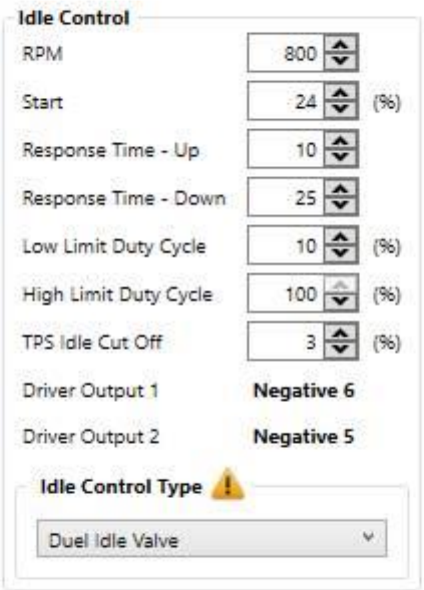
Idle Control

Engines do Idle Control in different ways. The main types are Throttle by Wire, Idle Valve solenoid type and Idle Stepper Valve. TxW use a complete controller. Idle Valve solenoid types can be controlled directly from the ECU. Idle Stepper valves require a Stepper Idle controller which is a standalone controller to do reverse and forward with only 1 wire connection from the ECU. This will not overload the ECU tasks and outputs required. It also minimises ECU cost as not all ECU's will require the components for it. Below is a photo of the controller. it comes in Type1 for 4 Coil common stepper motors or Type 2 for Bipolar Stepper motors.

Settings



The ECU has the feature to control different types of idle motors found on an engine. Before adjusting the idle control settings, you need to select which type of valve or stepper is on the engine. **Note**: The stepper types idle motor (4 to 6 wire), require the external electronic driver. Also note that the electronic unit differs between the 4 Wire bipolar type motor and the 6 Wire common supply type motor.

RPM

This setting is the target RPM's when the engine is on running temperature. When it is cold the ECU will automatically increase engine RPM's with up to 300 RPM's. This is calculated according to fuel enrichment on the water compensation map. Every 15% will increase 100 RPM on the Idle control.

Start %
This setting is used to increase the air intake when the engine is started hot or cold. The ECU will open the idle valve with this %. Note that on stepper motors it will activate 25% every time the key is switched on. If you don’t start it in one go then it may idle high at first then come back to the idle target.

Response Time Up
This setting will determine the rate at which the valve opens when the actual RPM’s fall below the set point in *Idle RPM*. The further the RPM fall below the set point, the faster the ECU will open the valve to let in more air. Low values will create a faster response time and high values will create a slower response time. This setting must prevent the engine from stalling when you switch the air conditioner on, or put it in drive.

Response Time Down
This setting will determine the rate at which the valve closes when the actual RPM’s go above the set point in *Idle RPM*. The further the RPM goes above the set point, the faster the ECU will close the valve to decrease airflow into the engine. This value is set higher than the *Response Up* value, to eliminate hunting. Low values will create a faster response time and high values will create a slower response time. This setting must bring fast idling down as fast as possible without hunting the engine.

Low Limit duty cycle
This setting will preload the solenoid against the spring in the idle valve so that the valve starts to open immediately when the ECU starts increasing the value. It can also be used to set minimum idling RPM for throttle valves that closes completely. To set the value start with a larger % and decrease until the desired idling RPM is reached.

High Limit duty cycle
This setting is used to limit the maximum idle RPM’s. No need to open the valve more than necessary. It also allows for the use of large valves in smaller engines. Make sure that when the engine is cold, it can still lift the RPM up to approx. 1500 RPM. This can be tested by entering a large *Idle RPM* value and limit the ECU from increasing it too high.

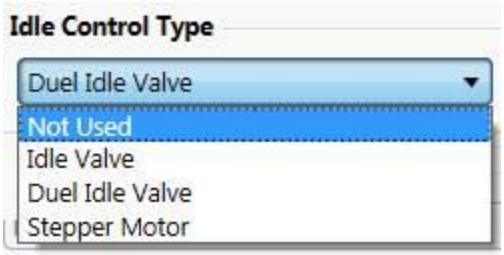
TPS Idle Cutoff %
This value is used to disable the idle control when the driver touches the throttle. The reason is that the ECU must know when not to control idle as the driver may need just a minimal amount of revs with slight throttle.

Drivers

Driver Output 1	**Negative 6**
Driver Output 2	**Negative 5**

This indication will show the installer which wires to connect on which outputs of the ECU. Driver 2 is only used for the dual valve to close. Note that positive and negative drivers may be used for idle control. If a valve is used, then make sure the Diode across it is wired correctly. Note the output pinout may vary on your application. (See the wiring diagrams and general purpose priority spreadsheet for correct installation.)

Idle Control Type



The ***Type Selection*** can select between the two-wire spring-loaded ***Idle Valve****,* the three-wire spring or non-spring loaded ***Dual idle valve****,* the Bipolar ***Stepper motor*** or common supply ***Stepper motor****.* Stepper motors do not use the Low Limit and High Limit settings as they keep their position when there is no signal present. If there is no idle control, select '*Not' used* to free up valuable processor time and general purpose outputs.

Idle Valve
Two wire spring loaded idle valve only use one output from the ECU. Note the output pinout may vary on your application.

Dual Idle Valve
Three spring or non-spring loaded idle valve two outputs from the ECU. Note the output pinout may vary on your application.

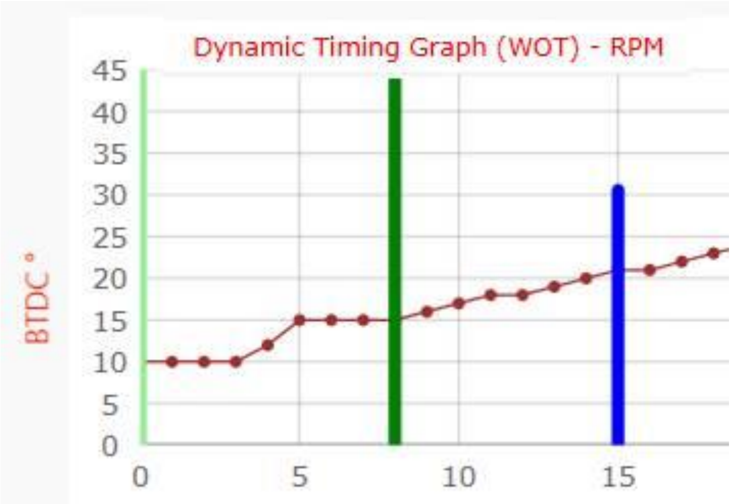
Stepper Motor Idle Valve
Four or Six wire idle valves operate with a Spitronics Type 1 or Type 2 stepper motor controller, use one output from the ECU. Note the output pinout may vary on your application.

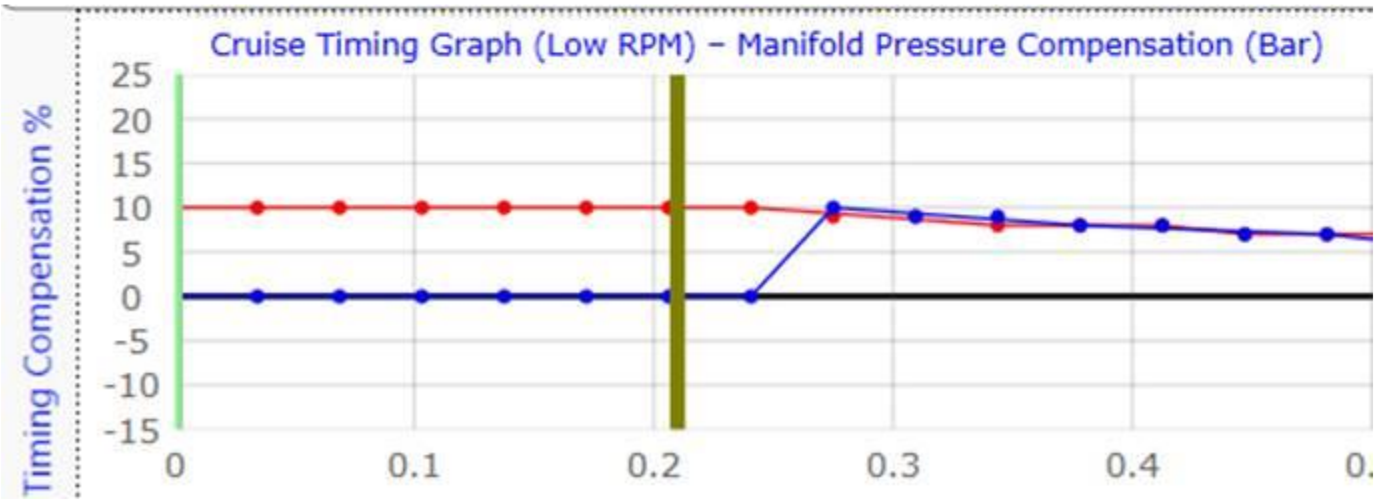
Idle control Tuning

Idle control is done with different methods. It could be external idle valve or stepper motor or it could be done with partial throttle motor or full drive by wire throttle. Due to the delay in mechanical control to stabilise idle, you need to tune the ECU and idle valve together. The reason is that the ECU can react faster than a mechanical air restrictor valve. And most of the times hunting is a result of incorrect engine tuning. If idle drops then the valve opens to correct. That adds more air resulting in a worst effect and it comes with a delay. Then the ECU will add fuel due to more air resulting in high rpm which in turn close the idle valve and this repeats out of control. Also after blip the idle valve must capture the engine rpm before it stalls. Again here the ECU can react faster by adding timing and fuel to assist in this process. This section describe what needs to be done on the ECU side to help smooth idle control. See the different types of idle control and how to adjust their settings in the idle control setup section.

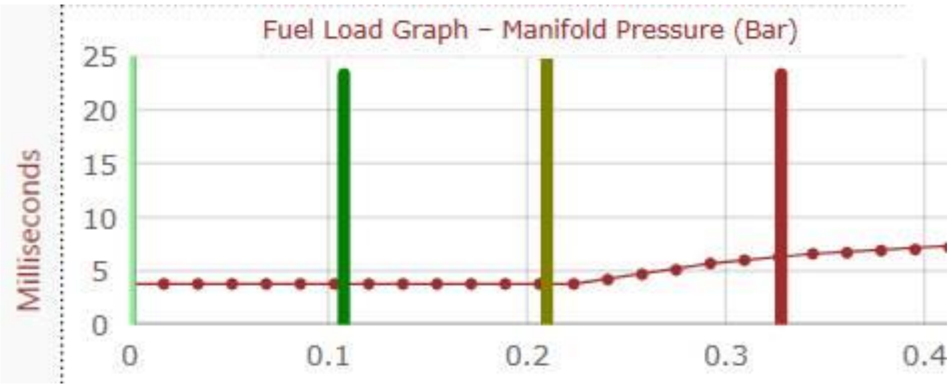
Setting the Idle Jet for Time & Fuel

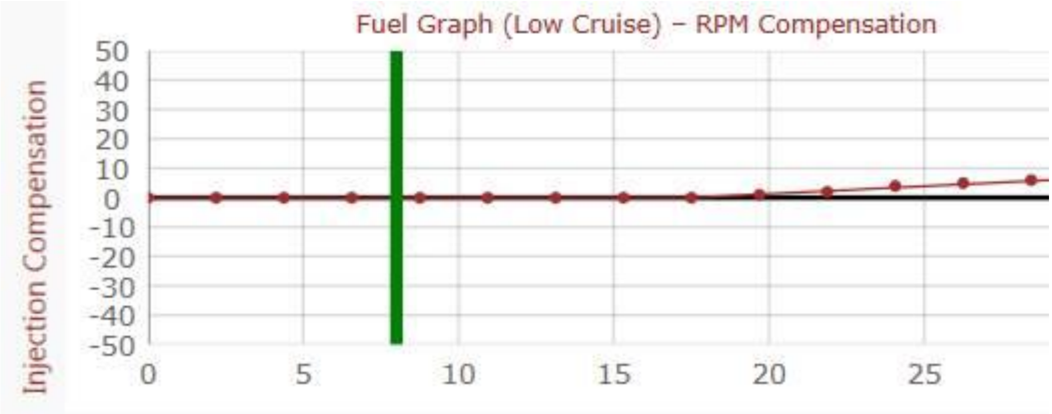
When an engine idles in neutral and is at working temperature, the idle timing should be around 15 to 18 degrees depending on altitude. This may vary from engines but this is a basic guideline. Increasing idling degrees usually result in higher RPM's. Do not confuse this thinking it is what the engine needs. All you will do is lowering the air volume to bring idle down. This will result in very poor power and engine will easily die off when you put a bit of load on it. The lower the engine timing the slower the engine idles and the more idle air it requires. It will also require a slightly richer mixture. Now if you put a little load on the engine, immediately add timing which will make more power due to the rich mixture with more air. Adjusting timing is immediate and there is no mechanical delay. Now when an engine wants to hunt you can effectively control power to it without the idle control valve or throttle movement. Below is some basic ECU settings. First adjust the timing so that at idle there is 15 degree dynamic timing and no vacuum timing.



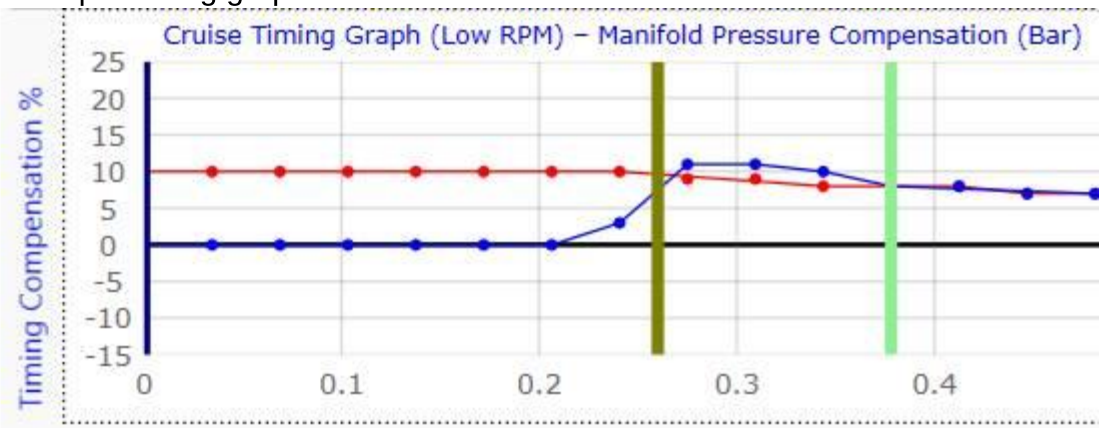


Adjust the Idle fuel so that the engine has just enough fuel to idle constant. Do not make it too rich. It should be close to avalanche point where if you go leaner the engine will lose power. The best way to see this point is where the vacuum signal will be at its lowest point for normal engines. Any more or less fuel will results in higher vacuum. Racing cams and matrix tuning will be saver to look at A/F ratio. Idling RPM’s should be on your Target RPM value. In this example 800 RPM. Notice that the green and brown graph below on RPM compensation is at zero compensation. Only the main graph determine idle fuel. Also make sure water and air compensation is zero.

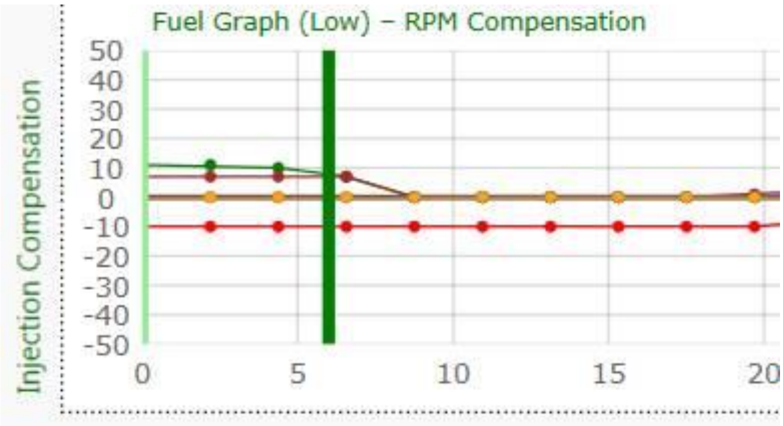


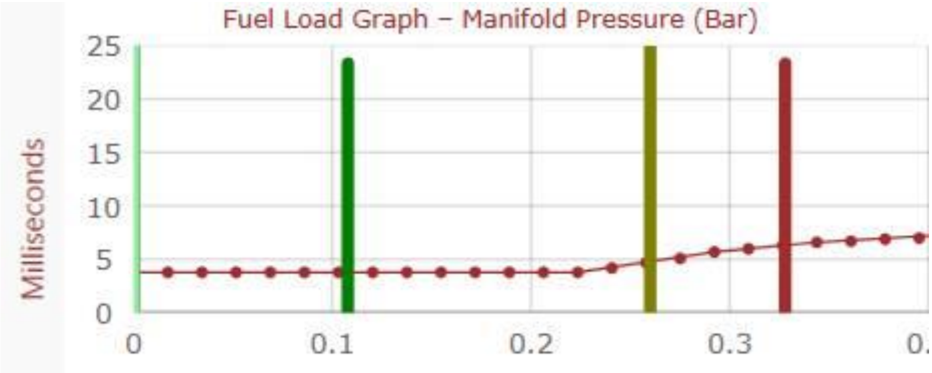


Now when the engine hunts we will use timing to control it before the idle valve needs to act. First you must understand what happens in hunting. The engine will lose power resulting in an increase in manifold vacuum. The vacuum bar will move to the right and the RPM bar will move to the left. Due to our slower timing we can increase timing to add power which will increase RPM. Adjust the Low rpm timing graph as below.

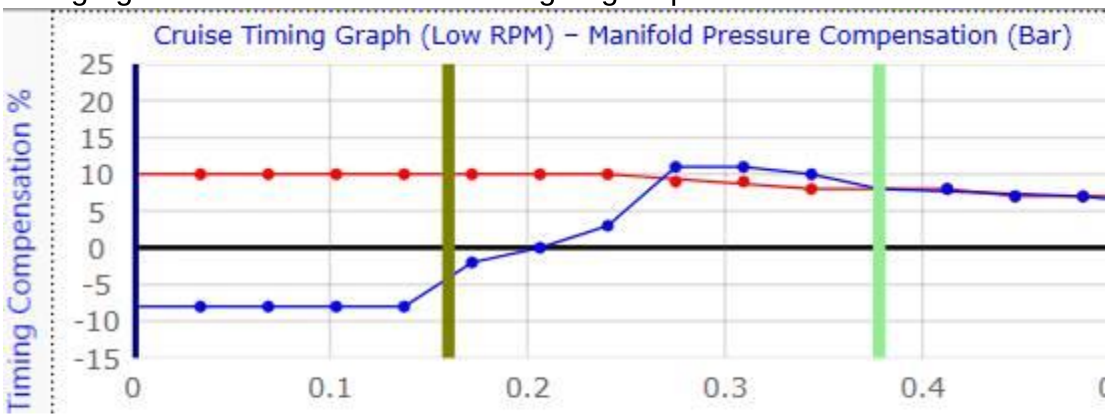


Lower rpm also brings more air in the manifold which requires a bit more fuel to make the mixture a power mix. Adjust the green and brown graph on the RPM graph ay the lower rpm range to add a certain % fuel. Note on the fuel load graph we already should have a slight increase in fuel.

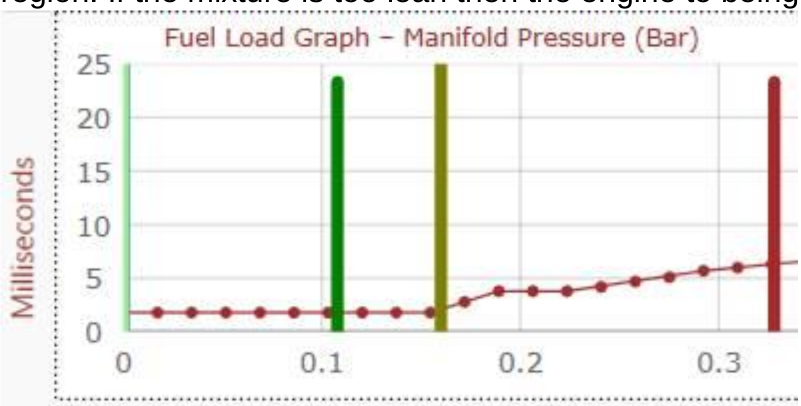




Now the above adjustments will capture falling RPM's and it may now cause the idle control valve to react as well adding air. This will increase RPM above target. There is an up and down response on the idle valve control settings. As a rule we make up response faster to ensure that the engine does not stall. Then we make down response slower to prevent hunting. Will result in more vacuum which makes the vacuum bar move left and the RPM bar moving right. First we use timing again to make it slower reducing engine power.

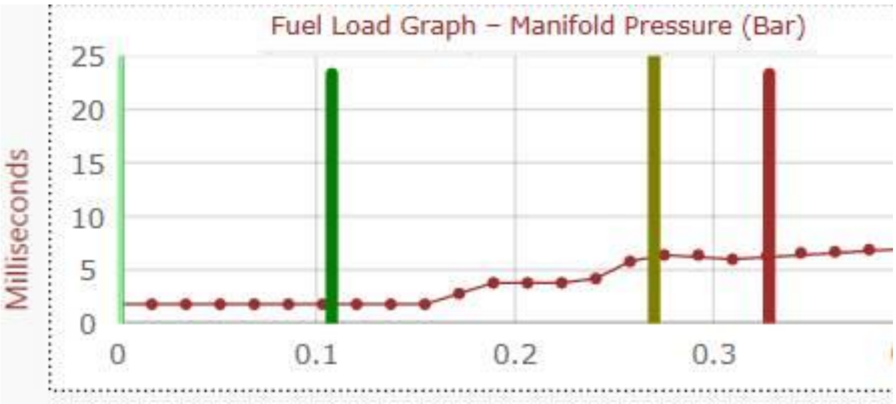


Then less air also needs less fuel. This time we adjust the fuel load graph as the engine don't use this part for normal riding. Note however, that deceleration will cause the vacuum to move in this region. If the mixture is too lean then the engine to being jerking due to too lean mixture.



Automatic Transmissions

For automatic transmissions tuning principles are the same as above. But there are two load steps that differs for neutral and drive. After you do the neutral tuning, then put the engine in drive. The load on the engine from the transmission will cause the vacuum bar to move to the right quite a bit. RPM is controlled and will stay the same. So you need to make sure that the idle fuel will increase for the added load.



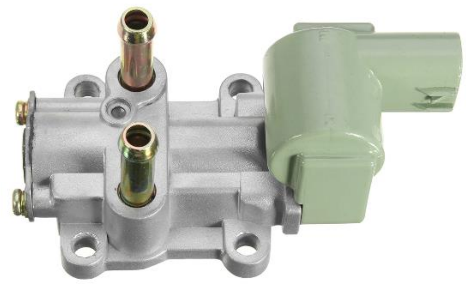
Hardware

Make sure you select the correct wiring drawing for each of the following types of Idle Control. Note that there is positive or negative driver output combinations. Idle control is secondary to other functions like injectors and coils. This means that some firmware will connect it to positive drivers and other firmware will connect to negative drivers. The final connections will be displayed on the GP Priority sheet of that firmware. Note that on the stepper controllers there are an ID wire to select between positive or negative input from the ECU. It must be connected accordingly. You can click on the heading to open a connection diagram.

Single Idle Valve with Spring Return

This example has 2 wires. 1x Solenoid with spring return. Power will act against the spring opening it gradually.

Dual Idle Valve with Spring Return



This example has 3 wires. 2x Solenoids with a common point. It contains a spring to return it to limp mode position should the power be taken away from the solenoids. Power from one side will open and power from other side will close.

Dual Idle Valve without Spring Return

This example has 3 wires. 2x Solenoids with a common point. It does not contain a spring as power from one side will open and power from other side will close.

Idle Control2 Type 1 Stepper

This example has 6 wires. 4x Solenoids with two common points. It is moved in small steps by pulsing the solenoids in sequence to move it in or out.

Idle Control2 Type 2 Stepper

This example has 4 wires. 2x Solenoids. It is moved in small steps by pulsing the solenoids with positive and negative power to move it in or out.

Toyota Black Idle Valve

This example has 3 wires. It has build in electronics which require power, earth and a negative going signal in PWM. It contains a spring to return it to limp mode position should the power be taken away from the solenoids.