

# FuelTech



**ETC**

Electronic Throttle Control

Operation and Installation Guide



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## 1. Warning and Warranty terms

The use of this equipment implies the total accordance with the terms described in this manual and exempts the manufacturer from any responsibility regarding to product misuse.

Read all the information in this manual before starting the product installation.

**This product must be installed and tuned by specialized auto shops and/or personnel with experience on engine preparation and tuning.**

Before starting any electric installation, disconnect the battery.

The inobservance of any of the warnings or precautions described in this manual might cause engine damage and lead to the invalidation of this product warranty. The improper adjustment of the product might cause engine damage.

This product does not have a certification for the use on aircrafts or any flying devices, as it has not been designed for such use purpose.

In some countries where an annual inspection of vehicles is enforced, no modification in the original fuel injection system is permitted. Be informed about local laws and regulations prior to the product installation.

Important warnings for the proper installation of this product:

- Always cut the unused parts of cables off – NEVER roll up the excess as it becomes an interference capturing antenna and it can result on equipment malfunction.
- The black wire in the cable MUST be connected directly to the **battery's negative terminal**, as well as each one of the sensors' ground wires.
- The black/white wire MUST be connected directly to the engine block or head. By doing so, many interference problems are avoided.

**The engines of throttle bodies have high power and can cause injuries. Never try to open or close the throttle manually with the harness connected to the ETC.**

We do not take any responsibility by the use of old versions of firmware and software with the FuelTech ETC. Follow these manual instructions to update the program and the firmware of the device.

### Limited Warranty

This product warranty is limited to one year from the purchase date and covers defects from manufacturing origin only.

Defects and damages caused by the misuse of this product are not covered by the warranty. This module has a serial number that is linked to the purchase invoice and to the warranty. In case of product exchange, contact FuelTech.

**The violation of the seal results in the invalidation of the Product Warranty and the loss of any access to new upgrade releases.**



## 2. Presentation

FuelTech ETC (Electronic Throttle Control) controls electronic throttle bodies, eliminating the need of replacing the original throttle by a mechanical one.

This device has six analogical inputs that monitor the sensors of throttle and pedal position, engine temperature and air conditioning button.

There is an air conditioning control output that can be programmed to turn the A/C off automatically in situations where it is necessary all the power of the engine. There are five ways of controlling the throttle, from the fastest sportive to the slowest and with smooth responses.

The FuelTech ETC actively controls the idle speed, always trying to maintain the target RPM. Another way is to configure a fixed opening of the throttle. The ETC has also a function of RPM limit through throttle closing, as the controls of original injections.

All the configurations can be easily accessed by any computer in a fast and simple way by the USB connection.

Safety routines allow the internal software of FuelTech ETC to detect any error with the position sensors or with the throttle motor, activating protections in order to avoid damages to the throttle and to the engine.

### Specifications:

- 5V supply output for TPS sensors (max current 250mA)
- Maximum operating voltage: 26V
- Minimum operating voltage: 9V
- Electronic throttle output maximum current: 6,2A
- High speed USB 2.0 connection
- Updatable via internet
- A/C signal input
- Engine temperature sensor input (FuelTech or customized)
- REV limiter by throttle closure
- A/C control output
- A/C output maximum current: 0,5A

### Dimensions:

W x H x L: 95(+18mm of each affixture edge) x 36 x 93mm  
Weight: 230g



### **3. Important – Read Before Installing**

#### **3.1 OEM ECU**

FuelTech ETC controls electronic throttles but it is not designed to work when the OEM ECU is controlling the engine. The OEM ECU usually starts working in safe mode (Go Home, Limp Home), letting the engine with failures and with the RPM limited.

One pre requirement for the installation of FuelTech ETC is using a programmable ECU that controls the injection and the ignition.

Additional modules of the vehicle like the security and comfort controls can have problems when the original injection is disabled or removed. These problems are out of the installation of the ETC. Be sure to foresee time for its resolution in case they appear.

Functions like ABS, traction control, stability control, air conditioning, etc. can also have their functioning not working well when the original injection and the throttle are disabled, therefore they should be studied case by case.

#### **3.2 Automatic Gearbox**

Cars with automatic gearboxes go almost ever in safe mode (Go Home, Limp Home, etc.). The only known option until now to solve this problem is the installation of an extra throttle in the engine, connected to the harness of the original injection. PEDAL 1 and PEDAL 2 signals should be divided between the two injections. 5V output and ground can be kept only by the FuelTech ETC. The diagram at chapter 4.4 shows how these signals must be shared.



## 4. Installation of FuelTech ETC

For ETC installation, the electric cables must be disconnected from the module and the vehicle's battery. It is very important that the cable length is the shortest possible and that exceeding unused parts of wires are cut off. Never roll up the excess of any wire in the cable; by doing so, interference problems, which are very usual with any electronic device, are avoided.

Choose an appropriate location to affix the module inside the car, and avoid passing the cable wires close to the ignition wires and cables, ignition coils and other sources of electric noise. Avoid placing the module at the engine compartment or where it may be exposed to liquids and heat. DON'T EVER, under any circumstance, install the module near the ignition module in order to avoid the risk of interferences.

The black wire in the cable is the signal ground wire, and must be connected to the battery's negative terminal. The black/white wire is the power ground wire, and must be connected to the vehicle's chassis.

The electric cable must be protected from contact with sharp parts on the vehicle's body that might damage the wires and cause short circuit. Be particularly attentive to wires passing through holes, and use rubber protectors or any other kind of protective material to prevent any damage to the wires. At the engine compartment, pass the wires through places where they will not be subject to excessive heat and will not obstruct any mobile parts in the engine. Always, when possible, use plastic insulation on cables.

The yellow wire, TPS1 of the throttle, can be connected to an ECU to supply the TPS sensor.

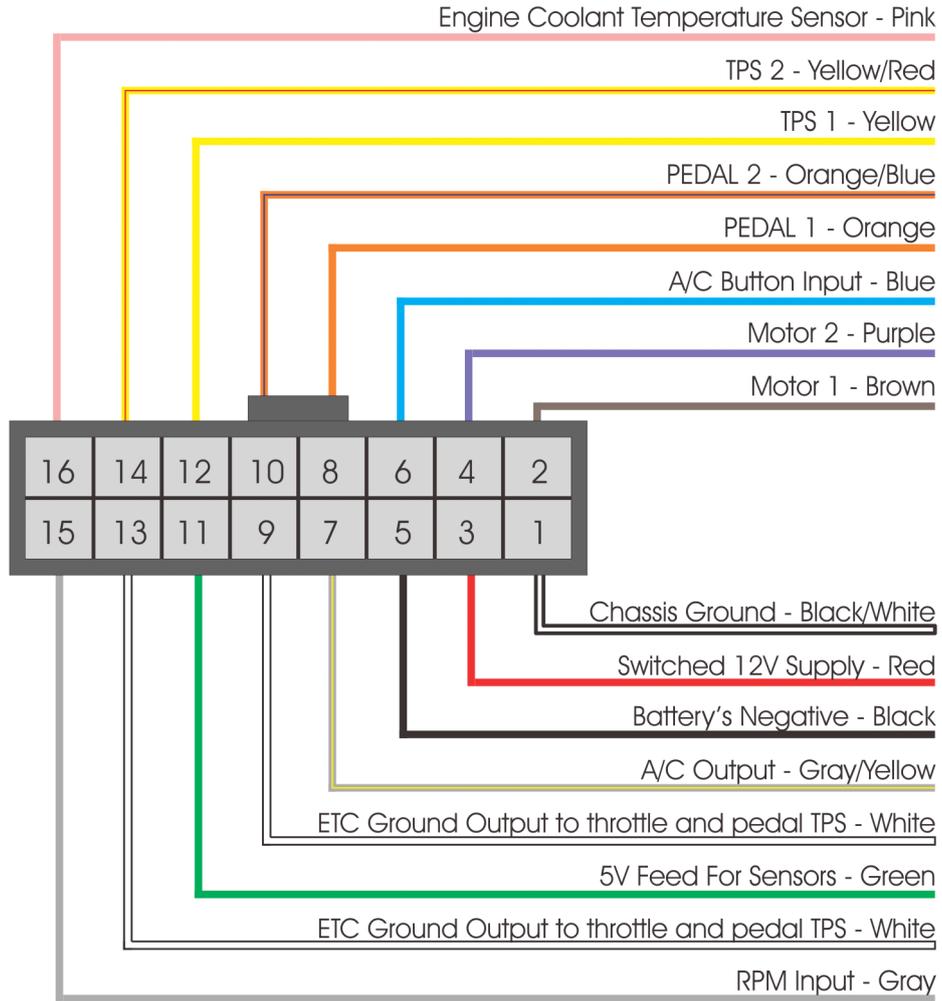
The USB cable that interconnects the ETC to the computer cannot exceed 1,8m under the risk of having communication failures.

### 4.1 Electrical Wiring Connections – Main Wiring

Wire Color	Pin	Connection	Note
Black/White	1	Chassis Ground	Power ground, connected to the vehicle's chassis. <b>Do not</b> connect this wire with the signal ground
Brown	2	Motor 1	Wire 1 of control of the throttle engine
Red	3	Switched 12V Supply	Use a 3A or a 5A fuse
Purple	4	Motor 2	Wire 2 of control of the throttle engine
Black	5	Battery's Negative Terminal	Must be directly connected to the battery; no add-ons or seams allowed. <b>Do not</b> connect this wire to the chassis ground
Blue	6	A/C Button Input	Connected to the A/C button at the dashboard
Gray/Yellow	7	A/C Output	Controls the A/C compressor relay
Orange	8	PEDAL 1 - Signal 1 of electronic pedal	PEDAL 1 voltage is usually higher than PEDAL 2 voltage
White	9	ETC Ground Output	Ground output to throttle and pedal position sensors (TPS)
Orange/blue	10	PEDAL 2 - Signal 2 of electronic pedal	The voltage of signal 2 of pedal is usually smaller than the value of signal 1
Green	11	5V Feed for Sensors	Feed for TPS, as well as other sensors.
Yellow	12	TPS 1 – Signal 1 of throttle	TPS signal for engine ECU
White	13	ETC Ground Output	Output ground for the sensors of throttle and pedal Position
Yellow/red	14	TPS 2 - signal 2 of throttle	With closed throttle the voltage of TPS 2 signal should be bigger than it is open
Gray	15	RPM Input	Connected to a tachometer signal output
Pink	16	Engine Coolant Temperature Sensor	This signal can be split with a FuelTech ECU or with the original ECU



4.2 Harness connections





## 5. Connecting the FuelTech ETC for the first time

Before connecting the ETC to the USB go to the FuelTech website and download the latest version of available software. When it is started for the first time, FuelTech ETC automatically shows the screen for the selection of the throttle used. It is not possible to continue without indicating the manufacturer and the model of throttle body used.

In case your throttle body is not in the list of software, disconnect the ETC from the USB and click "Update Throttle Body Database" under the "Tools" menu. An internet connection is needed to use this function.

**If, after updating the throttle body database, your throttle body part number is still not listed under the compatible throttle bodies on ETC software, please contact our tech support in order to have instructions about how to proceed.**

After setting up the throttle manufacturer, a screen will be shown asking to double check the options. Make sure everything is correctly setup.

If the ignition switch of the car is turned on, the ETC will go to the pedal calibration; otherwise, it will show the following notice: "In order to calibrate the pedal it is necessary turn the ignition switch on". It is not necessary to calibrate the pedal at this moment, but it must be calibrated before starting the engine. The notice will be repeated every time ETC is plugged to the USB without being calibrated.

### 5.1 Electronic Pedal Calibration

**Before starting the engine** it is necessary to calibrate the electronic pedal, otherwise the throttle will stay turned off. To calibrate the pedal it is necessary turn the ignition switch on (NOT THE ENGINE) and click "Calibrate Throttle Pedal" under the "Tools" menu.

To calibrate the pedal, leave it in the rest position (pedal at 0%) then press the button "Pedal in 0%". The fields Pedal 1 and Pedal 2 will be fulfilled with the voltage values read.

Repeat the operation with the accelerator pedal totally pressed, this time clicking the button "Pedal in 100%". The corresponding voltage values to this position of TPS will be saved. Press the button OK.

In case there is any error, the FuelTech ETC will show a warning message.

### 5.2 Throttle Body Calibration

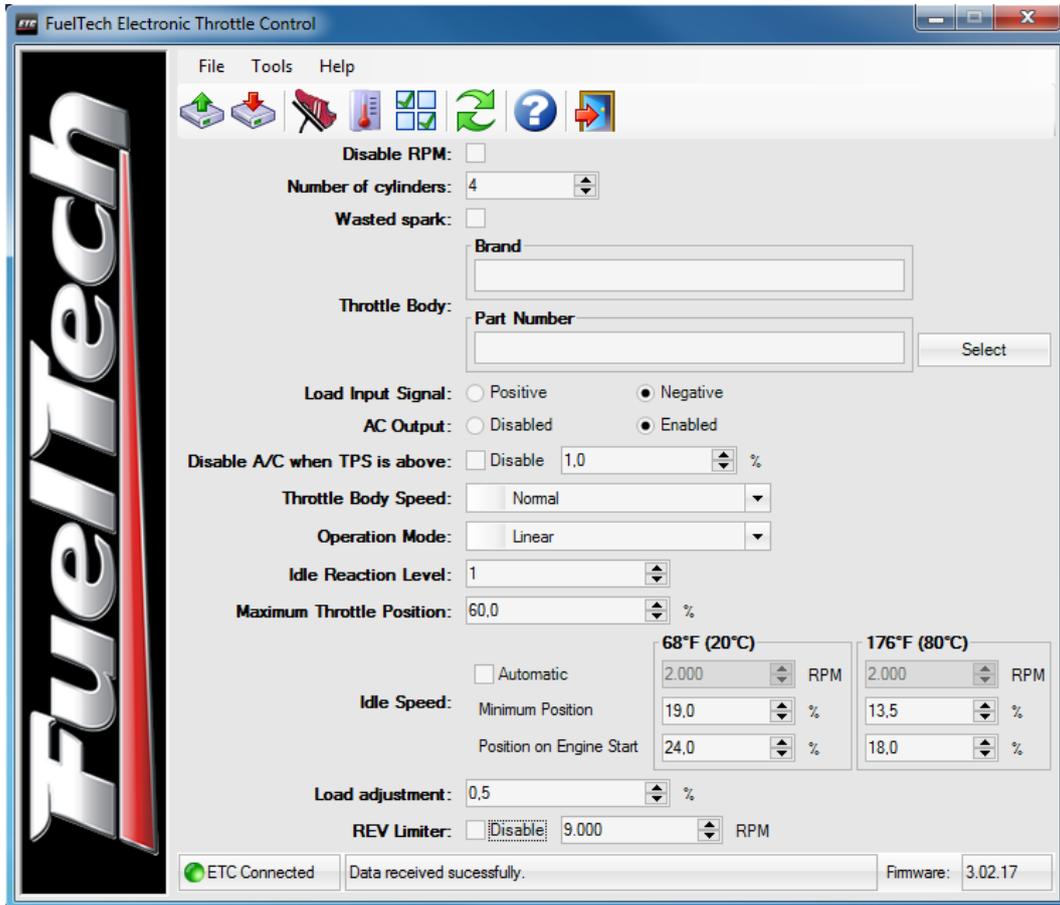
As soon as the calibration of the electronic pedal is done, FuelTech ETC automatically proceeds to the throttle calibration, totally opening and closing.

If, after calibration, the throttle stays fully opened, it may be necessary to twist the motor wires (MOTOR 1 and MOTOR 2) on the throttle connector. In this case, turn the ETC off immediately and change these wires, correcting the polarity inversion engine wires.

All the process above is based on the principle that the throttle has already been correctly configured through the FuelTech ETC Software.



## 6. Software Main Interface



### 6.1 Menu Bar

The menu "File" has the following options:

- Read ETC Settings : reads ETC configurations from the unit connected to the USB;
- Save Settings on ETC : saves on the ETC the configurations shown on the screen;
- Backup Settings: saves the configurations of ETC on the computer;
- Restore Settings: restores a backup file already saved on the computer;
- Reset Settings: reset all ETC settings;
- Language: allows selecting the software language;
- Exit : closes ETC software;

The menu "Tools" has the following options:

- Calibrate Throttle Pedal : opens the pedal calibration screen;
- Calibrate Temperature Sensor : opens the temperature sensor calibration screen;
- Diagnostics : screen with all the voltage values read by ETC;
- Update Throttle Body Database : updates the throttle body database of the software. An internet connection is needed.

Under the "Help" menu are some help files and information about the ETC software and firmware versions. The "FuelTech Updater", function allows software updates and checks if there are new versions available.



## 6.2 ETC Configuration

Before starting the engine, the ETC must be correctly setup, whose parameters are described below:

- **Disable RPM:** in certain cases it is not possible (or necessary) to read engine RPM. Check this option in order to ignore RPM readings (Some features are disabled when selecting this option);
- **Number of cylinders:** setup here the number of cylinders of vehicle in which the ETC is installed.
- **Wasted spark:** check this option only when ETC is reading the RPM signal directly from the negative of a coil working on wasted spark. **Do not mark this option** when capturing the RPM signal from a tach output.
- **Throttle Body:** this field shows the selected throttle. Press "Select" to change the throttle body manufacturer and part number;
- **Load Input Signal:** this is used to enable a throttle compensation when a load (like the A/C) is turned on. Select the signal polarity that indicates the load is turned on;
- **A/C Output:** this option enables an output to activate the vehicle A/C.
- **Disable A/C when TPS is above:** disables the A/C when the TPS goes over the value set here.
- **Throttle speed:** allows the selection of several modes of throttle control
  - **Normal:** normal throttle response, a bit faster than the OEM control.
  - **Fast:** fast throttle response. Sport/Race control.
  - **Winter:** the smoothest mode of throttle control, optimum for automatic cars. This mode is the most indicated to reduce the pollutant emissions, due to its slower responses.
  - **Winter until 122°F and regular when hot:** winter mode until 122°F, ideal for engine warm-up. After this it goes to normal mode automatically.
  - **Winter until 122°F and fast when hot:** winter mode until 122°F, ideal for engine warm-up. After this it goes to fast mode automatically.
- **Throttle Progression:** this parameter changes the proportion between pedal and throttle. There are three modes:
  - **Linear:** in this mode the throttle varies according to the variation of pedal, proportion 1:1. Indicated for cars equipped with manual gearbox.
  - **Aggressive:** the proportion between the throttle and the pedal of 2:1. When pressing 50% of pedal the throttle is already at 100%. It is usually used in engines equipped with automatic gearbox.
  - **Progressive:** this mode is specially designed to be used in street cars and with automatic gearbox.
- **Idle Speed Reaction Level:** the higher the value set on this parameter the more aggressive will be the reaction idle speed control when trying to avoid a RPM drop. This value varies a lot according to the engine therefore there's no default value. High values can make the idle speed to oscillate. The inverse makes the engine stall when an extra load is required.
- **Maximum Throttle Position:** set here the maximum opening position allowed for the throttle. Optimal to limit the performance of vehicle when desired.
- **Idle Speed:** setup here the idle speed control parameters:
  - **Automatic:** when this option is checked, the ETC opens and closes the throttle automatically to control the idle speed, trying always to keep the RPM next to the targets. Check the chapter 7.2 of this manual for further information on automatic idle speed.
  - **Minimum position:** minimal throttle position in any condition. When the parameter "Automatic" is not checked, this will be the throttle opening for idle speed.
  - **Position on engine start:** throttle position that the ETC will keep when the engine is below 600 RPM. When engine goes above 600RPM, ETC applies the values set in "Minimum Position".

The values of "Minimum Position" and "Position on engine start" are automatically interpolated between the temperatures shown on the main screen of the software. Remember considering this interpolation when changes this values.

- **Load adjustment:** throttle compensation when the ETC receives the signal to turn A/C on. When using "Automatic" idle speed, the compensation will be applied and then the idle speed will be back to the target RPM.
- **REV Limiter:** RPM limiter through throttle closure. When the engine reaches the RPM set here, ETC closes the throttle in order to limit RPM.



### 6.3 Diagnostics Screen

The FuelTech ETC has a diagnostics screen used to find possible errors and read all the voltages of each input and output.

The fields with the name "Actual value" show real time status when the ETC is connected to the vehicle with the ignition switch turned on.

Maximum Calibrated and Minimum Calibrated show the calibration values saved for throttle and position sensors.

The field "Errors logged by Unit" keep errors that happened during throttle control. To clean this list, click "Clear Error Log".

**IMPORTANT:** when an exception is stored on the ETC, the throttle control may be switched off until the button "Clear Error Log" is clicked. This is a safety feature to prevent throttle malfunctioning.

#### 6.3.1 Errors on the Diagnostics Screen

The Diagnostics screen of ETC shows a series of information and, stores error messages, described below:

- Correlation Error: impossible to calibrate the pedal or the throttle due to a problem with its position sensors voltage relation.
- Pedal or Throttle Signal Disconnected: a position sensor signal wire may be disconnected.
- Signal of pedal or throttle in short circuit for the ground: signal wire of throttle or pedal in short circuit with the ground/battery negative.
- High current on the throttle motor: there's a problem in the throttle body, dirty or an object obstructing the throttle movement.
- Throttle Position Error: throttle position is not following the pedal adequately. Causes are throttle incorrectly selected, problem on the throttle gears (they can be broken), dirty on the throttle.
- Error on the Position Control: ETC is reading electromagnetic interference on throttle or pedal signals. Common causes are ETC installation too close to the ignition or other source of noise, problem on the controller due to the excessive temperature (installed on an inadequate place).

### 6.4 Engine Temperature Sensor

This calibration is done according to the voltage variation that the sensor causes due to the variation of engine temperature. It is possible to inform directly the voltage value that the sensor shows or click on the buttons of confirmation (shown on the figure beside) for each value of temperature.

In order to calibrate through buttons, just click on the correspondent button to the current temperature of the sensor. The ideal is to follow the temperature of sensor with a laser thermometer to increase the precision.

"Current Voltage" shows the read voltage in real time by the input of engine temperature. This value will be inserted on the table when clicking in one of the buttons of confirmation.

In case of engine temperature is shared between the FuelTech injection and the ETC, just click the option "FuelTech". In this case it is not necessary to make any calibration.

### 6.5 Software and Firmware Update

In order to check your current software version it is necessary to access the menu "Help" and select the option "About". Be sure to have the last available software version before trying to update your FuelTech ETC.

Check FuelTech's website to download the latest software.

When connecting on the computer a FuelTech ETC with an outdated firmware version, the software shows a message informing the need of an update.

To update the firmware, click the "Help" menu and select "FuelTech Updater".

When the ETC is detected, a message on top of the window says "Device Connected".

Click "Update" to start the process.

After updating the ETC, reopen its software, click "File" and then "Reset Settings".



## 7. Starting the engine

### 7.1 First Start

After doing all the configurations of the previous chapters and certifying the installation was done according to the recommended, proceed to the engine first start.

When the ETC is turned on it automatically calibrates the throttle, but, in case it receives RPM signal or notices a variation of the throttle pedal, the calibration is aborted.

In case of problems to start the engine increase the throttle opening or the target RPM. Adjustments on the engine ECU may be also required.

### 7.2 Automatic Idle Speed Control Setup

In order for the automatic idle speed control to work properly, some adjustments are needed:

1. Warm the engine to its normal working temperature (around 176°F);
2. Let all the equipment of the car switched off (lights, A/C, etc.);
3. Uncheck the "Automatic" option for idle speed control and decrease throttle opening for 176°C until the engine stabilizes in an ideal RPM for the idle speed;
4. By doing this, you're informing the ETC the minimum throttle opening your engine needs to be kept running;
5. Check the option "Automatic" under idle speed control;
6. Next, switch the vehicle accessories on and off and check how it is the reaction of the idle speed control. In case the engine stalls sometimes, increase the "Idle reaction level" and the "Minimum Position".
7. Ignition timing on the ECU affects the idle speed. Usually values around 5° to 10° are ideal to help the idle speed control.
8. O2 readings also can affect the idle speed control. Be sure to check with your tuner the best values to use on idle.

**IMPORTANT:** when using automatic idle speed control, the engine ECU must be setup to control fuel on idle based on MAP readings. As the throttle opening changes automatically, MAP readings change along.



### 7.3 Diagnostics of anomalies

Problem	Cause	Solution
Idle speed is varying	Idle Reaction Level is too high. Too rich O2 readings on idle. Ignition timing is too advanced.	Decrease Idle Reaction Level. Correct O2 readings. Retard timing on idle.
The engine stalls when any accessory is switched on (A/C, fan, etc.)	Idle Reaction Level is too low. Minimum position is too low.	Increase the Idle Reaction Level. Increase the timing on RPMs just below the idle speed (400-800RPM). Increase the Minimum Position value.
Idle speed is too high.	Minimum Position with high values. False air input on the manifold.	Decrease the Minimum Position values (pay attention to the temperature field). Check manifold for false air intakes.
The engine stalls on decelerations	Minimum Position value is too low. Deceleration fuel cut-off is too low.	Increase the Minimum Position value (pay attention to the temperature field). Increase the RPM for deceleration fuel cut-off. Increase the timing on RPMs just below the idle speed (400-800RPM).

The idle speed RPM can change by factors like camshafts, temperature, ignition timing, etc. A lot of them have no relation with the electronic throttle control.

In order to make sure the RPM variations on idle are not caused by the ETC, disable the automatic idle speed control. The throttle will then assume a fixed position. If the RPM variation isn't affected, check your ECU tuner for fuel and timing map improvements.

The automatic idle speed control works with margins of error of 100RPM above and 50RPM below of the target RPM. Therefore, these variations are considered normal for idle speed.

It is important to say that a high profile camshaft causes a big vacuum variation at idle speed. This is a feature that cannot be totally outlined, so variations on the idle speed due to high profile camshafts are considered normal. For this situation, it is recommended to disable the automatic idle speed control.