SE-EFI

Small Engine Electronic Fuel Injection

– Conversion Kit

Honda GX35

Installation Manual

ECOTRONS LLC

V1.2.4

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.

Honda GX35 Engine Fuel Injection 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 (outside of the tank)
- Fuel pressure regulator
- Fuel filter
- High pressure fuel line
- Fuel hoses T-Pipes Clamps

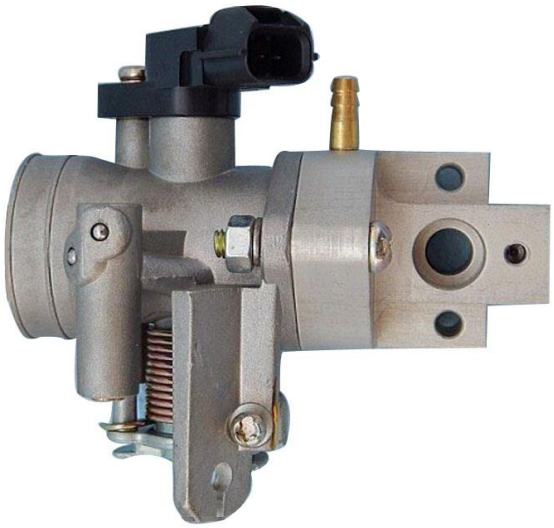
5. MAP sensor
6. Engine temperature sensor
7. Intake air temperature sensor
8. Serial communication cable (to a computer)
9. USB adaptor – included
10. Oxygen sensor and bungs (optional)
11. CD for tuning software (downloadable from our website)
12. CDI – ECU controlled (optional, you can use your own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

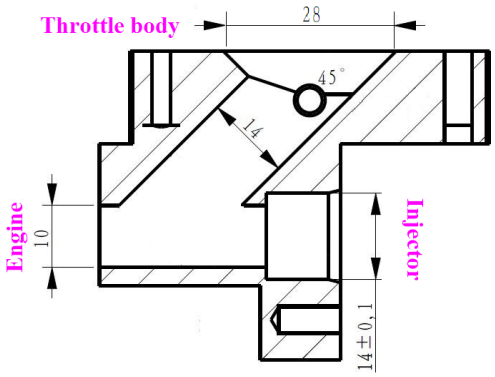
Though the EFI is meant to reduce the emissions than a carb system, this kit is not certified for any emission regulations. It is the user's responsibility to find out whether it's legal to use it.

Major components:

ECU



Throttle body with Intake manifold



Intake manifold

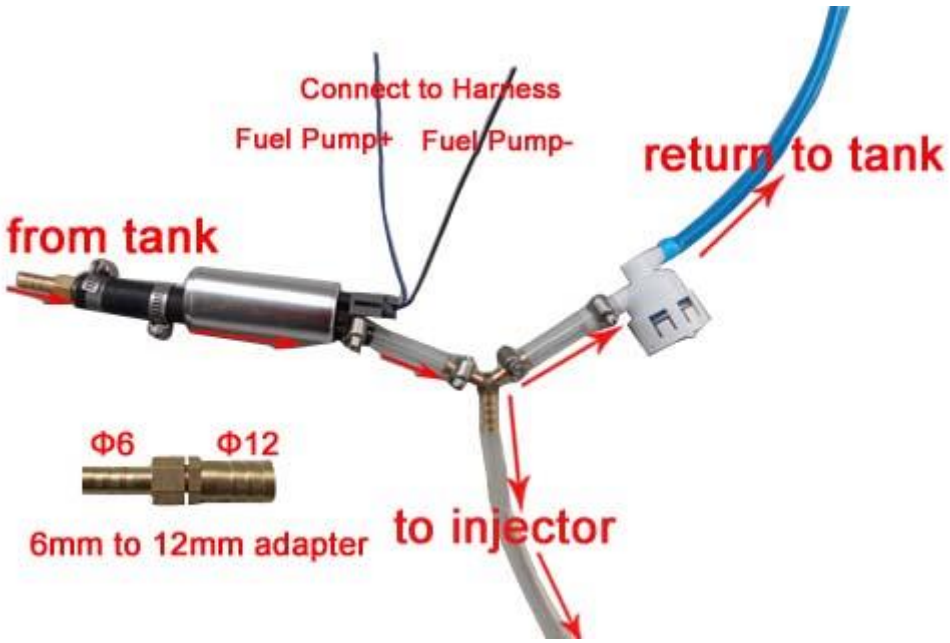
Hall sensor

MAP sensor

IAT Sensor

ECT Sensor

Temperature sensors



Fuel supply system assembly

Chapter 1 Installation Procedures

1. Replace the carburetor with the throttle body assembly

1.1 Remove the carburetor from the engine;

1.1.1 Remove side covers.

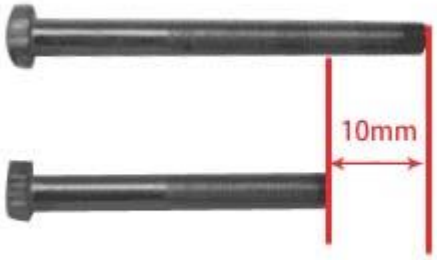
1.1.2 Disconnect and remove the battery if you have.

1.1.3 Remove the air filter and the carburetor.

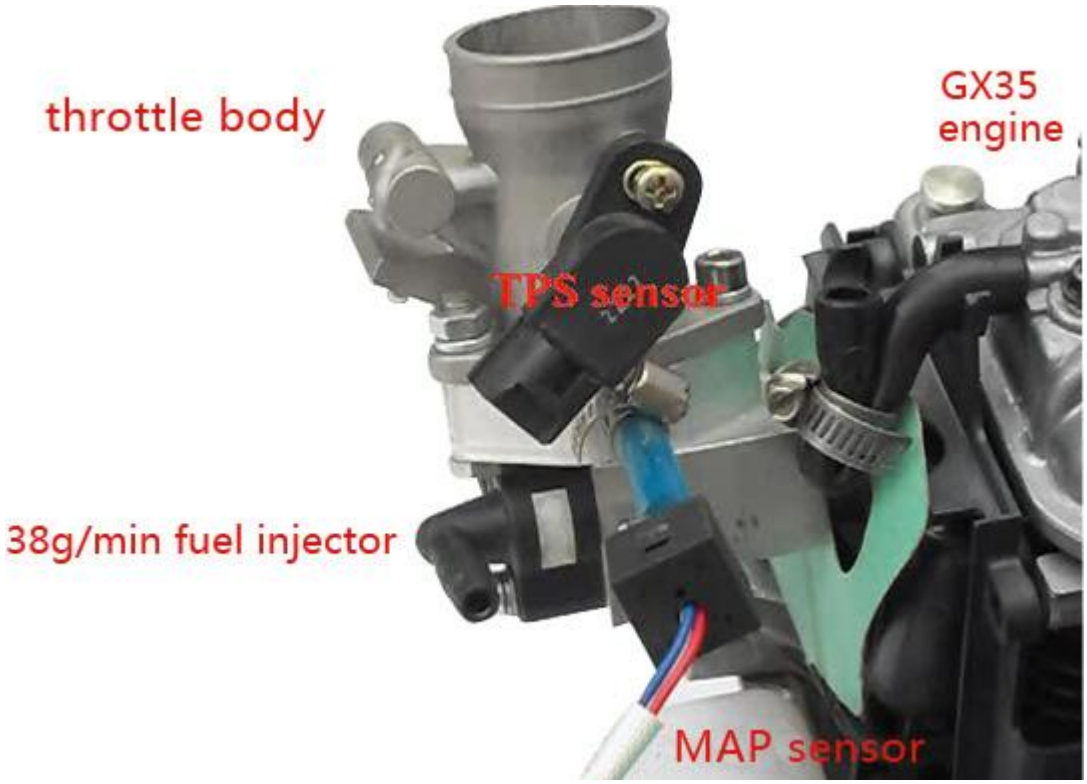
1.2 Install the throttle body.

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.



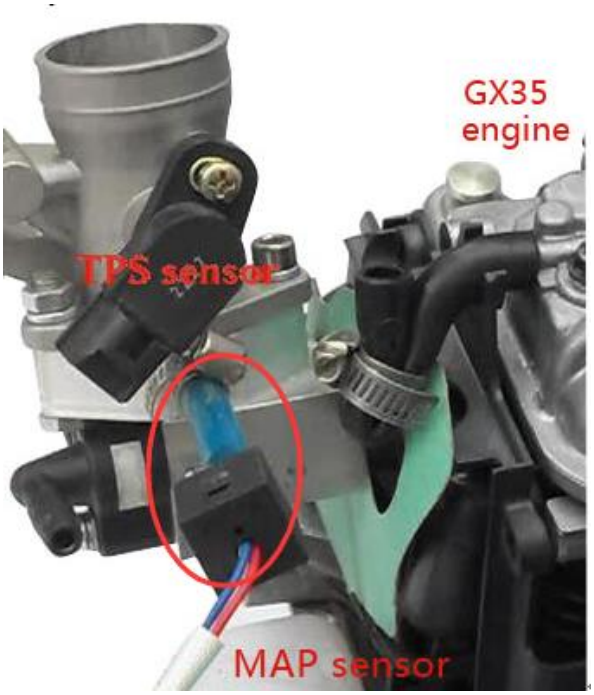
And then add a new air filter.

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

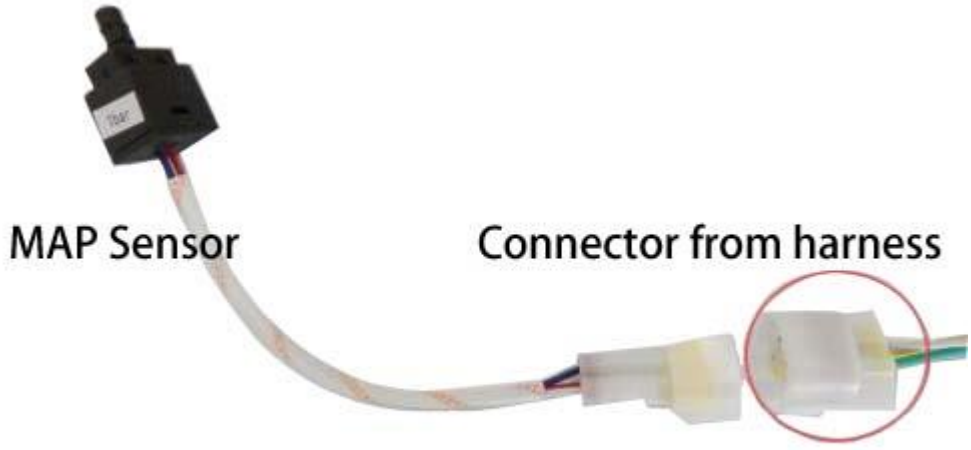
1.2.3 Find a secure place to install the MAP sensor. You'd better fix it to the frame which can protect it from hot engine. And Connect the MAP sensor to the intake manifold with the small pipe.

Note:

1. The MAP sensor is fixed not closed to the engine for avoiding 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.



Attach the MAP Sensor connector:



1.2.4 Seal the pipe. It is not used.

2. Fuel tank modification

This kit has a fuel return line, which needs to be routed to the tank. If you don't have an existing way to return the fuel back to the tank, you need to drill a hole on the tank. First, drain the fuel tank completely! (Warning: This will cause fire if you modify the fuel tank with any fuel!!!)

Please do as the following steps:

1) Please take the fuel tank off if necessary.
2) Drill a hole (diameter: 5mm~6mm) on the upper wall of fuel tank, or just below the fuel tank cap.

3) You can use the provided fuel tank adapter to fit the tank and to tighten it with a nut. And seal it.

4) Then clean the fuel tank if any debris falls into it. Install the fuel tank back finally.

Fuel tank adapter

3. Install the fuel pump assembly

1) The fuel pump should be between the fuel tank and the throttle body, and it should be tied to the inside of the frame. It should NOT be exposed to any external scratch or bump. It should not touch the ground when the motorcycle lies on the ground.

The correct order of fuel supply components should be (from high to low locations):

Tank → fuel filter → Fuel Pump

The fuel pump must be lower than the lowest point of the fuel tank.

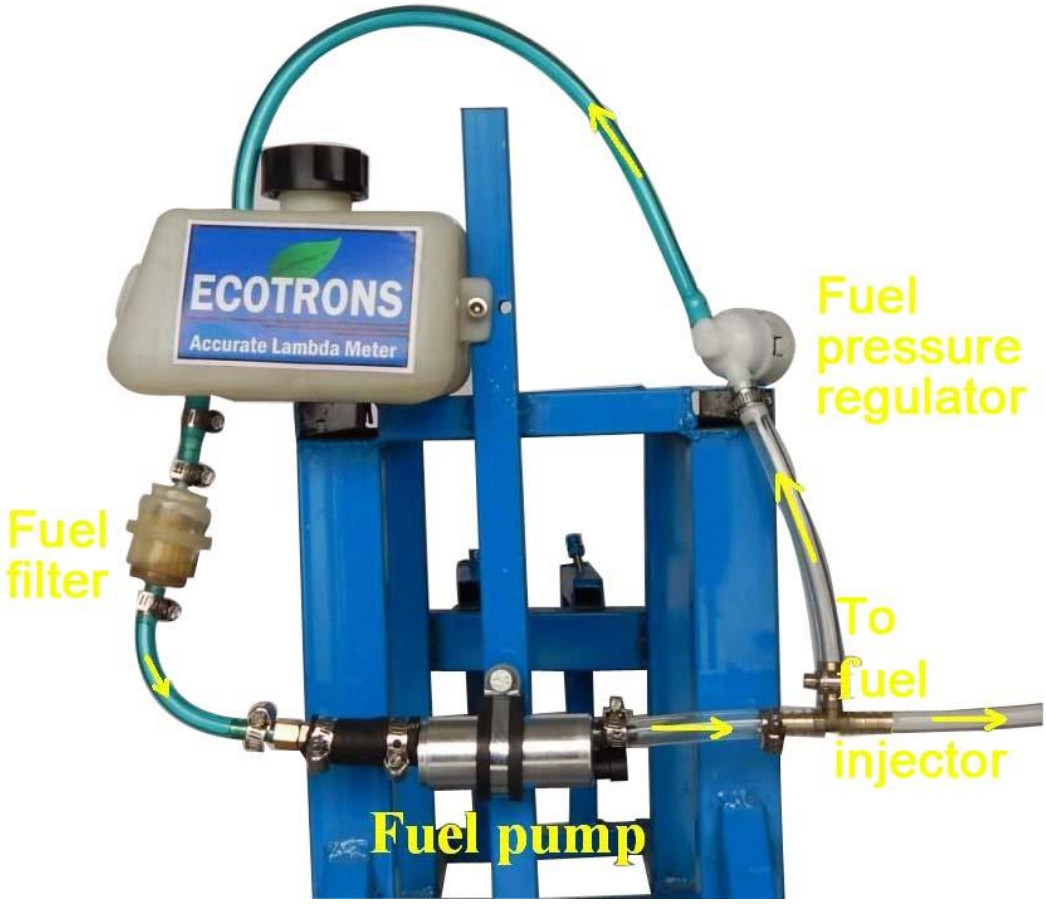
2) Connect the fuel feed line from the fuel tank outlet to the inlet of the fuel filter and fuel filter has been connected to the inlet of the fuel pump.

3) Connect the high pressure fuel lines from the fuel pump to the fuel injector.

4) Connect the fuel-return line to the T-pipe. The T-pipe, by default, merges the fuel bubble line and the fuel pressure regulator return line together and then returns the fuel to the tank.

5) Secure all fuel lines with supplied clamps, make sure no leak.

6) The overview of the fuel supply system should be like the below pictures:

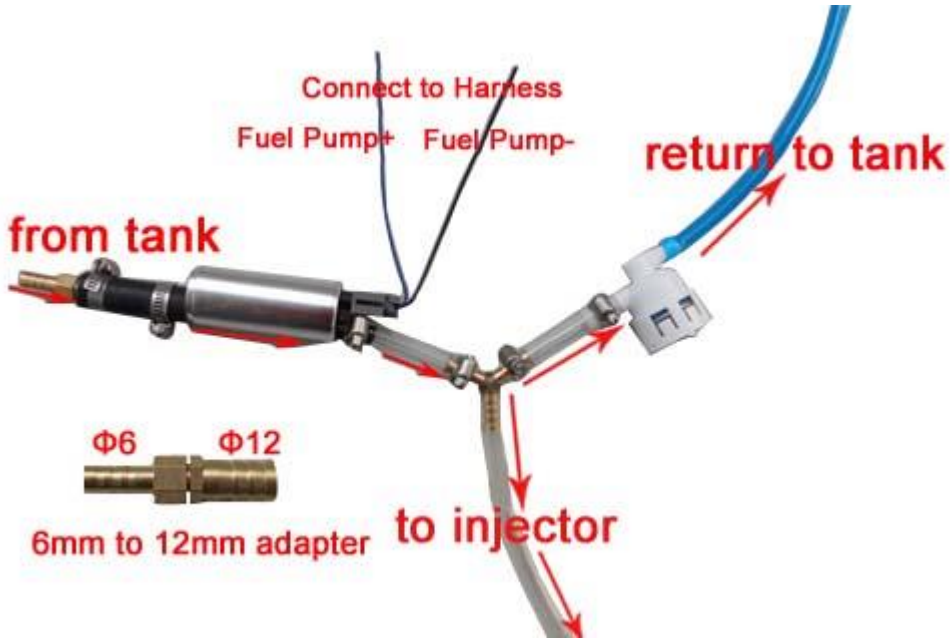


Note:

1) Some fuel tanks have a tank valve which requires the vacuum from the intake manifold to open, called **"petcock"**. In this case, you need to replace it with a simpler valve that does not require vacuum, and you can open and close it manually. Or if your petcock valve has a "Prime" position, that does not require vacuum, and set it to "**PRI**" position.

2) We recommend that you use the fuel line from ECOTRONS, other fuel line may be damage to the fuel supply system.

The below is the simplification drawing of fuel supply system installation:



Fuel Pump wire connection

The Small fuel pump is suitable for GX35 engine, which has a flow rate of 25L/H;

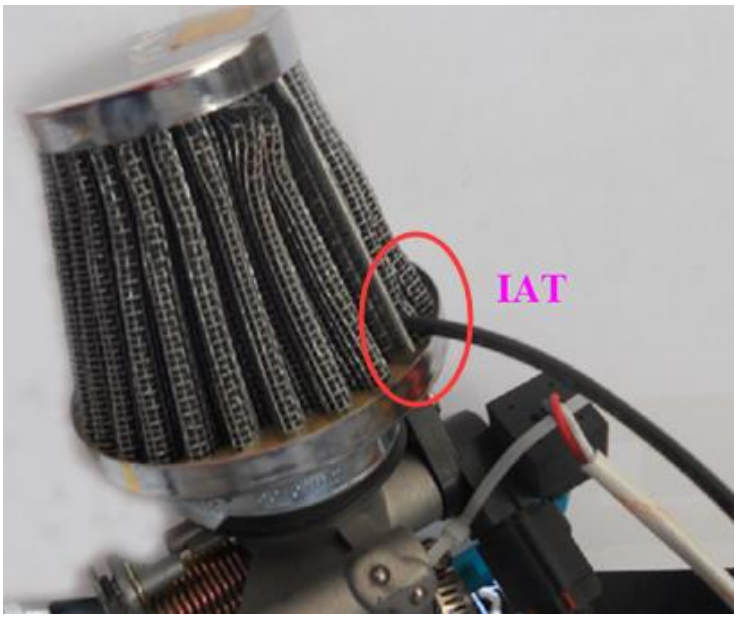
The fuel pump has one electrical terminal, and it is driven by 12v power. One terminal is "+" and one is "-". There are 2 wires on the harness to be connected to the fuel pump. As shown in the below pictures:

Small fuel pump terminals

4. Install the Intake Air temperature 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.



5. Install the engine temperature 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.

6. Hall sensor wire splices and ignition system

Ecotrons supplies hall sensor as your pick up sensor in the GX35 EFI kits. 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.

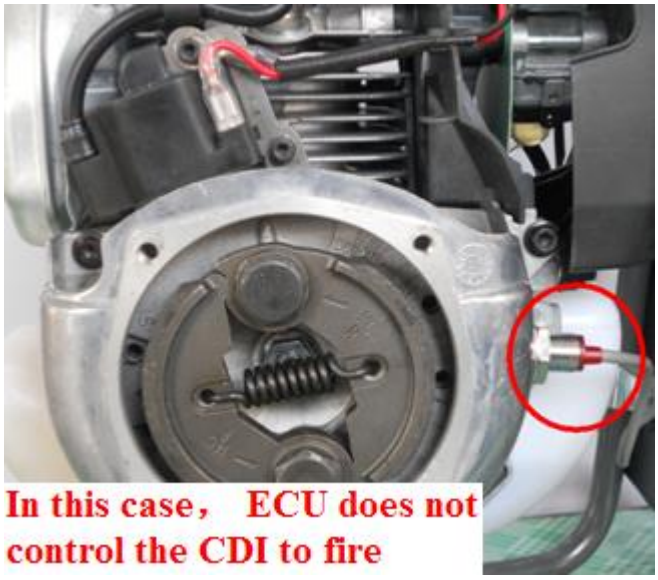
6.1 ECU does not control the ignition system.

In this case, ECU only controls fuel injection.

6.1.1 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.

6.1.2 Install the hall sensor.



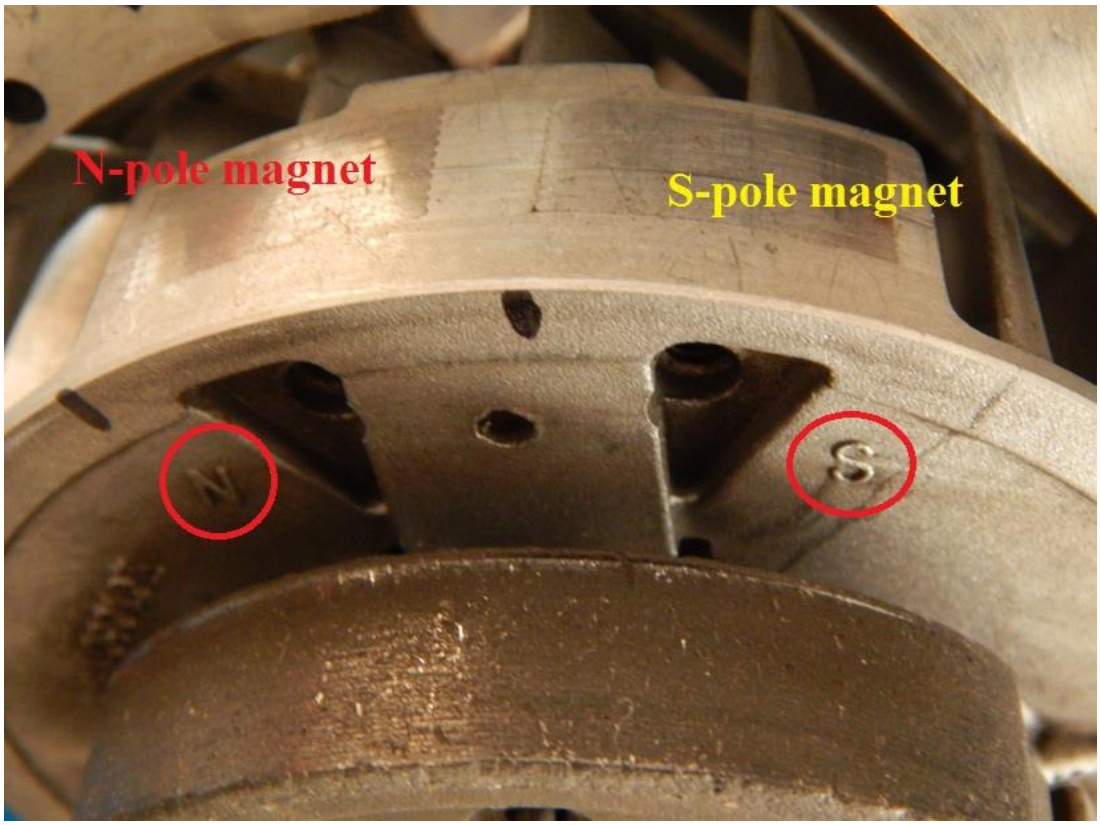
6.2 Use Ecotrons CDI to control ignition

In this case, ECU controls CDI to fire, and controls fuel injector too. You need to replace the original ignition coil with Ecotrons' CDI and Coil.

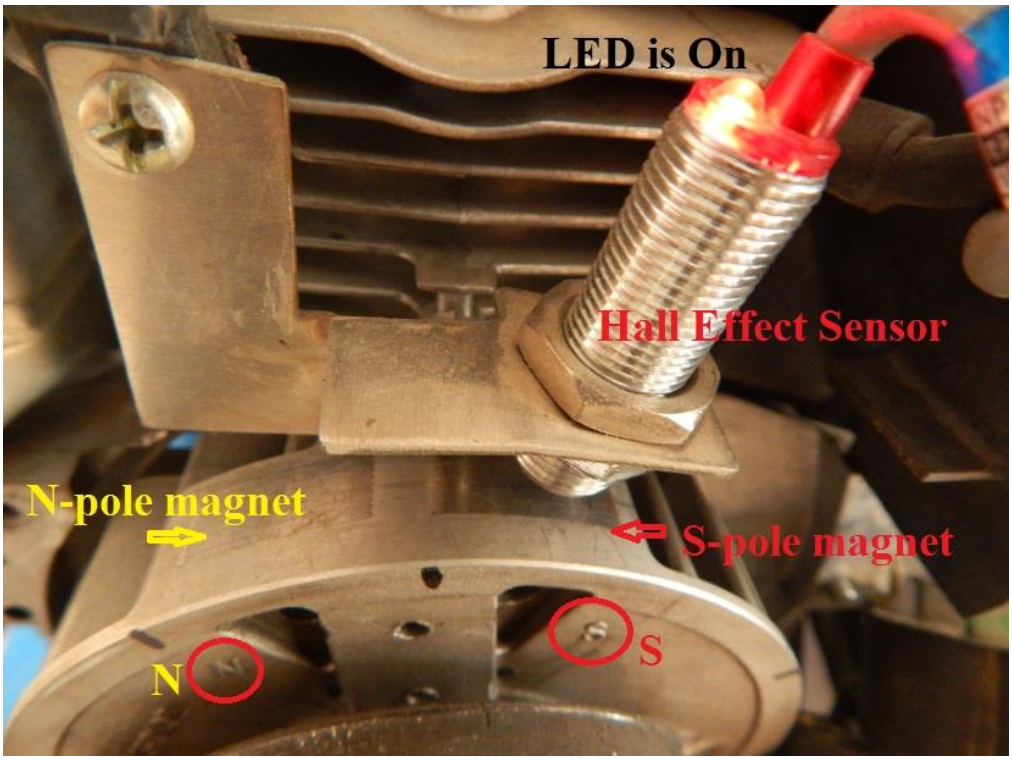
6.2.1 Remove the stock ignition coil.

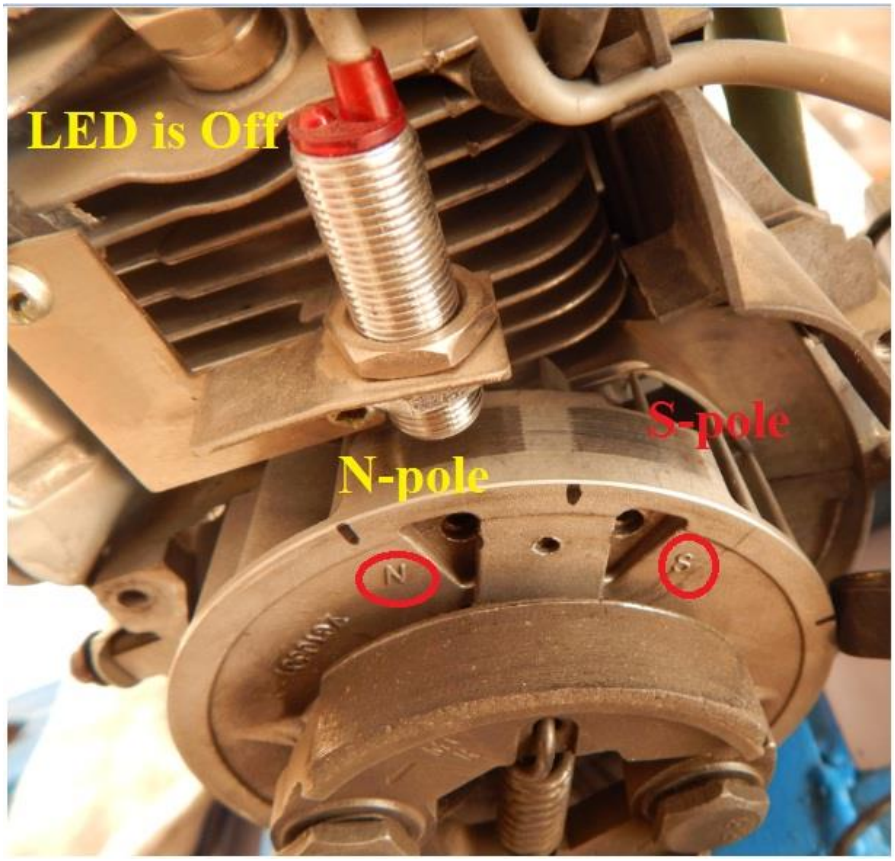
6.2.2 Install the hall sensor like below pictures.

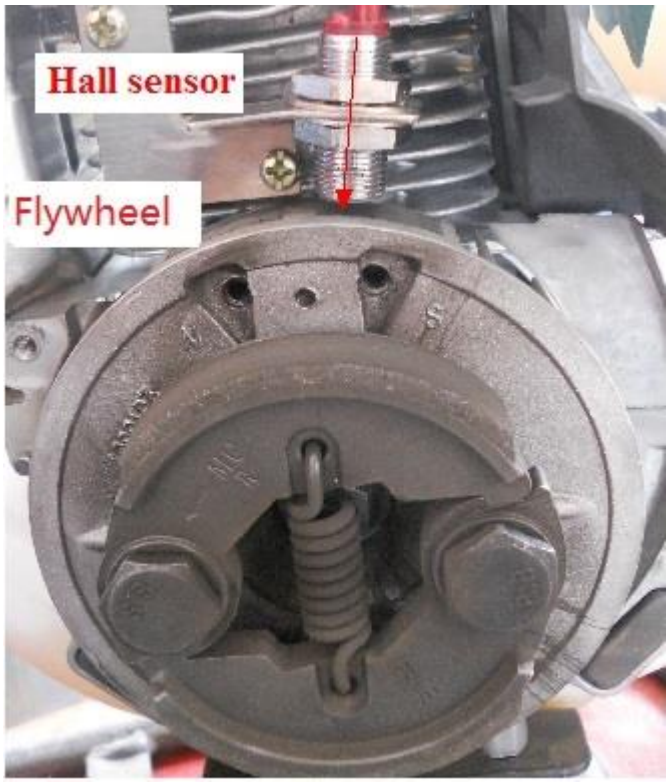
There are two magnets on the flywheel, one is N-pole magnet, and another is S-pole magnet.

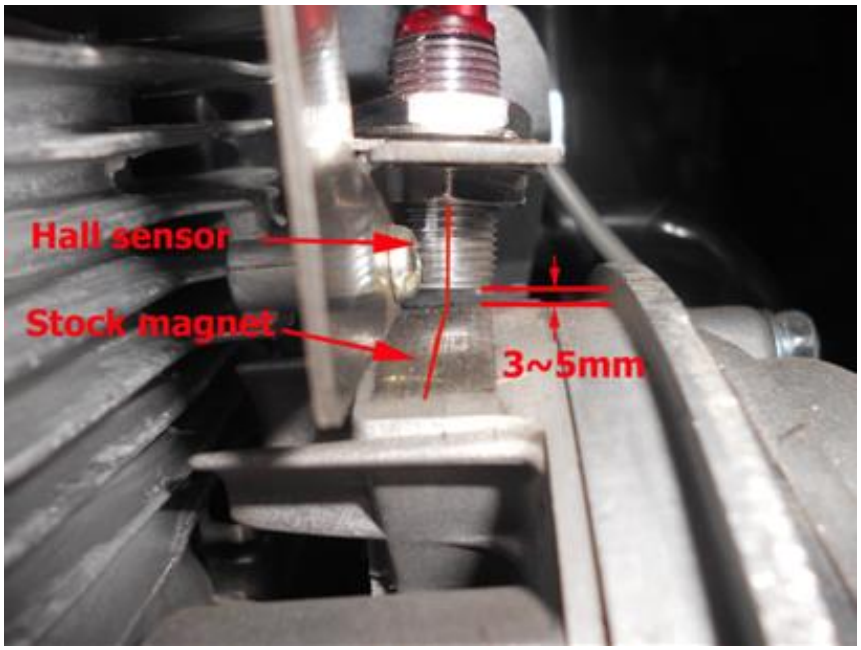


Our Hall Effect Sensor is by default South-Pole Magnet trigged.


LED is On
Hall Effect Sensor
N-pole magnet
S-pole magnet
N
S


LED is Off
S-pole
N-pole
N
S


Hall sensor
Flywheel

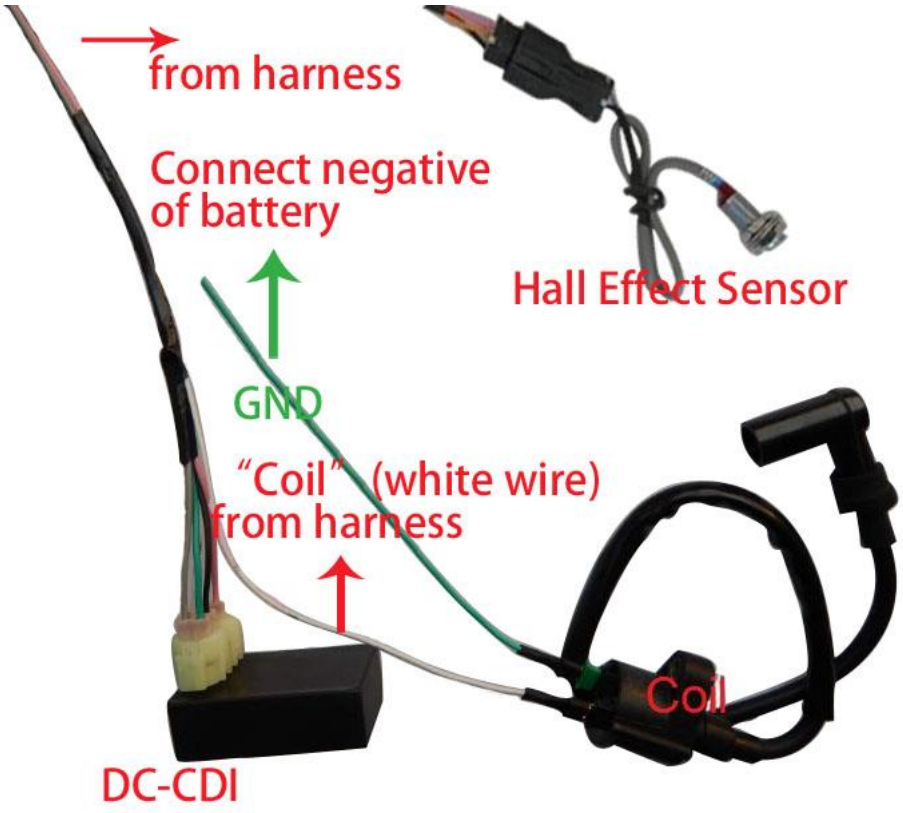


Note:

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.

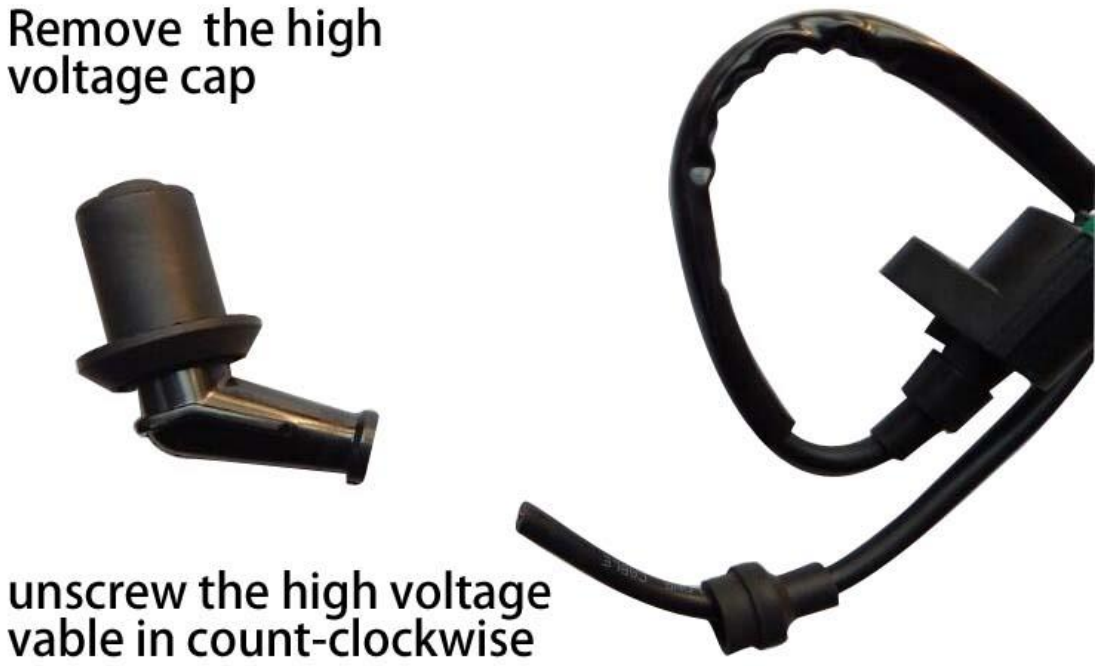
For some reasons, maybe some customers receive the Coil, but the high voltage cap is not fit the stock spark plug.

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

See below:

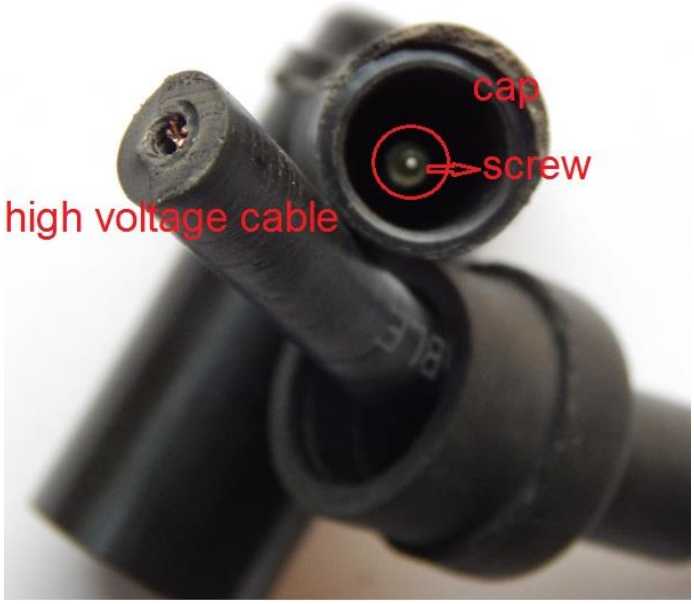
Then replace the un-suitable high voltage cap

Step1: Remove the improper high voltage cap from the coil



Step2: install the new high voltage cap on the coil


improper high voltage cap
suitable cap


cap
screw
high voltage cable

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 ignition 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.

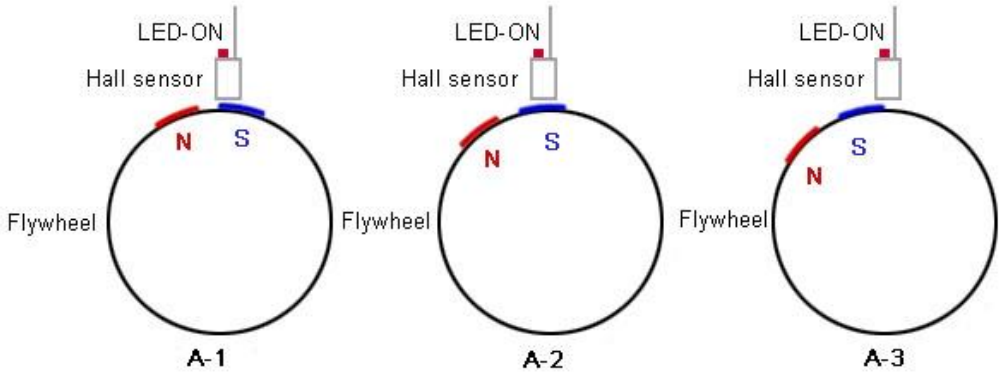
If you can't make sure to avoid the voltage leak, please don't try this, and use the first method to fit the spark plug.

6.3 Does the magnet match with 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 triggered by magnet, the LED of the sensor will light. Usually the LED turns on only once per circle.

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.



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

7. O2 sensor installation.

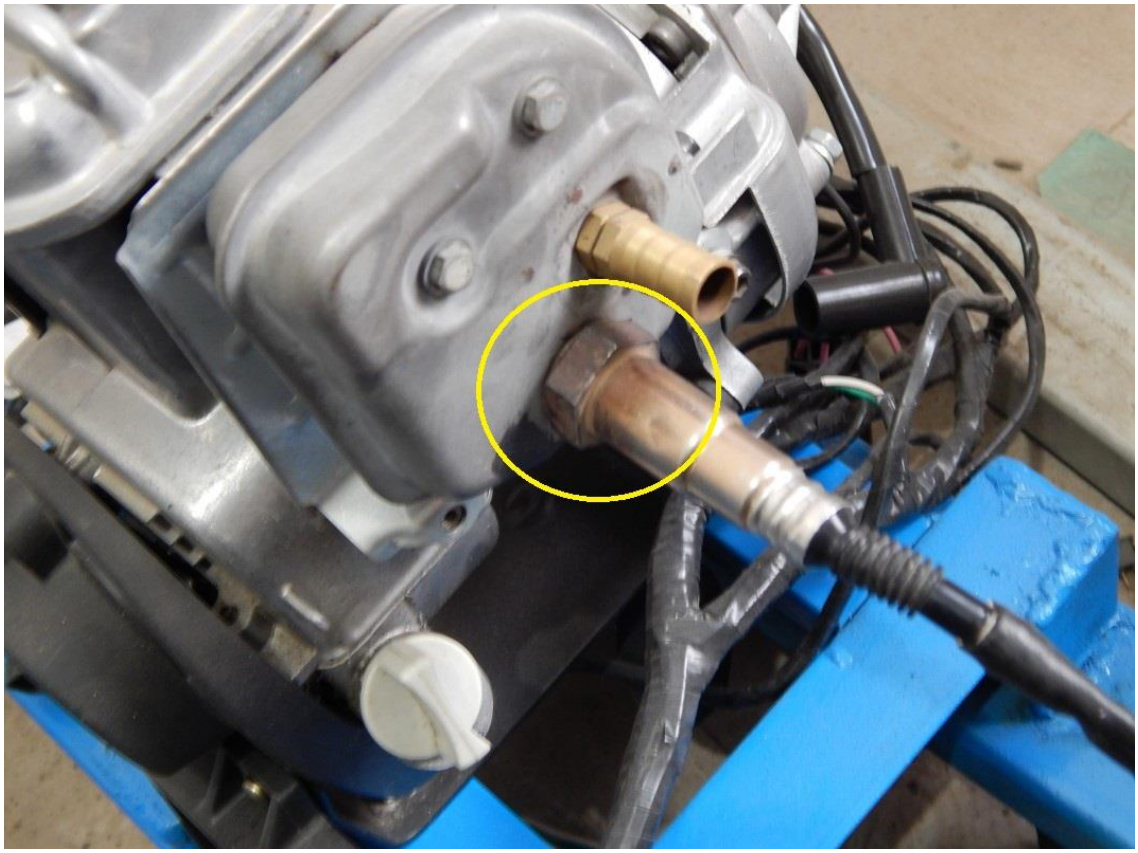
If your kit includes an O2 sensor, please follow the below steps to install the O2 sensor:

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.



8. Re-install the 12V battery.

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.

Attach Ecotrons ECU to the positive of 12V battery and the negative of 12V battery.

You must connect the negative of 12V battery to chassis ground.

9. KEYSW Installation

Splice the “key on switch” wire, and connect it to ECU “KEYSW”. 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.

"KEYSW" wire can be connected to the 12V+ if there is no key-switch on the vehicle. But you must insert a manual switch between 12V+ and KEYSW input. For some customers, we pre-install a manual switch between KEYSW wire and 12V+ wire as requested.

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

10. 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!

10.1 Electronic Control Unit

Install Ecotrons ECU in a suitable place, such as fixed it on the frame, avoid the severe vibration and severe hot conditions. Do not expose it to water / fluids.

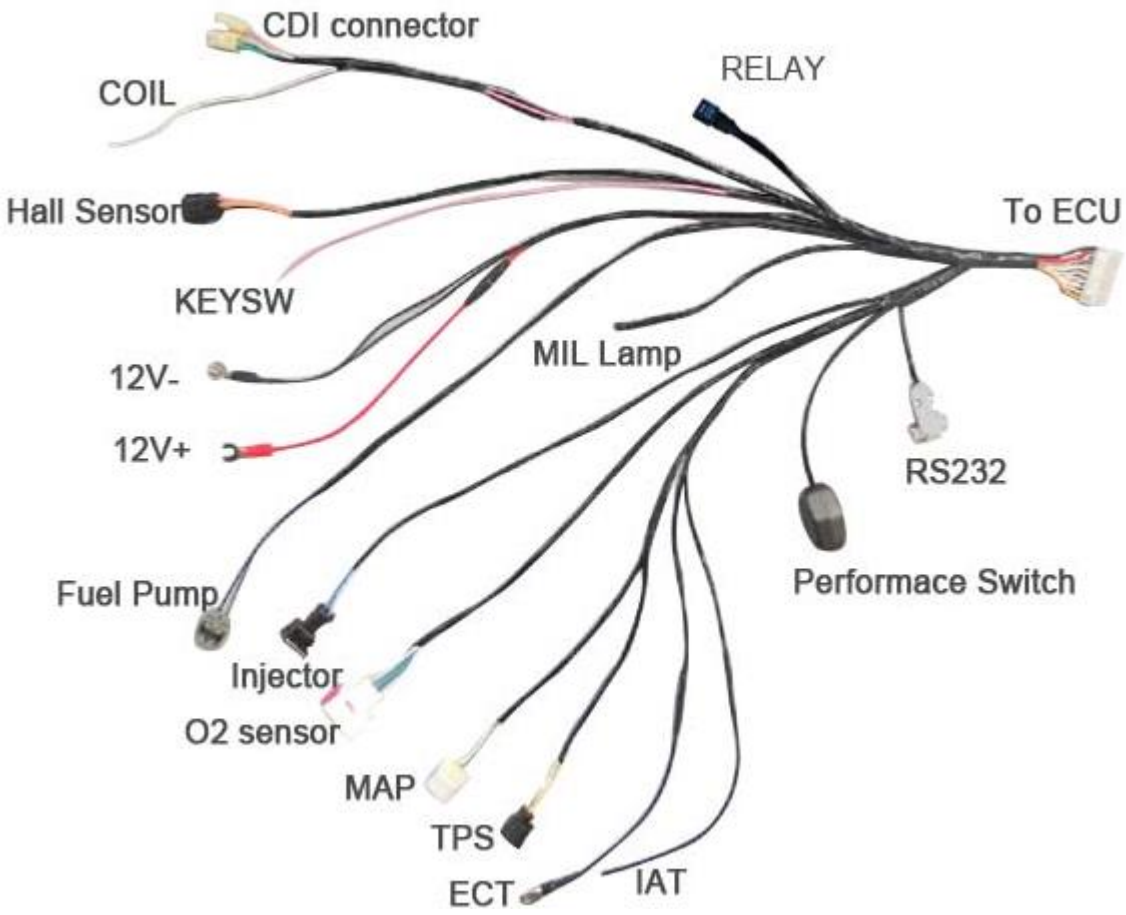
Note:

1. You need to add the thermal insulation between the engine and ECU.
2. Avoid the dirty, wet, and splash water.

10.2 Harness Routing

Find suitable locations for the harness. Connect all EFI components connectors included to ECU harness.

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**)	
CDI-Ctrl	CDI control output from ECU	**Gray**
GND	Ground (previously called Analog Ground)	**Green**
KEYSW	Key On switch (previously called IGNSW)	

Double checks 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 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

Chapter 3 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

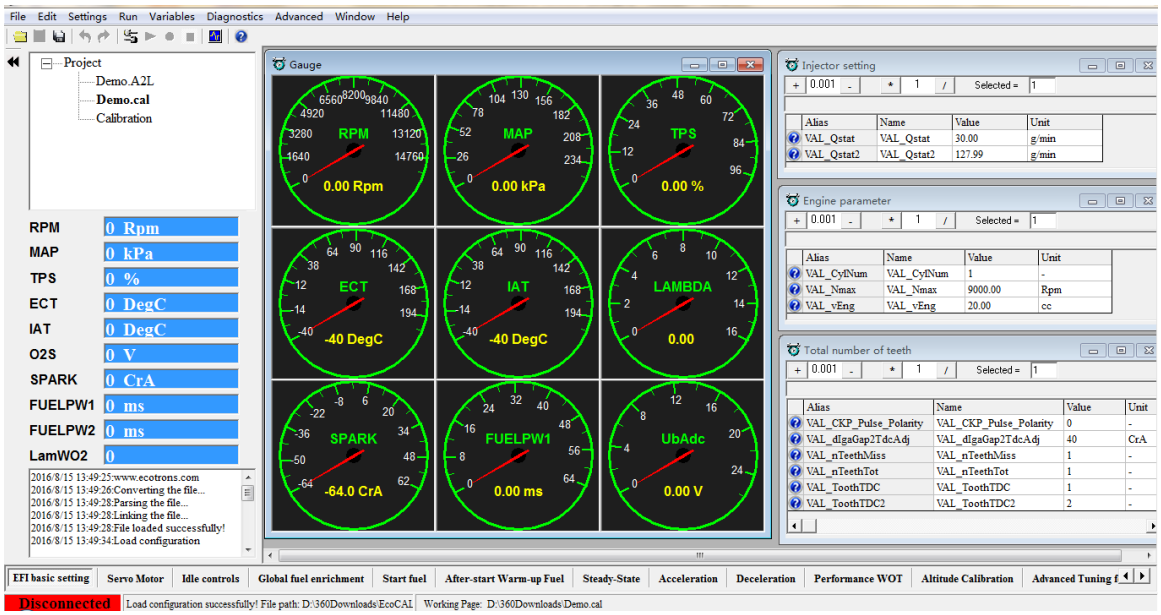
Chapter 4 How to install the provided EcoCAL software to your computer?

For details on how to use EcoCAL software, please refer to the EcoCAL User 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.

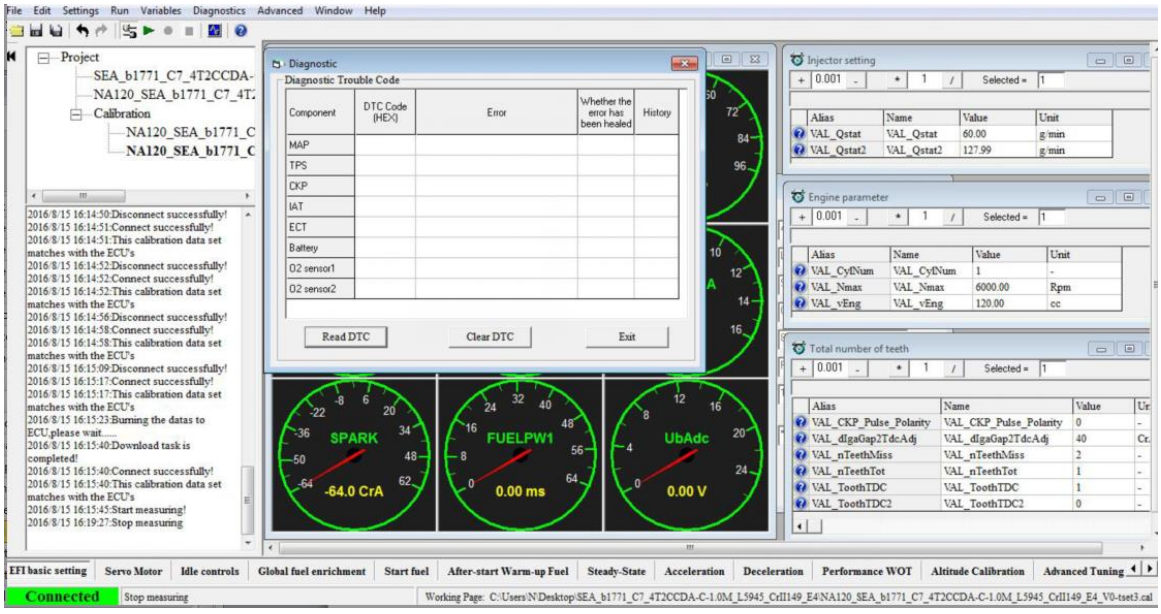
Connect ECU to laptop:

Go to menu->Run->Connect

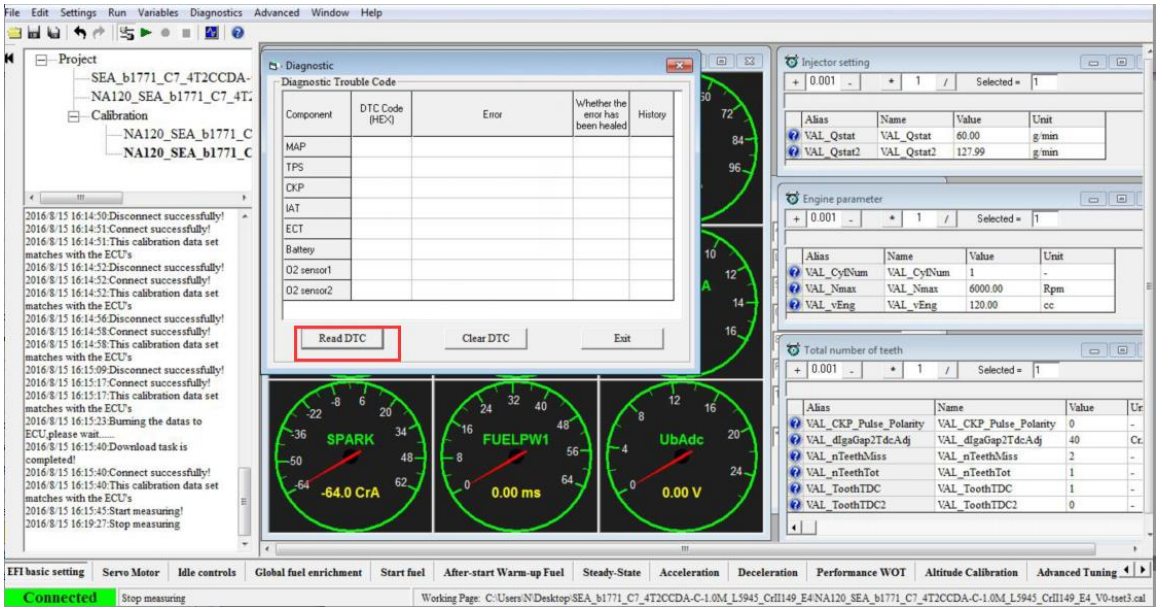
You also can use the shortcut button () of “Connect” to Connect to ECU

Read DTC:

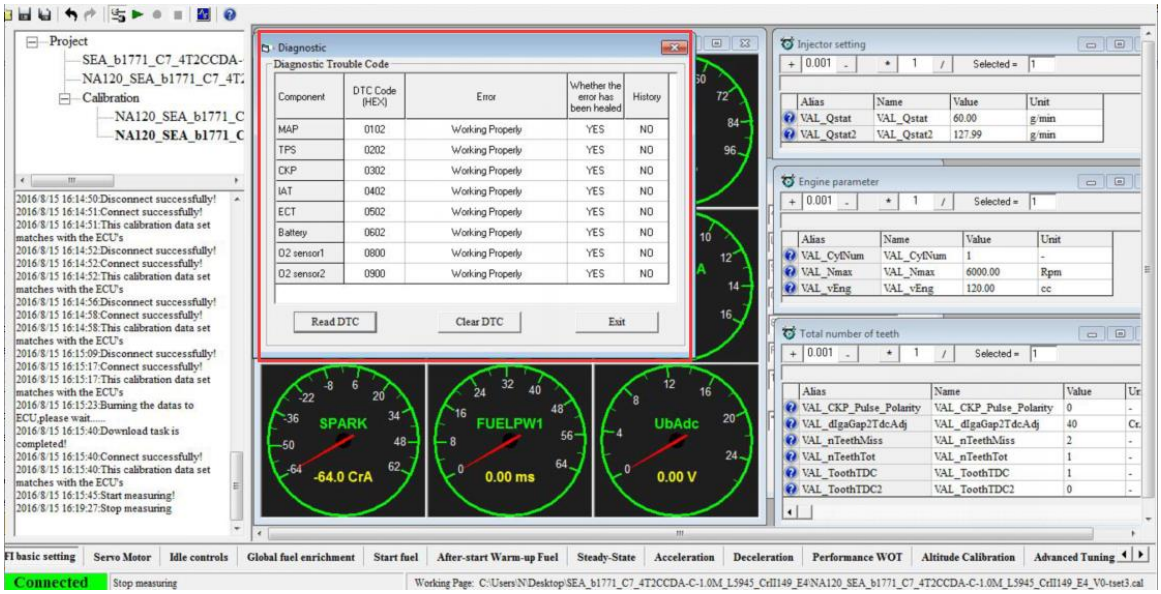
Go to menu->Diagnostics->ECU Diagnostics



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

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

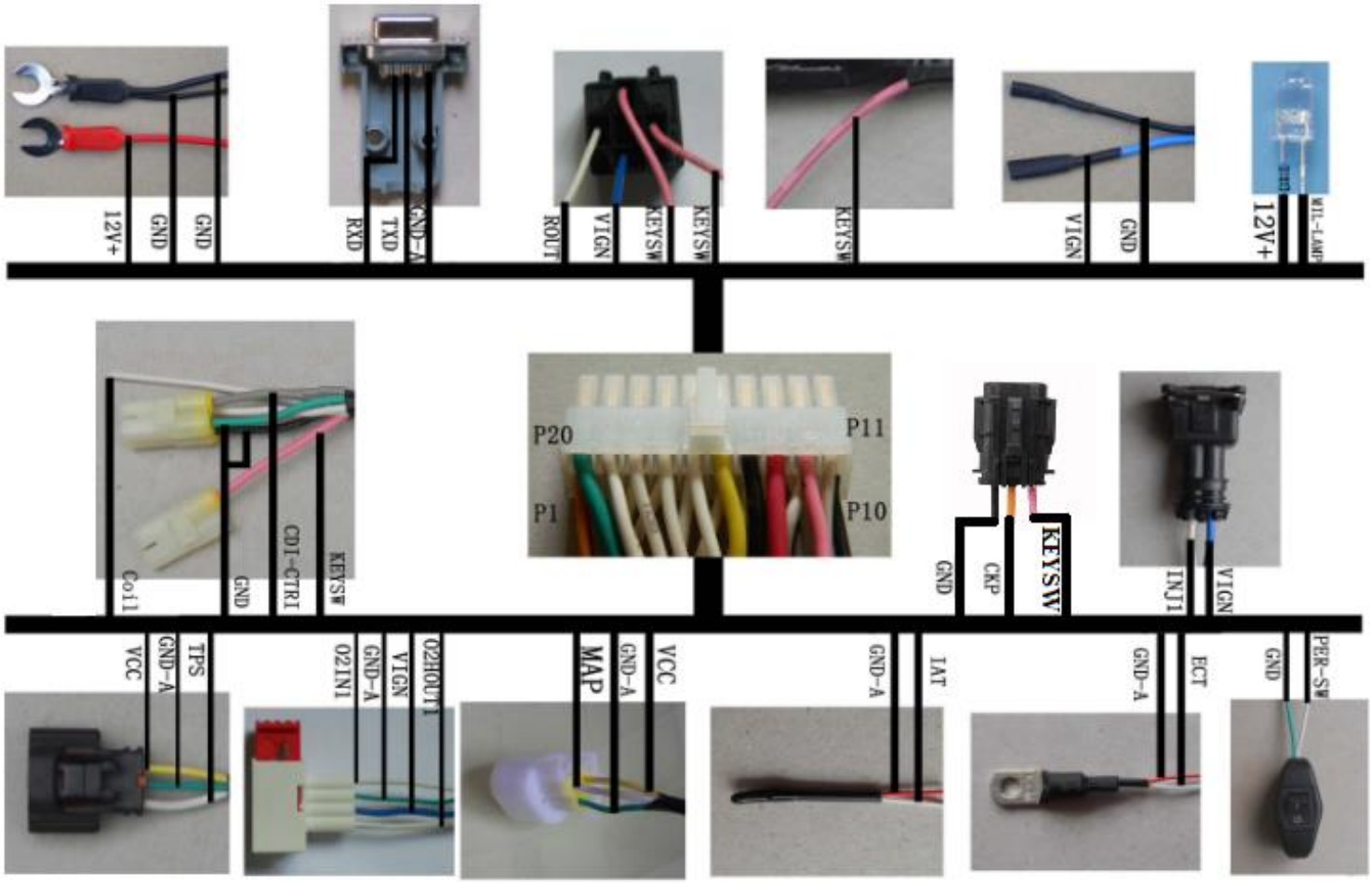
7) Go to menu -> Run -> Play Back

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**)

Appendix I: Wiring harness diagram



Appendix II: ECU main connector pin-out

Pin NO.	Component	Color(Version 2)	Color(Version 1)	Description
P1	CKP	Yellow/Black	Orange	Crank Position Sensor (connect igniting pickup sensor signal)
P2	Optional	Orange/Black	White/Black	Mil-lamp (Optional, Inj2: Blue/Red)
P3	MAP	White/Blue	White/Blue	Manifold Air Pressure Sensor Input
P4	IAT	White	White/Yellow	Intake Air Temperature Sensor
P5	RXD	White/Red	White/Red	Sent Data to RS232
P6	TXD	Blue/Red	White/Pink	Receive data from RS232
P7	ROUT	Light/Blue	White	Power relay LS Driver output
P8	CDI-CTRL	Gray	Gray	CDI control signal
P9	INJ1	Purple/White	Blue/Black	Injector #1 LS Driver Output
P10	GND	Black	Black	Power Ground
P11	O2HOUT1	Blue/Yellow	Blue/Yellow	O2 Sensor #1 Heater LS Driver output
P12	KEYSW	Purple	Pink	Key On Switch
P13	12V+	Red	Red	Reverse Battery Protected Supply
P14	GND	Black	Black	Power Ground
P15	VCC	Yellow	Yellow	+5V Volt Supply Output
P16	ECT	Blue	White/Brown	Engine (coolant) Temperature sensor

P17	TPS	White/Green	White/Green	Throttle Position Sensor input
P18	O2in	White/Black	Gray/Black	Oxygen Sensor signal input
P19	Per-SW	Orange	Gray/White	Performance Switch
P20	GND-A	Green	Green	Analog Ground