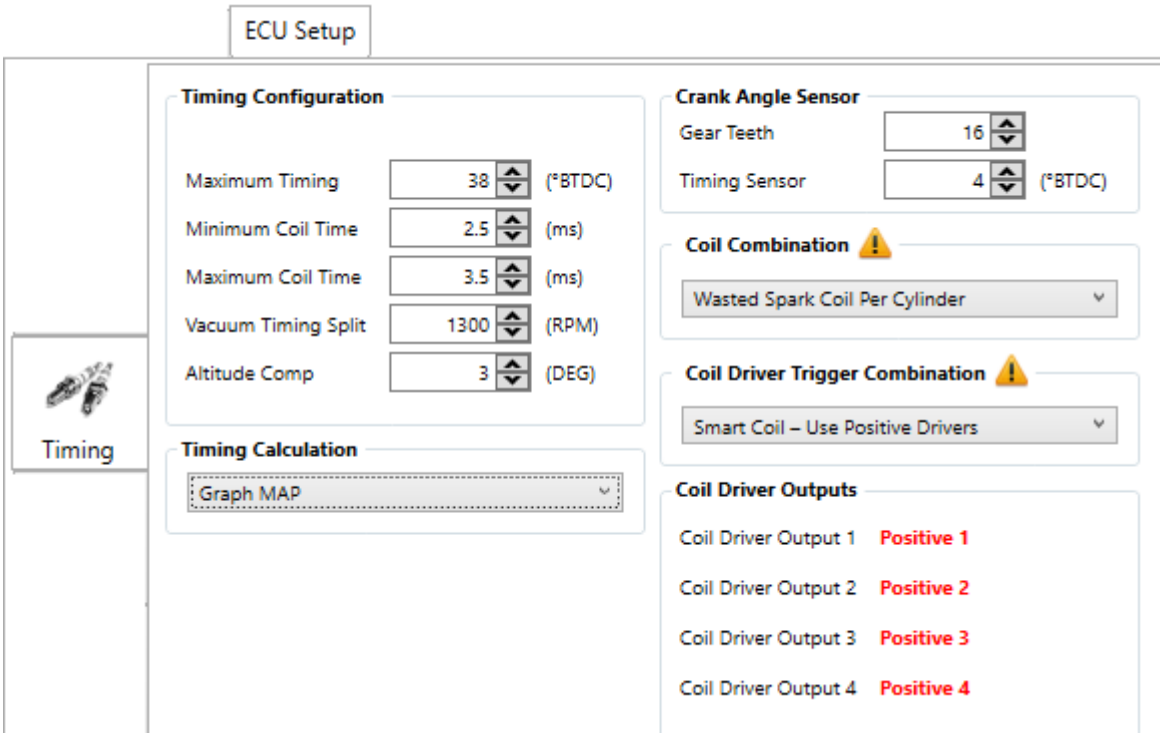
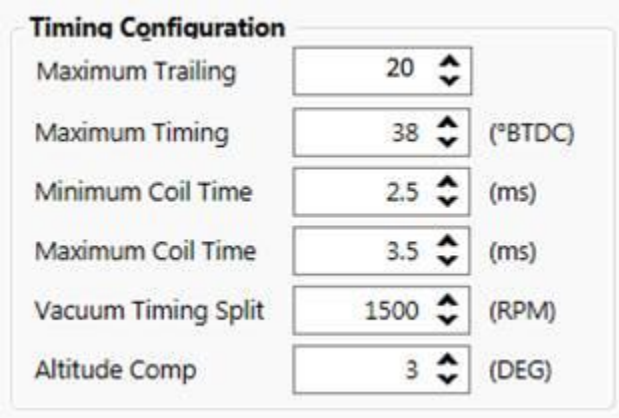
Timing Settings



Note that in your product and application some settings may not be visible or adjustable. This is the offline image on that page which will show all the settings available for training purposes. Below is a detailed explanation of each section.

Timing Configuration



Maximum trailing
This setting is for rotary engines only. It will prevent the trailing timing from being adjusted to far from the leading timing. In this example the trailing plugs will fire 20 degrees after the leading plugs. In piston engines this block is hidden.

Maximum Timing
This is the maximum combined timing allowed in degrees by all the timing maps combined. If the graphs are tuned for more degrees, it will be limited by this value. On the Timing Matrix this setting will prevent the tuner from selecting higher values in the tuning blocks.

Minimum Coil Time

This setting is the minimum coil charge time allowed. The ECU will vary the charge time automatically according to engine load from the minimum to the maximum value. It can be adjusted in 0.1 millisecond intervals from 1ms to 5ms. Standard coil setting is about 60% from the maximum value. Example if Max value is 3ms then make min 1.8ms. see the Maximum Coil Time to determine the right setting.

Maximum Coil Time

This setting is the maximum coil charge time allowed. The ECU will vary the charge time automatically according to engine load from the minimum to the maximum value. It can be adjusted in 0.1 millisecond intervals from 1ms to 5ms. Standard coil setting is 2.5 to 3.5 milliseconds for coils of around 0.9 ohms but some new coils are lower resistance and may need shorter times. Normally the driver will overheat and may be damaged if it runs too hot. Always start with a min value if you are not sure. Start with 2.0 to 2.5ms. Coils with a lower resistance in the 0.4 to 0.5-ohm region, use a value of 1.5 to 2ms. Its always a good idea to put a 5-Amp fuse in the power line of each coil. If you go too high the fuse will blow. If you use the Mercury Coil driver, then you can look at the overload LED. It comes on at 4-amp current. Most coils are rated at 5.5A. Adjust the maximum so that the OVL LED may come on at full load but not on at less than 70% load. During cold starting, this maximum value is used till the engine reaches 60°C. Thereafter spark control will commence.

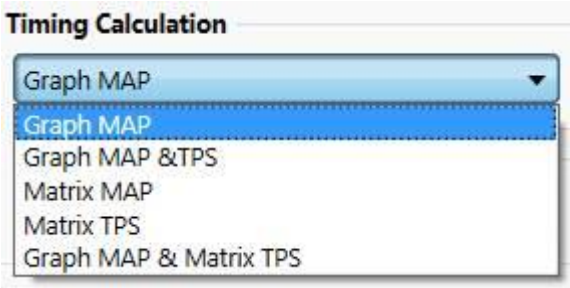
Vacuum Timing Split

This value sets the RPM split between the Low & High Vacuum Timing maps. This value is selected about 500 to 1000 RPM's above idling.

Altitude comp.

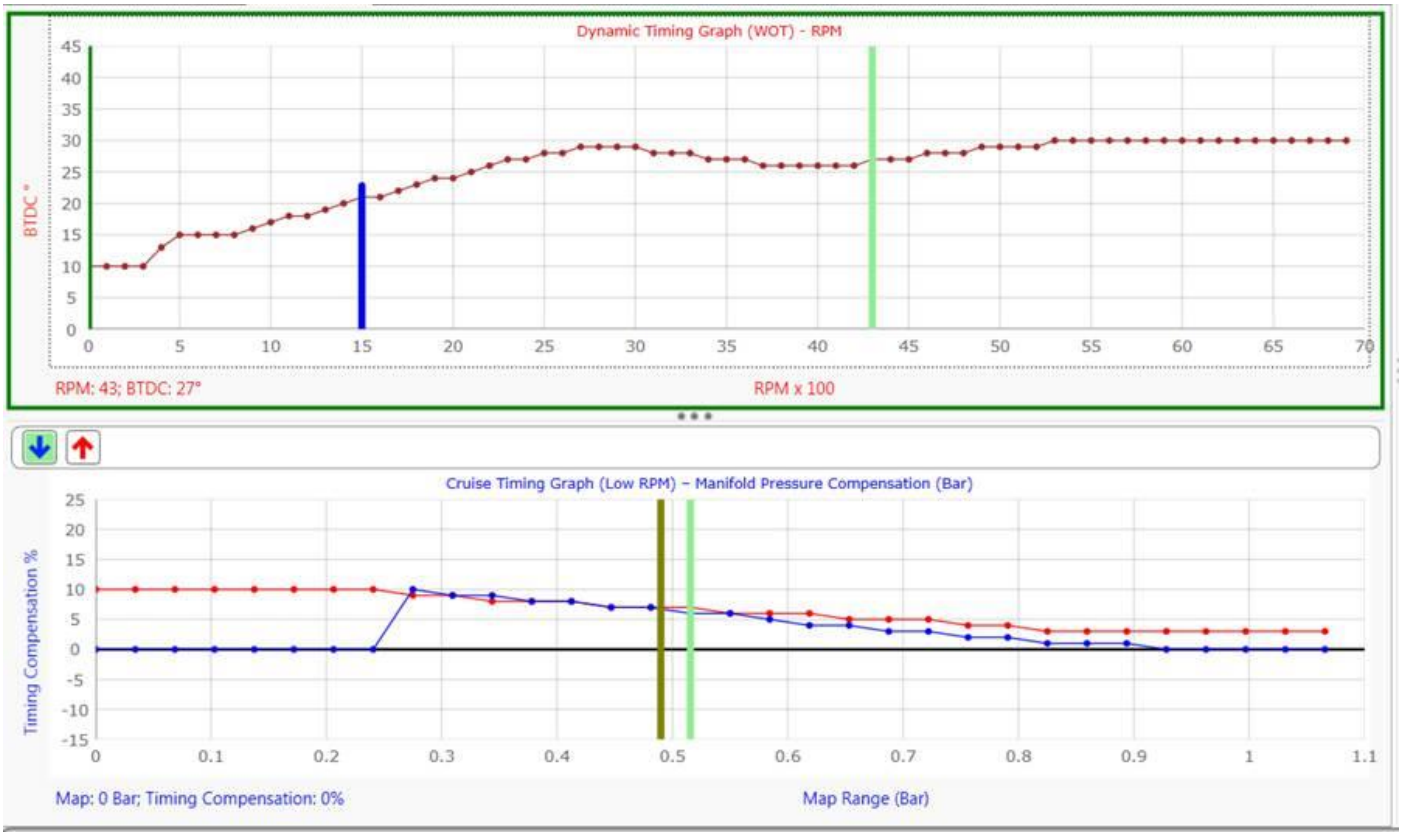
This setting is mainly used in Graph Map method for normal aspirated engines. This value sets the timing advance ratio for every 1000 meter above sea level. A value of 3 means that the timing will be advanced by 6 degrees at 2000 meter above sea level. If you tune the vehicle at a higher altitude, make sure this value is set. Then when the driver descends to lower altitude the ECU will retard the timing automatically.

Timing Calculation



This block will allow the tuner to choose different options to set up timing for this engine. Each of these methods will be discussed in detail under the tuning chapter further in the manual. You can see the ***Tuning*** section for detailed description on the tuning side.

Graph MAP

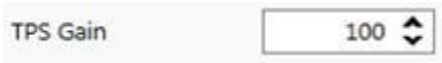


This method is for standard engines with a good vacuum signal and it allows for easy tuning in the street. It has a Dynamic timing map on top which is tuned at WOT. It has 2 vacuum tuning maps for pull-off and cruise timing adjustments.

Graph MAP+TPS

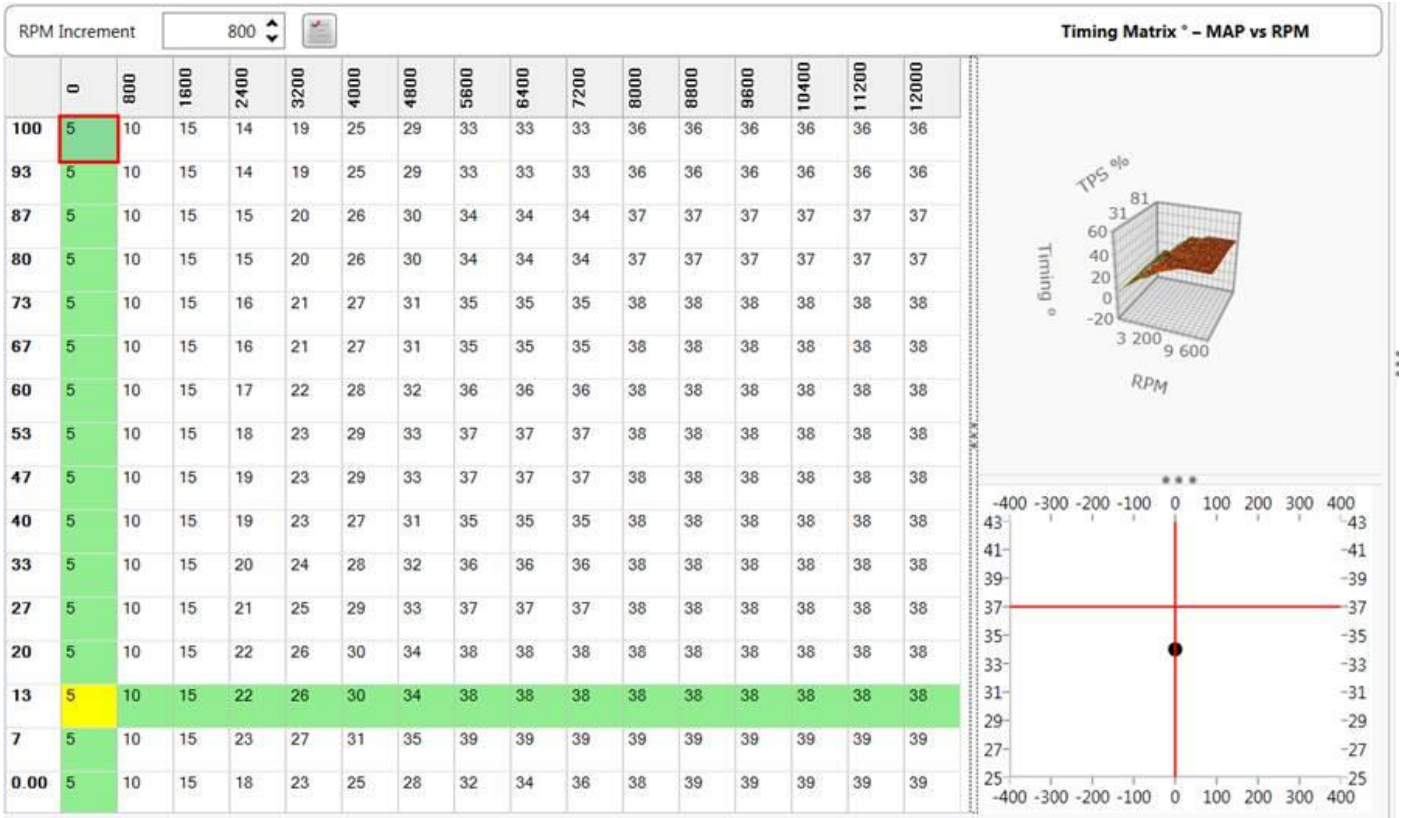
This method is used for engines with a poor vacuum signal at low RPM's and it still allows for easy tuning in the street. The ECU will use the TPS signal to calculate a MAP signal at low RPM's when there is no or little vacuum. It is used for engines where the vacuum signal is correct and above 1500RPM's. The graphs are the same as above with the addition of the following settings:

When the RPM's is below the RPM fuel cut off, then TPS idle is activated. The Vacuum Fuel Cut off setting then becomes the minimum manifold pressure value to start off from.



The TPS gain value will use the TPS signal to calculate a projected vacuum signal on the graph. When the actual vacuum is below the calculated vacuum then the ECU will use the lowest vacuum signal of the 2. Once RPM's are above the RPM fuel cut off, then TPS idle is de-activated.

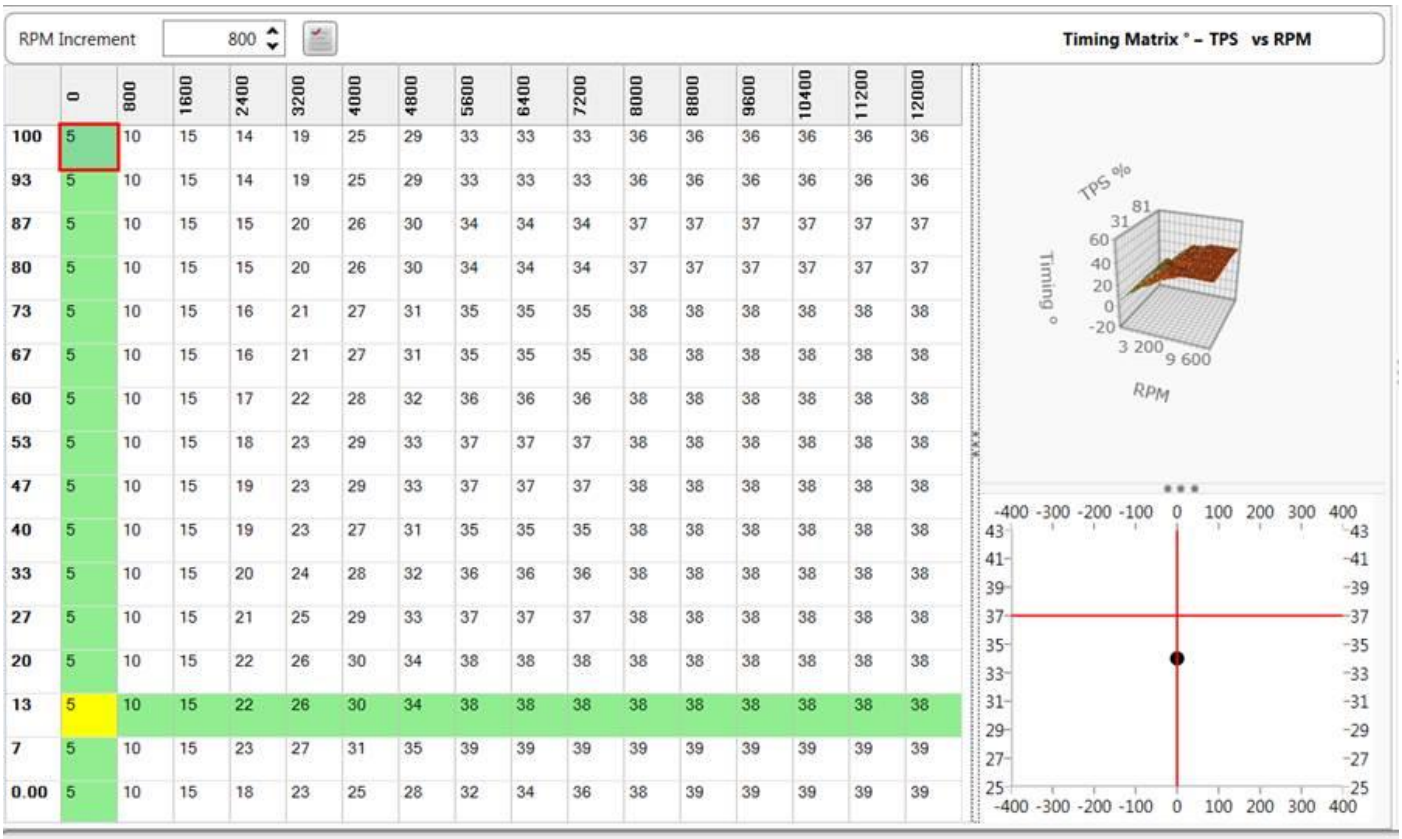
Matrix MAP



	0	800	1600	2400	3200	4000	4800	5600	6400	7200	8000	8800	9600	10400	11200	12000
100	5	10	15	14	19	25	29	33	33	33	36	36	36	36	36	36
93	5	10	15	14	19	25	29	33	33	33	36	36	36	36	36	36
87	5	10	15	15	20	26	30	34	34	34	37	37	37	37	37	37
80	5	10	15	15	20	26	30	34	34	34	37	37	37	37	37	37
73	5	10	15	16	21	27	31	35	35	35	38	38	38	38	38	38
67	5	10	15	16	21	27	31	35	35	35	38	38	38	38	38	38
60	5	10	15	17	22	28	32	36	36	36	38	38	38	38	38	38
53	5	10	15	18	23	29	33	37	37	37	38	38	38	38	38	38
47	5	10	15	19	23	29	33	37	37	37	38	38	38	38	38	38
40	5	10	15	19	23	27	31	35	35	35	38	38	38	38	38	38
33	5	10	15	20	24	28	32	36	36	36	38	38	38	38	38	38
27	5	10	15	21	25	29	33	37	37	37	38	38	38	38	38	38
20	5	10	15	22	26	30	34	38	38	38	38	38	38	38	38	38
13	5	10	15	22	26	30	34	38	38	38	38	38	38	38	38	38
7	5	10	15	23	27	31	35	39	39	39	39	39	39	39	39	39
0.00	5	10	15	18	23	25	28	32	34	36	38	39	39	39	39	39

This is for standard engines with a good vacuum signal and allows for easy dyno tuning. Here the MAP sensor versus RPM is used and the blocks are set in 1-degree resolution.

Matrix TPS



	0	800	1600	2400	3200	4000	4800	5600	6400	7200	8000	8800	9600	10400	11200	12000
100	5	10	15	14	19	25	29	33	33	33	36	36	36	36	36	36
93	5	10	15	14	19	25	29	33	33	33	36	36	36	36	36	36
87	5	10	15	15	20	26	30	34	34	34	37	37	37	37	37	37
80	5	10	15	15	20	26	30	34	34	34	37	37	37	37	37	37
73	5	10	15	16	21	27	31	35	35	35	38	38	38	38	38	38
67	5	10	15	16	21	27	31	35	35	35	38	38	38	38	38	38
60	5	10	15	17	22	28	32	36	36	36	38	38	38	38	38	38
53	5	10	15	18	23	29	33	37	37	37	38	38	38	38	38	38
47	5	10	15	19	23	29	33	37	37	37	38	38	38	38	38	38
40	5	10	15	19	23	27	31	35	35	35	38	38	38	38	38	38
33	5	10	15	20	24	28	32	36	36	36	38	38	38	38	38	38
27	5	10	15	21	25	29	33	37	37	37	38	38	38	38	38	38
20	5	10	15	22	26	30	34	38	38	38	38	38	38	38	38	38
13	5	10	15	22	26	30	34	38	38	38	38	38	38	38	38	38
7	5	10	15	23	27	31	35	39	39	39	39	39	39	39	39	39
0.00	5	10	15	18	23	25	28	32	34	36	38	39	39	39	39	39

This is for normal aspirated engines with poor vacuum signal or throttle bodies and allows for easy dyno tuning. Note: It is recommended to add the altitude sensor to compensate for altitude pressure changes. TPS versus RPM does not compensate for pressure changes. Here the TPS sensor versus RPM is used and the blocks are set in 1-degree resolution.

Graph MAP + Matrix TPS

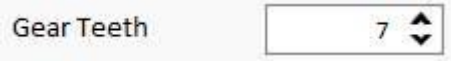
The Matrix is the same as TPS Matrix above. This is for turbo racing engines with a good or poor vacuum signal and allows for easy dyno tuning. Note: It is recommended to add the altitude sensor to compensate for altitude pressure changes in the TPS matrix. Here the normal aspirated tuning is done on the matrix and the boost timing tuning is done on the two Cruise timing graphs. They will become visible in this mode. Here the TPS sensor versus RPM is used on the matrix and the blocks are set in 1-degree resolution. Then Map sensor is used to modify timing in the cruise graphs.

Crank Angle Sensor

This block is used to indicate to the ECU where the exact TDC point is on the crank. It works differently for the different style of crank angle sensors. These settings will allow the ECU to synchronize software timing with the actual spark timing on the engine.

On gear type trigger wheels, the **Gear Teeth** will indicate to the ECU the amount of teeth between the slot and TDC. The **Timing Sensor** will do finer adjustments to precisely set the timing in-between the teeth.

The example below explains, if you put the engine of a 36-1 trigger wheel on TDC, count the number of teeth from the slot anti clockwise to the pickup sensor plus the one just past the sensor.

Put this value in 

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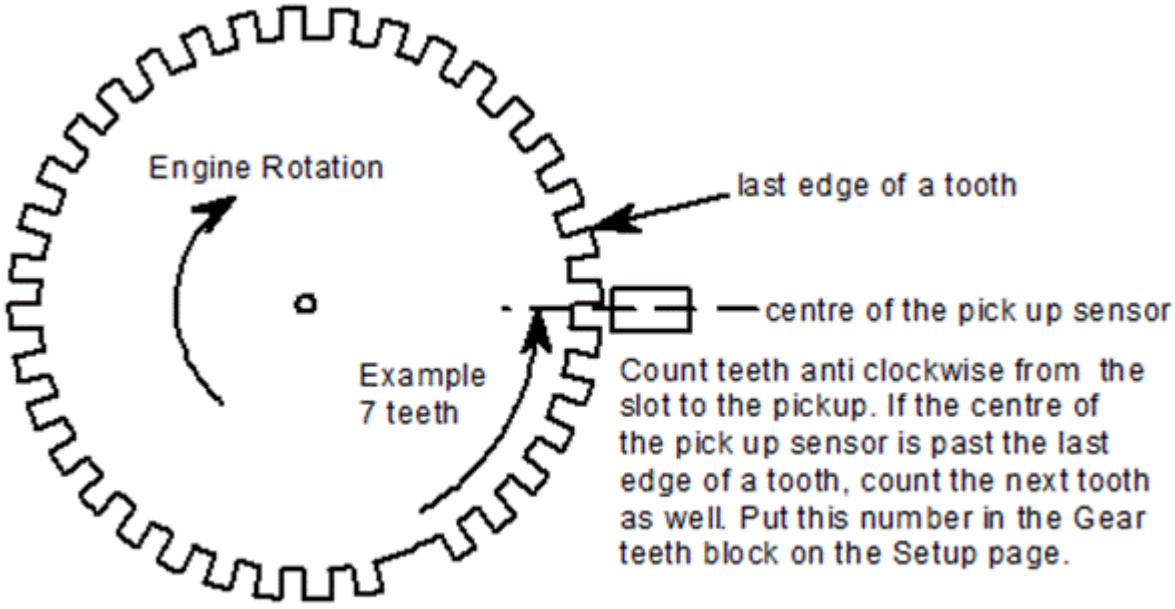
Then you may adjust the Timing Sensor 

from 0 to 9 degrees to precisely align the timing light to the tuning software. The example below should work out as Gear teeth 7 Timing Sensor 6 as the last edge of the teeth is in the center of the sensor.

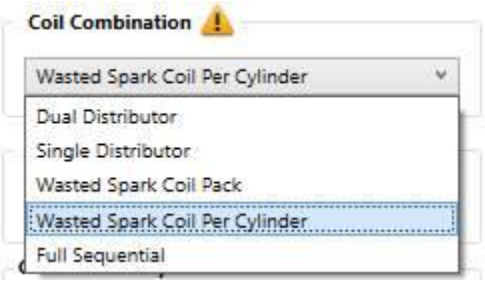


With the engine running match the timing as close as possible by using the Gear teeth setting. For example; the ECU software indicates 10° advance on the real-time bar, but you see 12° advance on the engine. The Timing sensor °BTDC will now be adjusted to accommodate the difference which is 2. With the Timing sensor adjusted the Timing light and the ECU should now be matched.

Important!
When using an Advance / Retard timing light on a wasted spark system the timing light will read double the timing of the engine. So if the timing light reads 20° advance, the actual ignition timing is 10° advance. If you are not sure rather put the timing light on zero degrees and use the pulley marks. Remember that the COP systems are still fired in wasted spark sequence.

On single event triggers you will find that gear teeth are not adjustable only the degrees between the triggers. On a 4Cyl Nissan for example the timing sensor may be adjusted to 180 degrees.

Coil Combination



This block indicates the type of coil combinations that can be used with this firmware. Some firmware programs will allow the user to select between the different coil combinations on his engine. **Note**: If you have an intermediate or lower hardware class ECU, you may only use single coil with distributor. Most COP coil per cylinder engines are fired in wasted spark configuration and each coil will have its own driver. (See the wiring diagrams for connections.)

The combo files can be loaded into intermediate, advance or ultimate ECU's. In an intermediate ECU only the single Distributer option will be available. In an advance ECU the tuner my select between single and wasted spark. Ultimate also has Full Sequential spark on some firmware.

Mazda Rotary On the Rotary programs the tuner may select between coil per cylinder or wasted spark. If the engine has the three coil setup where the leading spark plugs are on a wasted spark coil and the trailing are on coil per cylinder, this value is set on wasted spark. The two leading coil trigger wires must be tied together on the wasted spark coil negative. (See the connection diagrams). The charge time for the leadings will combine without overlapping and destroying the coil. Note that on high RPM's the leading spark will become weaker due to less time available to charge the coil. It has to charge twice per revolution.

Dual Distributor
Two ignition coil outputs will be activated and phased to run a dual distributor system as found on the Lexus 1uz-fe and BMW V12,

Single Distributor
Only one ignition coil output will be activated and phased to run a single distributor. Old school engines use these types.

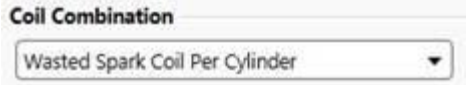
Wasted Spark Coil Pack
Coil outputs equal to half the number of cylinders will be activated to run a wasted spark ignition coil. This is a very popular choice on smaller engines.

Wasted Spark Coil per Cylinder
Coil outputs equal to the amount of cylinders, will be activated to COP coil per cylinder. They are fired in wasted spark sequence.

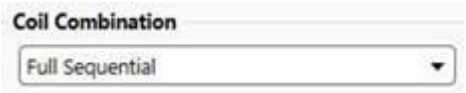
Full Sequential Coil per Cylinder
Coil outputs equal to the amount of cylinders will be activated to coil per cylinder. They are fired in full sequential mode. This requires a home pulse from a cam signal. This is the preferred method for NOZ systems that has fuel in the intake manifold.

Full Sequential Spark
This feature can do full sequential spark on the gear type triggers. Note that there is a driver for each coil. Should you select wasted spark COP, then the coils are still wired one coil per driver and not externally paired like the Ver 3.5A firmware. With this selection, two pairs of drivers will be pulsed together. To sink the spark over the two revolutions, requires a setting of the Gear Teeth. This setting can now adjust twice as many teeth as the crank gear has. This will cover the 2 revolutions. So a 36-1 gear can be adjusted for 72 teeth. This will determine if it fires on compression or exhaust stroke. This is universal firmware and for some engines it may be on rev one, and other ones it may be on rev two after the cam pulse was read. It depends on where and how the cam teeth are situated.

Example:
If you use the 36-1 gear and your timing mark is on 14 then it could also be on 14+36=50. A simple way to test will be to select COP wasted spark.



Now crank and start the engine. You may need to advance the timing if it wants to backfire through the intake. Use gear teeth settings from 1 to 36. If it starts and idle, then calibrate timing with a timing light then save the map. Now select full sequential mode and save again.



Now start the engine. If it starts, then you have the sink pulse right. If not, add 36 to your current gear teeth value and save. Crank again and it should start now.
Note that this program needs to find the home signal first before it will start the engine. This will prevent backfire through the intake.

Note that full sequential and wasted spark systems has no performance difference as both types will have a full load on the coil so spark is the same energy. It is merely required for overlap cams and NOS systems Also make sure that firmware is available for your application.

Coil Driver Trigger Combination

This block selects the coil type connected to the ECU. There are Basic Coils that requires an HV Coil driver and then there are Smart Coils that has built in drivers.

Basic Coils require a negative pulse to charge the coil and a positive pulse to fire the coil. This requires a high voltage power MOSSFET to control the high voltage found in the coil primary during the fire cycle. Orion2 have a total of 6 of these drivers. Two of them are shares with the POT and Dual Map Switch. This means you can do Full Sequential Spark on 4 and 6 cylinder engines and Wasted Spark for engines up to 12 cylinders.

Smart Coils are coils with this high voltage driver built in. Most new cars come with Smart Coils. They require a positive pulse to charge and a negative pulse to discharge. Orion2 have a total of 4 of these drivers. This means you can do Full Sequential Spark on 4 Cylinder engines and Wasted Spark for engines up to 8 cylinders.

Note! Do check if firmware is available before you do the wiring.

NB! The coils must get their power from the ECU power relay. At startup this relay is kept off till the ECU can read the map to see what type is selected. Having this wrong will destroy the drivers or the coils.

NB! This is a Critical setting that alters wiring connections. Do not change it on a running vehicle. It could damage drivers or coils.

Coil Driver Outputs

This will indicate how many drivers are allocated to coils and their connection pinout on your product. It may change according to Coil Driver Trigger Combination setting. This will allow the installer to do a printout of the drivers after setting up his unit.

Note! This connections is not firing order but merely a sequence in which the coils will be pulsed. Use the correct coil drawing for your product and application to determine the coil sequence.

Coils Hardware

This section contains all combinations of wiring options for Coils. The main choices are, no of cylinders, basic or built-in driver coils, wasted spark or COP coils and the type of spark required namely Distributor, Wasted Spark or Full sequential spark. Each folder contains its different variations for your engine. Note that the drawings are generic and you have to dial in your own firing order to see which wire colour goes to which coil. Print the document and write on it before you begin.

Abbreviations in this section.

F/S - Full Sequential
W/S - Wasted Spark
COP - Coil On Plug

Ignition Coils

Distributed Spark System
With this system, which was popular in the older cars, there is only one ignition coil for all the cylinders. The spark is distributed to the spark plugs with a rotor and distributor cap. Here only one driver is required from the ECU. The disadvantage of this system is that the coil has to charge and discharge a couple of times in one revolution. With high revving and performance motors this means that spark quality will deteriorate with increased RPM’s. Another problem is spark deterioration with the gap between rotor and cap. It also has a higher maintenance service. Very important for these systems is the rotor fazing. Advantage is one coil and driver and full sequential spark system. (View it further in the manual.)

Wasted Spark System
With this system there is one coil for the two cylinders that move up and down simultaneously. The cylinders that are 360 degrees apart are paired. These coils have two High Tension towers which spark on the two plugs simultaneously, one on compression stroke and the other on exhaust stroke. Each dual coil is being driven by its own driver in sequence from the ECU. The advantage is less drivers and coils and better spark than distributors. This method only requires a crank gear with TDC slot. Disadvantage is the coils energy is divided between 2 spark plugs. Also the fact that current is reversed through on plug. This deteriorate copper cored sparkplugs unevenly.

Multi Coil Spark system
With this system there is one coil for every spark plug. The coils must be driven by separate drivers from the ECU. This makes the ECU larger and more expensive. The coils are fired in full sequential or wasted spark method. The advantage is more spark energy per cylinder. Disadvantage is the number of coils and drivers required.

Different Types of Coils

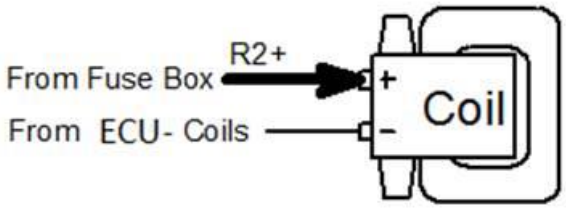
Coil Selection
It is important to know which coil on the engine has a faulty setting as this may destroy the ECU driver or coil. Always start the ECU with a disconnected output connecter till you set the trigger level output to the correct setting, or alternatively wire the ECU correctly. Start with a 5A Fuse in the coil positive circuit which will blow quickly if you have an error. If you have coil packs with a common positive, insert 5A fuses in each driver signal to protect the coil against damage.

Oil filled coils
The point-condenser coil has a resistance of +/- 1.5 ohm and a charge-time of 7 m/s. the spark on this coil will be weak. Should you need to use it do not connect the ballast resistor. If the coil has a resistance of 3 to 3.5 ohms it has a built in ballast resistor and will produce poor spark. It is not recommended to use these coils.

Electronic ignition coils were designed for variable dwell systems to improve spark at high Rpm's. They have a resistance of +/- 0.8 ohm. and a charge time of 3 to 3.5 ms. they can be used effectively but are being phased out by manufacturers. Some coils go as low as 0.4 ohm and need charge times of 1.5 to 2ms. For these coils Mercury2 must be used with the Mercury Coil driver.

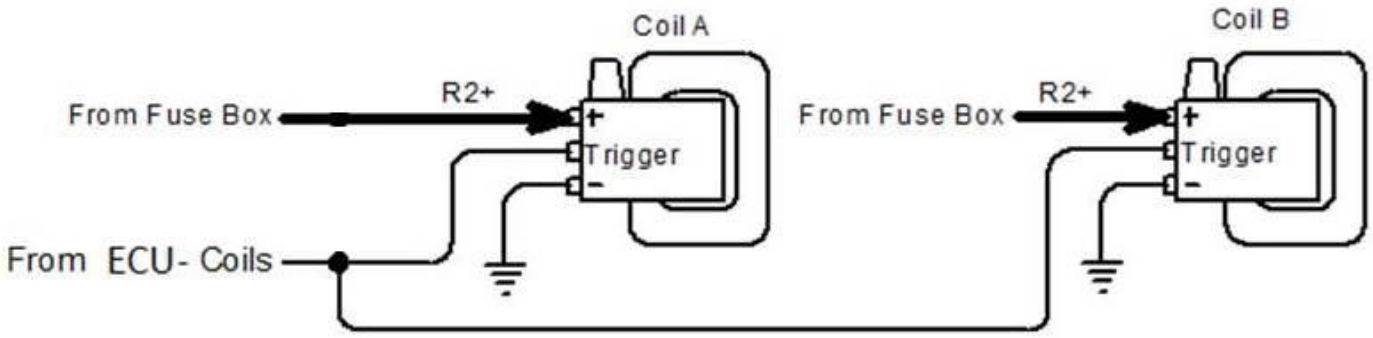
Epoxy filled Basic coils
These hard resin coils and consist of single, wasted spark, COP or combinations of coils in a single housing. Some have built in driver electronics. If it has no driver there is usually a common pin and one pin for each coil. To measure this coil put the meter on Ohms and measure all the points. You

should get a 0.8 Ohm reading for each coil. If you measure over the two coils it should read 1.6 Ohm. For these coils Mercury2 must be used with the Mercury Coil driver.



Epoxy filled coils with built in drivers

If you measure high resistances on open circuit, then the coils have an internal driver. These coils normally have a positive, ground and trigger input for each coil. These coils are normally charged with a positive pulse and fired with a negative going pulse. Mercury2 can drive these coils directly. These Coils with internal drivers can be connected two coils per output. You must make sure on the firing order to connect the two cylinders of these coils that move up and down simultaneously.



Spark Plugs and Leads

Use high quality inductive suppression leads such as Bougi Cord. Don’t use wire leads: Possible interference.

Be careful when changing spark plug type. Always consult the vehicle's owner’s manual first. Some ignition coils are sensitive to the type of spark plug used. If the ignition system uses resistive type plugs from the factory NEVER use non-resistive plugs as it may result in coil failure.

Run high tension leads as far from the ECU wiring as possible (especially sensor signals). Otherwise reconsider the wiring loom and layout. If the loom must cross the ignition wiring it should do so at 90° angles to minimize the interference.