

Fuel Smart

With Install Kit

Installation Instructions



Patents Pending
MADE IN USA

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Thank you for purchasing a Fuel Smart! This product has undergone many years of extensive engineering, development and testing. In addition, all units are manufactured in the USA on brand new, state of the art, very high speed robotic assembly equipment to ensure high accuracy and low manufacturing costs.

With proper installation the unit will give many years of trouble free service and pay for itself many times over. If, at a later date, you decide to sell your vehicle, this unit may also increase your vehicle's resale value or you may remove the unit and reinstall on a newer vehicle.

WARNING: *If the unit is installed incorrectly, it could cause your engine to not run properly, cause loss of fuel economy and even possible engine component damage.* Although relatively simple in theory, this installation should NOT be done by any self-proclaimed auto mechanics or the like. If, in the unlikely event that you need to return the unit, DO NOT cut the wires from the unit as they are NOT replaceable and this will void the warranty. Any returns must be in the same exact condition as when they left the factory.

This manual is written for **professional electronics technicians only** and should be read **entirely** before starting installation. It is understood that automotive electrical wiring, DC circuits, voltmeter usage, crimping, soldering, fuel injection, fuel injector basics, and OBDII scanners, such as the Actron CP9125 Pocket Scan Code Reader are understood.

Before installing the unit, it is highly recommended to locate a service manual wiring diagram for your specific year and model vehicle to properly identify the correct wires and their corresponding colors to assure proper installation. Due to the multitude of vehicles, Fuel Smart Corp. has no way of knowing which color wire goes where, on each and every vehicle ever produced. Your local Fuel Smart Corp. distributor has been trained at the factory and may be able to assist you with a volt/ohm meter in determining which color wire is associated with the proper installation if a wiring diagram for your vehicle is unobtainable.

Overview

The innovative Fuel Smart unit uses patent pending proprietary circuitry running at 5,000,000 instructions per second. This proprietary hardware, plus patent pending artificial intelligence algorithms, will help improve your vehicle's fuel economy at little or no noticeable changes in engine idle characteristics. The unit's microprocessor does this by monitoring your brake light and throttle position sensor 100 times per seconds allowing instantaneous calculations of horsepower requirements and then intelligently interrupting the signal/wire that normally turns on each fuel injector.

For example, when the microprocessor senses that you want to accelerate, it allows all fuel injectors to operate normally so there is never a loss of acceleration or power. When the microprocessor senses that you no longer want to accelerate, it only allows a certain number of fuel injectors to work and thus saves you fuel. The number of fuel injectors that are deactivated is based upon the *rate* of deceleration, engine rpm, unit settings, etc. This number is constantly changing to save you the maximum amount of fuel without turning on any check engine lights or causing the engine to excessively run rough.

There is no noticeable change to engine running characteristics at higher engine or vehicle speeds. The only time you may notice a difference in engine idle quality is at low rpm and sitting at a red light, etc. However, this is compensated for with different settings so the engine idle quality can be adjusted to suit your vehicle.

The amount of fuel that you will save is based upon many factors, such as the user selected algorithm, user selected time adjustment setting, braking time, throttle position sensor (TPS) deactivation, personal driving habits, vehicle type, road conditions, traffic conditions, head winds, tail winds, grade of fuel etc., etc.

In addition to adding a Fuel Smart unit, it is *always* a good idea to check for proper tire inflation, change your air filters, change your oil to a high quality synthetic such as Mobil 1, and have a tune up.

For ease of installation and trouble shooting, there are numerous LED indicators to acknowledge proper installation and operation. There is an indicator for proper power connection and an indicator to acknowledge when the unit is in fuel saving mode versus acceleration. There is also an LED for each and every fuel injector input and an LED for each and every fuel injector output so that you can verify that you have indeed installed the unit properly.

Mounting

The Fuel Smart unit is fully weather proof and can be conveniently mounted under-hood or user selected position. The unit's circuit board is completely encapsulated in epoxy, so moisture and vibrations will not harm the unit. However, it is recommended to mount the unit high to prevent impact with road debris. It is also imperative that the unit is NOT mounted by any high heat areas such as exhaust or this will **void the warranty!** There are two mounting flanges on the box, and the box may be fastened in any convenient location or orientation.

Circuits

There are three groups of wires coming out of the Fuel Smart box. The two set of wires on either side of the unit goes to the injectors on each side of the vehicles motor. These easily place on the left & right bank for V8, V6, V4, etc. All wires in these groups have OEM style connectors and simply snap into place.

The center group has the unit power and sensor input wires, which include:

Red wire = Ignition 12V+ power.

Brown wire = 12V+ brake signal

Gray wire = rising voltage signal from the Throttle Position Sensor (TPS).

Black & White wires both connect to chassis ground. The White wire allows you to "Deactivate" the unit if so desired, simply install a switch or disconnect.

LED Indicators

The following LEDs will illuminate with proper installation.

Green (Center Right) - This LED indicates that the internal power supply. Always On with key on.

Green (Upper Edge) - This LED indicates that the unit is active in fuel savings mode. It is on when the brake pedal is pressed and the active time delay has not expired.

Row of 8 Green (above external wires) – Signal from the ECU to each injector circuit – this will illuminate in pulses when the ECU enables the particular injector.

Row of 8 Red (just above row of green) – Each of the red LEDs will illuminate in pulses when the vehicle is started and the fuel injector is activated and the signal is passed thru the Fuel Smart to the injector. The green and red LEDs will pulse together on each individual injector's circuit. **When in fuel savings mode, red pulses will be randomly blocked with only the green LED pulsing – this indicates the Fuel Smart has deactivated the particular cylinder on a particular revolution.

If any of the red or green LEDs in the two rows do not illuminate when the engine is first started, this indicates an improper connection.

Wire and Color Codes

See the chart to reference wire color and function.

Description	Color	Destination	Comments
+12V	Red	Fused ignition	Power only when key is on.
GND	Black	Ground	
Unit activation switch	White	Share with Ground	Must be grounded to activate.
Brake Pedal	Brown	+12 V when brake is pressed	Signal at ECU, pedal or switch.
Throttle Position Sensor	Grey	TPS output wire	Rising voltage when throttle is depressed

Injector Circuit # 1	TAN	Any ECU Injector Input signal to Fuel Smart
	TAN/white	Output of same signal to injector
Injector Circuit # 2	GREEN	Any ECU Injector Input signal to Fuel Smart
	GREEN/white	Output of same signal to injector
Injector Circuit # 3	PINK	Any ECU Injector Input signal to Fuel Smart
	PINK/white	Output of same signal to injector
Injector Circuit # 4	PURPLE	Any ECU Injector Input signal to Fuel Smart

	PURPLE/white	Output of same signal to injector
Injector Circuit # 5	BLUE	Any ECU Injector Input signal to Fuel Smart
	BLUE/white	Output of same signal to injector
Injector Circuit # 6	Lt GREEN	Any ECU Injector Input signal to Fuel Smart
	Lt GREEN/white	Output of same signal to injector
Injector Circuit # 7	ORANGE	Any ECU Injector Input signal to Fuel Smart
	ORANGE/white	Output of same signal to injector
Injector Circuit # 8	YELLOW	Any ECU Injector Input signal to Fuel Smart
	YELLOW/white	Output of same signal to injector

Control wires must all be soldered to ensure trouble free service!

IGNITION POWER (positive)

The RED wire from the Fuel Smart has to splice onto any +12 volt fused wire that is hot when the key is turned on. This wire is referred to as the IGN signal. It is important to NOT connect to a constant power wire or the unit will stay on after the engine is turned off and the battery will be drained and the vehicle will not start! Additionally, verify the Ignition source has as close to battery voltage as possible – as vehicles age and resistance builds in circuits or relays, the voltage can drop. If the Fuel Smart does not receive a minimum of 11.5V while cranking, the unit will not turn on and the vehicle will not start. Vehicles with a weak battery or one that has trouble maintaining a charge should have the battery replaced to ensure trouble free operation.

GROUND (negative)

The Black wire must connect to a GOOD vehicle ground. This ground is very important since it carries the 1A injector pulse current. It must not connect to a weak ground. The ground lug at the battery, or strap from the battery to the body is best. DO NOT USE SKOTCHLOCK type devices for power or ground.

Unit Activation line (negative ground)

The White wire must connect to a GOOD ground and can be installed with the Black wire to ground. Install a quick connect or toggle switch near the unit & wire the end to ground with Black wire. *This allows for a quick disconnect to run engine diagnostics or testing without the Fuel Smart unit activating.

Injectors

Every Fuel Smart with Installation Kit has paired connectors for the individual fuel injectors. Be careful to connect only one injector at a time – failure to go 1 by 1 could result in injector control signals being mismatched & cause drivability issues. To connect, simply remove stock injector connector and snap it onto the Male connector on the harness, then snap the corresponding female connector onto the injector.

Brake Pedal Switch

The Brown wire coming from the center bundle must be connected to the brake pedal 12V+ signal. This wire should be a 0 volts when the brake pedal is off and @ 12V+ or more (battery voltage) when the brake pedal is pressed. The signal can be found at the brake pedal switch on some vehicles, and most late model vehicles will have a Brake 12V+ signal at the ECU.

The Fuel Smart unit must see 4 brake inputs before it will activate – this is to ensure the engine has reached a normal operating condition. On the 5th application of the brakes, the Fuel Smart will activate a fuel savings mode and illuminate a Green LED in the top right corner of the unit. If testing, only tap the brakes enough to have the brake lights on is needed. The Fuel Smart also has a timer function before it will activate after initial startup, so a combination of 30 seconds run time and pressing the brakes 5 times is needed to activate the unit.

Throttle Position Sensor (TPS)

The Gray wire in the center bundle must be connected to the RISING voltage signal (0-5 volts). Typically this signal is .5 – 1.5 volts with key on or at idle and rises to almost 5 volts at Full Throttle.

The TPS input on vehicles with Drive-by-wire throttle bodies and accelerator pedals needs to be the RISING voltage signal from the throttle body sensor, NOT the accelerator pedal. This is because there is no voltage change at the pedal when cruise control is engaged and the ECU makes changes to throttle position even when pedal is constant. Failure to use the correct TPS signal can reduce or negate fuel savings and cause drivability issues.

Other Considerations

- 1- All control wires MUST be soldered and heat shrink wrapped for trouble free service.
- 2- Power must be OFF before adjusting the dip switches or potentiometer.
- 3- Dip switches adjust idle quality for when the engine is in gear with brakes applied.

- 4- Potentiometer adjusts length of time (per cycle) the unit will stay in fuel saving mode – start fully clockwise and test drive. If check engine light is set, reset check engine light then adjust in small increments counter clockwise and test drive until check engine light does not set. Repeat as needed. A small degree of rotation can have a large impact on fuel savings, so taking time to fine tune this setting is critical for maximizing fuel savings.
- 5- Fuel Smart installs between the engine computer (ECM) and the injectors. The unit monitors throttle position sensor and 12v brake input, as well as pulse width commanded by the ECM.
- 6- The Fuel Smart does not send any communication to the ECM.
- 7- Works on all gasoline multiport fuel injection systems – will NOT work on TBI or single injection models like early Vortex motors or carbureted vehicles.
- 8- On late model vehicles, locating a 12V+ brake signal for the brown wire/center outlet can be problematic as many newer vehicles utilize Body Control Modules/ BCM or equivalent and the subsequent switch at the brake pedal is a data signal rather than a 12V+ output. Many late model vehicles have a brake 12V+ signal to the ECM that can be used. If the vehicle is equipped with a third brake light that operates on 12V+, this is a good solution. Some 3rd brake lights are LED and do not use 12V+ (verifying actual voltage is crucial). In which case, a relay will have to be used utilizing the BCM outputs for left rear & right rear brake lights. **Do not use only one signal as it will cause the unit to deactivate cylinders when the turn signal is activated.
- 9- If installing a Fuel Smart on a vehicle with less than 8 cylinders, simply plug additional connectors together and secure away from heat sources and moving parts.
- 10- TPS input on vehicles with Drive-by-wire throttle bodies/ accelerator pedals need to be the RISING voltage signal from the throttle body sensor, NOT the accelerator pedal. This is because there is no voltage change at the pedal when cruise control is engaged and the ECM makes changes to throttle position even when pedal is constant.
- 11- Unit Activation – After start up, the Fuel Smart unit must see 4 brake inputs before it will enable fuel savings mode. This is done to prevent engine stalling or roughness when the motor is cold at first start up. If testing the unit, you must press and release the brake pedal 4 times pausing briefly between each and hold the brake pedal a 5th time to enable the fuel savings mode. This is also indicated by a green LED in the top right corner near the letter A in the printed “Fuel Smart” text.
**On some Chrysler units a red LED will illuminate when brakes are applied.

Installation

- Ensure to use proper protective equipment!
- With the vehicle off, open the hood and check the engine bay is not hot.
- Unravel the wire harnesses and place the Fuel Smart in the desired mounting location.
- Check wires reach all injectors and then mount the Fuel Smart unit. Mounting options include utilizing the mounting tabs, using double sided adhesive mounting pad or adhesive Velcro.
- Identify ground location, trim **Black & White** wires to length and use eyelet connector.
 - * Solder the wires to the eyelet, as it will ensure trouble-free service.
 - * Install disconnect or switch on the White wire near the unit for ability to disable the Fuel Smart.
- Identify a good Ignition 12V+ source (key on power only), disconnect battery, trim **RED** wire to desired length and utilize one of the included connectors with the bullet disconnect.
 - * Strip insulation of ignition source wire about 1/4", press bare wire into connector & solder.
- Ensure ignition wire is wrapped and insulated, and then reconnect battery.
- Identify 12V+ brake light signal, trim **Brown** wire to desired length, and utilize one of the included connectors with the bullet disconnect.
 - * Strip insulation of ignition source wire about 1/4", press bare wire into connector & solder.
- Identify TPS with RISING voltage, trim **Gray** wire to desired length, and utilize one of the included connectors with the bullet disconnect.
 - * Strip insulation of ignition source wire about 1/4", press bare wire into connector & solder.
- Turn key "on" and check green LED in top right corner is on, indicating the unit is powered correctly. Turn key off.
- **Injector Connections**
- One injector at a time, simply remove stock injector connector and snap it onto the Male connector on the harness, then snap the corresponding female connector onto the injector. Repeat on the remaining injectors. Be careful to connect only one injector at a time – failure to go 1 by 1 could result in injector control signals being mismatched & cause drivability issues.
- Ensure all connectors have seated fully and no wires have backed out of the connector housing.
- Tie off excess wire harness so that it is not next to a heat source or near any moving parts that it could entangle with.

- Start vehicle and verify all Green and Red LEDs on the injector circuits (two rows on bottom) are flashing in paired sequence.

If any of the circuits are not wired correctly, the engine will have a noticeable miss with the unit disabled. If the signal from the ECU to any injector is not wired correctly, the Green LED for that injector will either be off (non-blinking). If its corresponding Red LED is illuminated without the Green LED, then the wire connection is incorrect.

- Use split wire loom to cover control wires and secure all wires away from heat sources (exhaust and coolant hoses) and rotating parts.

Fuel Smart Algorithm Selection Switches

The “Dip switches” are used to select different algorithms for operation, with the result effectively being a soft RPM cut off. The Dip switches setting primarily affect idle quality. Setting the switches too aggressive = cause rough idle and can negate fuel saving or even cause a loss of fuel efficiency. Follow the adjust procedure carefully.

Power must be OFF before adjusting the dip switches or potentiometer

- 11 Both switches up algorithm - High RPM
- 10 First up, second down algorithm - Mostly higher RPM
- 01 First down, second up algorithm - Mostly lower RPM
- 00 Both switches down algorithm - Low RPM

Potentiometer / Rotary Dial

There is a potentiometer directly above the Dip switches that is used for setting the timing of fuel savings mode. This adjustment is used to determine the length of time that the unit will be in fuel savings mode until it resets, clears all cylinders and then determines if it should go back into fuel savings mode again. This timer is used to eliminate the check engine light from turning on from lean conditions or misfires. By turning the adjustment clockwise, the unit will stay in fuel savings mode for a longer period of time, however the risk of a check engine light turning on is increased. If the adjustment is turned counterclockwise, the unit will enter fuel savings mode for less time, but more often, before it returns to normal engine operation. The unit never stays in fuel savings mode for longer than 60 seconds at a time, at which time it exits this mode, allows the engine to run with all cylinders for approximately 15-20 seconds and then re-enters fuel savings mode if the brake is still depressed or the microprocessor has determined that the TPS is still not calling for additional power. The unit will continuously run through this loop until the brake is released or the TPS voltage has increased. The key is to set the dial so that no check engine codes are set or pending codes are indicated.

Proper Adjustment of Fuel Smart Controllers

An automotive scan tool is needed to properly adjust a Fuel Smart unit. Although most scanners will work, please verify the scanner being used is capable of displaying PENDING codes. Adjustments to a Fuel Smart unit should always be done with key OFF. The Fuel Smart unit must be properly installed before adjustments are made. Power must be OFF before adjusting the dip switches or potentiometer.

1. With key OFF, remove Fuel Smart unit cover and set aside.
 - Select the desired dip switch setting & rotate the dial above completely clockwise.
 - Most vehicles will need both dip switches in the UP position.
 - Dip switch settings primarily affects idle quality.

2. Start engine, wait 30 seconds and cycle the brake light 5 times.
 - Simply press the pedal enough to illuminate brake lights 5 times.
 - Turn A/C on, and then put vehicle in Drive and hold brakes for 60 seconds.
 - ◆ Manual transmission vehicles should be idling in neutral with air conditioning on, brakes applied.
 - If idle becomes rough when Fuel Smart engages, the dip switch setting is too aggressive; put in park and shut off vehicle. Start at step 1 to adjust dip switches.
 - If idle quality is smooth with vehicle in gear and AC on, proceed to step #3.

3. Turn engine off and turn key ON without engine running.
 - Use scanner to check for any LEAN bank or LEAN condition codes or PENDING codes.
 - LEAN Codes or PENDING LEAN Codes indicate the ECM is compensating.
 - Reset any codes.

4. Test drive vehicle several miles, ensuring several full stops at traffic lights or stop sign and cruising at steady speeds.

5. Turn engine off and then turn key ON without engine running.
 - Use scanner to check for any LEAN bank or LEAN condition codes or PENDING codes.
 - If NO codes or PENDING codes present, proceed to Step #6.
 - If codes or PENDING codes are present, Reset codes and turn key off.
 - Rotate dial on Fuel Smart counter clockwise one clock position – i.e., from 5 o'clock position to the 4 o'clock position.
 - Repeat steps #4 & #5 until no codes or PENDING codes are set during test drive.

6. Place cover on the Fuel Smart Unit and enjoy your fuel savings!