - PN 2955
For use with Master Kit PN 2950. Provides the correct brackets and EV-1 injector connectors for the early car intake manifolds identified by a 3-bolt throttle body.
- Thread Sealer for Intake Bolts

Not legal for use on pollution controlled vehicles: The MSD Atomic LS EFI system is not CARB approved for use on emission controlled vehicles. This system is designed to control the EFI and ignition on LS based engines being retro-fit into older vehicles that do not require emission controls.

WARNING

Installation of this product requires detailed knowledge of automotive systems and repair procedures. Installation of fuel system parts and any fuel tank modifications must be carried out by a qualified automotive technician. Installation of fuel system parts requires handling of gasoline. Ensure that work is performed in a well ventilated area with an approved fire extinguisher nearby. Extinguish all open flames, prohibit smoking and eliminate all sources of ignition in the area of the vehicle before beginning the installation.

When working with fuel systems, eye goggles and other safety apparel should be worn to protect against debris and sprayed gasoline. The finished work must be thoroughly checked to ensure there are no fuel leaks.

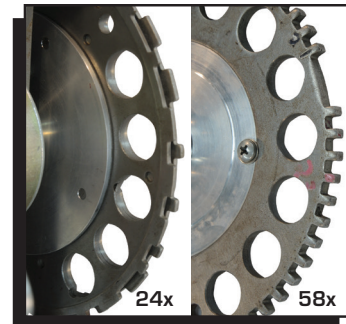
CAPABILITIES

The Atomic LS EFI system is designed to fit OE intake manifolds, as well as some aftermarket intakes. The Atomic EFI is a self-tuning fuel system that continuously adjusts after the basic configuration is complete. There is no laptop programming. Based on the engine descriptors you input, the Atomic will automatically create a base fuel map to get the engine running. Once running, the self learning system will optimize those maps resulting in the best performance possible. If you change altitude, outside temperature, or other factors the Atomic will adjust accordingly, on the fly. This ensures that your engine will produce excellent driveability at all times, even if you drive from the sunny coast to the cold mountains.

The Atomic LS fuel injection system is capable of running the fuel and ignition system of most LS engines. The system incorporates OE style connectors to use with the factory sensors on the engine. The only external sensor required to add is the supplied Wide-Band Oxygen sensor.

There are four main components of the Atomic LS system; the driver's side and passenger side integrated fuel rails, the Power Module and the Handheld Monitor. The ECU of the system is divided onto the fuel rail assemblies and communicate to each other, as well as the Power Module, through MSD's proprietary CAN-Bus technology.

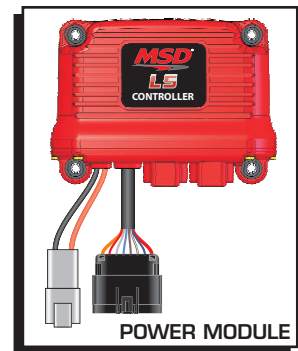
Crankshaft Trigger Wheel ID: It is important to know what crankshaft trigger wheel your engine is fit with. There are two; early engines used a 24-tooth wheel and later model engines use a 58-tooth wheel. These can be identified by removing the crank sensor (located behind the starter) and looking inside the engine (see photo at the right).



Fuel/ECU Rails: The unique fuel rails of the Atomic LS EFI system also incorporate the ECU of the system. The two banks receive power from the Power Module and communicate to the system through MSD's CAN-Bus network. To install the rails to the intake manifold, the covers will need to be removed (which is outlined in the instructions).

Each bank has OEM connectors that plug into the injectors, coils and specific sensors of the engine. Each bank has a ground wire that must be connected to the block. The fuel line inlets of the rail accept -6 AN and -8 AN fittings and internally are equivalent to a -8 line (-6 AN fittings are supplied.)

Power Module: The Power Module of the Atomic LS is the communication hub of the system and provides the high current fuel pump circuit and other input/outputs for optional features. The unit has two ports for the MSD CAN system as well as a wiring harness. There are connections for the WB02, the Handheld Monitor as well as power and communication to the integrated fuel rails.



Programming: The Atomic EFI is a self-tuning fuel system that continuously adjusts after the basic configuration is complete. There is no laptop programming. Based on the engine descriptors you input, the Atomic will automatically create a base fuel map to get the engine running. Once running, the self-learning system will continuously adjust those maps to obtain the desired air/fuel ratio. This feature ensures that your engine will have the right fuel mixture at all times, no matter where you are driving.

Intake Manifolds: The Atomic LS EFI system is designed to fit most OE intake manifolds, as well as some aftermarket intakes. There are different mounting brackets available for several of the key intake manifolds. MSD offers two Installation Kits that are supplied with different injector connects and fuel rail brackets for manifolds such as the LS1 or truck. They are described in the 'Not Included' list of parts above.

Fuel System: The Atomic LS system can be used with return or returnless EFI system. Review the Fuel System Information section starting on page 3 for detailed information.

Wide-Band O2 Sensor: A Wide-Band O2 sensor is supplied in the Atomic LS Master Kit. This sensor is responsible for constantly monitoring the exhaust gases and relaying that information to the ECU where adjustments are constantly made to the fuel delivery in order to meet the air/fuel targets. Only one sensor is required. Page 5 outlines the sensor installation.

Crank Sensor: The LS engine platform has used two different crank position sensors through the years. There is a 24-tooth wheel or a 58-tooth wheel on the crankshaft. The sensor has always been located behind the starter. The 24-tooth sensor has a black connector whereas the 58-tooth sensor has a gray connector. The Master Kits are supplied with connectors for both the 24x and 58x trigger sensors.

Cam Sensor: The Cam Sensor of LS engines has changed throughout the years. Not only it's location, but its wiring as well. Early models have the cam sensor located at the back of the block near the deck surface. During 2005, as a running change, the location changed to the front of the block between the cam and crankshaft. The Atomic LS system can function with both designs.

Throttle Body and Sensors: The Atomic LS requires a mechanically operated throttle body. In the future Throttle by Wire applications will be covered. The Atomic has all of the OE connections for the throttle body including Throttle Position (TPS) and Idle Air Control Solenoid (IAC).

Intake Air Temperature (IAT) Sensor: This sensor is supplied and it is recommended to install it in the air intake duct before the throttle body. A 3/4" hole is required for the sensor.

Rev Limiter: There are two settings for a rev limiter; one through fuel, one through ignition. There is an optional 2-Step Rev Limiter that can be used on the starting line for a low rpm limit. This is temporarily activated through the Dark Blue wire of the Power Module to produce consistent launch rpm.

Aftermarket Auxiliary Settings: The Atomic LS system can support aftermarket performance parts or power adders that carry a CARB Executive Order number. There are accessory controls to properly adjust the timing and fuel delivery to meet the requirements of these auxiliary components. See the advanced settings on pages 15-16.

FUEL SYSTEM REQUIREMENTS

The Atomic LS fuel injection system requires a high pressure fuel pump system. The fuel system is not supplied due the large variety of applications incorporating the LS engine platform. Depending on your engine combination, the Atomic LS requires a minimum of 58-62 psi to operate. When selecting a pump, regulator and lines, be sure each component is designed to perform at high pressure. MSD offers fuel pumps, hose and accessories to complete your installation. Following are some guidelines in helping set up a fuel system for your Atomic as well as components available separately from MSD.

- The Atomic is capable of operating with a return or returnless style system. For best results with either system, MSD strongly recommends an in-tank pump. Installing the fuel pump in the tank results in quieter operation, less chance of cavitation and a reduction in pump temperature.
- When running a returnless fuel system (Pulse Width Modulated) the fuel pump must be mounted in the tank. It is recommended to use an MSD Atomic Fuel Pump, PN 2925 or PN 2926.
- MSD supplies -6 AN clamp-style fittings for the fuel rails. These fittings must be used with MSD's high pressure EFI hose. Refer to page 9 for installation.
- If mounting the pump in the tank is not an option, install the pump as close as possible to the tank. Within 2-feet of sending unit is recommended.
- Do not use hard line when plumbing the fuel system. When using a PWM fuel system, pulsations and harmonics could cause unstable fuel pressure resulting in pump cavitation or poor engine performance.

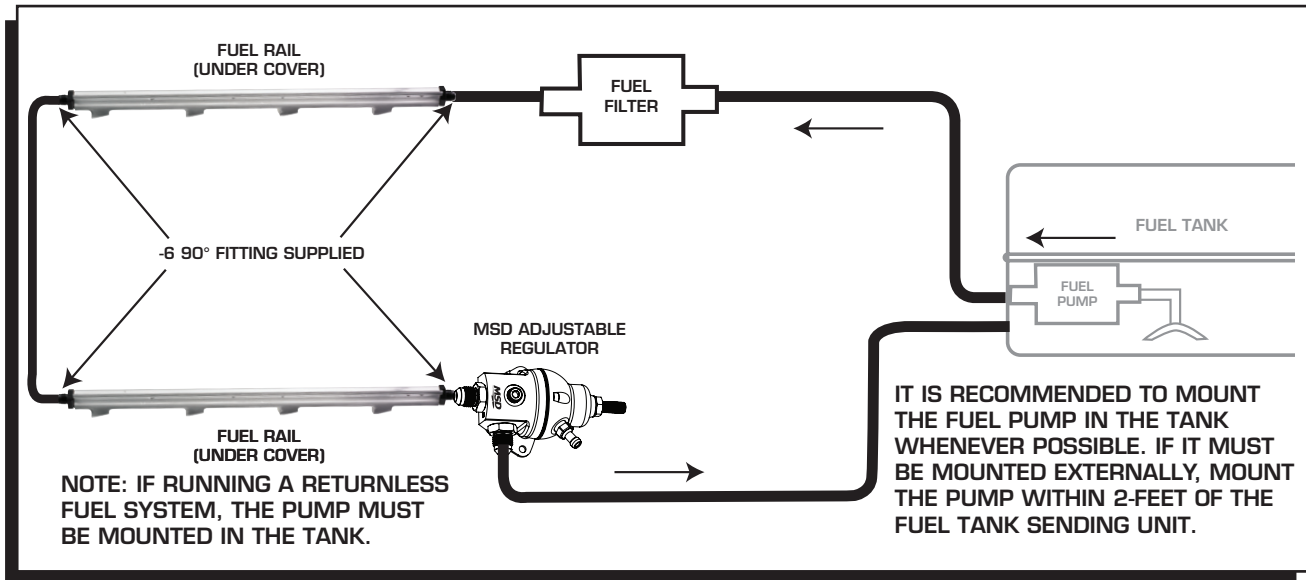


Figure 1 Atomic LS Return Fuel System.

In-Tank Pumps

The MSD Atomic Fuel Pump (not supplied) can be used in the tank however it would require a sock, or filter element, on the pickup side. It is important to note that the wiring used to run the pump will need to meet requirements to be submersed in fuel. When wiring an in-tank pump, it is recommended to use a wire that conforms to SAE specifications J1128 and J378. This wiring features a Thermoplastic insulated wiring with polyvinyl chloride insulation for protection against gasoline, oil, and more. In addition, different fuel line will be required internally if the pump is to be mounted in the tank. Fuel line that meets SAE 30R10 specifications MUST be used. Failure to do so will cause severe damage to your engine and/or fuel system.

WARNING: Improper installation or use of fuel system components can cause severe damage your engine and/or fuel system that will not be covered by the manufacturer's warranty.

Atomic Fuel Pump, PN 2925: This pump features 3/8" inlet and outlet. The pump will support approximately 525 hp and is approved for in-tank use (no wiring or in-tank mounting hardware/pickup element are supplied).

Fuel Pump Kit, PN 2920: This Kit is supplied with MSD's PWM Fuel Pump, a pre and post-filter, 15-ft of 3/8 fuel injection line and mounting hardware.

Fuel System Return Kit, PN 2922: If you plan on running a return line with your Atomic LS, this kit provides another 15-ft of 3/8" injection line, an MSD Regulator and -6AN-to-hose fittings.

High Horsepower Fuel Kit, PN 2921: This pump will support the power demands of engines up to 650 horsepower. The pump features 3/8" inlet and outlet. The pump will support approximately 650 hp and is approved for in-tank use (no wiring or in-tank mounting hardware/sock are supplied).

WARNING: MSD's hose fittings are designed for use with MSD fuel hose only. Do not use the MSD fuel hose with other fittings. Do not use MSD fittings with other fuel hose. Compatibility issues may cause fuel leaks.

WIDE BAND OXYGEN SENSOR INSTALLATION

The MSD Atomic EFI system requires a single Wide Band Oxygen Sensor (WBO2) for operation. MSD suggests that the bung for this sensor be installed prior to starting any other part of the conversion process. By having the WBO2 in place first, there is a reduced chance of the vehicle being immobilized for an extended time. The bung for the WBO2 provided by MSD has a plug included so that the vehicle can be driven between the time of exhaust modification and installing the rest of the Atomic system, if needed.

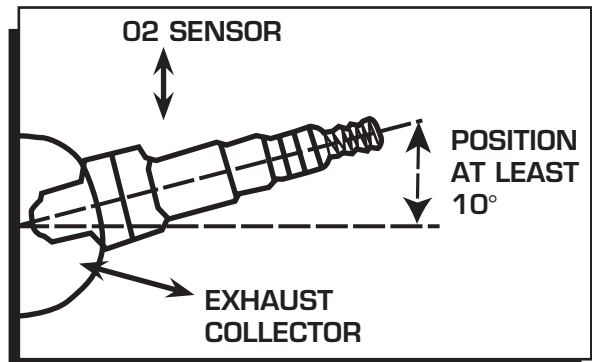


Figure 2 WBO2 Sensor Location.

The WBO2 can be installed in downstream of either exhaust bank. The sensor connects to the Power Module, so install the sensor on the bank closest to where you plan to mount the Module. The bung should be installed by a qualified exhaust technician and pressure tested. Proper installation of the oxygen sensor is critical to the performance of the Atomic EFI. Improper installation could lead to engine damage.

1. Locate the ideal spot to install the WBO2.
 - a. This location should be 2-4 inches after the exhaust collector. The sensor must be more than 18 inches forward of the exhaust tip. For applications where short or open headers are used, install the WBO2 in the primary tube of the rear cylinder at least 8 inches away from the exhaust port. The Atomic will not work on "Zoomie" style headers.
 - b. The WBO2 sensor should be at least 10° above horizontal to allow condensation runoff. Without this angle the sensor is significantly more likely to sustain water damage (Figure 2).
 - c. Never place a WBO2 on the outside of a bend.
 - d. The WBO2 **must** be mounted in the exhaust prior to any catalytic converter, if applicable.
2. Drill a 7/8" hole in the exhaust where the WBO2 will go.
3. Weld in the supplied bung. Ensure the weld goes completely around the bung and is air tight.
4. Insert supplied plug in bung. Never run the vehicle with a WBO2 installed but not powered; it will damage the sensor.
5. When completing the Atomic EFI installation, remove the plug and insert the WBO2 for use. MSD suggests using a small amount of anti-seize on the threads.

Note: The Atomic EFI is extremely sensitive to air leaks in the exhaust system. Any air leak between the engine and the WBO2 will cause the Atomic to have false readings, which can lead to poor engine performance, misfires, and an inability to properly auto-tune. Extended running of the Atomic EFI with an exhaust leak can result in detonation and severe engine damage. Improper installation of the oxygen sensor, and any damage that may result from such an installation, is not covered by the manufacturer's warranty.

INSTALLING THE INTEGRATED FUEL/ECU RAILS

The integrated fuel/ECU rails are supplied with the covers installed. The rails are designed to install to OEM intake manifolds and many aftermarket designs. To prepare the rails for installation, locate the four intake manifold bolts supplied with the Atomic LS Master Kit, as well as the four mounting brackets.

It is important to note at this point, that you have the correct injectors for your application as well as O-ring seals and the injector retainers. These components are not supplied in the master kit.

WARNING: Care must be used when installing the fuel injectors and rail assemblies.

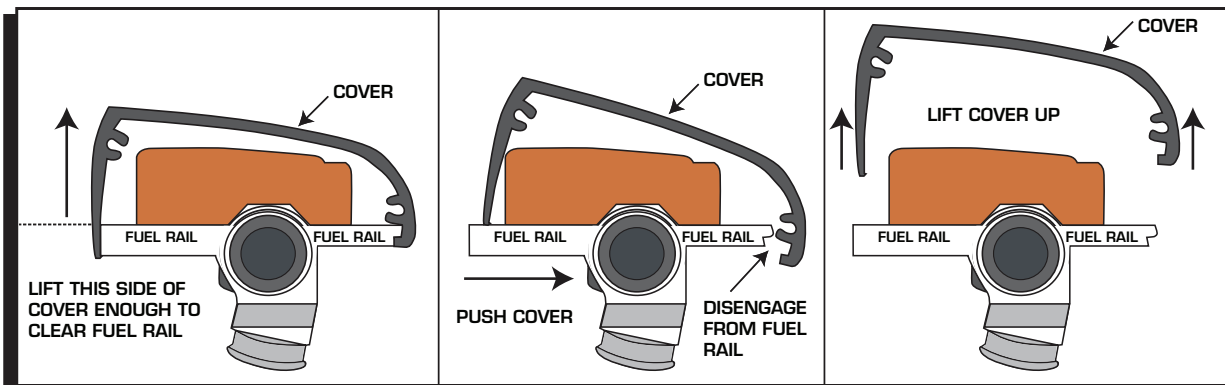


Figure 3 Removing Fuel Rail Covers.

The following steps will guide you through the installation of the two fuel rail assemblies.

1. The fuel rails are supplied with the covers in place. Remove the covers to prepare and install the rail assemblies (Figure 3). Also, determine which rail is which by reviewing the sensor connectors and location as shown in Figure 9 on page 8.
2. Figure 4 shows the location for the fuel rail brackets. Remove the hardware from the intake manifold and install the brackets as shown using the supplied longer intake bolts. Use GM 1245383 thread sealant or equivalent on the intake manifold bolts. Note that the passenger rear bracket requires a spacer (supplied) as shown in Figure 4. Torque the new intake bolts to 89 in-lbs.

NOTE: If installing the intake manifold for the first time follow the torque sequence in Figure 4. Torque in steps; 44 in-lbs first, followed by 89 in-lbs. It is recommended to hold a straight edge against the brackets to ensure alignment while torquing.

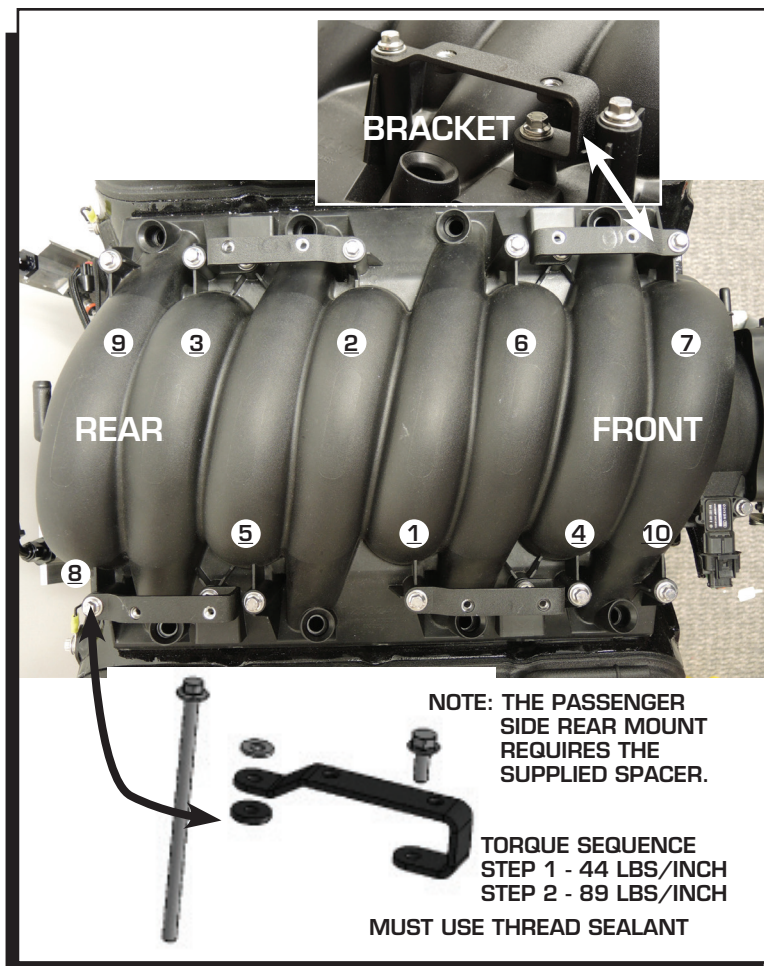


Figure 4 Fuel Rail Bracket Locations.

3. Locate the four injector harness pigtails. These need to be connected to the fuel rails (Figure 5).
4. With the brackets and injector pigtails installed on the intake manifold, it is time to install the injectors to the fuel rails. Apply a dab of engine oil to the o-ring seals of the injectors. Insert the injector with its connector facing towards the outside of engine into the fuel rail. Install the injector retainer securely and check that it is properly installed and sealed to the rail (Figure 6). Continue with the other three injectors.
5. With the injectors installed, it is time to install the fuel rail assembly to the engine. Position the rail assembly over the intake manifold with the injectors aligning with their mounting pockets on the intake (Figure 7).
6. With the injectors lined up, lightly press down on the fuel rail using caution not to bind any of the injectors or connectors. The fuel rail assembly should come close to contacting the manifold brackets with very little pressure. Use caution not to bind or tear any injector O-rings.

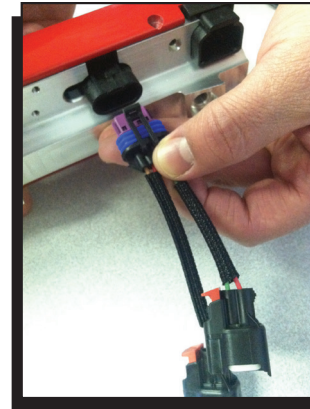


Figure 5 Connecting Injector Pigtail.



Figure 6 Installing the Injectors.

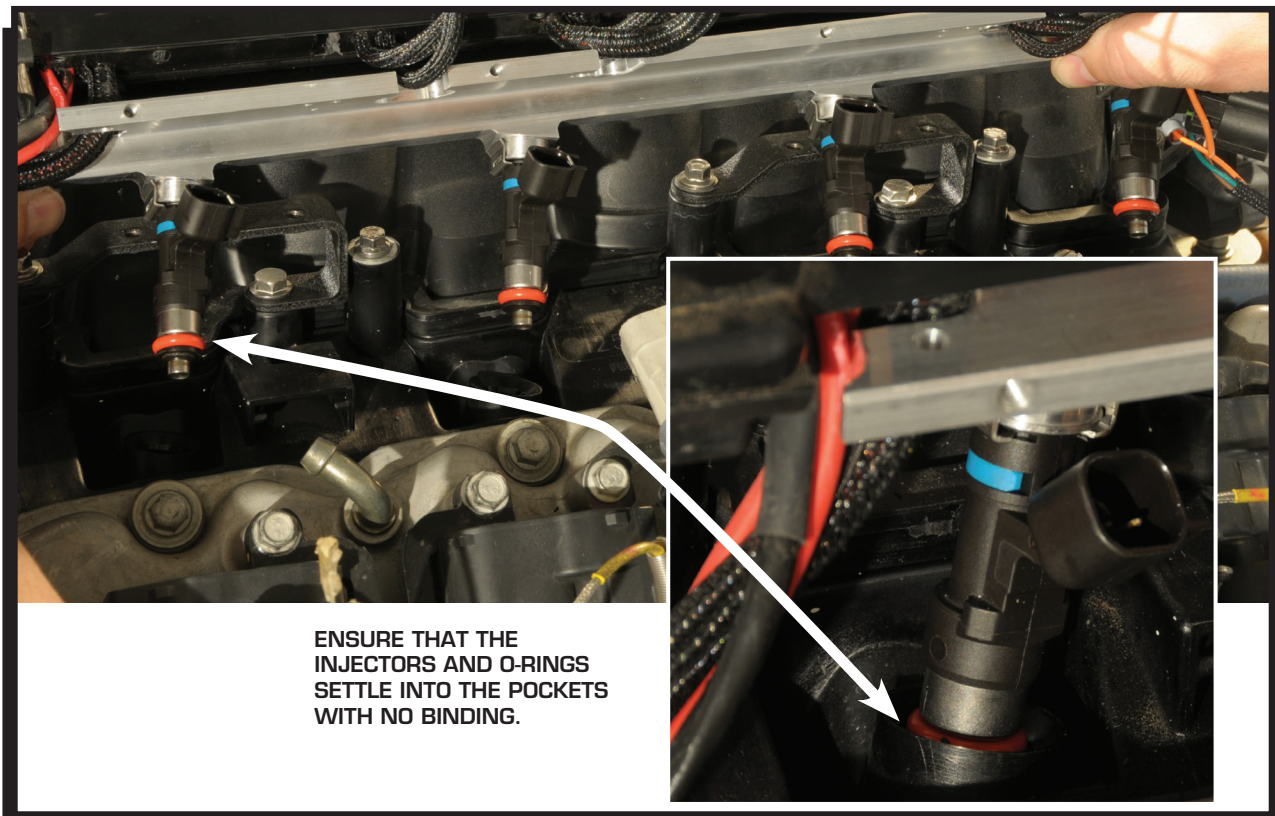


Figure 7 Installing the Rail Assemblies.

7. Install the retaining bolts and washers to secure the fuel/ECU rails to the mounting brackets. Move between the retainers as they are tightened to ensure even pressure (Figure 8).
8. Connect the injector wiring, coil packs and other wiring.
9. Repeat (Figure 9) the procedure for the opposite engine bank.



Figure 8 Tighten the Fuel Rail Bolts.

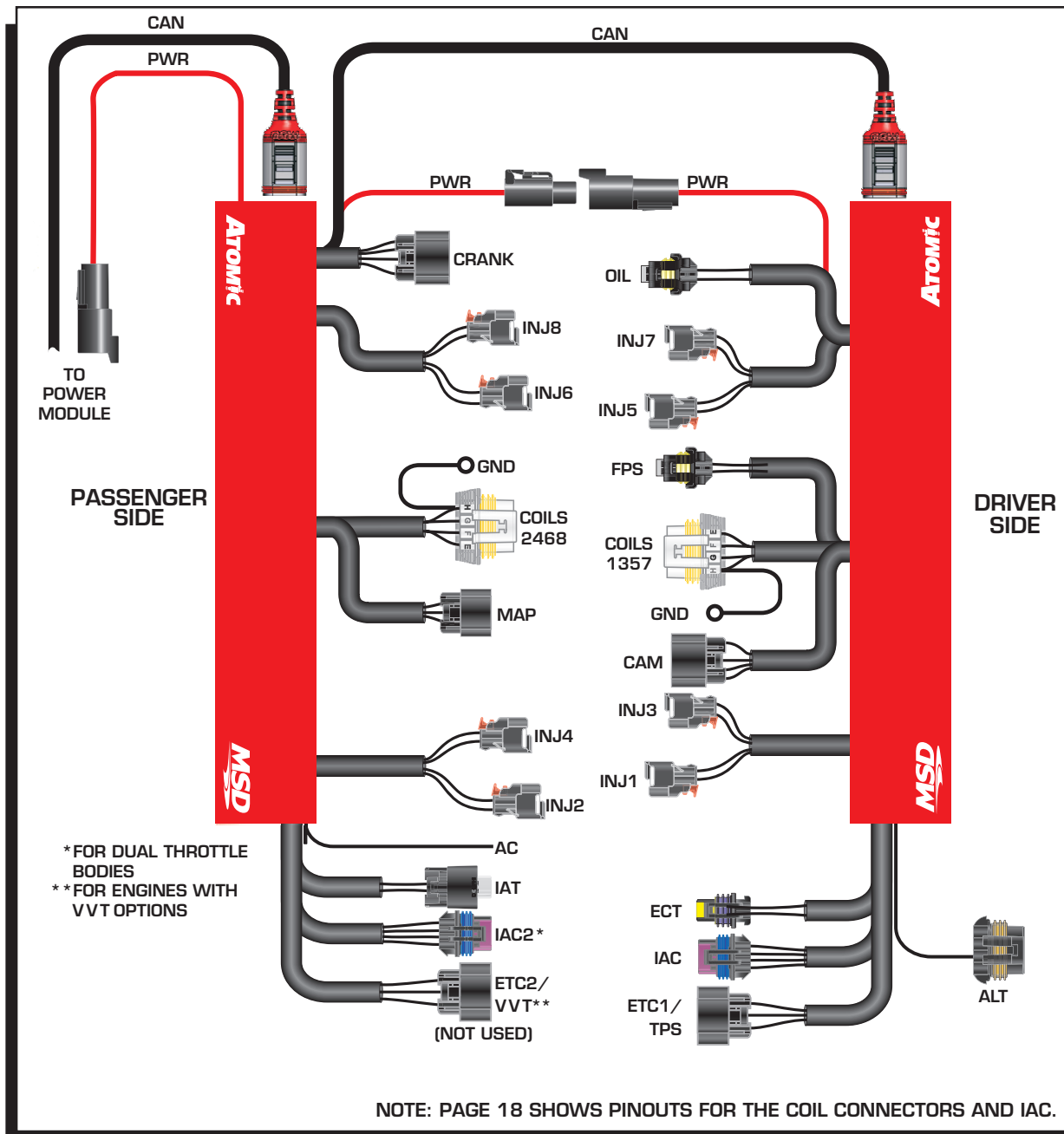


Figure 9 Fuel Rails and Connections.

Fuel Inlet Fittings and Cross-Over Line: LS engines require a cross-over fuel line to route the fuel from one bank to the other. This is typically done at the front of the engine. (Figure 10) Due to the variety of intake manifolds and accessories, a cross-over line must be made for each application



Figure 10 Installing Fuel Hose to AN Fittings.

MSD supplies a length of fuel hose and two 90° -6AN fittings to prepare a fuel crossover line. The fittings are designed for use with the supplied hose and clamps.

Proper installation begins with a clean, square cut of the hose. A hose cutting tool or a new razor blade are recommended. When installing the hose, it is important that the hose is pushed all the way to the backstop. The clamp must be centered between the fitting rib and the backstop before it is tightened.



Figure 11 Severing the Hose Properly.

1. Determine the length of hose needed. Mark the hose and cut it using a hose cutter or new razor blade. There should be minimal disturbance of the jacket and braids. The cut plane should be perpendicular to the hose axis (Figure 11).
2. Before installing the hose to the fitting, it is important to anchor the fitting (Figure 12). Proper installation may be difficult when holding the hose and fitting with your hands. For best results, the hose should be installed with minimal twisting or pausing.
3. Apply a light coating of oil to the rib on the fitting. Use care not to get oil on the outside of the hose as it will be impossible to maintain a grip on the hose.
4. With the fitting anchored securely, push the hose over the fitting until it bottoms against the backstop. Center the clamp between the rib and backstop before tightening (Figure 13).

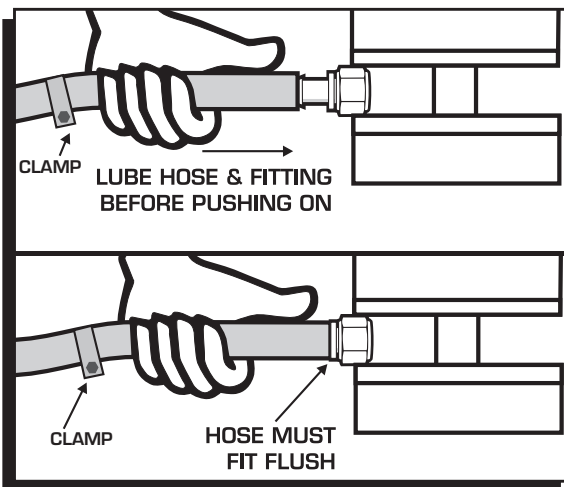


Figure 12 Installing Fuel Hose to the Push-Lock Fittings.

WARNING: The supplied MSD AN Fittings are designed only for use with the supplied fuel hose. We do not recommend mixing fittings and hoses from different manufacturers. Doing so may result in fuel leaks and expose other dangerous incompatibilities.

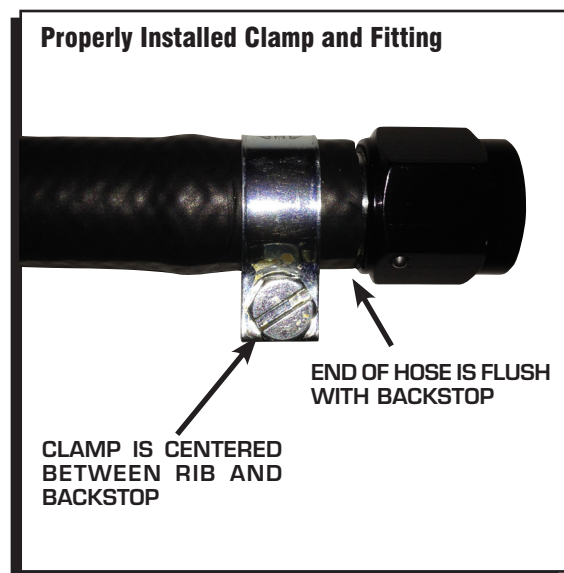


Figure 13 Installed Fitting and Clamp.

POWER MODULE INSTALLATION

The Power Module of the Atomic EFI system handles high current circuits such as the fuel pump and WBO2. The unit has two ports for the MSD CAN system as well as a wiring harness. The CAN ports will provide communication between the Power Module, the passenger side fuel/ECU rail and the Handheld Monitor.

It is important to select a proper mounting location for the Power Module. The unit can be mounted in the interior or the engine compartment as long as it is away from direct heat sources. It is not recommended to mount the unit in an enclosed area, such as the glovebox. When a suitable location is found, make sure all wires reach their connections. Also be sure that the CAN port can be accessed for use with the Handheld Monitor.

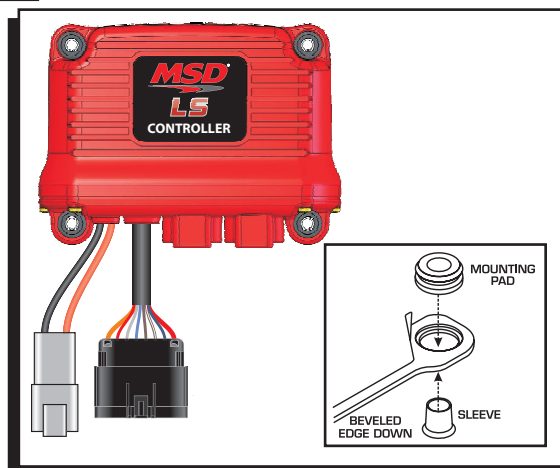


Figure 14 Power Module Wiring Diagram.

Use the Power Module as a template and mark the location of the holes. Use a size #20 drill bit to prepare for the supplied self tapping screws. Install the supplied rubber grommets (Figure 14).

POWER MODULE WIRING

There are a number of electrical connections on the Power Module that are required for proper operation (Figure 15). Other wires, such as the nitrous input, 2-step rev control or electric fan controls, only need to be connected if their optional functions are being used. In the chart below, wires marked "REQ" must be connected for the system to operate while those marked "OPT" are optional depending on the features being used. For the installation it is recommended to connect only the required wires.

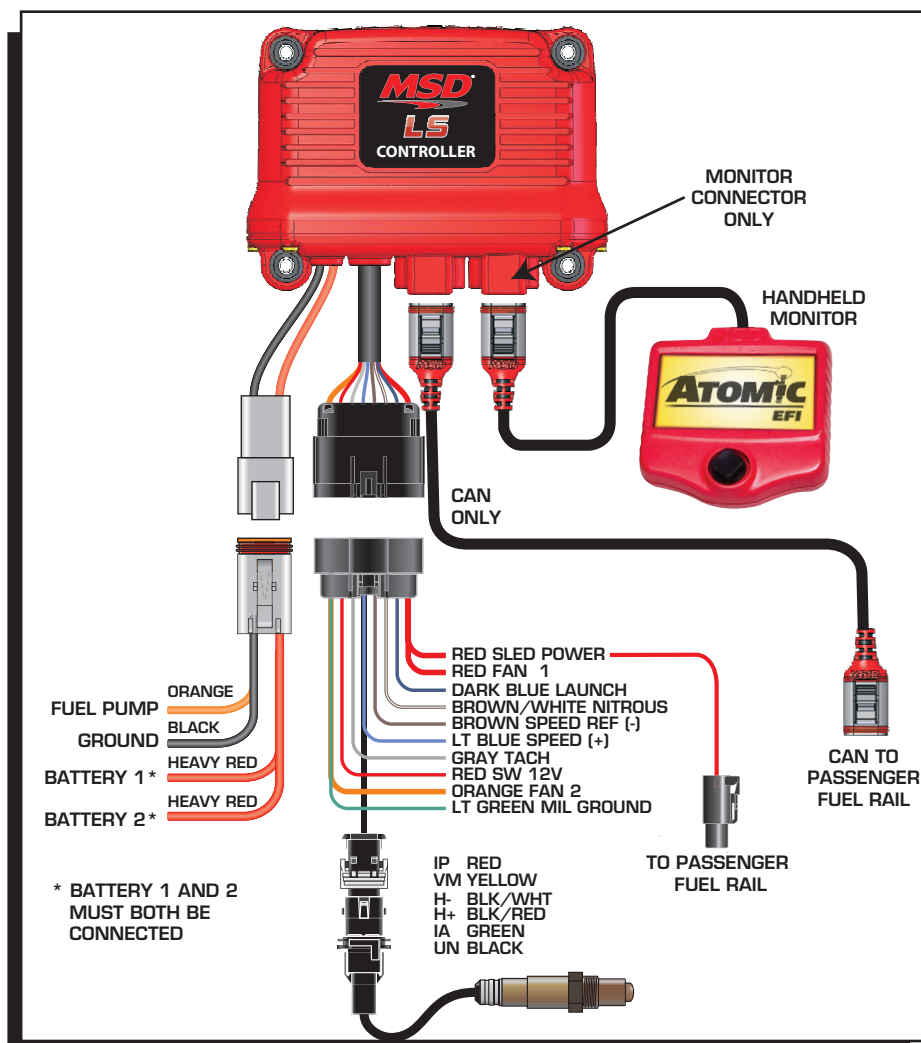


Figure 15 Power Module Wiring Diagram.

Power Module

CONNECTOR Deutsch 4-Way	Pin	Color	Use	Function	
	1	Red	REQ	Battery 1, Connect to Positive Battery terminal.	
	2	Black	REQ	Ground, Connect to solid, clean engine ground.	
	3	Orange	REQ	Pump, Connect to Fuel Pump Positive terminal.	
	4	Red	REQ	Battery 2, Connect to Battery Positive terminal.	
CONNECTOR GT Series 16 Way	A	Red	OPT	Fan 1, Supplies ground to activate Fan 1	
	B	Blue	OPT	Launch, Connect to 12 volts to activate 2-step RPM limit.	
	C	Bro/Wht	OPT	Auxiliary Timing and Fuel, When supplied with 12 volts, timing will be retarded and the air/fuel ratio will be corrected to the target auxiliary setting.	
	D	Brown	OPT	Speed Ref.	
	E	Lt Blue	OPT	Speed Signal	
	F	Gray	OPT	Tach, Supplies 12V square wave signal	
	G	Red	REQ	Switched 12V, Connect to ignition switch	
	H	Orange	OPT	Fan 2, Supplies ground to activate Fan 2 at desired temperature.	
	J	Red	REQ	Supplies power to the Fuel Rail	
	K	Red	REQ	WBO2	IP
	L	Yellow	REQ		VM
	M	Blk/Wht	REQ		H-
	N	Blk/Red	REQ		H+
	P	Green	REQ		IA
	R	Black	REQ		UN
	S	Lt Green	OPT	MIL Ground	It is recommended to connect a Malfunction Indicator Lamp (MIL) to your dash. A simple bulb is required with switched 12 volts on one side and this Light Green wire on the ground side. If there is a malfunction in the system, ground will be supplied through this wire to illuminate the lamp.

Sleds

Wire	Function
(2) Black wires w/ring lugs	Coil ground wires that should be attached to the cylinder heads.
(1) Orange flying Lead	A/C kick up wire. This should be wired to a source that gets 12V then the A/C compressor clutch is engaged. This will open the IAC up slightly and will also kick on fan #1 regardless of coolant temperature.

STOP HERE

REVIEW YOUR INSTALLATION

It is recommended to review your installation at this point. The 02 Sensor should be installed and connected as well as the Power Module and corresponding wiring. Confirm that all of the rail wiring connections are complete including the injectors and sensors. Ensure all fuel lines and fittings are tight and secure from any heat sources or sharp edges. The next section will require powering the Atomic LS to go through the Initial Setup menus and the fuel pump will run. **DO NOT START THE ENGINE AT THIS TIME!**

ENGINE IDENTIFICATION INFORMATION

GM has produced a number of different LS based engine platforms. When setting up your Atomic LS system, it is helpful to know the model engine you have. If you don't know what engine you have, locate the casting number on the back of the block, below the driver's side cylinder head (Figure 16). That number will assist in determining what engine you have and can be looked up at www.atomicEFI.com. If you still have no idea of your engine's origin, you can select a base calibration from the menu to get the engine started.



Figure 16 Casting

WARNING: DO NOT ATTEMPT TO START THE ENGINE. Before turning the ignition key to the ON position, confirm all fuel line connections are tight and all electrical connections are correct. After confirming all electrical connections and fuel lines, turn the ignition key to the ON position. Check every hose and fitting connection for any signs of fuel leaks. The Handheld screen should illuminate and display the Main Menu.

PROGRAMMING

The Handheld Monitor plugs into the Power Module via the CAN connection. It can be removed once the initial setup is complete, or can remain connected for use of features such as the dash or digital gauge displays. The Handheld Monitor features a joystick to scroll through the settings. Scroll up and down to the setting and push the joy stick to the right to select the options. When the selection is made, either push in, or go back (push to the left) to save/confirm settings changes.

MAIN MENU

Six selections will come up the Monitor under the Main Menu. If this is the first time powering up the Atomic LS, select Initial Setup (Figure 17).

Atomic LS Dash: This selection allows you to view a variety of engine functions in real time when the engine is running. Refer to page 19 for a complete description of each parameter in the Atomic Dash.

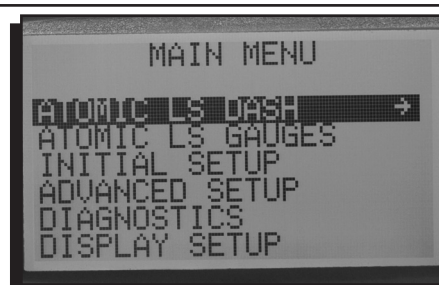
Atomic LS Gauges: This setting puts five important values in gauge form to ease viewing the data. This includes engine rpm, oil pressure, engine coolant temperature, speed (when connected), battery voltage, and air/fuel ratio.

Initial Setup: These are values that are required to start the engine.

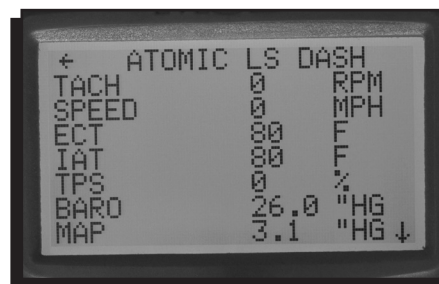
Advanced Setup: Optional settings for features and optimized drivability settings.

Diagnostics: This screen will help you troubleshoot and identify potential issues.

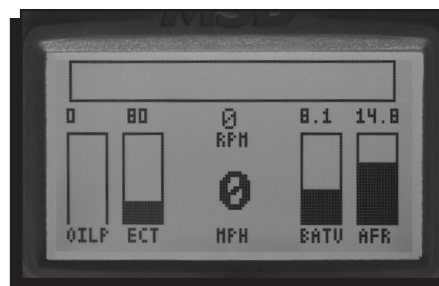
Display Setup: Provides adjustments for the appearance of the monitor screen. See page 18 for more information.



Main Menu



Atomic LS Dash



Atomic LS Gauges

Figure 17 Monitor Main Menu

INITIAL SETUP PROGRAMMING

Scroll down to Initial Setup and push the joystick to the right. The following parameters must be programmed.

Engine Type: This value determines the engine platform (Figure 18). There are over 26 engine combinations to select from. This setting is important as once an engine type is programmed, other settings will default to the OEM components that were supplied on that engine. For example, if LS1 is selected, the coil, injector and MAP sensor will automatically set to the OEM components.

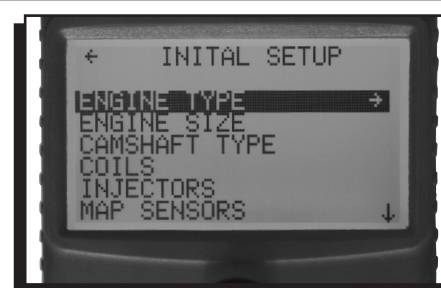
Engine Size: Once the engine type has been selected, the stock cubic inches will automatically be set. If the engine has been modified with a different stroke or bore, select and input the size. The range is from 100-800 cubic inches (Figure 18).

Camshaft Type: There are three cam selections to choose; Street/Stock, Mild and Performance. Note that if the lobe separation angle (LSA) is less than 108°, it is recommended to input the next larger cam. Cams with over 250° are not recommended for use with the Atomic LS system (Figure 18).

CAM	DURATION AT .050"
Street Stock	Less than 210°
Mild	211° - 230°
Performance	231° - 250°

Coils: Once the engine type is selected, the OEM coil pack will be automatically loaded in the default calibration file. If a different coil or an MSD LS Coil pack is used, change the setting to the correct coil type (Figure 18).

Note: There is a setting in Display Setup labeled User Mode. When User Mode is changed from Basic to Advanced, the coil selection menu will open up to all the coil combinations preprogrammed into the Atomic LS system.



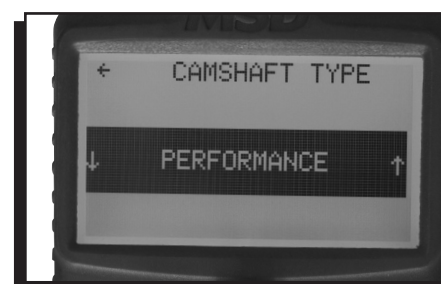
Handheld Main Menu



Engine Type



Engine Size



Camshaft Type



Coils

Figure 18

Fuel Injector: Once the engine type is selected above, the OEM style injector will be automatically loaded in the default calibration file. If a different injector is used, change the setting to the correct injector. Most LS based injectors have the part number stamped on them (Figure 19).

Note: There is a setting in Display Setup labeled User Mode. When User Mode is changed from Basic to Advanced, the fuel injector selection menu will open up to all the fuel injector combinations preprogrammed into the Atomic LS system. This setting will also unlock a setting called User Defined. User Defined allows the injector flow rate to manually be entered by selecting Set Calibration (Figure 19).

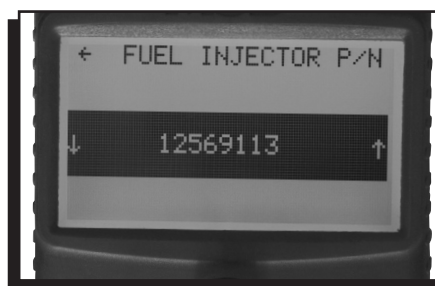
MAP Sensor: Once the engine type is selected above, the OEM MAP Sensor will be automatically selected. (Figure 19).

Note: There is a setting in Display Setup labeled User Mode. When User Mode is changed from Basic to Advanced, the MAP sensor selection menu will open up to all the MAP Sensor combinations preprogrammed into the Atomic LS system. This setting will also unlock a setting called User Defined. User Defined allows the Slope and offset to manually be entered by selecting Set Calibration.

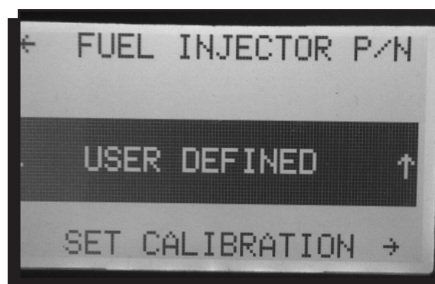
Fuel Pump Type: There are three selections for the fuel pump system. Select the system in use with the Atomic LS system (Figure 19).

- **Pulse Width Modulated:** This selection is used only when running a returnless fuel system with NO regulator.
- **Non-PWM with Regulator:** This selection is used when running a return style system with a regulator.
- **PWM with Regulator:** This selection is used when running a return style system with a regulator. It will run the pump at 50% duty cycle at idle producing quieter pump operation and will increase the duty cycle to 100% as the throttle and injector load increase.

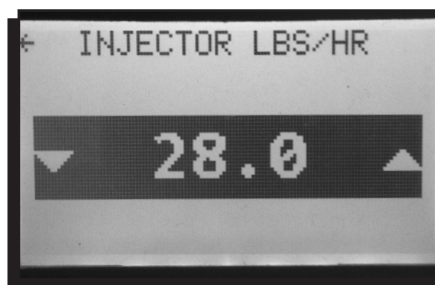
Note: It is recommended to use Non-PWM with a regulator when setting fuel pressure as the PWM setting may decrease fuel pressure slightly at idle.



Fuel Injector Type



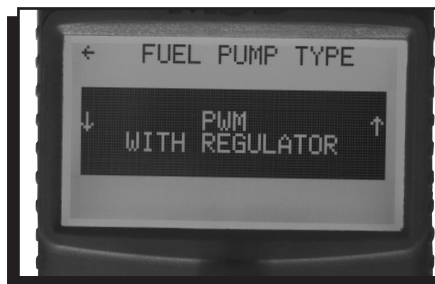
Fuel Injector



Injector Lbs/Hr



Map Sensor



Fuel Pump Type

Figure 19

Idle RPM Target: Select the rpm that the engine should idle at. The rpm range is adjustable in 25 rpm increments (Figure 20).

Note: Running too high of an idle speed in an automatic transmission equipped vehicle with a stock torque converter can cause idle issues in gear. The IAC counts should be set at approximately 10-30 in neutral with the engine warmed up, running and the A/C off. This is done by opening or closing the throttle blade. It must be set after the commanded idle is entered here.

Rev Limit: The rev limiter can be set as a fuel cut-off or ignition cut-off limiter. The default setting is as a fuel cut-off limiter set at 6500 RPM. The programming range for both rev-limiters is 3000 RPM-10,000 RPM (Figure 20). The ignition cut should only be used on race vehicles with a very free flowing exhaust. **DO NOT use with catalytic converters or severe damage may result!**

Once all of the settings in the Initial Setup menu are selected, the Atomic has enough information to start and run the engine. It is recommended to scroll through the advanced settings to program selections that may be useful after the initial start up (such as the cooling fan activation temperatures).

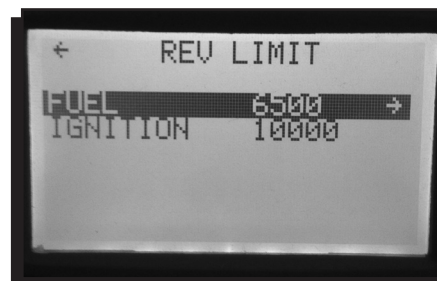
ADVANCED SETUP

The Advanced Setup features are optional as the Initial Setup menu provides the Atomic EFI with the values needed to run the engine. Features in the Advanced Menu are designed to deliver additional features and advanced tuning functions to further enhance the drivability and overall performance of the engine.

Fans: This setting sets the temperatures to activate two electric fans. Each circuit will be activated by supplying ground through the Red (Pin A) and Orange (Pin H) wires of the GT-Series 16 pin harness from the Power Module. A relay is required for both circuits since those wires are a low current ground. The fans will activate at the desired temperature and will remain on until the temperature falls below 10° of the setting. Settings are 100°-300°F (Figure 20).



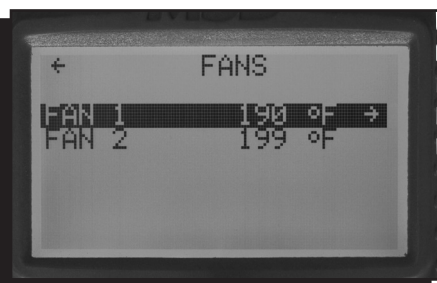
Idle RPM Target



Rev Limit



Advanced Setup



Fans

Figure 20

A/F Targets: The Atomic LS provides an option to set an air/fuel target for Idle, Part Throttle, Wide Open (WOT), Boost and an Auxiliary setting. The Atomic will use its self-learning technology to adjust the fuel delivery to meet the target air/fuel ratio. The values are adjusted in 0.1 increments and range from rich at 10:1 to dead lean at 16:1. The ideal air/fuel ratio for cruising is called stoichiometric and is commonly referred as a 14.7:1 air/fuel ratio.

Boost: The Atomic will switch to the commanded boost A/F ratio once the manifold pressure reaches 110Kpa (approximately 16 psia - 32.5in/Hg) (Figure 21).

Ignition Timing: The Atomic provides a base timing table for each engine application. These values can also be modified to compensate for CARB approved accessories. Each setting is adjustable +/-10°. Note that the values programmed are set for stock engines using 91 octane fuel. For lower octane fuels it is recommended to retard the timing 5° as a starting point. Timing can be retarded up to 20° in 0.1° increments. Note that in order to alter the timing for auxiliary use, the Auxiliary Selection in the Advanced menu MUST be programmed to ENABLE. When 12 volts are applied to the Brown/White wire (Pin C), the timing will retard (Figure 21).

TPS Enrichment: To assist in throttle transitions the Atomic EFI has a feature to increase fuel delivery by a prescribed percentage any time there is an increase in throttle position. If needed, make small changes in no more than 5% increments without further testing. Most engines will find 25% sufficient. Most applications will accept 15%-35% enrichment. Adjustable from 0-100% in 1% increments (Figure 21).

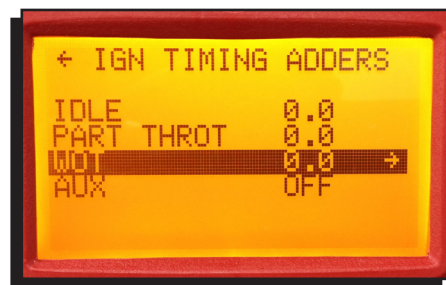
MAP Enrichment: To assist in manifold pressure transitions the Atomic EFI offers a MAP enrichment feature. This function adds fuel based on MAP transitions while moving the throttle. Large cam vehicles with low vacuum generally required a slightly smaller number while stock/small camshaft vehicles with a high vacuum may require more. If needed make small changes of no more than 5% increments without further testing, 25% is sufficient for most engines but between 15-35% is normal. Typically, the higher the vacuum the higher the percentage needed. Adjustable from 0-100% in 1% increments (Figure 21).

2-Step: This setting will rev-limit the engine at the programmed RPM when the Blue wire is activated with 12V. The 2-Step setting is used in drag racing applications to help launch the car at a consistent RPM. The blue wire is normally connected to a clutch switch or a brake switch. The default setting is 10,000 RPM and can be adjusted from 1000 RPM to 7500 RPM in 25 RPM increments (Figure 21). The ignition cut should only be used on race vehicles with a very free flowing exhaust.

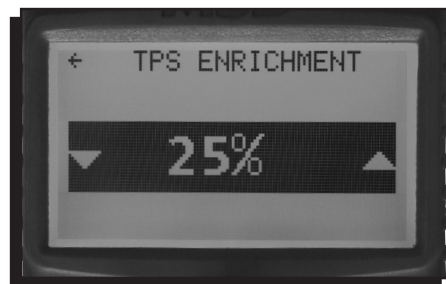
DO NOT use with catalytic converters or severe damage may result!



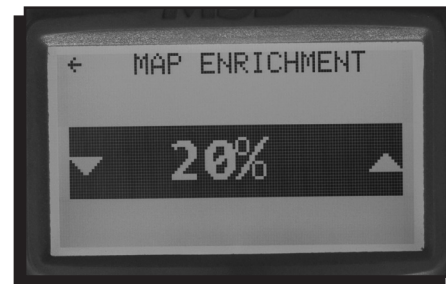
A/F Targets



Igniton Timing



TPS Enrichment



MAP Enrichment Setting



2-Step RPM Limit

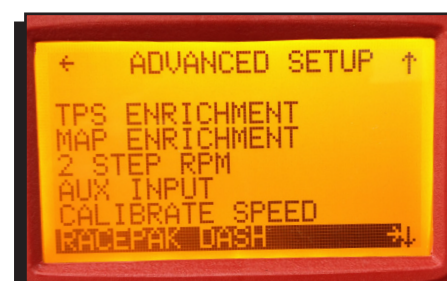
Figure 21

Auxiliary: When switched to Enabled, this setting will ready the Auxiliary timing retard and Air/Fuel Ratio settings to compensate for approved accessories when the Brown/White wire is connected to 12v. The default setting is DISABLED (Figure 22).

Calibrate Speed: If there is speed output on the transmission, a reference signal can be delivered to the Atomic LS. On manual transmission equipped vehicles, the Calibrate Speed option improves drivability when transitioning from high RPM conditions to an idle (such as coming off of a hill / between moving and coming to a complete stop). The Power Module has a Brown (Pin D) wire and a Light Blue (Pin E) wire. These wires connect to a magnetic pickup monitoring driveshaft speed with a collar mounted on a yoke. To program the calibration, drive to 40mph on an open road to maintain speed. Once at 40mph, select YES on the handheld. This will calibrate the speed input. This option will also enable a speedometer reading in the handheld Atomic LS Dash (Figure 22).

Note: Use of a minimum four magnet collar is recommended with this option.

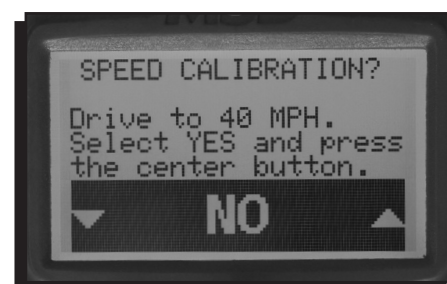
Racepak Dash: This setting allows the Atomic LS kit to interface with a Racepak dash such as an IQ3. Disable is the default setting. Racepak offers an optional V-net sensor to connect their dash to the MSD Can-Bus connector (Figure 22).



Advanced Setup



Enable or Disable Nitrous



Speed Reference Setting



Racepak Dash Option

Figure 22

PRE-START CHECK LIST

Before attempting to start the motor, run through the pre-start check list to ensure a safe and successful start.

- Double-check all wiring
- Power and ground leads are connected directly to the battery.
- Red (Pin G) should be connected to a 12v ignition source that is hot in the RUN and START positions of the key cycle.
- All wiring, modules, and fuel components are mounted away from heat sources such as exhaust and pinch points.
- Wideband O2 sensor is installed and plugged into the Power Module
- There are no exhaust leaks.
- The throttle linkage is connected and moves freely with no binding.
- The initial programming has been set in the handheld menu.
- Key on the ignition a few times to prime the fuel pump. The fuel pressure may need to be adjusted to 58-60psi. Fuel pressure can be monitored in the Atomic Dash section of the handheld menu.
- With the fuel system under pressure from priming the system, check for leaks or fuel spraying. Do not attempt to start the engine if fuel leaks are present.
- Monitor Engine RPM in the Atomic Dash in the handheld unit as the engine is cranked over to ensure the crank sensor is providing an RPM signal.

HANDHELD DISPLAY OPTIONS

Display Setup: The display Setup controls the look of the handheld unit and the Firmware version. The Atomic LS can be reset to factory default in this section as well (Figure 23).

LCD Contrast: Adjust the contrast on the LCD screen if it is hard to see the display. Contrast is adjusted using the joystick to go up or down in five percentage increments.

Backlight Level: The brightness of the screen is determined by this setting. The Backlight Level may need to be adjusted depending on outside light levels. Brightness is adjusted using the joystick to go up or down in five percentage increments (Figure 23).

Display Units: The Atomic can display items in either English (cubic inches, Fahrenheit) or Metric (liters, Celsius). **Set Atomic Defaults:** Use this feature to reset the Atomic EFI. Selecting "YES" on this screen will take all setting, including fuel maps, back to the factory defaults. This can be done when installing the Atomic on a different engine, or for troubleshooting reasons (Figure 23).

User Mode: This setting can be changed from Basic to Advanced. When the User Mode setting is changed to Advance the fuel injector selection menu, coil selection menu, and the MAP sensor menu will open up to all the combinations preprogrammed into the Atomic LS system. The fuel injector flow rate and MAP sensor Slope and Offset can be manually entered by selecting user defined in the selection menu (Figure 23).

Set Atomic Defaults: This setting resets all the programming parameters to the default settings out of the box (Figure 23).

Firmware Versions: The Atomic Firmware version can be found in this section (Figure 23).



Figure 23 Monitor Display Selections.

The Atomic LS Dash is a live display when the engine is running.
This is a brief description of each parameter in the Atomic LS Dash.

ATOMIC LS DASH:	
Tach	Displays engine RPM.
Speed	Displays Speed if speed if speed sensor is equipped and calibrated.
ECT	Displays coolant temperature.
IAT	Displays intake air temperature.
TPS	Displays throttle position sensor percentage.
BARO	Displays barometric pressure
MAP	Displays manifold absolute pressure
FUEL PRESS	Displays fuel pressure.
OIL PRESS	Displays oil pressure.
BAT VOLTS	Displays battery voltage.
A/F RATIO	Displays air/fuel ratio.
INJ DUTY	Displays injector duty cycle.
IGN TIMING	Displays ignition timing.
IAC POS	Displays idle air control motor position.
THROTTLE	Displays throttle condition closed/part/WOT (Wide Open Throttle)
CLOSED LOOP	Displays closed loop on or off.
LEARNING	Displays Atomic LS learning on or off.
FAN 1	Displays Fan 1 on or off.
FAN 2	Displays Fan 2 on or off.
DECEL FUEL	Displays if decel fuel is active
IDLE COND	Displays if engine is in an idle condition
FLOOD CLEAR	Displays if throttle is in a flood clear condition (no fuel will go in)
REV LIMIT	Displays if the rev limiter is active
TWO STEP	Displays if the two step is active.
AUXILIARY	Displays if the Auxiliary timing/AFR is active.

DIAGNOSTICS

There is a self-diagnosing system built into the Atomic EFI. Each covered parameter can show a status in one of three ways (Figure 24).

- “OK”: the parameter is functioning normally.
- “Error C”: there is currently an error occurring.
- “Error H”: A previous error that has been reset since it did not reoccur within the last ten ignition cycles.

The following chart gives the most likely solution(s) to each possible error.

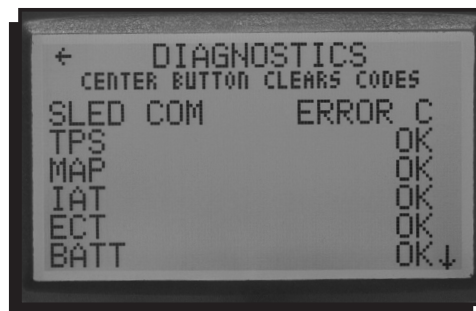


Figure 24

CLEARING HISTORY ERRORS

CODE NAME	WHAT IT MEANS	PROBABLE CORRECTION(S)
TPS	There is no reading for the Throttle Position Sensor.	The sensor may be at fault. Check wiring and/or replace sensor.
MAP	There is no reading for the Manifold Absolute Pressure Sensor.	The sensor maybe at fault. Check wiring and/or replace sensor.
IAT	There is no reading for the Inlet Air Temperature Sensor. The ECU will default to 275°F when shorted or -40°F when open.	Faulty sensor; loose or no connection. Check wiring and/or replace sensor.
ECT	There is no reading for the Engine Coolant Temperature Sensor. The ECU will default to 275°F when shorted or -40°F when open.	Faulty sensor; loose or no connection. Check wiring and/or replace sensor.
BATT	The Atomic is receiving the wrong voltage. The unit is measuring either less than 9 volts or greater than 16 volts.	Check the battery connection from the Power Module to the battery. Ensure that the battery and alternator are working correctly.
INJ DC	Excessive Injector Duty Cycle	If you are running a returnless fuel system, your engine's needs may exceed the Atomic's maximum capabilities. If you are running a return system check to see that you are maintaining the recommended fuel pressure. If you have adequate fuel pressure the engine's needs may exceed the Atomic's system capabilities.
FUEL PRESSURE	There is no reading for the Fuel Pressure Sensor.	Faulty sensor; loose or no connection. Check wiring and/or replace sensor.
WBO2	A. "NOT CONNECTED" indicates that no sensor is detected. B. "ERROR" indicates that the sensor has failed.	A. Check to see that the sensor is securely plugged into the system. Inspect wiring if it is plugged into the system. B. The sensor will need to be replaced. Note that 'warming up' is normal during start-up for the first 20 seconds.
FP CAV	This code will set if there is an issue with Fuel Pump Cavitation (similar to vapor lock). It can only set when running a returnless fuel system. This may occur when the commanded fuel pressure (from the ECU) is different than the fuel pressure (at the sending unit).	Check the fuel system and determine that it meets the requirements to run a returnless (PWM) system. Check the filters, the sock in the tank, and inspect the lines for any kinks or pinches that would affect the fuel flow and pressure of the system. If the code continues, the fuel system may need to be converted to an in-tank fuel pump and/or regulated (return) fuel system.
MAP SELECT	ECU compares the MAP reading with the Baro reading on key up. If these are different by more than 5kPa, the code is activated.	Double check your MAP selection and make sure that you selected the correct P/N of sensor. It could also mean a problem with the Baro or MAP sensor itself (see above codes).
BARO	The Baro sensor voltage is out of range, and the ECU has defaulted to the last known good Baro value.	Turn the ignition off. Wait 10 seconds, and turn the ignition back on. If the code remains, call customer service. Unless the vehicle has been through a large change in altitude since the last ignition on/off cycle (towed somewhere), everything will function normally.

CLEAR FLOOD

If a flood condition occurs, turn the key on then press the accelerator to wide-open throttle. This tells the ECU to turn off the injectors. Crank the engine to clear the flood condition until the engine starts (release the throttle).

Note: The TPS is self calibrating so the key must be in the ON position prior to pressing the accelerator.

INSTRUCTIONS FOR UPDATING THE ATOMIC EFI

In order to update the Atomic EFI you will first need to download the updated files from AtomicEFI.com. (Right click and choose "Save Target As" if it doesn't download automatically)

UPDATED: 05-31-13 Version numbers below.

ALL THREE UPDATES MUST BE DONE SIMULTANEOUSLY



1. The update will reset all settings in the Atomic EFI.
 - a. Be sure that you make note of all settings in the Initial and Advanced Set-ups prior to performing the update.
2. Download the update files from AtomicEFI.com
 - a. Be sure they are saved in a place that you will find them (the desktop is often the best place to save them).
 - b. DO NOT rename the files, the Atomic EFI will only recognize files with the names assigned by MSD.
3. Transfer the files to the Micro-SD Card that came with the Atomic.

You will need an SD Card reader for this – if you do already not have a reader, they can be found at most electronics stores for less than \$10.

- a. Open the Micro-SD card's window on your computer.
 - b. Drag and drop the MSD files into the folder.
 - c. The files must remain in the main folder do NOT put them in a sub-folder.
4. Move the Micro-SD card to the Atomic EFI's Handheld
5. Ensure the Handheld is plugged in to the Power Module
6. Turn the vehicle's ignition switch to Key-On
 - a. Do not start the engine
7. At this time the Atomic will automatically update the Handheld.
 - a. This process will take approximately 30 seconds, do not remove power.
8. When the handheld update is complete you will be prompted to update the Atomic ECU as well.
 - a. Use the Handheld joystick see "YES" by pushing the joystick up.
 - b. Push the joystick in to accept.
9. At this time the Atomic ECU will be updated.
 - a. This process will take approximately 30 seconds.
 - b. The beginning of this process will display "Erasing" – this is normal, do not remove power.
 - c. The handheld's screen will notify you when the update is complete.
10. Use the handheld's joystick to go back (left) to the main menu.
11. Input all previous settings for the Initial and Advanced setups.
12. Enjoy your updated Atomic EFI.

You can check to see that the Atomic update is successful by looking at the version numbers on the Handheld. To do so go to:

- Display setup
- Firmware versions
- Dash – 2.0.3
- EFI – 1.1.1
- P.M. – 1.0.7

TECH NOTES

[illegible]

TECH NOTES

[illegible]



This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

When returning the unit for repair, leave all wires at the length in which you have them installed. Be sure to include a detailed account of any problems experienced, and what components and accessories are installed on the vehicle. The repaired unit will be returned as soon as possible using Ground shipping methods (ground shipping is covered by warranty). For more information, call MSD at (915) 855-7123. MSD technicians are available from 7:00 a.m. to 5:00 p.m. Monday - Friday (mountain time).

*Intended normal use means that this item is being used as was originally intended and for the original application as sold by MSD. Any modifications to this item or if it is used on an application other than what MSD markets the product, the warranty will be void. It is the sole responsibility of the customer to determine that this item will work for the application they are intending. MSD will accept no liability for custom applications.