SE-EFI

Small Engine Electronic Fuel Injection

– Conversion Kit

Honda GX35

Installation Manual

ECOTRONS LLC

V1.3

Note: this manual is written based on a conversion with a Honda GX35 engine, but it can also be used as guidelines for other similar engines. Some common sense shall be used to convert different engines. If you are not sure about any specific details, please contact us at info@ecotrons.com.


Small Engine EFI kits for Honda GX35 engine (PNP)
IAT
ECT
Harness
ECU
RS232 cable
USB conneccivity
Throttle body
& adaptor
CDI
ECU controlled
Software and
Documents
MAP sensor
O2 sensor
Injector
Fuel line
Fuel filter
HALL sensor (S)
Fuel pressure
regulator
Fuel Pump
T-pipes

SE-EFI Kit

Introduction

SE-EFI is an Electronic Fuel Injection conversion kit for small engines. This install procedure is a customized version for the Honda GX35. It is only a hardware installation guide. It does not cover any tuning or ECU Programming. The locations of the components are up to you, the ones shown here are preferred locations by some early adopters.

This EFI kit has below features:

- Electronic fuel injection (EFI)
- Quick engine start even at cold temperatures
- More power and torque than the carbureted version
- High fuel efficiency and low carbon emissions
- Decel-fuel-cut-off
- OBD - on board diagnosis
- Performance tuning for advanced users.

Parts:

1. ECU
2. Harness (including the connectors)
3. Throttle Body and Intake manifold Assembly
   - Throttle body (including TPS sensor)
   - Intake manifold
   - Fuel injector
4. Fuel pump assembly
   - Fuel pump assembly (outside of the tank)
   - Fuel filter
   - High pressure fuel line
   - Fuel hoses T-Pipes Clamps

5. MAP sensor
6. Engine temperature sensor
7. Intake air temperature sensor
8. Serial communication cable (to a computer)
9. USB adaptor – included
10. Oxygen sensor and bungs (optional)
11. CD for tuning software (downloadable from our website)
12. CDI – ECU controlled (optional, you can use your own CDI).
13. Ignition Coil – Either CDI driven or ECU driven inductive type coil (optional)
14. Hall sensor

Note: **the kit needs 12V charging system for power supply.** The charging requirement is 3A current max or 45W power as the minimum. This kit may need tuning to achieve some desired results.

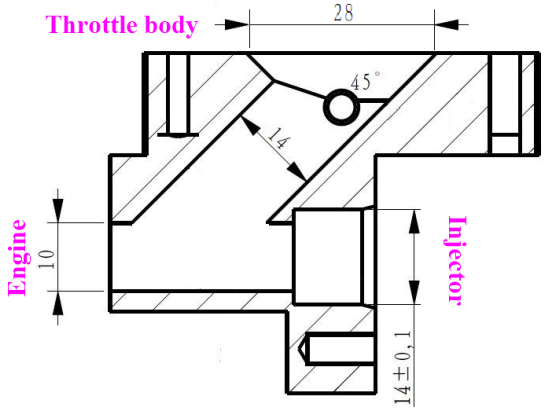
Though the EFI is meant to reduce the emissions than a carb system, this kit is not certified for any emission regulations. It is the user's responsibility to find out whether it's legal to use it.

Major components:

ECU

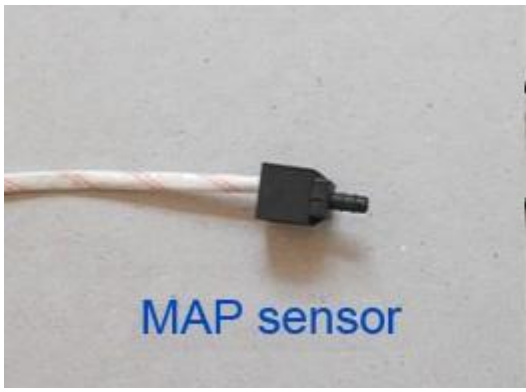
Harness

Throttle body

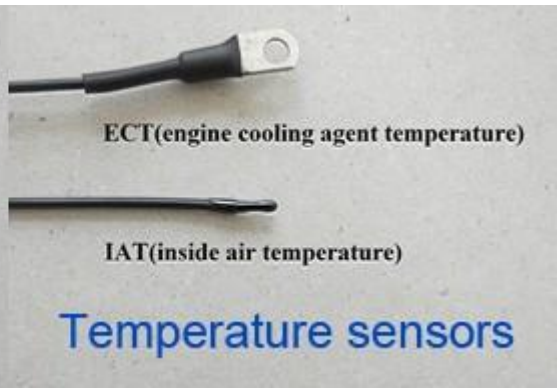


Intake manifold

Hall sensor



MAP sensor



Temperature sensors

Small fuel pump assembly

Chapter 1 Installation Procedures

1. Install the throttle body assembly

1.1 Remove the carburetor from the engine

1.1.1 Remove side covers.

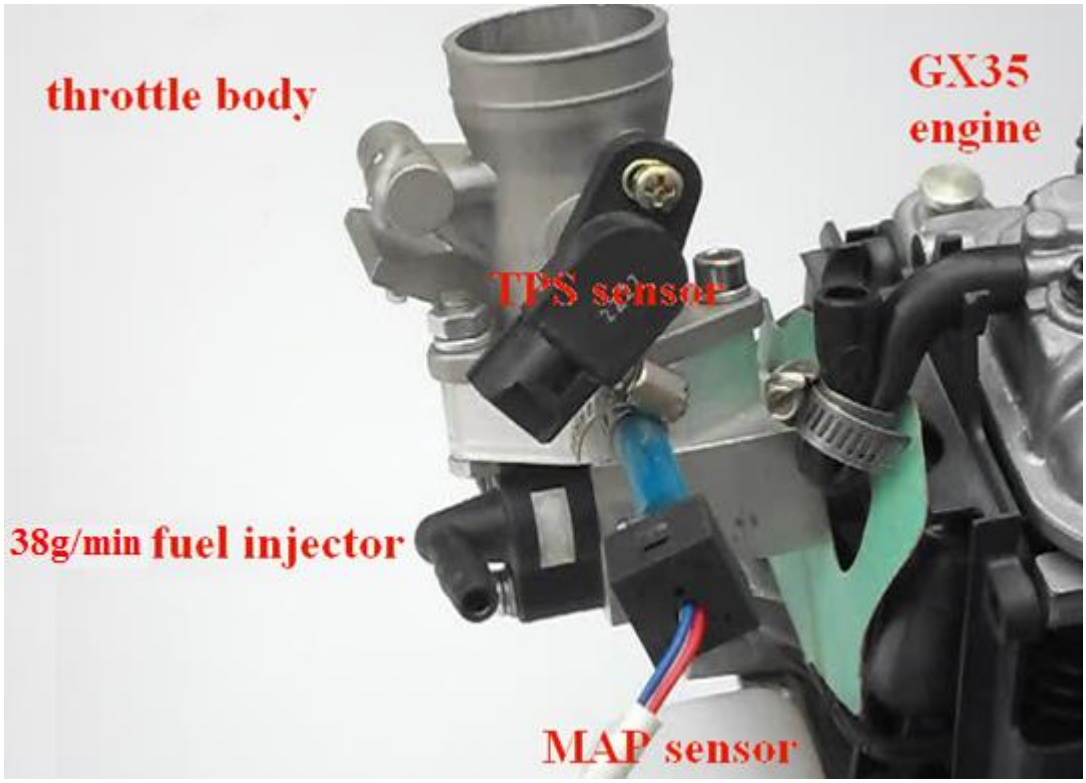
1.1.2 Disconnect and remove the battery if you have.

1.1.3 Remove the air filter and the carburetor.

1.2 Install the throttle body.

1.2.1 The screws fixed carburetor is too long; the throttle can not be installed. So Cut the screws shorter about 10mm.

1.2.2 Install the new throttle body



And then add a new air filter.

Note: The TPS sensor and the fuel injector have been installed on the throttle.

1.2.3 Find a secure place to install the MAP sensor.

You'd better fix it to the frame which can protect it from hot engine. And Connect the MAP sensor to the intake manifold with the small pipe.

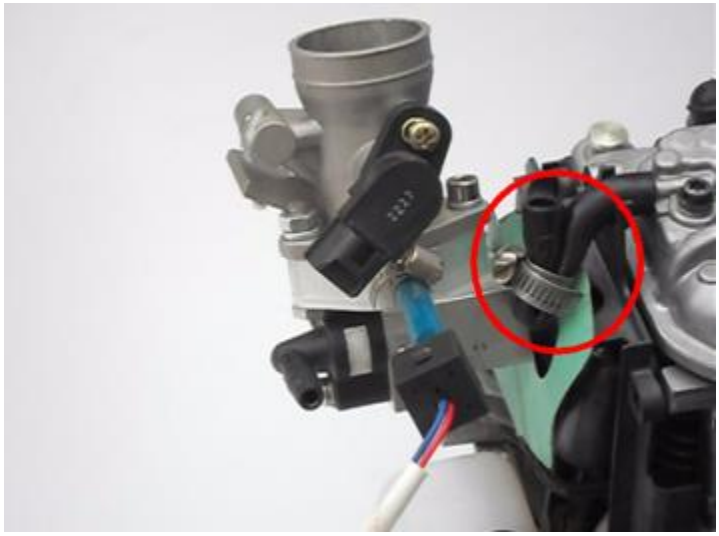
Note:

1. The MAP sensor is fixed not closed to the engine avoid damaged the sensor because of high temperature.

2. The MAP sensor pipe should be about 5cm, but not longer than 10cm.

3. the sensor hose is not severely bent, or not routed in circle. Or there could be a pocket that the fuel puddle is formed. Fuel puddle could damage the MAP sensor.

1.2.4 Seal the pipe. It is not used



2. Fuel tank modification

2.1 This kit has a fuel return line which needs to be somehow feed-back to the tank. If your tank has an existing hole on the top (for example the vent hose between the tank and charcoal canister, or a possible hole through the fuel sender fixture). You can take advantage of that, and connect the fuel return line to that hole and make sure the fuel can be returned to the tank from the pressure regulator. (A T-pipe can be used here).

2.3 You need to drill a hole on the tank. First, drain the fuel tank completely! (WARNING: modifying the fuel tank with any fuel in it can cause fire!!!)

2.4 Take the fuel tank off, if necessary.

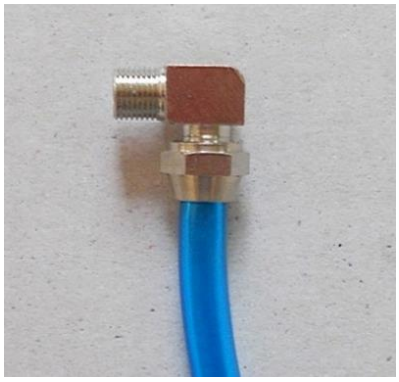
2.5 Drill a hole (diameter: **5mm~6mm**) on the upper wall of fuel tank, or just below the fuel tank cap.

2.6 Use provided fuel return-line nipple to fit to the tank and tighten it with a nut.

And seal it.

2.7 Clean the fuel tank if any debris falling into it.

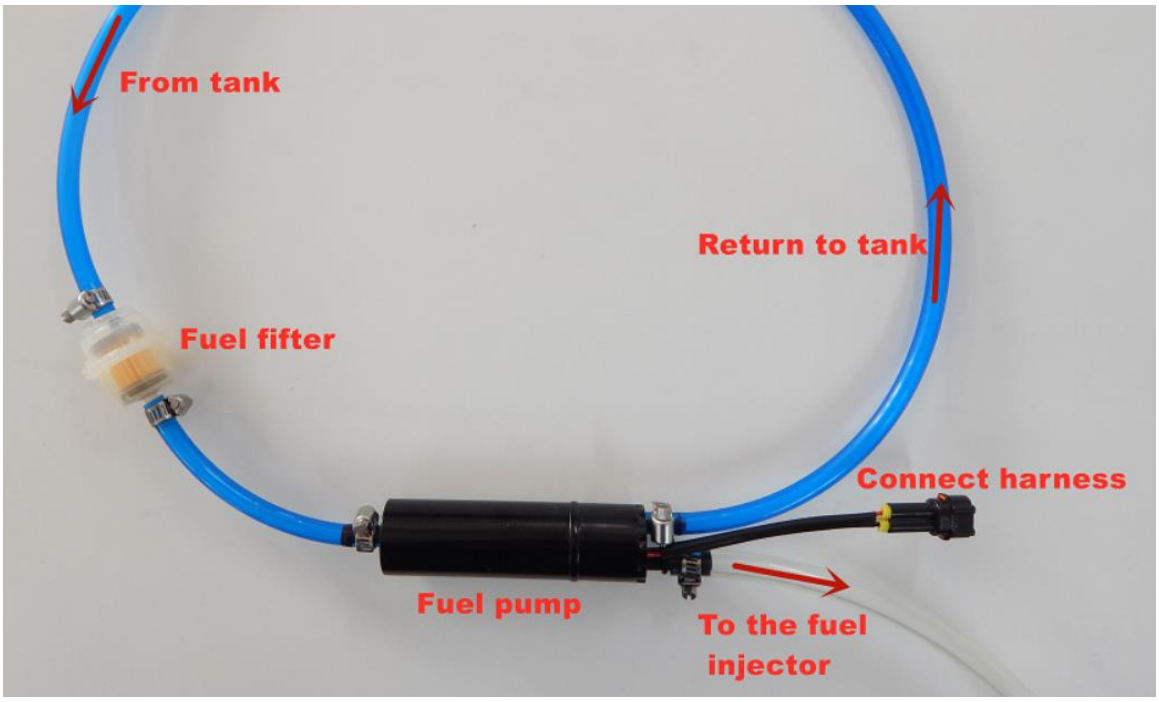
2.8 Install the fuel tank back.



Fit the fuel returns line to the tank with the fuel tap.

3. Install fuel supply system

Please have to find a good location to install the fuel pump. By default, the fuel pump should be lower than the fuel tank.

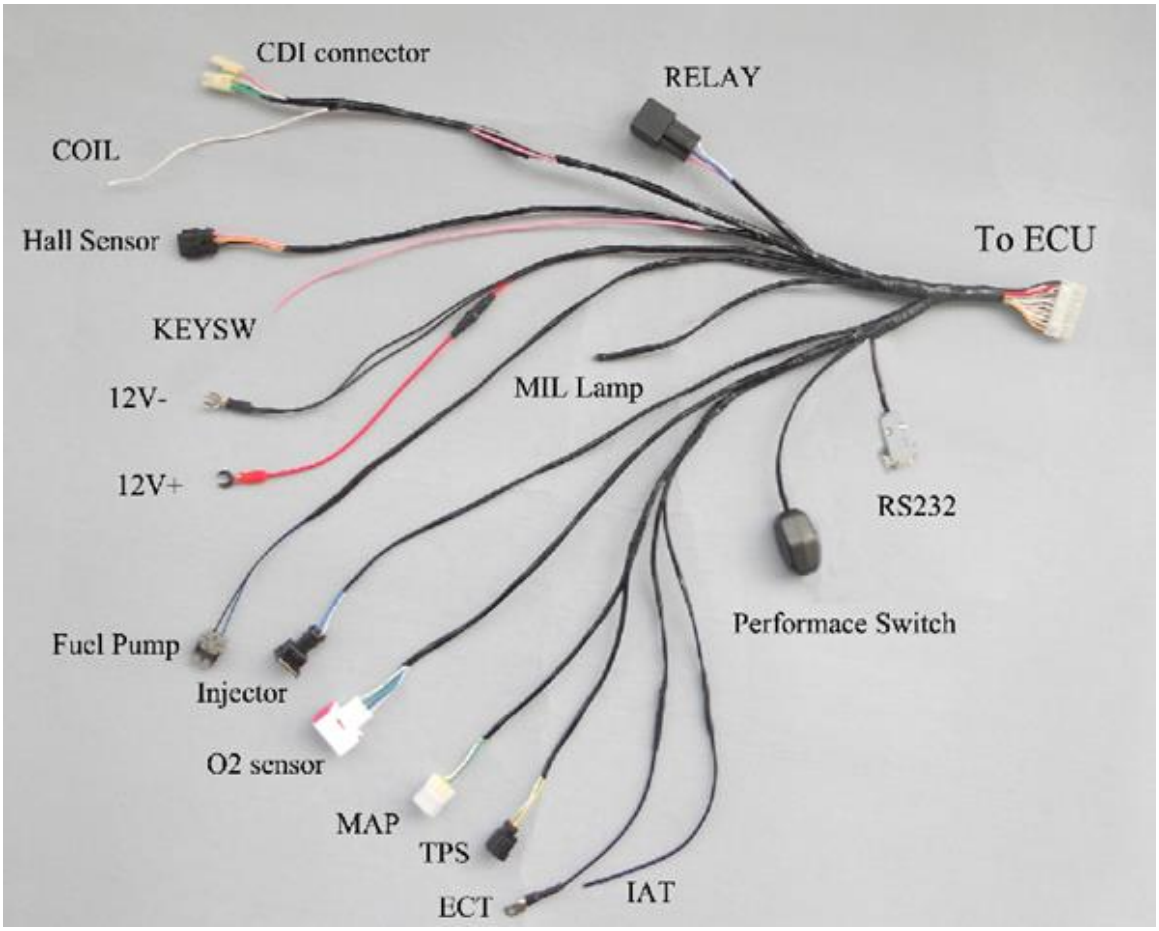


The fuel pump is a rotor type, has 25L/h flow rate. It has only limited sucking power. If there are too many air bubbles in the fuel lines, the pump will not work. Air must be FULLY purged from all fuel lines before attempting startup. Any air bubbles will impede fuel flow and cause reduced performance or “No Start “condition.

4. Install ECU harness

Note: The only wire that can be connected to the +12V directly is the RED 12V+ wire. NONE of other individual wires should be connected to +12V battery directly. Otherwise the ECU could be damaged!

Here is a real harness picture:



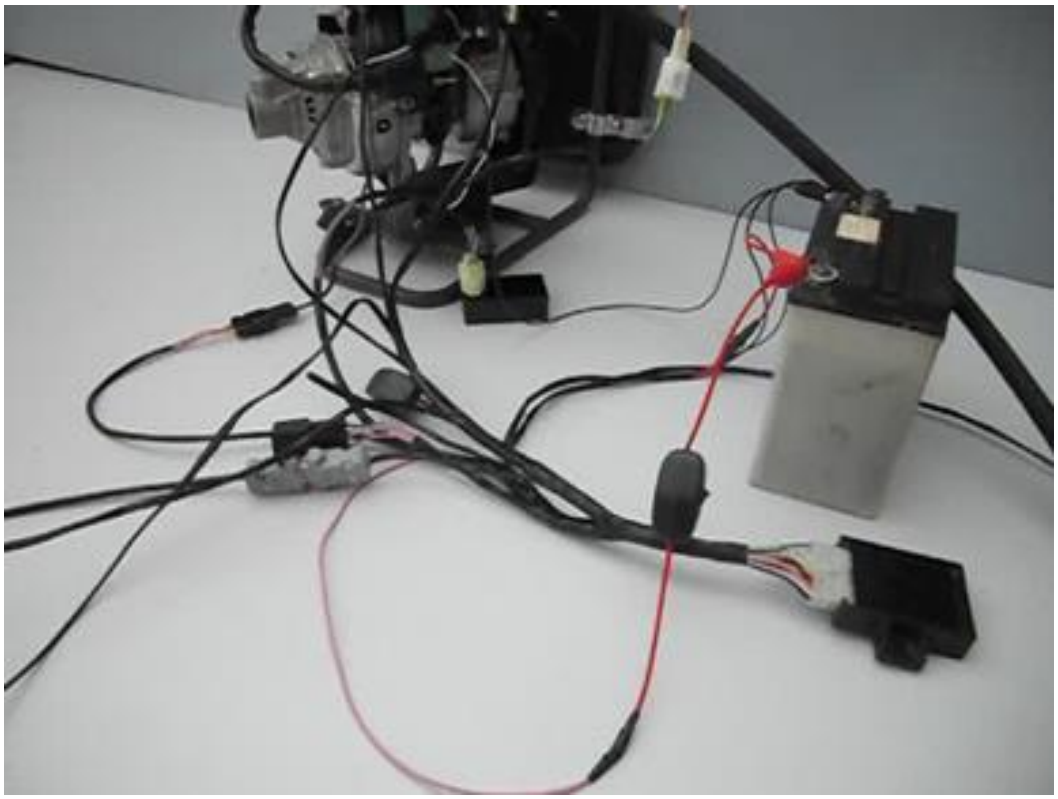
Label descriptions

label	Descriptions	Notes
ECU	Electronic Control Unit	
RS232	Serial comm. cable to a PC computer	
O2S	Oxygen sensor	
Fuel Pump	Fuel pump power and ground	
12V-	Battery 12V-	
12V+	Battery 12V+	
IAT	Intake Air Temperature sensor	
ECT	Engine (Coolant) Temperature sensor	
Performance switch	Manual switch to select fuel tables: ECO mode vs. Rich mode	
TPS	Throttle position sensor	
MAP	Manifold absolute pressure	
INJ	Injector	
CKP	**Crank Position sensor Connect HALL sensor** (or **VRS sensor**)	**Orange**
CDI-Ctrl	CDI control output from ECU	**Gray**
GND	Ground (previously called Analog Ground)	**Green**
KEYSW	Key On switch (previously called IGNSW)	**Pink**

Note: the wire color scheme may be different for old versions. If your harness looks different than the one in the picture, please contact us for exact wiring info.

5. Install the ECU

Install Ecotrons' ECU unit in a suitable place, such as fixed it on the frame.



6. Harness Routing

Find suitable locations for the harness.

7. Hall sensor wire splices

Ecotrons supplies hall sensor or VRS sensor as your pick up sensor. So you need install it first. If ECU needs control the CDI to fire, you need replace the original ignition coil with the hall sensor and Ecotrons CDI. If not, only install the hall sensor, and do not remove the original ignition coil.

The hall sensor connector has been included in the harness.

7.1 keep the ignition system

In this case, ECU only controls fuel injector.

7.1.1 Remove the shroud, and drill a hole (12mm).

Note: the hall sensor must face to the center of both the fly wheel

and the magnet.

7.1.2 Install the hall sensor.

7.2 ECU control ignition

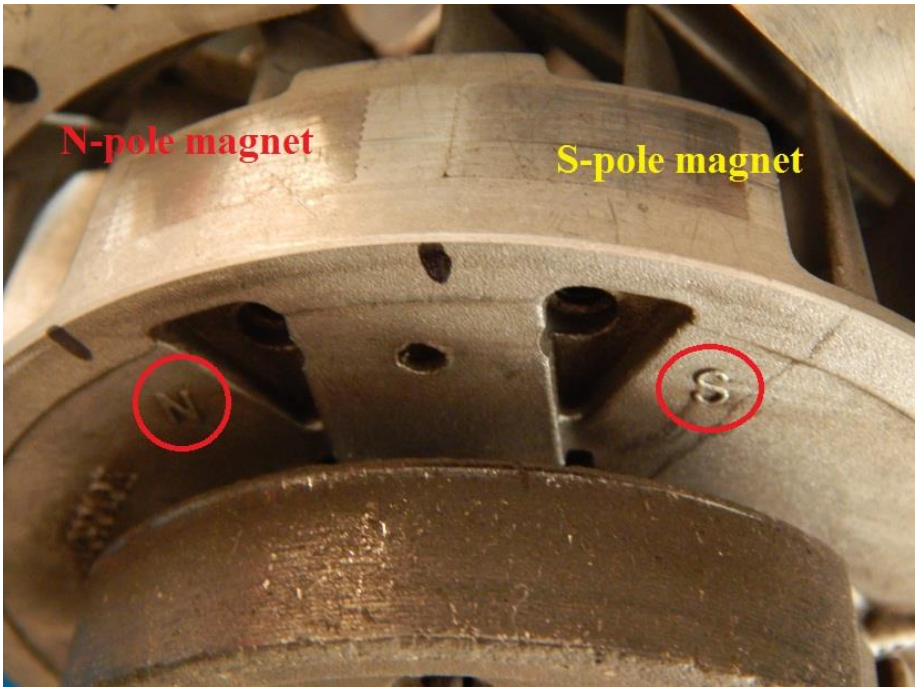
In this case, ECU controls CDI to fire, and controls fuel injector too.

You need replace the original ignition coil with Ecotrons' CDI and Coil.

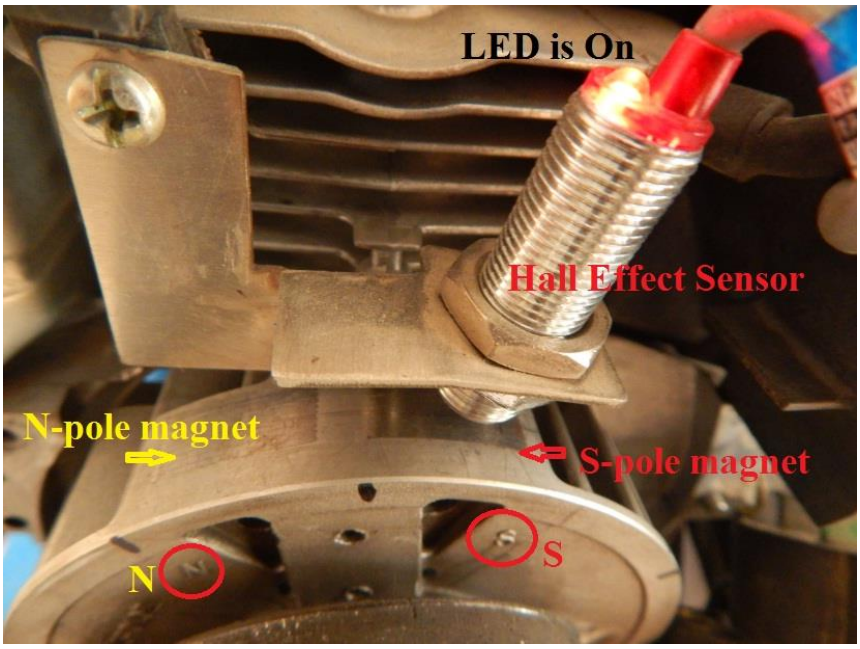
7.2.1 Remove the stock ignition coil.

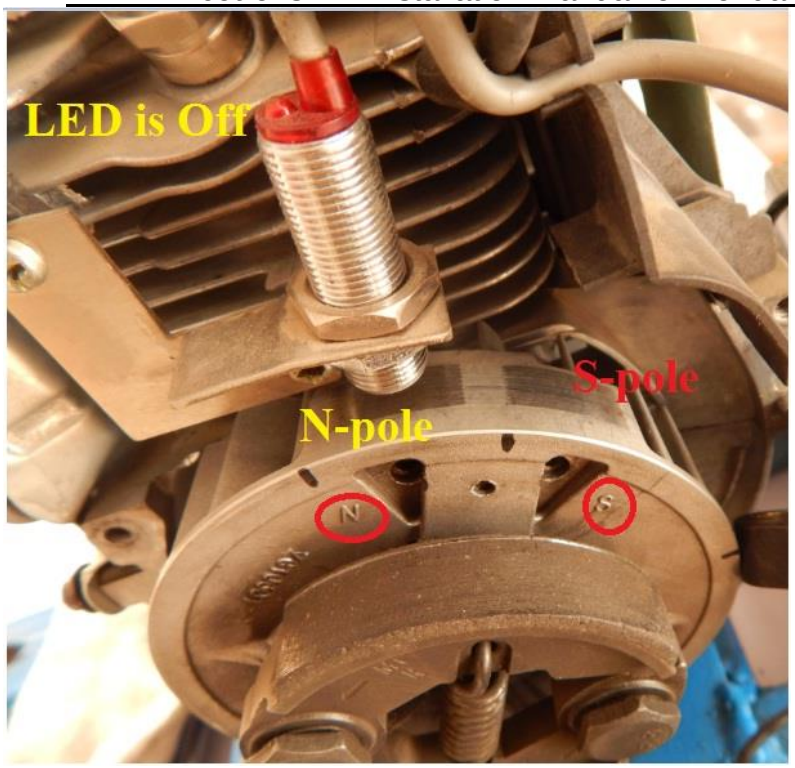
7.2.2 Install the hall sensor like below pictures.

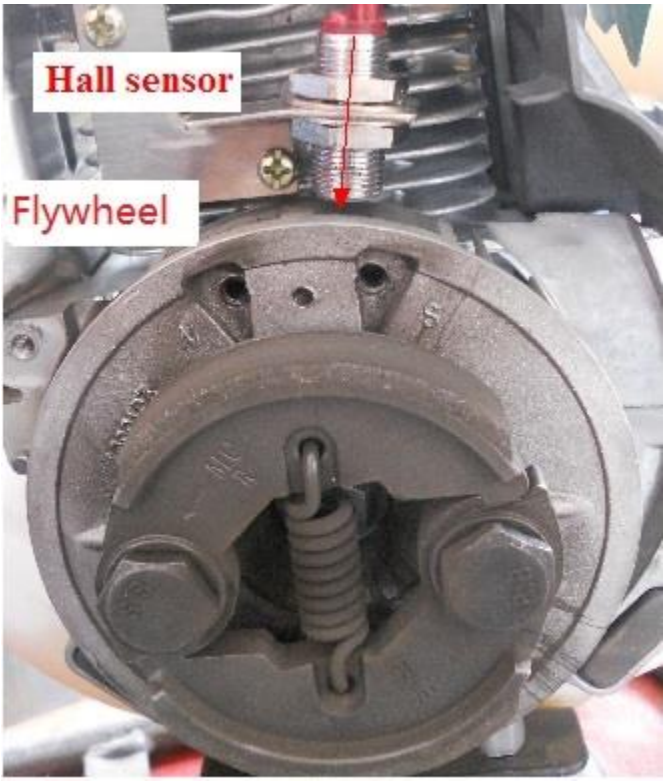
There are two magnets on the flywheel, one is N-pole magnet, and another is S-pole magnet.

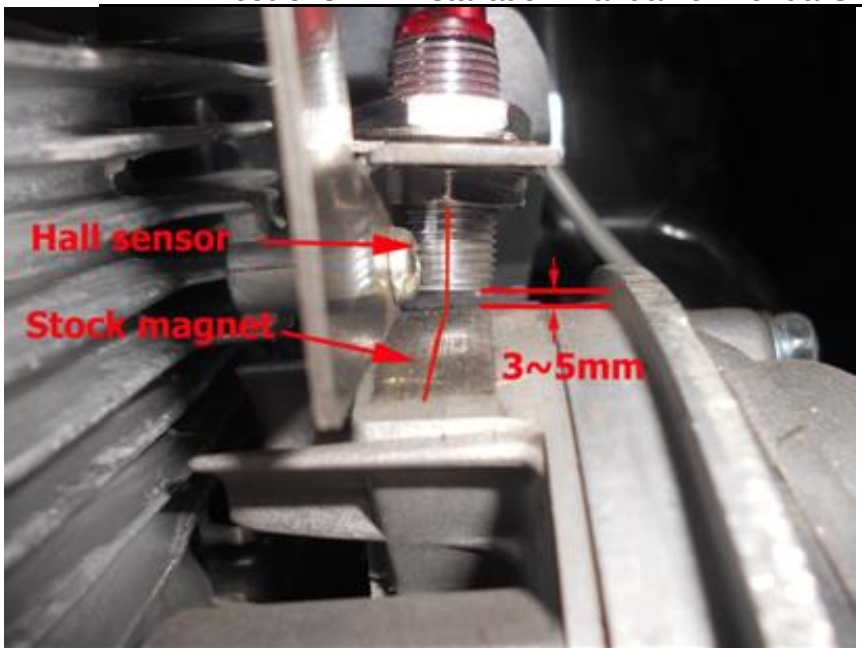


Our Hall Effect Sensor is by default South-Pole Magnet trigged.




LED is Off
S-pole
N-pole
N
S


Hall sensor
Flywheel

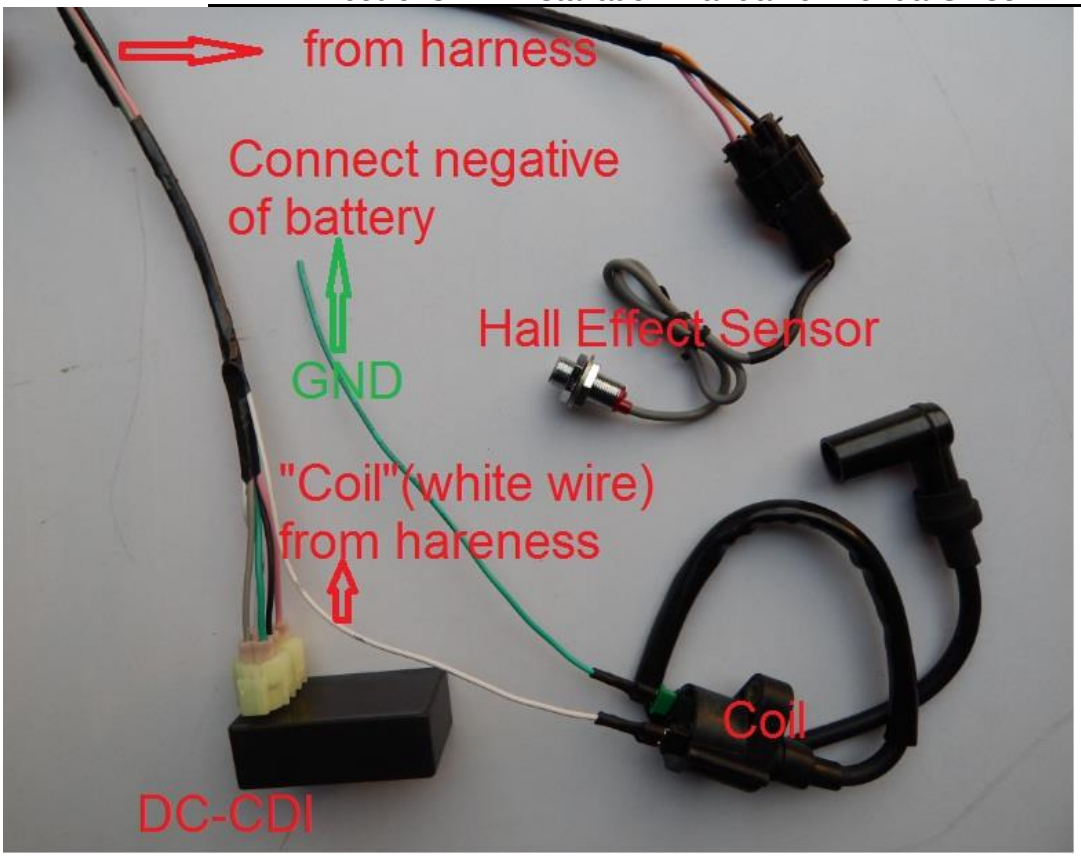


Note:

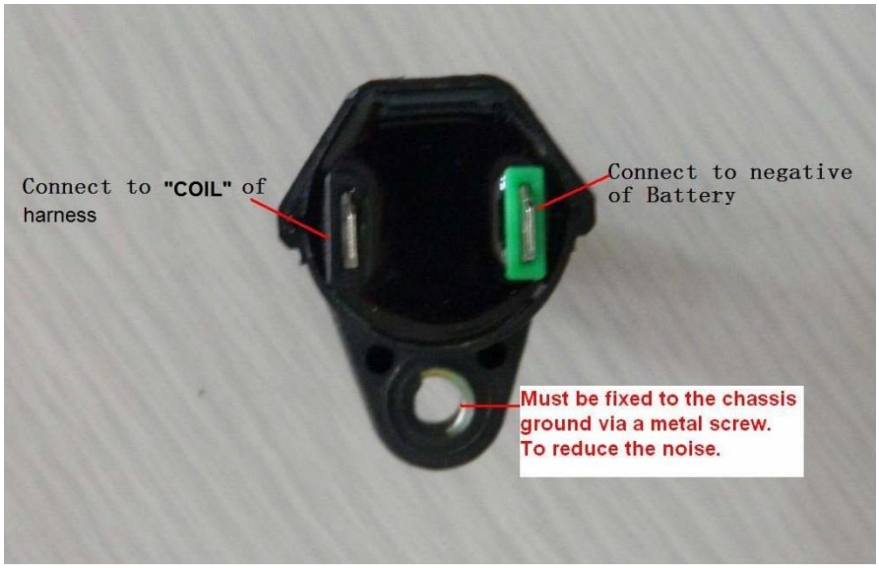
1. **The distance between hall sensor and magnet is 3~5mm recommended.**
2. **The hall sensor should face to the center of the fly wheel**
3. **Also the sensor should face to the center of the magnet.**
4. **Both length and width of the magnet must be 12mm at least.**

6.2.3 How to install the CDI and Coil?

We will provide the Hall Effect sensor, DC-CDI, and Coil on the EFI kits. Find suitable locations for the CDI installation. Connect them as flows.



Details of ignition coil.

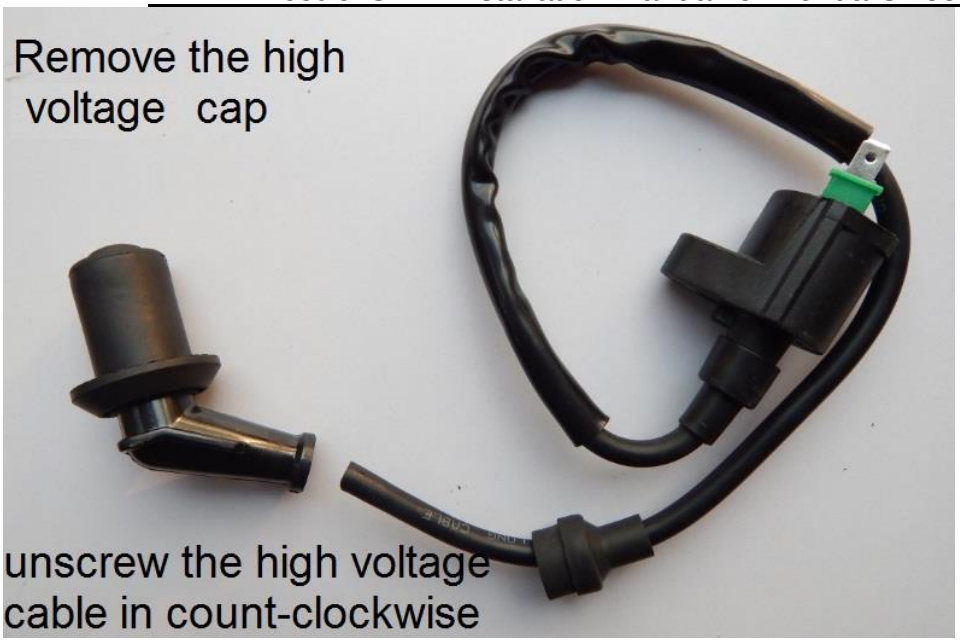


Note: if you use the coil from Ecotrons, because of the length of high voltage cap, maybe the stock plastic shell is not be installed again.

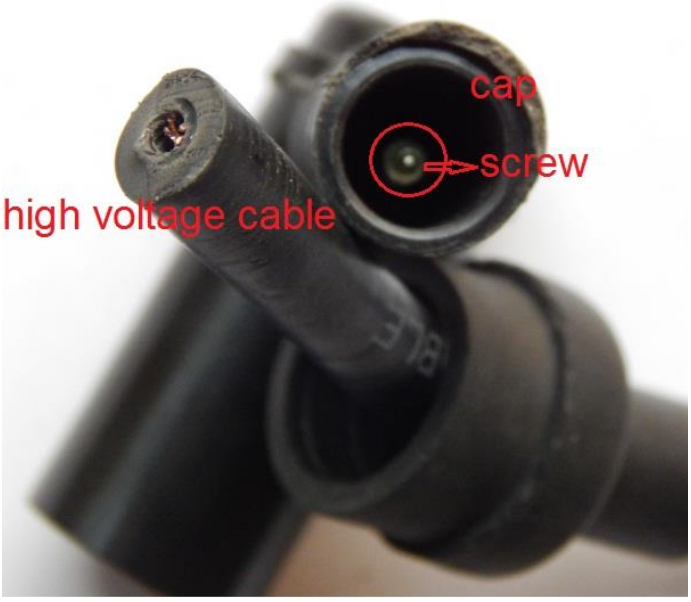
For some reasons, maybe some customers receive the Coil, but the high voltage cap is not fit the stock spark plug.

So you need find and buy a suitable high voltage cap on aftermarket or ebay to replace the un-suitable cap.
See bellows:

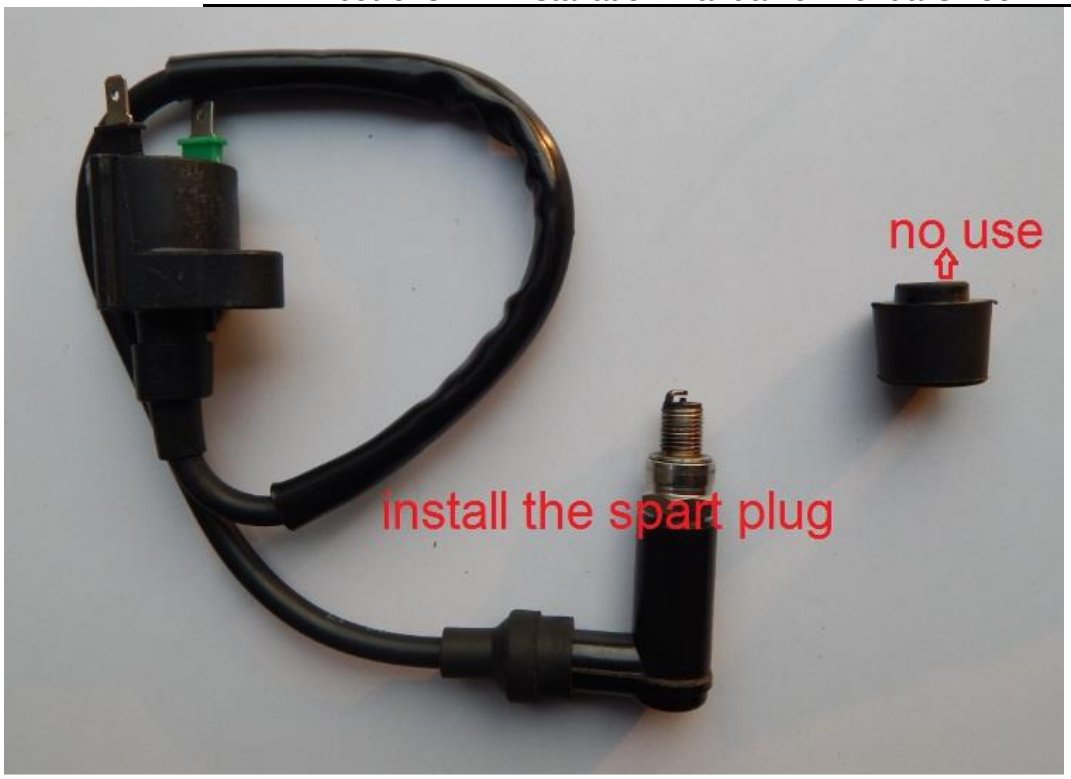
Then replace the un-suitable high voltage cap
Step1: Remove the improper high voltage cap from the coil



Step2: install the new high voltage cap on the coil



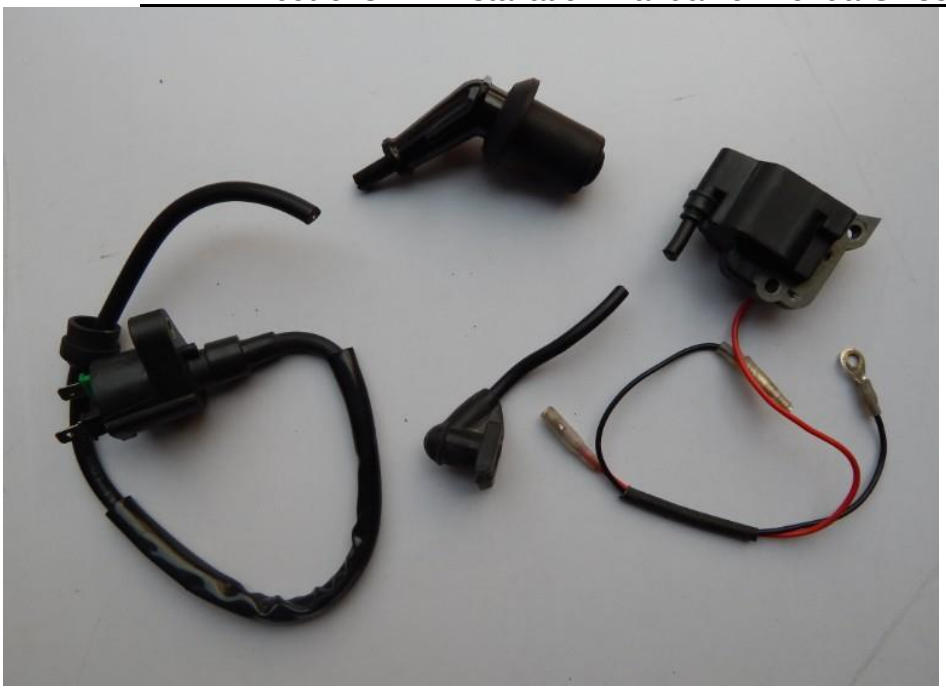
There is a screw on the high voltage cap, so please tight the screw into the high voltage cable.



Another method:

Use the stock coil and the new coil from Ecotrons to product one new coil

Step 1: Cut off the two coils by using a knife or shears



Step2: Put the Ecotrons high voltage cable and stock high voltage cap together.

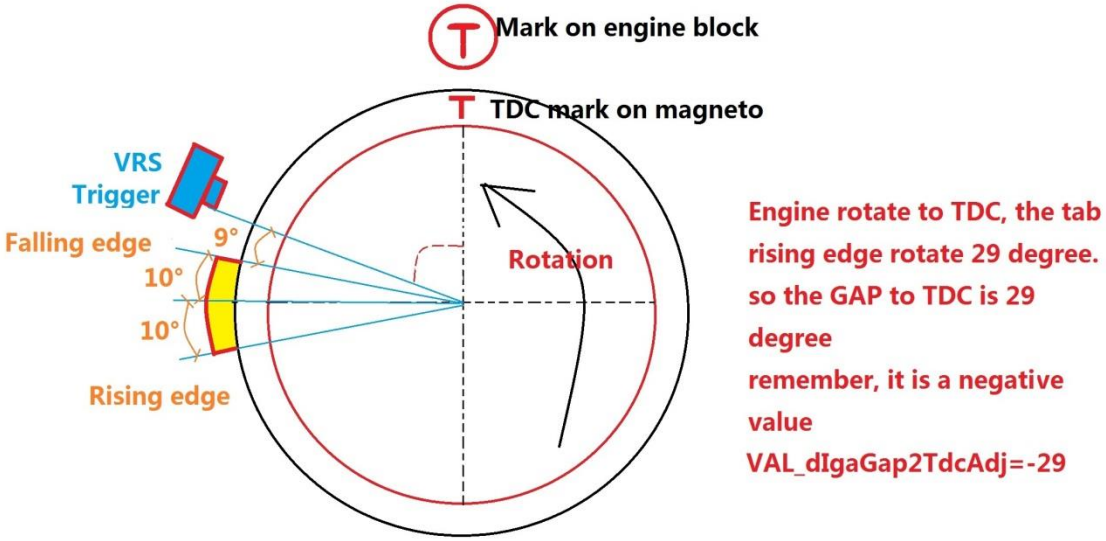
Connect them together

Note: because of the high voltage on the cable, about 15k-30k V, so you must tape them with High voltage proof material for safe.

If you can't make sure to avoid the voltage leak, please don't try this, and use the first method to fit the spark plug.

Ignition control by ECU

If you use ECU to control ignition you need to find the angle from Trigger pulse (magnet) to TDC for ignition control



Note: It is a negative value. It is different than the ignition angle table, where the negative means after TDC.

We have measured the angle of GX35 engine. This default number (-60) is OK for Gx35 engines with S-pole Hall Effect Sensor, that you don't have to change.

For example, when you command 0 degree ignition angle, you should see the 60 degree between the trigger pulse and the ignition fire pulse.

More details, please read the Tuning Guide Manual.

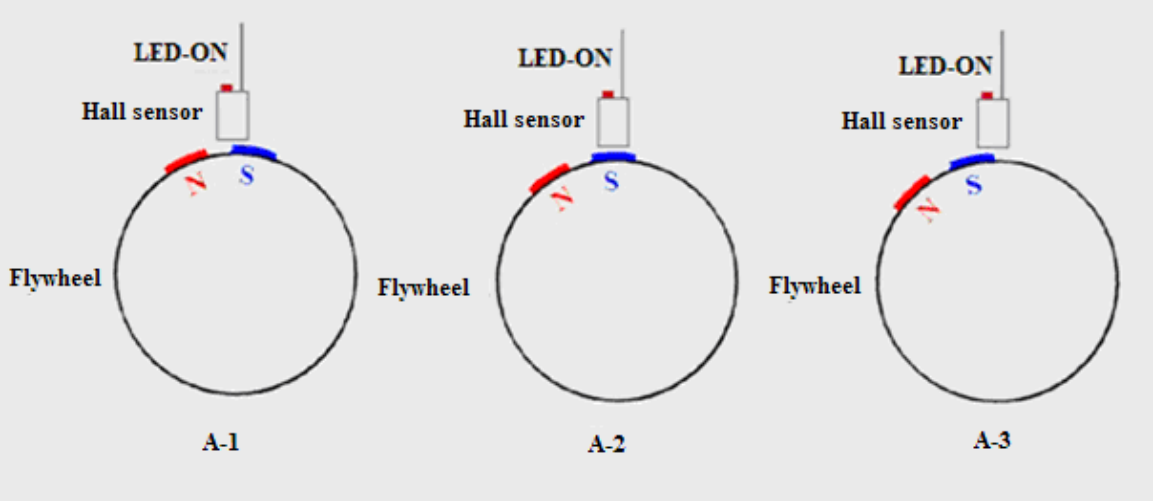
7.3 Check the hall sensor

The hall-effect sensor which comes from Ecotrons works with S polarity of magnet acquiescently. When you get one hall sensor, you need test it to make sure whether it can work with your magnet.

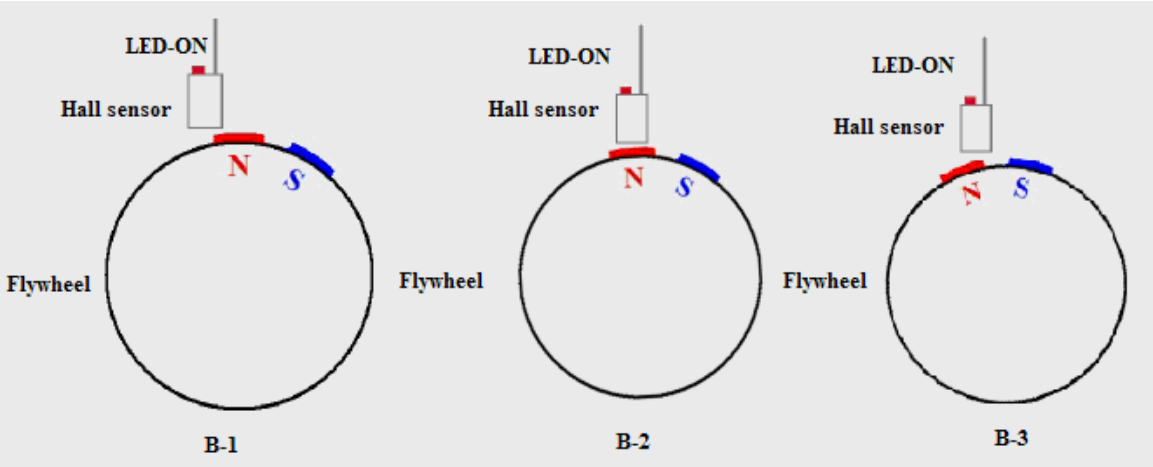
After installed, key on please, and then the sensor will be powered on. Revolve the flywheel slowly. When the hall sensor is trigged by magnet, the LED of the sensor will light. Usually the LED turns on only once per circle.

7.3.1 If the LED lights at the center and the edges of the S magnet, but is off at any other place, it means the hall sensor works with S polarity of magnet.

It is acquiescent for GX35.



7.3.2 **If the LED lights at the center and the edges of the N magnet, but is off at any other place, it means the hall sensor works with N of magnet,** please change VAL_dIgaGap2TdcAdj= -90 for GX35.

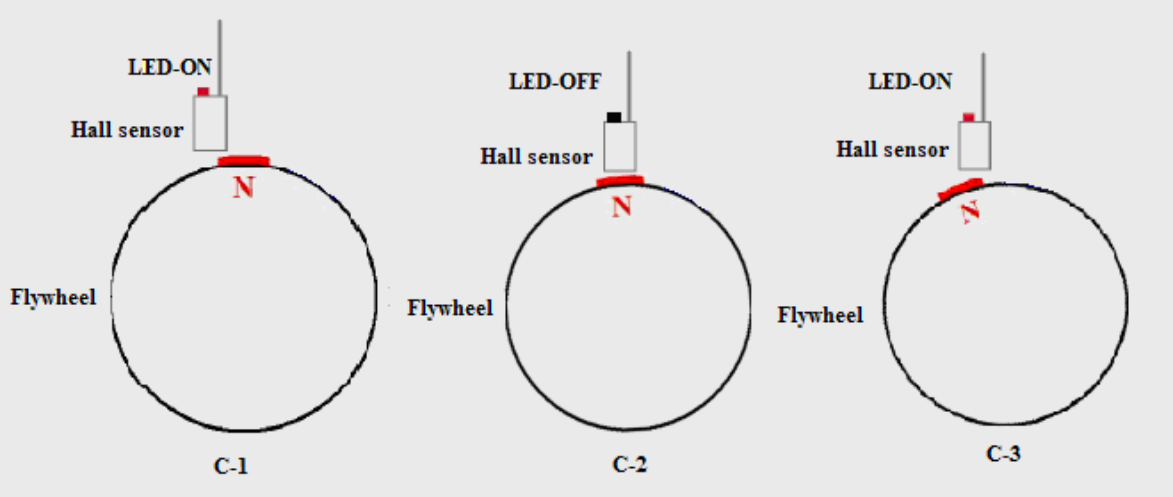


7.3.3 If your engine may be Honda GX200, Briggs engine or other engine. No matter how many magnets there are in the flywheel, if the sensor turns on only at the edge of one magnet, and turns off at the center or any other place, please change VAL_ignore_second_tooth_enable=1, and

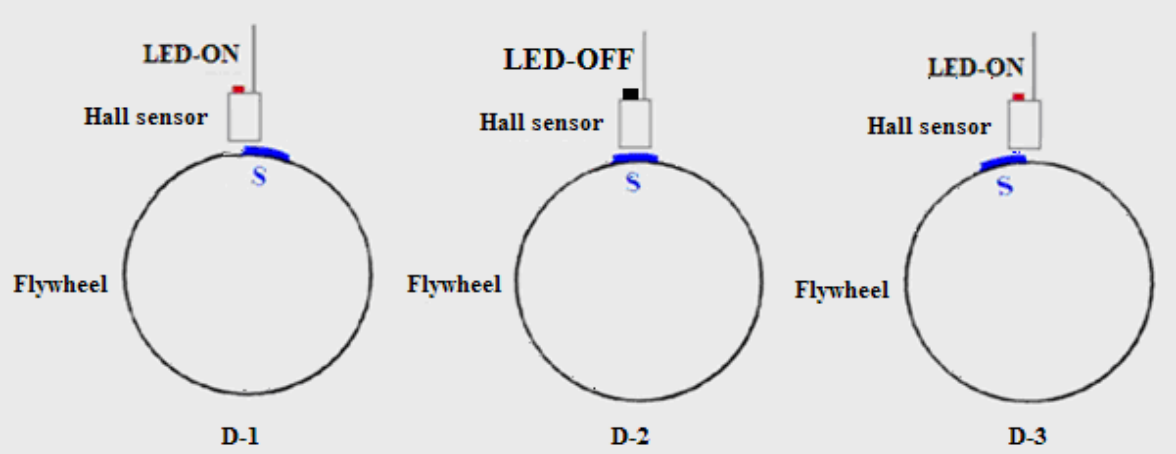
VAL_ignore_second_tooth_x_apart=2 .

It is suitable for following conditions.

The hall sensor can work with an S polarity of magnet, but the magnet is N polarity.



Or the hall sensor can work with N polarity of magnet, but the magnet is S polarity.



Note: if the LED turns on more than once per circle, please contact us at info@ecotrons.com for more information.

8. KEY ON Switch

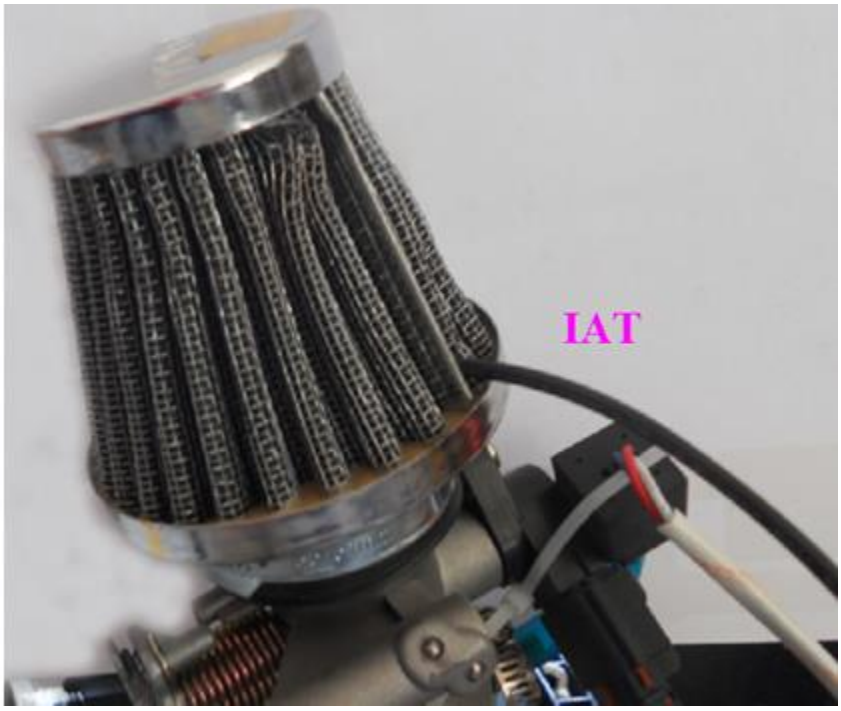
Splice the “key on switch” wire, and connect it to ECU “KEYSW” input (Pink wire). The “key on switch” is the 12V+ signal coming from the key-on signal; for some motorcycles, it also goes through “stop switch / kill switch”. The location of the splice should be after the “stop switch” on the motorcycle, or after the “key switch” if there is no “stop switch”. This is the ECU power-on trigger. Without this wire connected, ECU will not power on.

NOTE: if your GX35 engine does not have a “key on switch”, please add one, which can accept 5A current.

9. Install the IAT sensor.

It can be placed between the Throttle Body and Air Filter, or any convenient location where the intake air flows through.

Drill a small hole and insert the Sensor. Bond it with silicon sealer or other sealing agent.

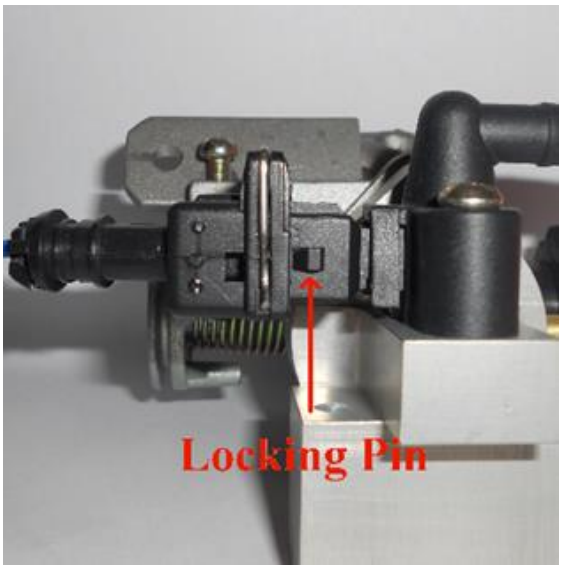


10.Install the ECT sensor

Find a place on the cylinder header, where it has the lowest air flow (usually the backside of the engine), attach the sensor to a bolt and fix it.

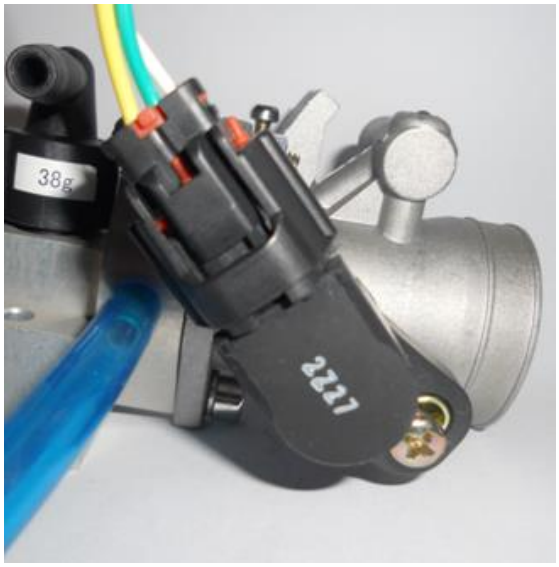
11.Install injector connector

Attach the Injector connector connects to the injector. Be sure connector is locked in it.

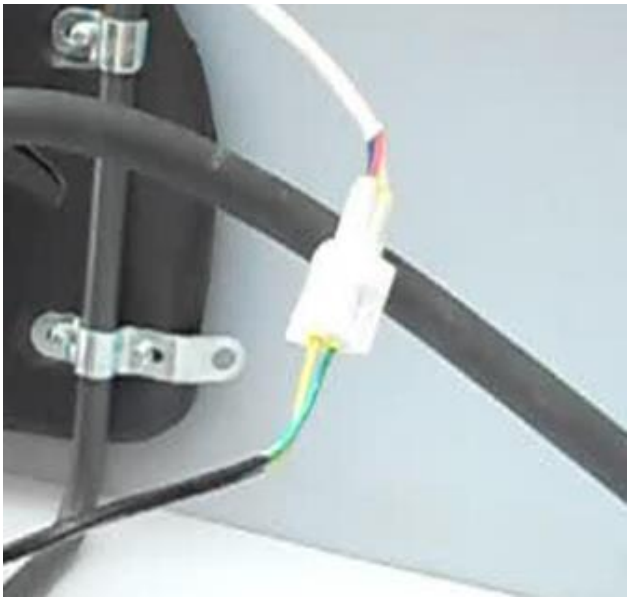


12.Install TPS sensor connector

Attach the Throttle Position Sensor connector. Please connect TPS to connector of TPS.



13.Install MAP sensor connector



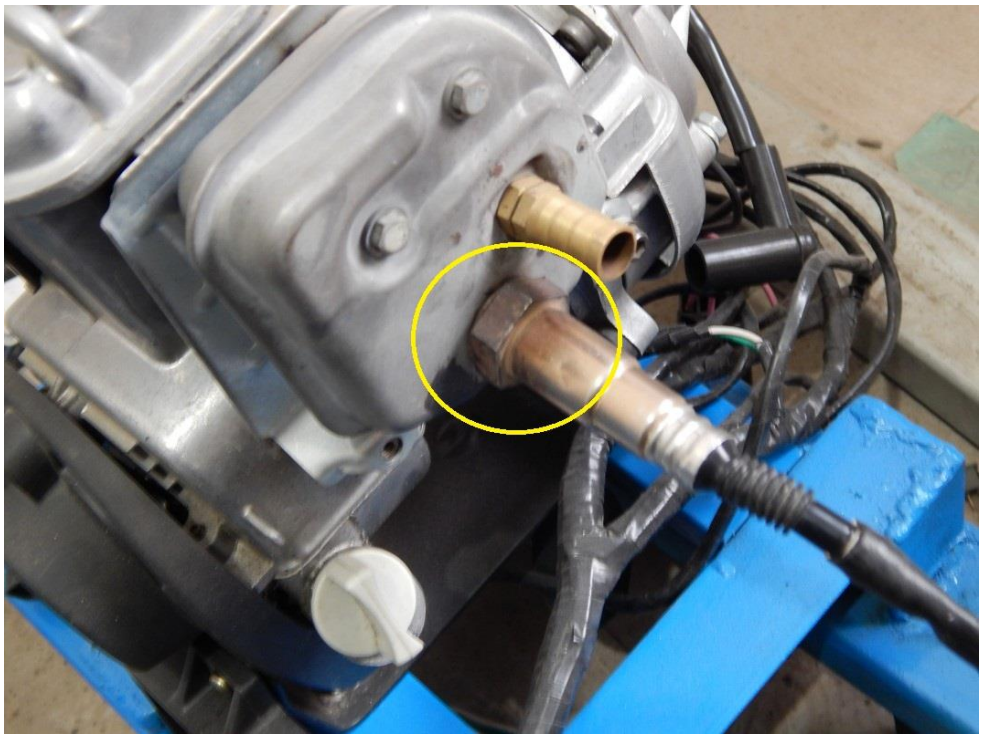
14.Install NB O2 sensor

If your kit includes an O2 sensor, please follow the below steps to install the O2 sensor:

1) Find the correct the location to install the O2 sensor. It needs to be close to the exhaust port, but not too close (3-4" away). Rule of thumb: the O2 sensor can take the advantage of the exhaust heat, so it does not have to be heated all by itself. But you don't want it to be heated too much, because the good temperature range is 300C to 900C.

2) Drill a hole on the exhaust pipe. Weld the O2 sensor bung (provided) on the hole. Make sure the sensor head can be fully exposed to the exhaust gas; yet NOT to block the exhaust pipe.

3) Install the sensor in the bung. Connect the O2 sensor cable.



15.Connect 12V +/- wire

Make sure the negative of battery is connected to the chassis ground! If your engine or vehicle did not have a 12V battery before, and you need add one good charging battery, in this case, you must connect the negative of battery to chassis.

You must connect the 12V – to chassis ground.

Double check and make sure all wires are connected as they should be.

You have finished installation with the initial hardware installation of the Honda GX35 Ecotrons EFI kit.

Chapter 2 Initial test and diagnostics after the installation

1. Before you do the initial test of the EFI kit, make sure the installation is done as the previous section.
2. Key-on and **KEY-ON ONLY**!
3. You should hear fuel pump noise running for a few seconds, if this is not happening, you must have some wiring problem. Re-check all your wires! If every wire is sure correctly connected, then the ECU may have a problem.
4. If you hear the fuel pump running and then stop, this indicates the ECU is working. Now you can fill the fuel tank with the regular gasoline.
5. Repeat the above step 3 times, to make sure the fuel supply lines are filled up with fuel. No air pocket! No bubbles!
6. Sometime, you have to manually purge out all the air bubbles in the fuel supply system, because it is possible that if the fuel pump itself has a lot bubbles in there, it could not pump fuel at all, it is only spinning like idle without load. In this case the noise of fuel pump is little higher pitch than with fuel pumping. In this case you will not be able to start no matter what, because no fuel pumping. If you have any doubt that the fuel supply system has some air pocket or air bubbles, you can un-plug the high pressure fuel line, pointing it into a bottle, and key-on, you should see fuel sprout out if fuel pump is working and no air bubbles.
7. In many cases, you can visually see the fuel flow out of the fuel pressure regulator and return back to the tank if the fuel supply system is working normally. This is another indication you can check.
8. After you make sure the fuel supply system is working normally, try to key-start the engine.
9. First time you start the engine, there may be still some air bubbles in the fuel supply system needs to be purged. So don't be surprised that the first start takes longer, or even you need to start multiple times to be successful.

10. If the engine does not start, go to the next section for diagnosis.
11. After the engine starts, if it's rough idling; let it warm up, and let the ECU self-adapting to the engine for a while.
12. After the idle stabilizes, drive the vehicle in a steady state (constant throttles or constant speeds) at different throttle/speeds. Let the ECU self-adapting further.

13. Then you can try different transient conditions, like fast opening of the throttle, etc.

My engine does not start, why?

Please follow the below trouble shooting procedures:

1) Have you followed the installation manual completely?

1.1) Can you tell that the ECU is controlling the fuel pump?

1.1.1) when you turn on the key, do you hear the fuel pump running for a few seconds, and then stop? If not, you have wiring issues.

1.1.2) Key-off for 3s, and key-on, do you hear the fuel pump running for a few seconds, and then stop? If not, you have wiring issues.

1.1.3) Every time when you try to start the engine (engine spins), do you hear the fuel pump running until engine stalls? If not, your wiring has issues.

1.1.4) If you have key on and off too many times without engine starts, you need to do this: with Key-ON only, disconnect the ECU from the harness, and connect it back. This is to give a power reset of the ECU, so some counters are reset

to 0.

1.2) Do you have the fuel pump installed correctly?

1.2.1) is the fuel pump lower than the tank? The fuel pump must be lower than the tank to avoid fuel starvation. The fuel pump can be higher than the injector, if limited by the space.

1.2.2) Have you replaced the “petcock” tank valve with a manual valve? EFI does not work with the petcock that does not have a PRIME position.

1.2.3) Do you have a fuel return line back to the fuel tank? Our EFI kit currently needs a way to return the fuel to the tank.

1.2.4) Is there impurity in the gasoline? Check your fuel filter.

1.3) Do you have the ignition pick up sensor connected correctly?

1.3.1) Do you have a correct pick up signal input to ECU (CKP wire on the harness)?

1.3.2) Do you have the ground wire of pickup sensor connected to ECU ground wire (GREEN wire on the harness)?

1.3.3) Are you using the stock ignition system (to isolate the starting problem, please use the stock ignition system)?

1.3.4) Can you tell the spark plug is firing when you try to start?

1.4) Do you have the MAP sensor installed correctly?

1.4.1) is the MAP sensor connected to the throttle body tube via the small hose (included in the kit)?

1.4.2) is the intake air system air tight (no other way for free air going into the cylinder except through the throttle)?

2) Do you have the MIL Lamp on (if your harness comes with a MIL Lamp installed)? If yes, go to install the EcoCAL software and read the DTC

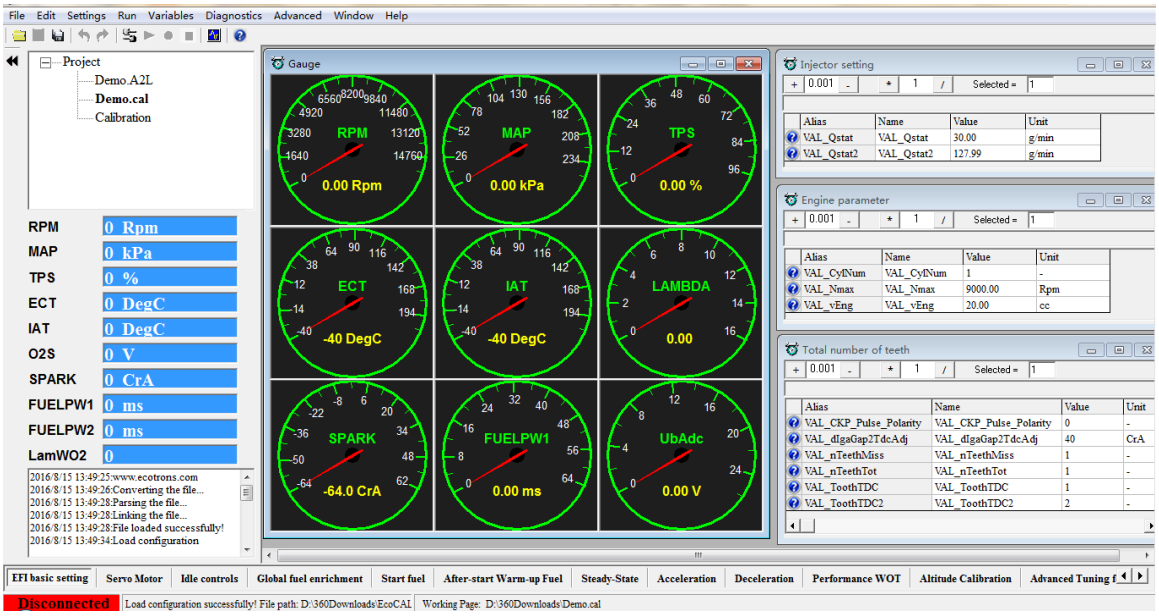
Chapter 3 How to install the provided EcoCAL software to your computer?

For details on how to use EcoCAL software, please refer to the EcoCAL Manual, downloadable here:

www.ecotrons.com/support

Run EcoCAL, you will see below windows:

When you start the EcoCAL at the first time when you finish installation, the EcoCAL will load the Demo files automatically with the default page settings.



Note: If EcoCAL does NOT automatically load the default configuration, likely you do not have the necessary A2L file and CAL file, in the installation folder of "C:\EcoCAL". You should copy and paste the necessary A2L file and CAL file into that folder, if the folder contains no such files.

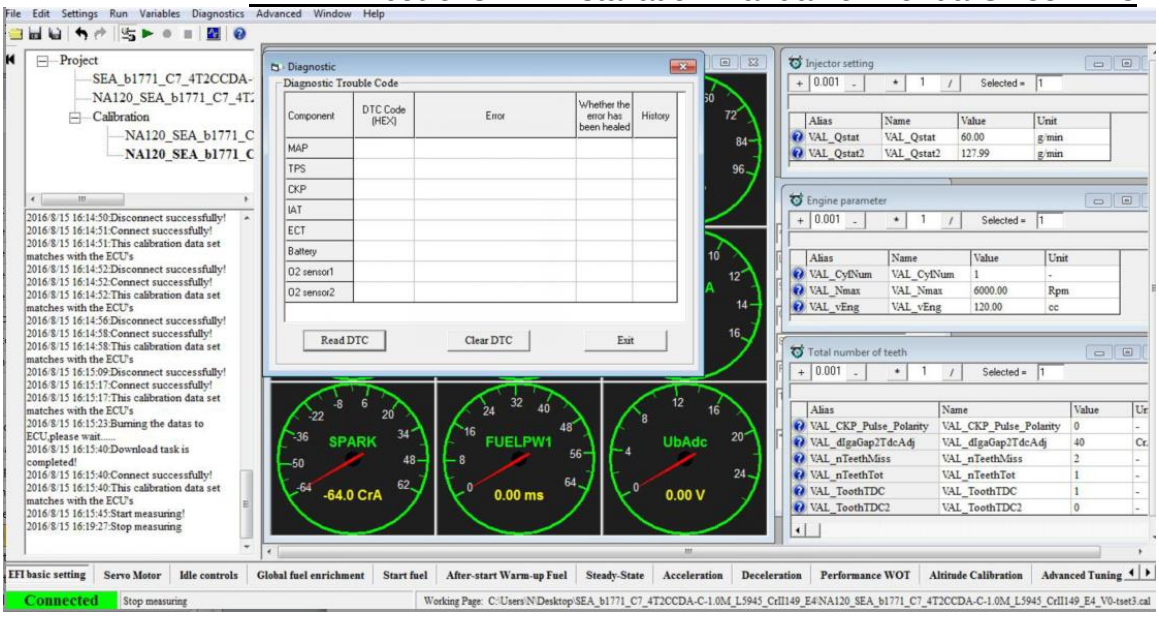
Connect ECU to laptop:

Go to menu->Run->Connect

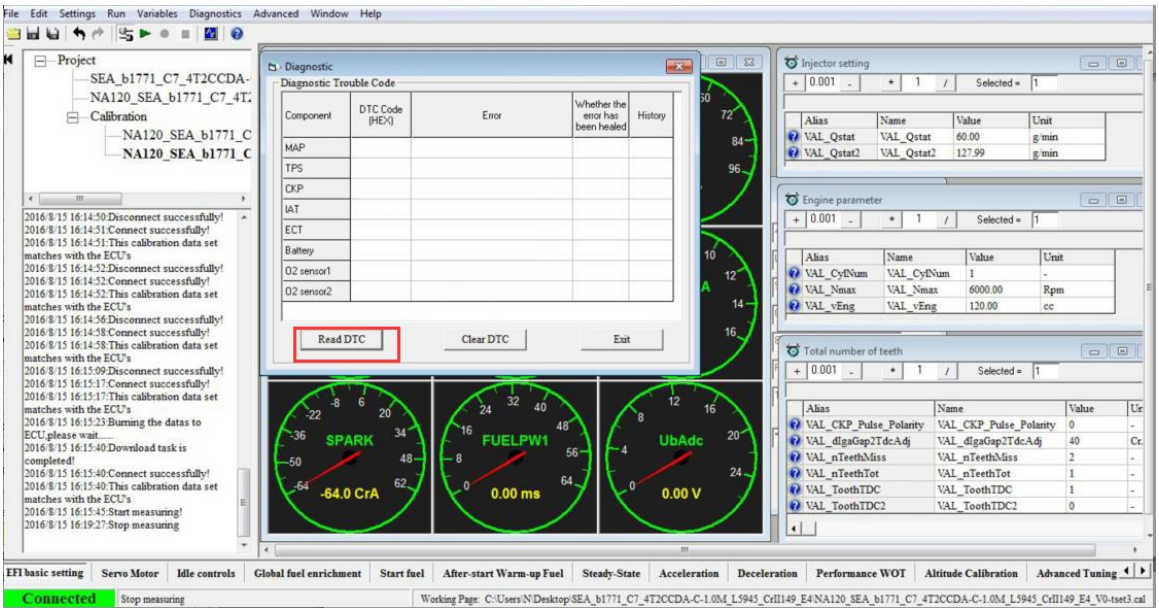
You also can use the shortcut button () of “Connect” to Connect to ECU

Read DTC:

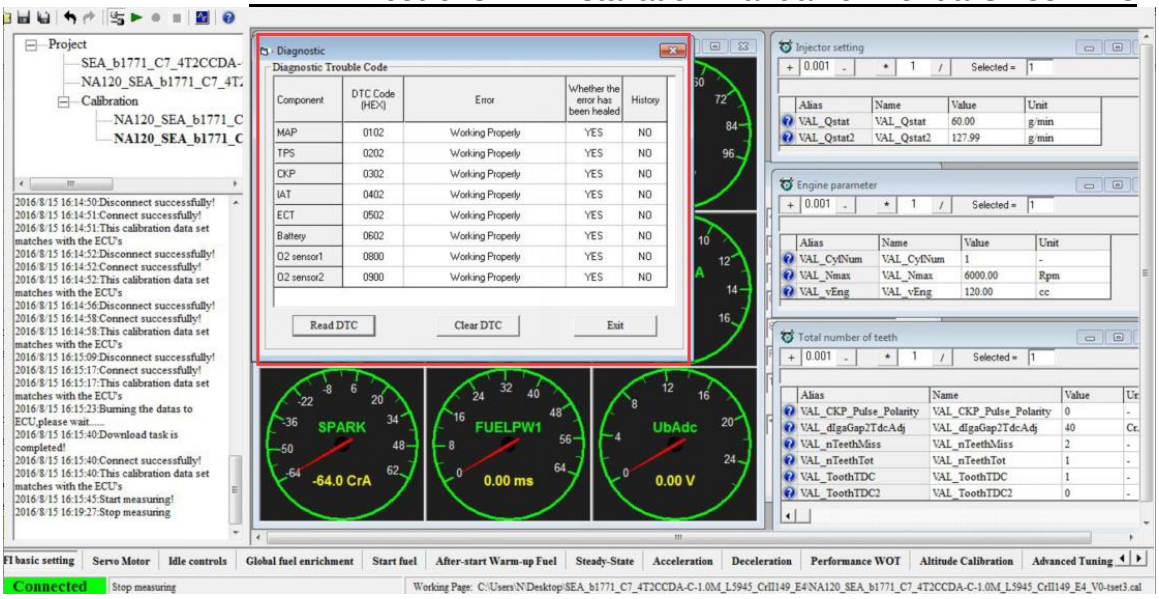
Go to menu->Diagnostics->ECU Diagnostics



Click "Read DTC":



Supported DTC list (TBD)



Diagnosis of the communications between your laptop and ECU:

1.1 Check your serial communication cable; make sure the cable is plugged in completely.

1.2 Check your USB adaptor; make sure it is fully plugged into your laptop.

1.3 If your laptop has a built-in COM port (many old laptops have that); you can use the COM port directly without the USB adaptor.

1.4 Go to "Menu→ setting→ communication settings" select correct port: USB or COM port or other.

1.5 Click "Connect" button in EcoCAL.

How to use EcoCAL to log data:

1) Run EcoCAL (load the correct A2L and CAL file).

2) Key-on; and Key-on only;

3) Go to menu -> run -> connect

4) Go to menu -> run -> start measuring (the numbers in the window should change now...)

5) Go to menu -> run -> start recording

Start the engine, do you test.

Note: You must keep your laptop awake all the time for logging.

6) When you done the test, go to menu -> run -> stop recording

7) Go to menu -> Run -> Play Back

8) In Data Analyzer, click "Open", it will pop up a window, show the folder: "xxx\record"; that's where the logged files are.

Or you can go to: "**C:\EcoCAL\Record**"

9) When you click down the button, EcoCAL will record the data automatically. And save the record file at the installation path of EcoCAL, "C:\EcoCAL\record", and it is named with the time of recording. For example, the record named "2015-7-25-9-31-35-986" is the record file in record. If you need us to help you on tuning, please send the recorded files to us. (**Don't change the file names**)

Diagnosis of the communications between your laptop and ECU:

1.1 Check your serial communication cable; make sure the cable is pushed in completely.

1.2 Check your USB adaptor; make sure it is fully plugged into your laptop.

1.3 If your laptop has a built-in COM port (many old laptops have that); you can use the COM port directly without the USB adaptor.

1.4 **Go to menu->Settings->Communication Settings:** select correct port: USB or COM port.

1.5 Click “Connect” button in EcoCAL.

Advanced Diagnosis:

The advanced diagnosis documentations are still under development; contact us for specific questions… It is always helpful if you can log the data with EcoCAL and send us with your questions:

How to use EcoCAL to log data:

1) Run EcoCAL (load the correct A2L and CAL file).

2) Key-on; and Key-on only;

3) go to menu -> run -> connect

4) Go to menu -> run -> start measuring (the numbers in the window should change now...)

5) Go to menu -> run -> start recording

Start the engine, do you test….

Note, you must keep your laptop awake all the time for logging….

6) When you do the test, go to menu -> run -> stop recording

7) Go to menu -> run -> play back

8) In Data Analyzer, click "File → open", it will pop up a window, show the folder: "...\record"; that's where the logged files are.

Chapter 4 How does the performance switch work?

"Performance Switch" has 2 positions: ECO vs RICH. In ECO position, the EFI will run the base fuel "map", or stoic metric AFR (normal cases), which gives the best fuel economy, and least emissions. In RICH mode, the EFI will run the enriched "map", or rich AFR (at high load, high RPM, esp. at WOT), which gives more power.

ECO mode: close loop fuel with O2 sensor feedback, with ECU self-tuning capability.

RICH mode: open loop fuel, fixed map, no ECU self-tuning capability.

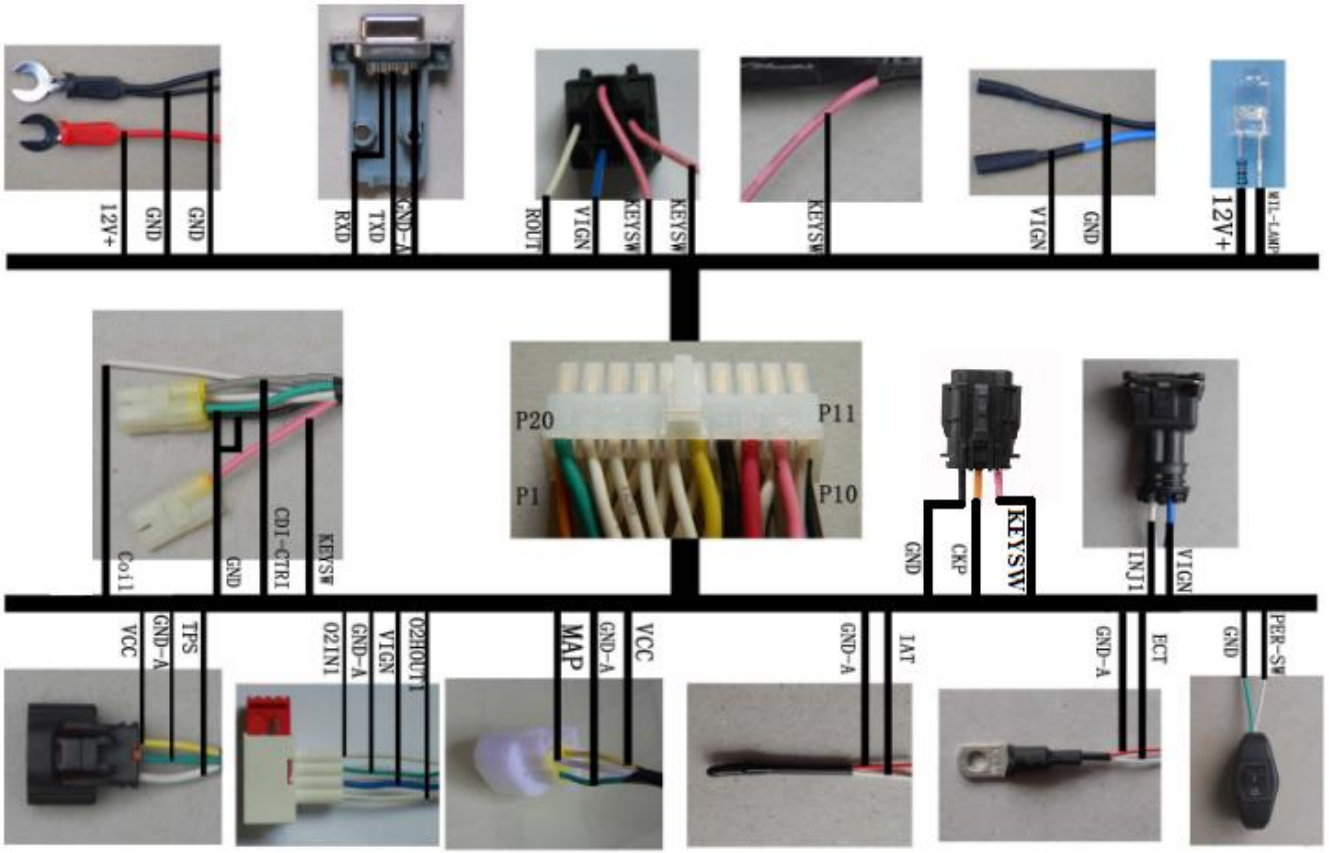
RICH mode is only good if you have a well tuned engine mapping.

Recommend to use ECO mode most of time, and only use RICH mode for temporary fuel enrichment to gain some extra power.

"Performance Switch" is meant to let the user's easily switch between the economy and enrichment modes in real-time, so that he can run for economy when cruising around the town; and can immediately switch to performance mode as he wants.

OFF -> ECO -> STOIC
ON->RICH -> POWER

Appendix I: Wiring harness diagram



Appendix II: ECU main connector pin-out

P1 CKP
-- Crank Position Sensor, connect to ignition pickup sensor signal

P2 MIL-LAMP
--Malfunction Indicator Lamp

P3 MAP
-- Manifold Air Pressure Sensor input

P4 IAT
--intake air temp

P5 RXD
--Send Data to RS232

P6 TXD
--Receive Data from RS232

P7 ROUT
--Power Relay LS Driver output

P8 CDI-CTRL
--CDI control output from ECU

P9 INJ1
--Injector 1 LS Driver output

P10 GND
--Power Ground

P11 O2HOUT1
--O2 Sensor Heater LS Driver output

P12 KEYSW
--Key On Switch

P13 12V+
--Reverse Battery Protected Supply

P14 GND
--Power Ground

P15 VCC
-- +5 Volt supply output

P16 ECT
-- engine (coolant) temp

P17 TPS
--Throttle Position Sensor input

P18 O2IN
-- Oxygen Sensor input

P19 PER-SW
-- Performance Switch

P20 GND-A
-- Analog Ground