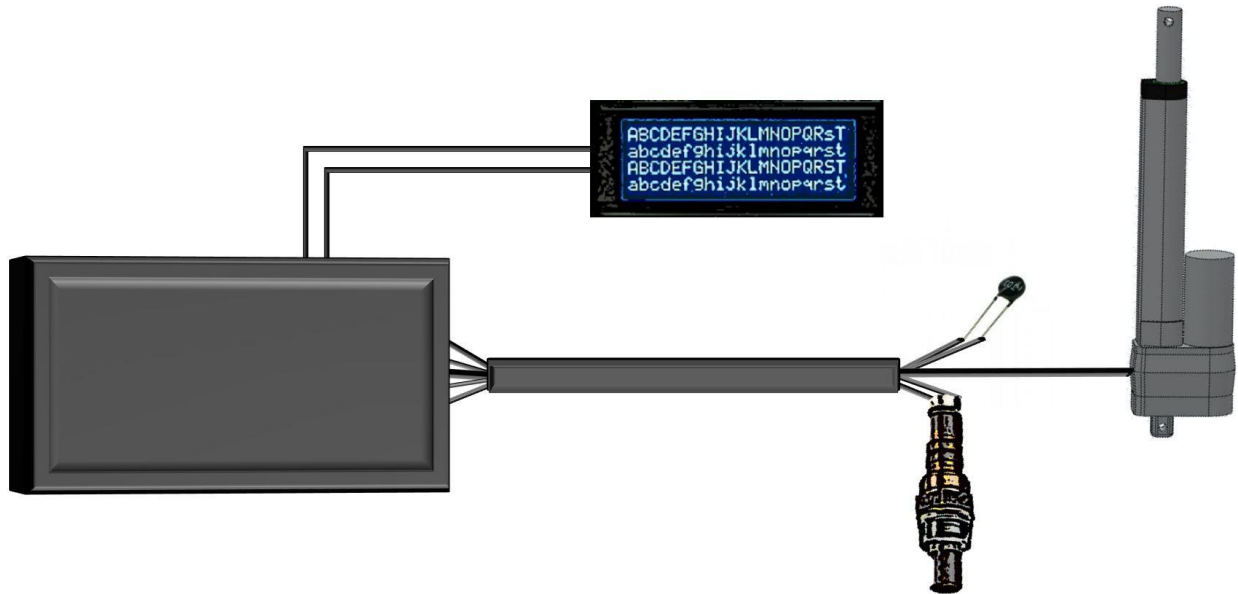


Carburetor Automator

User Manual



Thank you for purchasing the Carburetor Automator. In this manual, you will find instructions for the installation and use of your Carburetor Automator. Please read this manual carefully before installing or using your product to avoid complications and safety hazards. Please also be aware that some information in this manual is subject to change as updates and improvements may become necessary to the system design.

The manufacturer assumes no responsibility for omissions in this manual. If information is missing or incomplete, please contact the manufacturer through the information provided with your purchase.

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1. Introduction

The Carburetor Automator is a simple-to-use, practical fuel system controller. It is designed to improve the performance of carbureted engines, which are unable to dynamically adjust the fuel mixture that they deliver to the engine. By adjusting the behavior of the carburetor, this device will help reduce your vehicle's harmful emissions, protect its engine, and provide better running performance.

The idea of this system is similar to that of what has widely replaced carburetors: electronic fuel injection (EFI). EFI uses a number of sensors to detect how much gasoline and how much oxygen are making into a vehicle's engine. For the most optimal combustion to occur, an air-to-fuel ratio (AFR) of about 14.7 parts air to 1 part gasoline should enter the engine. Depending on the ratio detected by the sensors, and EFI system decides to inject more or less fuel into the engine to bring the AFR closer to 14.7. This is also what the Carburetor Automator aims to do by opening or closing the choke incrementally according to the system's sensor readings.

The system uses four main groups of components (called "modules" in the rest of this document) that work in unison to provide these benefits. It is designed to fit a wide variety of vehicles and can be adjusted as needed to fit your particular vehicle. The function of each of module is explained under section 3 of this user manual.

2. Safety

Installation of the Carburetor Automator should be done in a clean, well-lit area. As the installation requires some force to be applied to parts of the vehicle, the vehicle should be on flat ground with motorcycles leaned on their kickstand or center stand. When making any changes to the wiring/electrical system of your vehicle, ensure that both of your hands are dry and that the ground on which you and the vehicle stand is dry. Never allow a metal tool touch two unconnected, exposed metal points. If there is a voltage between the metal points, a dangerous electrical current may flow through the tool.

Before operating your vehicle with the Carburetor Automator installed, ensure that the brightness of the display is not distracting or uncomfortable to your eyes. If it is bothersome or distracting, you may disable the display using the killswitch labeled "DISP". If you notice your vehicle's engine performance begin to drop or act erratically, you should either disable the choke adjustments with the killswitch labeled "MECH" (this option will keep the sensor and display modules on) OR turn off the entire system with the killswitch labeled "MAIN".

NEVER attempt to make adjustments to the system while driving (such as reconnecting a loose wire). NEVER touch the oxygen sensor while the system is on or the engine is running. This sensor contains heating elements to bring it more quickly to its operating temperature. As this device is also installed directly into the exhaust stream, the exhaust gases from the engine will likely cause the sensor to reach over 200°F. The actual temperature will depend on your engine, but that temperature will always be high enough to cause severe burns.

Before operating your vehicle (especially with motorcycles), you should visually inspect the components of the sensor module and microcontroller module. If there is an oil leak caused by the temperature sensor or an exhaust leak caused by the oxygen sensor, you may need to reinstall the sensors and complete any associated repairs before operating the engine. Failure to do so may result in catastrophic engine failure and potentially physical harm to the operator.

3. Description of Equipment

This section will list the items received as part of the Carburetor Automator. A full description of each item's physical aspects and their functions can be found here.

3.1. List of Modules

You should have received four separate (no interconnected wires) modules as part of the Carburetor Automator. If you do not have four distinct parts in your package, please contact the manufacturer or the retailer through which the Carburetor Automator was purchased. Each of the modules are packaged with their own mounting equipment. However, due to the great variation in vehicle

3.1.1. Microcontroller Module

The Microcontroller Module contains the only computational components of the Carburetor Automator. It is contained in a rectangular, plastic, splash-proof case and is the module with the most wires exiting the case.

This module collects data from the Sensor Module, sends that data to the Display Module, and decides whether or not to engage the Mechanical Module. Main power to the system is routed through this module. Thus, disconnecting this module from the vehicle battery will cut power off to

all modules (this is done by flipping the killswitch labeled “MAIN” on the Display Module).

3.1.2. Mechanical Module

The Mechanical Module consists solely of the actuator and a few interfacing pieces. The actuator is silver with a single black cord connected to it. It has a cylindrical component (the actual motor) and a slightly taller, semi-cylindrical component (the actuator shaft housing).

This module will connect to the choke mechanism of your vehicle’s engine, either using the head of the plunger on vehicles that use one or directly to the user end of the choke cable. This module is responsible for altering the carburetor’s performance. It can be disabled by flipping the killswitch labeled “MECH” on the Display Module. Doing so will allow the user to continue monitoring the engine temperature and air-to-fuel ratio without adjustments being made to the choke.

3.1.3. Sensor Module

The Sensor Module consists of two individual components (not connected): a temperature sensor and an oxygen sensor (also known as a “lambda” sensor). The wire lengths of both sensors may be adjusted to fit the needs of your unique vehicle. If lengthening the wires becomes necessary, it is recommended that you use solid-core, 22 AWG copper wire as this is what was used in the manufacturing process.

The oxygen sensor is the larger of the two individual components and has four wires connected to it. This sensor will be installed directly into the exhaust stream of your vehicle, mounting directly into one of the exhaust pipes. This sensor detects the amount of unburnt oxygen that remains in your vehicle’s exhaust, which indicates the value of the incoming air-to-fuel ratio. This value is used to determine what changes should be made to the choke to provide a better mixture of air and gasoline to your engine.

The temperature sensor is rather small. It has only two wires and is connected to some additional circuitry housed within the microcontroller module. This sensor’s uses are two-fold: the microcontroller module will not consider the oxygen sensor readings until a certain engine temperature

is reached, and the temperature sensor can detect if the engine approaches harmful temperatures.

Conventionally, the choke should be fully engaged at “low” temperatures to allow the engine strong enough performance until it heats up. When the engine is sufficiently warm, it should be able to run without the choke engaged. However, if the engine becomes too hot (often a symptom of lean fuel mixtures), components inside the engine will likely wear out quicker or become damaged.

Please note that there is no killswitch for this module; the Carburetor Automator is of no practical use without these sensor readings as no information will be displayed to the user and no adjustments will be made to the choke.

3.1.4. Display Module

The Display Module consists of an LCD and three killswitches: “MAIN”, “MECH”, and “DISP”. The display reports the engine temperature, the current air-to-fuel ratio value, the current choke position (given as a percentage, with 100% being fully closed), and any necessary system warnings.

The “MAIN” killswitch will disconnect the microcontroller module from the vehicle’s battery. This cuts off power to ALL system components, so very little or no power will be consumed by the Carburetor Automator.

IMPORTANT: The “MAIN” killswitch should ALWAYS be placed in the OFF position when the vehicle is NOT RUNNING. Otherwise, the Microcontroller Module, Sensor Module, and any other module that is not disabled will continue consuming energy from the vehicle’s battery. When the engine is running the alternator should be constantly resupplying the energy that the battery delivers to the Carb Automator.

The “MECH” killswitch cuts off power to the Mechanical Module. This will prevent adjustments to the choke but will allow the user to continue monitoring sensor data if the Display Module is still on.

The “DISP” killswitch cuts off power to the Display Module. This will turn off the LCD but will allow adjustments to still be made to the choke if

the Mechanical Module is still on. **Cutting off power to the Display Module does NOT affect the other killswitches – power will still be delivered through the other killswitches if they are in the ON position.**

3.2. Mounting

IMPORTANT: As is stated above, each module comes with some mounting equipment. Please note that this equipment MIGHT NOT FIT your particular vehicle. The manufacturer will not issue refunds if the only issue is non-fitting stock mounting equipment. If the equipment can be proven somehow faulty, this clause does not apply.

This section will list, in more general terms, how to mount the system to your specific vehicle.

3.2.1. Microcontroller Module

The Microcontroller Module will require 6” of vehicle frame. If possible, find a place on your vehicle frame that has an unobstructed bar like is shown in the figure below. This tends to be the easiest place to mount, and the mounts supplied are most likely to work for such an area.

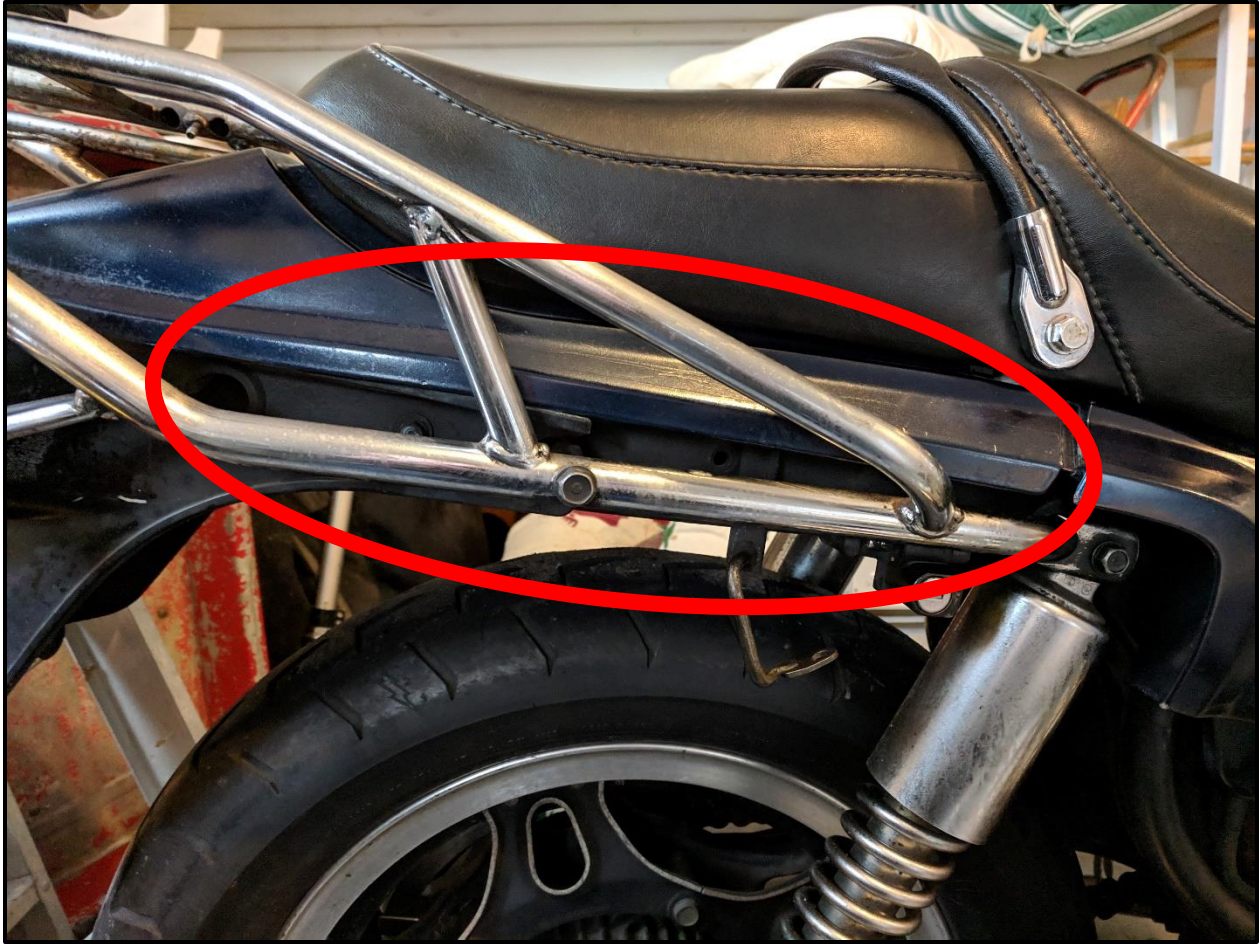


Figure 1 - Example mount area for Microcontroller Module

3.2.2. Mechanical Module

The Mechanical Module is restricted as to where it can be mounted, as it must be mounted near the user end of the choke cable. It should be mounted to a very secure location, as it will apply significant force against its mount to push the choke control mechanism. The actuator is rated to 900N (225 lbs.), though it is unlikely that that much force will be applied to the mounts, as the choke mechanism should move freely with the actuator.

IMPORTANT: For your Carburetor Automator to be most effective, you or a professional mechanic will need to adjust your vehicle's carburetor so that it runs TOO LEAN when the choke is FULLY OPEN. This may be tedious, but it is necessary for your Carburetor Automator to be able to provide better performance when the throttle is open. Typically, opening

the throttle will cause the air-to-fuel ratio to drop. If the carburetor is not adjusted as described in this notice, then the Carburetor Automator will not be able to lean out the air-to-fuel ratio under normal operating conditions, thus hampering its practicality.

3.2.3. Sensor Module

Installation of the Sensor Module should only be performed by people that are knowledgeable and familiar with the target vehicle. The manufacturer assumes no responsibility for poorly installed sensors.

The temperature sensor must be installed such that the yellow tip sits inside the oil reservoir and submersed in oil, and both the wires are accessible outside the engine. Installation will have to be done with the oil reservoir completely empty.

Installation can be achieved by sticking a small needle through the reservoir gasket followed by the wire, repeated for both wires. A high-temperature gasket maker should be used on the inside of the gasket surrounding the inserted sensor to ensure gasket integrity.

Installation of the oxygen sensor also incurs a significant modification to the vehicle engine; it must be inserted into the exhaust stream by boring a hole through the exhaust pipe. The diameter of the hole bored into the exhaust pipe should match the diameter of the threaded portion of the oxygen sensor. See Figure 2 for visual reference.

Once the oxygen sensor is placed in the opening, some high-temperature bond such as SteelStik or another J-B Weld product should be used generously around the mount to prevent exhaust leakage. However, ensure that none of the bond enters the oxygen sensor element through the grating on the tip of the sensor.



Figure 2 - Oxygen sensor threaded region.

3.2.4. Display Module

The Display Module should be placed where it is easily visible and accessible. This module contains all of the killswitches, which are important to the system's operation. On a motorcycle, it can easily be mounted to the handlebar. The housing for this module includes four mount points. The Display Module should be mounted in a way that disallows rotation. For example, if the module is to be mounted to a motorcycle handlebar similar to the one shown in Figure 3, metal cable ties could be inserted through at least two of the mount points and around the handlebar clamp plate as indicated by the red lines. When taut, the metal ties should conform to the semi-flat surface of the clamp plate and disallow rotation.



Figure 3 – Example mount area for Display Module

4. List of Required Materials

This section lists tools and materials needed for installation. **This list is not exhaustive, as mounting the system is unique to the target vehicle.**

- Ratchet and socket set OR wrench set
- Flat-head screw driver
- J-B Weld SteelStik or similar high-temperature reinforced bond
- 22 AWG or similar solid-core copper wire
- High-temperature gasket maker
- Soldering iron and soldering materials (flux, solder wire, etc.)
- High-power drill, drill press, hole saw, metal auger, or any other tool capable of boring a hole through steel exhaust pipe
- Fasteners such as thick zip-ties, ring clamps, hose clamps, etc.

- Replacement oil appropriate for your vehicle's engine
- Wire cutters

5. Instructions for Use

This section features a step-by-step list of instructions for you to start using the Carburetor Automator after installation.

1. Ensure that the "MAIN" and "DISP" killswitches are in the OFF position with the "MECH" killswitch in the ON position.
2. Ensure that the choke is FULLY OPEN (not engaged)
3. Flip the "MAIN" killswitch to the ON position before starting your vehicle. This will allow the system to determine the engine temperature and properly set the choke for your engine to start. Keeping the Display Module off at this point will help to conserve battery.
4. Wait about 3 seconds, then start your engine.
5. Turn on the Display Module when/if wanted.
6. If your vehicle typically needs to warm up before being able to run stably, give it time to do so. If not, you are ready to go!
7. When you are ready to stop operating your vehicle, be sure to return the killswitches to the positions described in step 1 BEFORE shutting off your vehicle. Doing so after your shut off your vehicle will not be catastrophic, but it will cause the Carburetor Automator to run strictly off of your battery rather than the alternator. This can drain your battery and make it difficult to restart your engine.
8. Ensure that the choke is FULLY OPEN (not engaged) before leaving your vehicle. This is necessary for the system to recalibrate the choke position for the next time it is on.

6. Troubleshooting

If a problem is encountered during use, the first thing you should check is the wiring and the integrity of the Sensor Module mount areas. These are the most probable trouble areas. **Do not attempt to operate a vehicle with a faulty Carburetor Automator turned on.**

If you have determined that the wires are and the sensors seem to be in their proper places, please consult the following list of situations. If you do not find your answer, feel free to contact the manufacturer for further assistance.

- Situation: Abnormal AFR readings.

With the vehicle COOL (COLD ENGINE) and the “MAIN” killswitch in the OFF position, unplug the wire labeled “H+” from the Microcontroller Module. Place the “MECH” killswitch in the OFF position, as it will not be needed for this test. Connect a multimeter that is configured to measure about 700 mA of current between the wire you unplugged and its port on the Microcontroller Module. Put the “MAIN” killswitch in the ON position. After a second or two, the multimeter should read a non-zero value.

If the value is zero, disconnect the multimeter and configure it to read 12 volts. Measure the voltage at the “H+” port on the Microcontroller Module. It should have the same value as the voltage across your vehicle battery.

If the voltage is correct, and the electrical system of your vehicle and the Carburetor Automator are still being fully powered, you likely have a faulty oxygen sensor or there is an issue with the Microcontroller Module. If the vehicle’s electrical system (headlights, stereo, etc.) is noticeably weaker, then you may have an issue with your alternator (not part of the Carburetor Automator) and should have that addressed.

If the voltage is not correct (it will likely be 0V if it is not correct), then there is an issue internal to the Microcontroller Module. If you have determined that the issue is with the Microcontroller Module or the oxygen sensor, please contact the manufacturer.

- Situation: Temperature sensor not recognized

IMPORTANT: If you have confirmed that the temperature sensor wires are correctly in place but still get this error message, **DO NOT TURN ON YOUR ENGINE!** Though unlikely, it is possible that the portion of the temperature sensor that was installed to your oil reservoir has been broken off, and it may be loose in the oil circulation system. This can cause catastrophic failure to your engine if it is run.

The first thing you should test in this situation is the Microcontroller Module. Remove the wires labeled “T+” and “T-” from the Microcontroller Module. Use another wire to directly connect these two ports, ensuring a good connection. Place the “MECH” killswitch in the OFF position but keep the Display Module powered on. Turn on the Carburetor Automator and check if the Display Module still reports the “Temp sensor not found” error. If so, the issue is with the Microcontroller Module.

If the Display Module does not report the error, then you will have to check the temperature sensor itself. Unfortunately, this will require you to drain the oil reservoir again. Drain the oil and remove the oil reservoir cover. Check to see if the temperature sensor head (the small, yellow portion) is still attached. If it is not, and you are unable to find it, you will have to disassemble or have a mechanic disassemble portions of your engine until it is located and removed.

The manufacturer will not pay for repairs if the temperature sensor head has been disconnected, as a multitude of situations that are not the fault of the manufacturer may have caused the failure. At any rate, if you find that the temperature sensor or Microcontroller Module are at fault, please contact the manufacturer.

- Situation: O² sensor not recognized

Though this situation is similar to the previous one, there are no dire consequences for running the engine with this error (unless the oxygen sensor has somehow completely fallen out of its mounting point). The procedure is also similar. In this case, the engine needs to be fully warm. Caution should be used when working around a hot engine.

Remove the wires labeled “H+”, “H-”, “3V3”, and “O2” from the Microcontroller Module. Use a wire to connect the “3V3” and “O2” ports, ensuring a good connection. Place the “MECH” killswitch in the OFF position but keep the Display Module powered on. Turn on the Carburetor Automator and check if the Display Module still reports the “Oxgn sensor not found” error. If so, the issue is with the Microcontroller Module.

If the Display Module does not report the error, then the issue is likely with the oxygen sensor or the way it is mounted. Please contact the manufacturer at this point.

- Situation: Mechanical Module not making any adjustments

Before moving on, if you have not let the vehicle and Carburetor Automator run for more than five minutes, please ensure that the choke is FULLY OPEN (not engaged) before starting your engine and then let them run for at least five minutes. Check if the issue persists.

If the Mechanical Module still is not making adjustments to your choke, the issue cannot be determined without disassembly of the Microcontroller Module. Any Microcontroller Modules that are tampered with outside of the manufacturer’s

facilities will no longer be under any warranty. Please contact the manufacturer to have this issue investigated.

- Situation: Display Module not turning on/displaying anything

The LCD used in this module has a component that controls the contrast of the characters displayed. Without changing any of the wiring inside the Display Module housing, carefully open the module. On the back of the LCD, you will see a small, blue square with a screwhead in the center. If you need to touch the circuit board for better grip, use latex gloves or gloves of a similar material. Rotating the screwhead clockwise will increase the contrast of the characters, and rotating it counter-clockwise will decrease the contrast of the characters. If the wiring internal to the Display Module has been modified, the system will no longer be under any warranty.

If this procedure does not solve the issue, please contact the manufacturer.