

# SE-EFI

Small Engine Electronic Fuel Injection  
– Conversion Kit

## Installation Manual

ECOTRONS LLC

V2.1

Note: this manual is written based on a conversion with a GY6 scooter engine, but it can also be used as guidelines for all other small 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](mailto:info@ecotrons.com).

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## SE-EFI Kit

# Introduction

SE-EFI is an Electronic Fuel Injection conversion kit for small engines. It can be a bolt-on EFI kit to a lot of small engines used on variant applications: motorcycles, scooters, ATVs, Go-Carts, boats, snowmobiles, etc. The displacements of the engines can be in the range of 35cc up to 1200cc. This kit replaces the OEM's carbureted fuel system completely, and it requires the minimum modifications of the engine. It could be a plug-and-play EFI kit for some popular small engines like GY6 engines, or monkey bike engines in the range of 50cc, 125cc, 150cc; 180cc, etc. For many other engines, you may need to do some mechanical fittings, and fine tuning. But at least you get a pre-loaded software with the kit that will start and run your engine after you install it. The ECU is fully programmable, and tuning is made easy for those who are interested, and the tuning software is free, downloadable.

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:

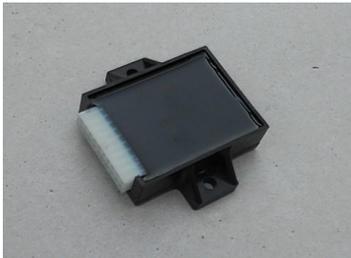
1. ECU
2. Harness (including the connectors)
3. Throttle Body and Intake manifold Assembly
  - Throttle body (including TPS sensor)
  - Intake manifold (only available for GY6 24mm throttle body)
  - Fuel injector
4. Fuel pump assembly
  - Fuel pump (outside of the tank)
  - Fuel pressure regulator
  - Fuel filter
  - High pressure fuel line
  - Fuel hoses
  - T-Pipes
  - Clamps
5. MAP sensor
6. Engine temperature sensor
7. Intake air temperature sensor
8. Oxygen sensor and bungs (optional)
9. Serial communication cable (to a computer)

- 10.CD for tuning software (downloadable from our website)
- 11.CDI – ECU controlled (optional, you can use your own CDI).
- 12.Ignition Coil – Either CDI driven or ECU driven inductive type coil (optional )
- 13.USB adaptor – standard

Note: **the kit needs 12V charging system for power supply.** The charging requirement is 2.5A current or 45W power as the minimum. This kit may need tuning to achieve some desired results.

Though the EFI is meant to have lower 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:



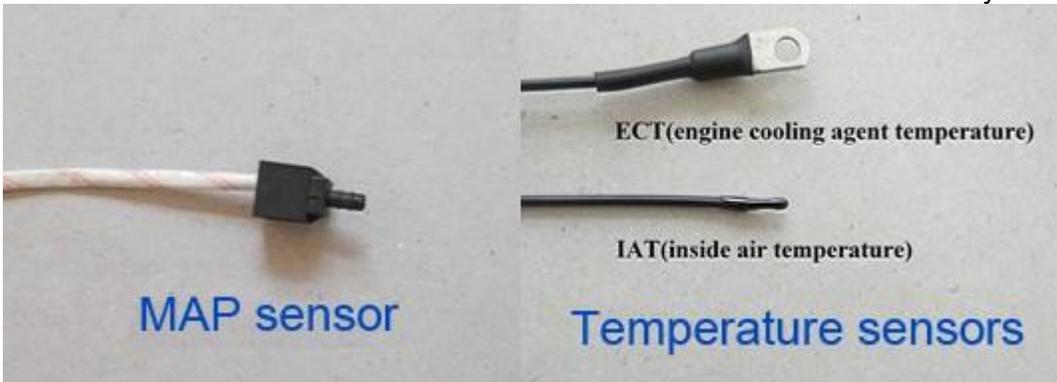
ECU



Harness



Throttle body



MAP sensor

Temperature sensors



Fuel pump assembly

# Prerequisites for conversions

## Questions to be answered before you decide to order an EFI kit:

### 1. What is your engine displacement?

You need to tell us your engine displacement when you order the kit because that determines the sizes of most components.

So far our EFI kits can convert engines in the range of 35cc all the way up to 1200cc engines, single cylinder engines or 2-cylinder engines; parallel twin or V-twin engines.

We are also capable of developing customer kits for 3 or 4 cylinder EFI kits.

#### The EFI kits can be categorized in the below classes:

- **35cc to 110cc** engines: many scooter engines are in this range, typically GY6 style, or horizontal style engine. For this type of engine, you may use a 24mm throttle body with a bolt on intake manifold. The injector is mounted on the manifold.
- **125cc, 150cc to 200cc** engines: for GY6 style or monkey bikes; dirt bikes, etc. You may use our 28mm throttle body (TB), either hose mounting or flange mounting styles. The injector mount is on the TB. No intake manifold is included yet.
- **250cc to 400cc** engines: (single cylinder engines), you may use our 34mm TB, with a built-in idle air control (IAC) motor, The injector mount is on the TB.
- **400cc to 800cc** engines (single cylinder): you may use our 38mm, 42mm, 45mm, 50mm, or even 60mm TBs. Note, only 38mm and 42mm TBs have the injector mount built on the intake manifold adaptor; other TBs you may need to get your own intake manifold or injector mounts;
- **250cc to 1500cc 2-cylinder engines (V-twin or parallel twin):** This category covers a wide range of different engines. Some engines we have done the conversion and it's kind of bolt-on kit already, for example, Kawasaki Ninja 250r kits. We have also done many customer conversion kits. You are welcome to contact us to co-develop some kits for your applications.
- **3-cylinder or 4-cylinder engines:** this category is very customer specific applications. Contact us for details.

### 2. What is the current ignition system on your engine?

You can either keep your existing ignition system if you like it, or you can use our ECU controlled ignition system, which are optional for some engine

categories.

### **CDI ignition system**

Our ECU needs a timing input from your existing ignition system, if there is one. The typical timing input we use is the pickup of your stock **CDI** ignition system.

Most small engines use a small **pickup** coil as the trigger to generate a pulse to fire the CDI. This is the first and the easiest option for our ECU timing input (CKP wire, or Crank Position sensor).

Most CDI systems use a pickup that only generates **one pulse per revolution**. That is the default input to our ECU CKP.

Some engines have a pickup that generates 2 pulses per revolution. You need to find that out and tell us when you order a kit. Our ECU can handle 2 pulses per rev, or even multiple pulses per rev. But the pre-loaded software will be a little different.

### **Integrated ignition coil (TCI) system**

TCI stands for Transistorized Charging Ignition system. Many small engines, like Honda GX series, as GX50, GX200, etc; and Briggs & Stratton engines; have an integrated ignition coil installed next to the flywheel; and use a magnet to trigger the coil and fire the spark plug directly, there is no CDI, or standalone ignition coil. There is no dedicated pickup signal of this type of ignition system. (Note the kill switch wire from this type coil could be used as the pickup, depending on specific engines). To convert this type engines, you may use 3 of our components to replace this one integrated ignition coil, namely: Hall-effect sensor, CDI, and a coil.

The Hall-effect sensor acts like a pickup, it shall be installed at the same location as or close to the stock ignition coil. A bracket may be needed; CDI is driven by our ECU; and our coil is driven by our CDI, and the coil drives the spark plug. It seems more complicated, but the benefits are the fully controlled ignition system, you can program the ignition maps as you want!

### **Mechanical break-point style ignition system**

There are still a lot of vintage engines that are running on break-point style ignition systems. In this case you have to convert it to electrical ignition system for fuel injection. There are 2 ways to convert this type of ignition system:

- Convert it to CDI system: good for single engines; you need to install a magnet on the flywheel, or somewhere that makes sense; and install our Hall effect sensor to be triggered by the magnet; then our CDI and coil will be controlled by our ECU;

- Convert it to high-tooth trigger wheel: good for 2 cylinder engines; you need to install a multi-tooth trigger wheel, like 12-1, 24-1, 36-2; or even 60-2 tooth wheels; and then install a VR type sensor (we can provide); then our ECU will control our inductive coils directly and fire the spark plugs, like most modern cars! This is the best solution though most efforts!

### **3, 4-cylinder ignition system**

Ignition system for 3, 4-cylinder engines, or even most 2-cylinder engines are recommended to use high-tooth trigger wheel and inductive coils driven directly by ECU. It's better, it more efficient, and it's simply the right way.

Or you have to keep your stock ignition system. Just provide a pickup to ECU. ECU will control fuel only.

## **3. What is the RPM range of your engine?**

The RPM range for a 2 stroke engine is critical! because it determines whether you need 1 or 2 injectors per cylinder. And that drives different hardware and the prices.

For 2-stroke engines that run less than 10k RPM, one injector is often enough; for engines of 12k RPM or higher, 2 injectors are needed. Between 10k to 12k RPM, you need to confirm with us.

## **4. Are you turbo charging your engine?**

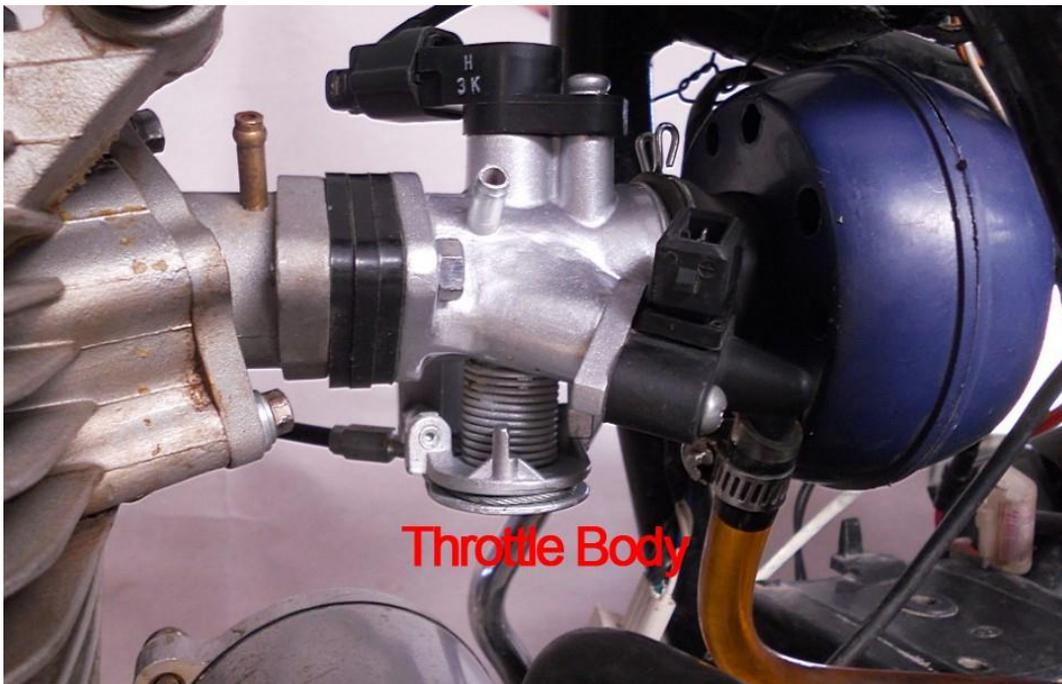
If you have a turbo installed on your engine, please order the turbo EFI kit, which will come with a 2.5bar MAP sensor, and a bigger injector for the boost pressure and more power.

We do carry a small engine turbo, VZ21, similar to RHB31 turbo. Check it out at our website.

## Installation Procedures

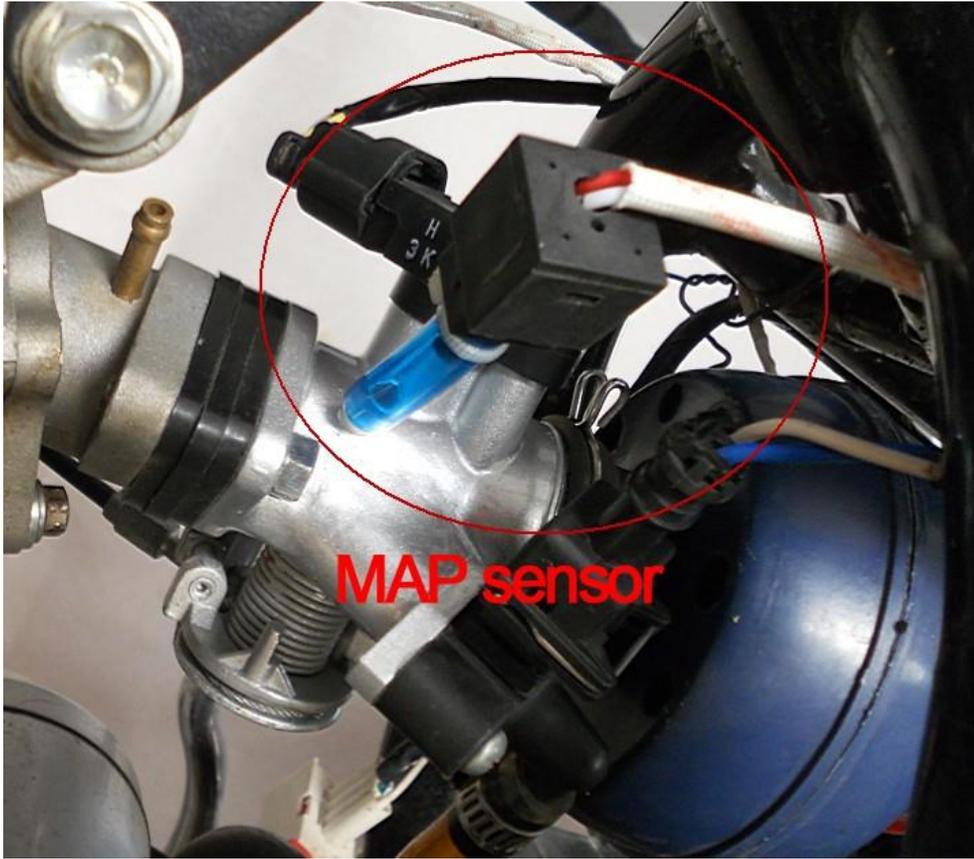
### 1. Replace the carburetor with the throttle body assembly

- 1.1 Remove the carburetor and the old intake manifold from the motorcycle;
- 1.2 Install the new throttle body and the new intake manifold assembly:
  - 1.2.1 Connecting the throttle body inlet to the air hose from the air filter;
  - 1.2.2 Bolt-on the new intake manifold to the inlet of the engine, with the heat insulator in between (black, like a washer). In case the total length of the intake manifold is a little short to reach the inlet of the engine, you can use 2 heat insulators stacking together.
  - 1.2.3 Install the existing throttle cable to the throttle body.



2.1 Find a secure place to install the MAP sensor, see the picture (a tie-wraper can do the job).

2.2 Connect the MAP sensor to the intake manifold with the small pipe (4mm diameter)

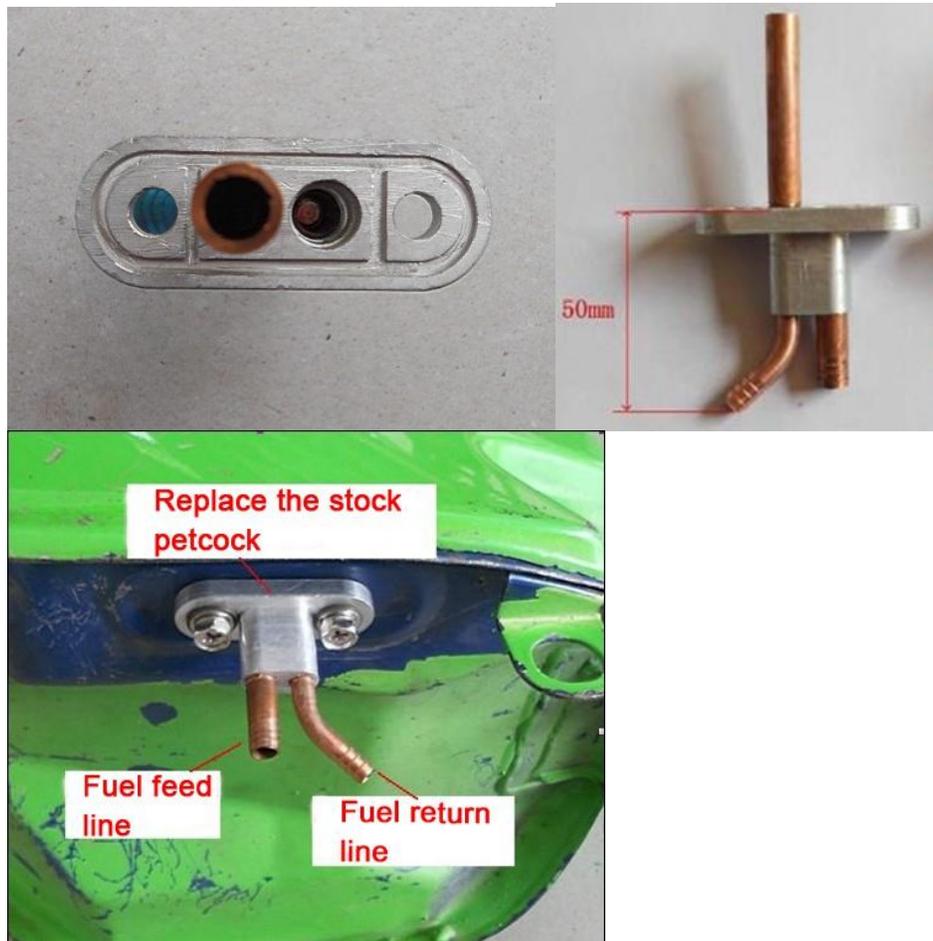


The example to install the MAP sensor

## 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 freely. (A T-pipe can be used here).

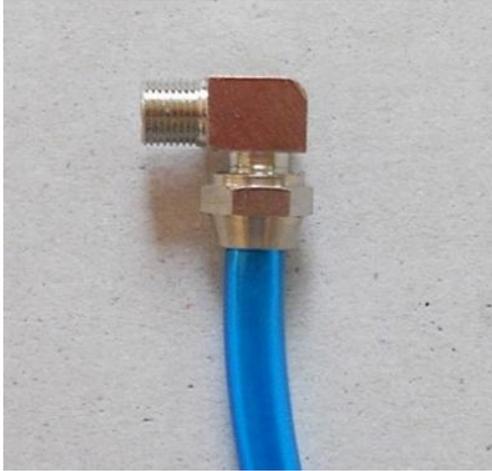
2.2 We now have a fuel tap for some engines. It has a feed-tube and return-tube built-in. The fuel tap replaces the stock petcock easily. For those engines, you do NOT need to modify the tank any more! Note: this fuel tap does not apply to all engines. So far we have it for Ninja 250r engine, DR650 engines, and some others.



2.3 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: modifying the fuel tank with any fuel in it can cause fire!!!)

2.4 Take the fuel tank off, if necessary.

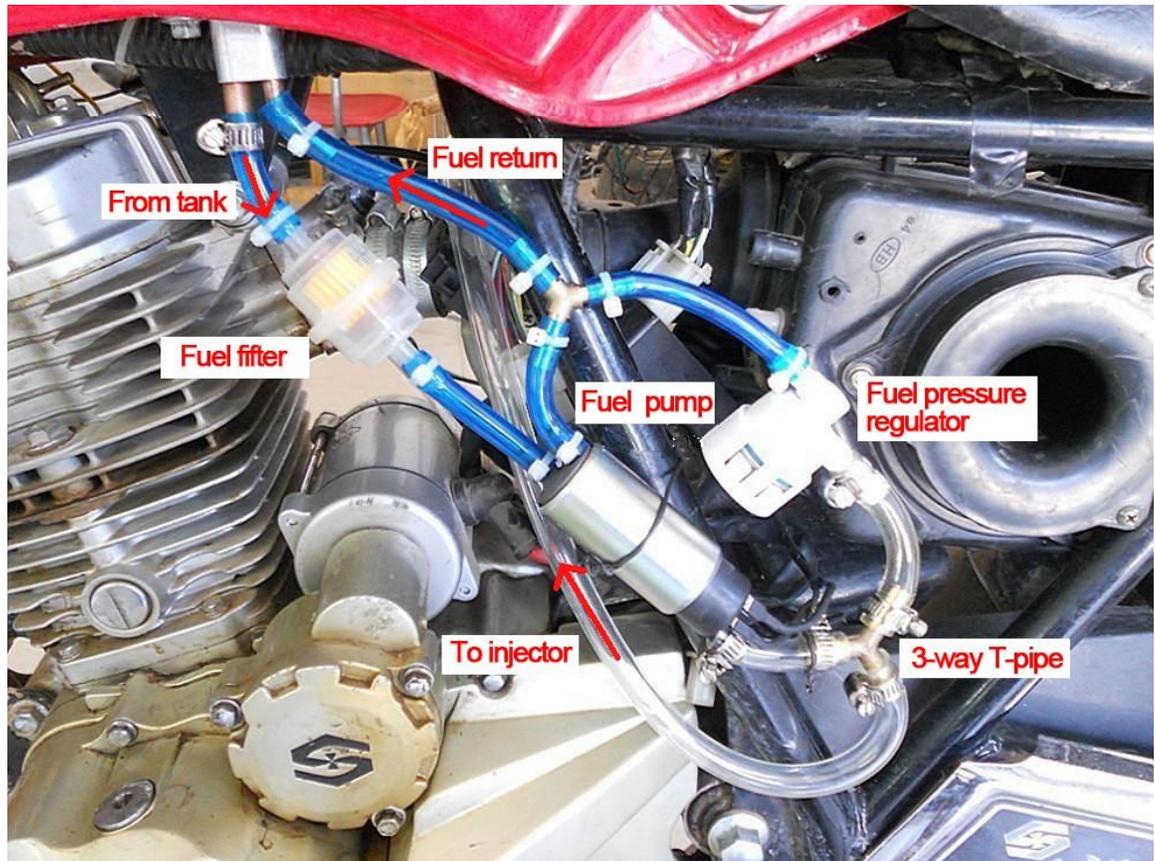
- 2.5 Drill a hole (diameter: **5mm~6mm**) on the upper wall of fuel tank, or just below the fuel tank cap.
- 2.6 Use provided fuel return-line nipple to fit to the tank and tighten it with a nut. And seal it.
- 2.7 Clean the fuel tank if any debris falling into it.
- 2.8 Install the fuel tank back.



The example to fit the fuel return line

### 3. Install the fuel pump assembly

- 3.1 Find a **safe place** to install the fuel pump: it should be between the fuel tank and the throttle body, so that both the fuel feed line and the fuel return lines can be short; and it should be tied to the inside of the frame, so that it is protected by 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.
- 3.2 Connect the fuel feed line from the fuel tank outlet to the inlet of the fuel filter (fuel filter, by default, has been connected to the inlet of the fuel pump).
- 3.3 Connect the high pressure fuel line from the fuel pump to the fuel injector, which is located on the intake manifold or throttle body.
- 3.4 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.
- 3.5 Secure all fuel lines with supplied clamps, make sure no leak.
- 3.6 The overview of the fuel supply system should be like the below pictures:



Note:

- **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.**
- 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, set it to **“PRI”** position.

See Appendix I ([Fuel supply system schematics](#))

## Fuel Pump wire connection

There are so far 2 types of fuel pumps supplied by Ecotrons. Small size and medium size.

Small fuel pump has a flow rate of 25L/H, it is suitable for 150cc, 250cc, up to 400cc engines. It may also run with smaller engines like 50cc, with some excess.

Medium pump has a flow rate of 45L/H, and it is suitable for 400cc up, like 650cc, 800cc and even 1100cc engines.

Both fuel pumps has 2 electrical terminals, and they are driven by 12v power. One terminal is “+” and one is “-“. There are 2 wires on the harness to be connected to the fuel pump. The “**BLUE**” wire is for the “+”; and the “**BLACK**” wire is for the “-“. As shown in the below pictures:



Small fuel pump terminals



Medium fuel pump terminals

#### **4. 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.



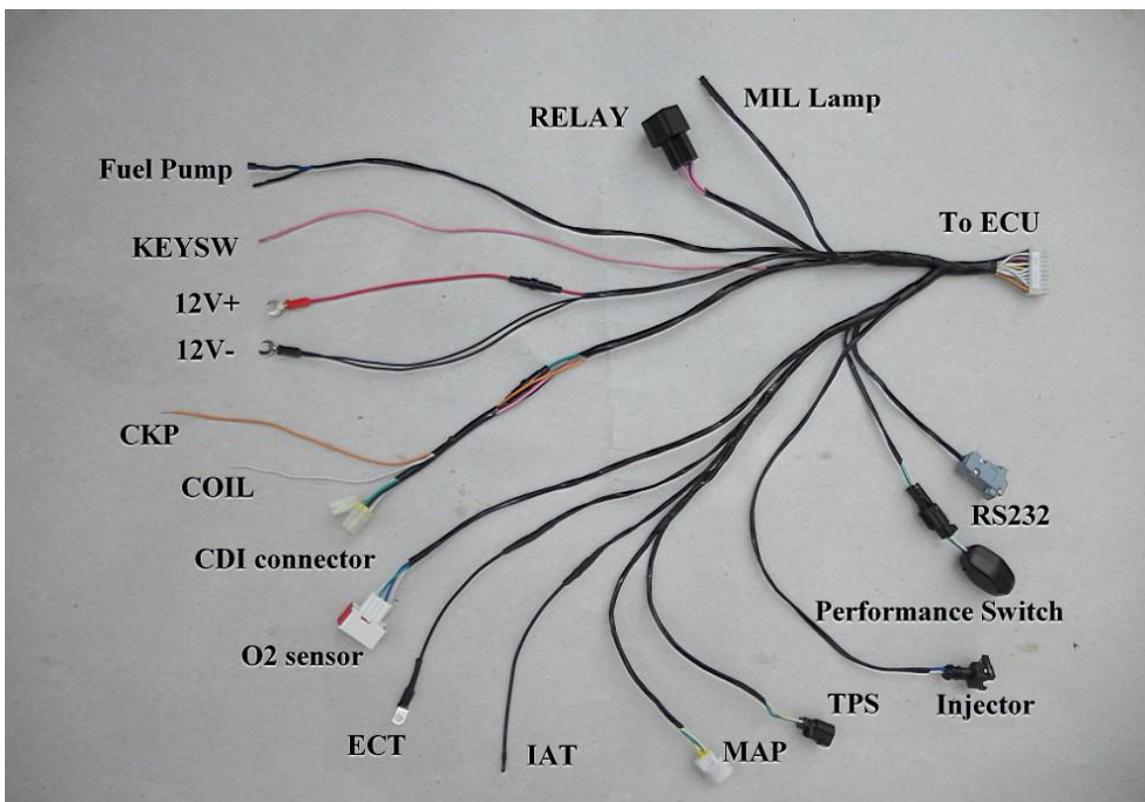
#### **5. Install the intake air temperature sensor.**

Insert the sensor into the air filter or somewhere between the air filter and the throttle body (if a hole is drilled on the air hose, make sure all the debris is cleaned immediately after the drilling!).

## Section 2: 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	
<b>CKP</b>	<b>Crank Position sensor Connect to Ignition pickup wire</b> (also called <b>VRS before</b> )	<b>Orange</b>
<b>CDI-Ctrl</b>	CDI control output from ECU	<b>Gray</b>
<b>GND</b>	Ground (previously called Analog Ground)	<b>Green</b>
<b>KEYSW</b>	Key On switch (previously called IGNSW)	<b>Pink</b>

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.

Note: some abbreviations and gloss have been changed compared to previous versions:

CKP = VRS

CDI-Ctrl = CDI-PG (pulse generator)

GND = AGND

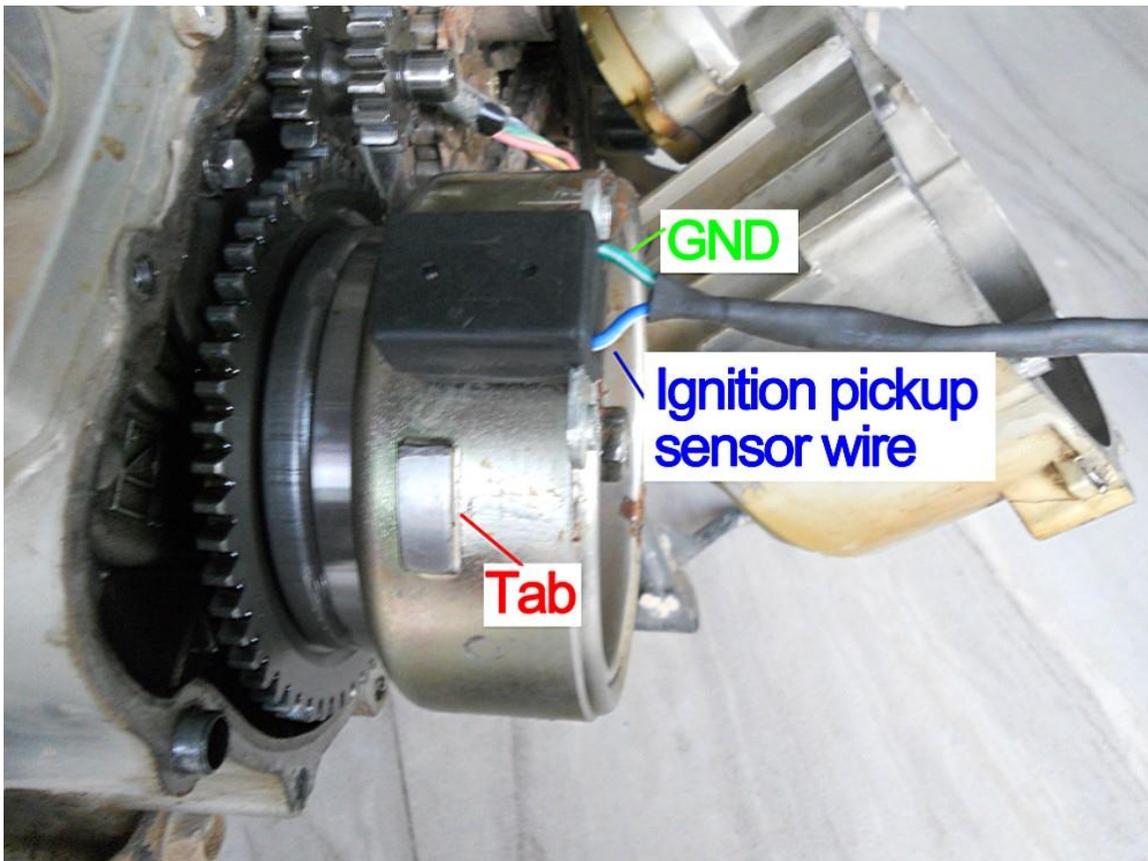
KEYSW = IGNSW

## 6. Ignition pickup sensor wire splices

6.1 Identify the “**Ignition pickup sensor Signal and GND**” on your CDI box, refer to the below picture if you don’t know how. Most CDIs use a small pickup sensor which is installed on the crankcase, next to the flywheel, as the trigger source. There is one metal tab / tooth (some engines have two), on the flywheel external surface; and when this metal tab passes by the pickup sensor, it generates a pulse, and triggers the CDI. This is how CDI knows when to fire the ignition. Our ECU uses this same pickup as the timing input to determine when to fire the injector and ignitions.

There are usually 2 wires coming out of this pickup sensor. One is trigger signal wire, the other is usually grounded.

To tell which wire is the **ignition pickup sensor wire** and which is the sensor **GND** wire on the connector of CDI, refer to the below picture. Use a multi-meter to check the continuity of the wires between the ignition pickup sensor and the CDI connector.



6.2 Tap the “**Ignition pickup sensor wire**” with the ECU **CKP** wire, (**Orange** wire on the ECU harness); and then secure the splice with electrical tape or better solder it. This wire is the ignition pickup signal (or as we called it, the Crank Position sensor – also called VRS, variable reluctant sensor, before);

6.3 Tap the “**Ignition pickup sensor GND**” with the ECU **GND** wire (**Green** wire on the ECU harness). Note, some engines have only one wire coming out of the pickup sensor, the ground wire is connected to chassis internally. In this case, you need to connect ECU **GND** wire (**Green** wire on the CDI connector) to chassis too.

Note, some engines have a CDI using both pickup “+” and Pickup “-“; meaning none of the 2 pickup wires are grounded. In this case, you need to figure out which one is the Pickup “+” and tap our CKP wire to it. And connect the ECU **GND** wire (**Green** wire on the our CDI connector) to chassis.

If you don't want to use our ECU to control the CDI, **Then go to step 7.**

For some popular scooter engines like GY6 150cc engine, our CDI is compatible, and you can install CDI immediately. This way our ECU will control both fuel and sparks. For those engines, our harness comes with CDI connectors already in place.

For many other engines, which have their own special CDI, it is a good practice not to use the ECU to control the CDI first, get the engine run first; and then try to use ECU to control the CDI later, or simply keep the stock ignition system, which reduce a big variable here.

If you want to use our ECU to control the CDI ignition timing, and if you have our 6-pin CDI included in the kit, you need to do this: Cut the ignition pickup sensor wire, and connect the wire from the sensor side to the ECU **CKP** input (**Orange** wire on the harness).

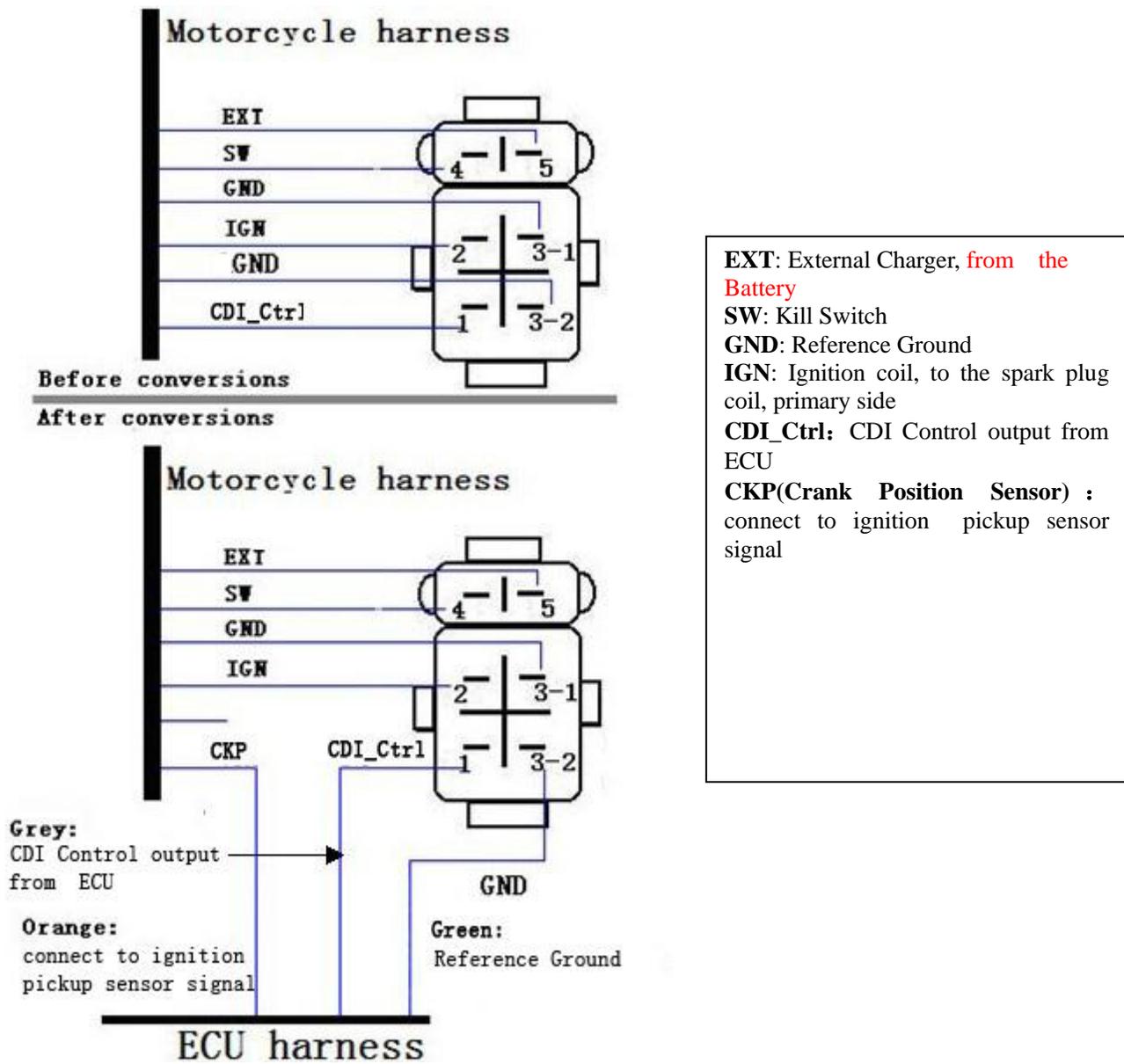
6.4 Then connect the other side of the wire you just cut (which goes into the CDI box) to the ECU **CDI-Ctrl** wire, (**Gray** wire on the ECU harness) . (for GY6 engines, see the picture below for this wire; some manufacturer called it “sensor signal” on the CDI connector).

**Note: if you use our ECU to control your own CDI, it may not work, contact us to confirm.**

**Note: if you use your own CDI, and if you don't know the pin definitions**

**on the CDI connector, DO NOT CONNECT CDI-Ctrl wire! Mis-connection of Pickup and CDI-Ctrl wires can damage the ECU.**

- 6.5 Secure the splices of **CKP** and **CDI-Ctrl** wires with electrical tape, or better, solder them and then tape them.
  
- 6.6 For most **CDIs**, there are 2 ground wires (**GND**) on the **CDI** connector, and likely only one of them is connected to the chassis ground.. We suggest you to connect the other **GND** wire to the chassis ground.



## GY6 125cc scooter 6-pin CDI wiring diagram

**Note:**  
**VRS = CKP**  
**PG = CDI-Ctrl**  
**Just different names.**

## **6.7 Hall-effect sensor installations and ignition controls with Ecotrons CDI.**

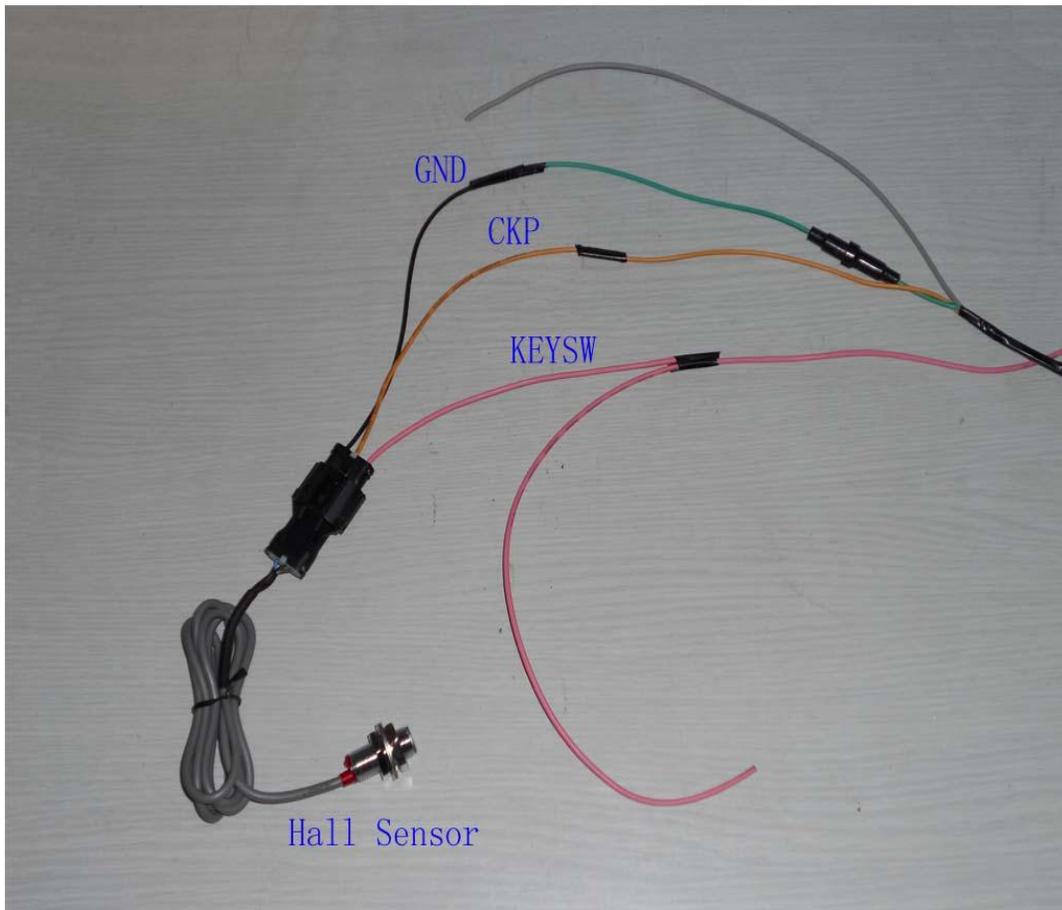
There are many engines that do not have a CDI. Instead, it has an integrated ignition module, called TCI (transistorized charging ignition) system. For example, Honda GX200, GX390, etc. and Briggs & Stratton engines, those engines have an ignition module installed right next to the flywheel. And there is a magnet built in the flywheel. When the magnet passes by the ignition module, it triggers the coil inside and fires the spark plug directly via a high voltage cable. For this type of ignition system, there is no standalone pickup sensor. The only wire that comes out of the ignition module is the kill wire.

This kill wire could be used as the pickup because it is basically connected to the primary side of the coil. . The primary side of the coil will generate a big pulse with some oscillations when the magnet passes by the coil. After all, when you press the kill button, the kill wire is to ground the primary coil to suppress the trigger pulse so the secondary coil does not fire at all.

As said, the kill wire can pass the trigger pulse from the primary coil to ECU, but with a lot of the noises. The noises are generated by the firing event of the secondary coil. To use the kill wire signal as the CKP input, some intensive filtering process is needed. The ECU has some built in filters to handle noises. In most cases, it can handle the kill wire signal with noises. But because there are so many different engines out there, some kill wire noises may not be filtered. In that case, a further hardware circuit (customized) could be used to filter the noise. Or you can use a dedicated Hall-effect sensor as the pickup.

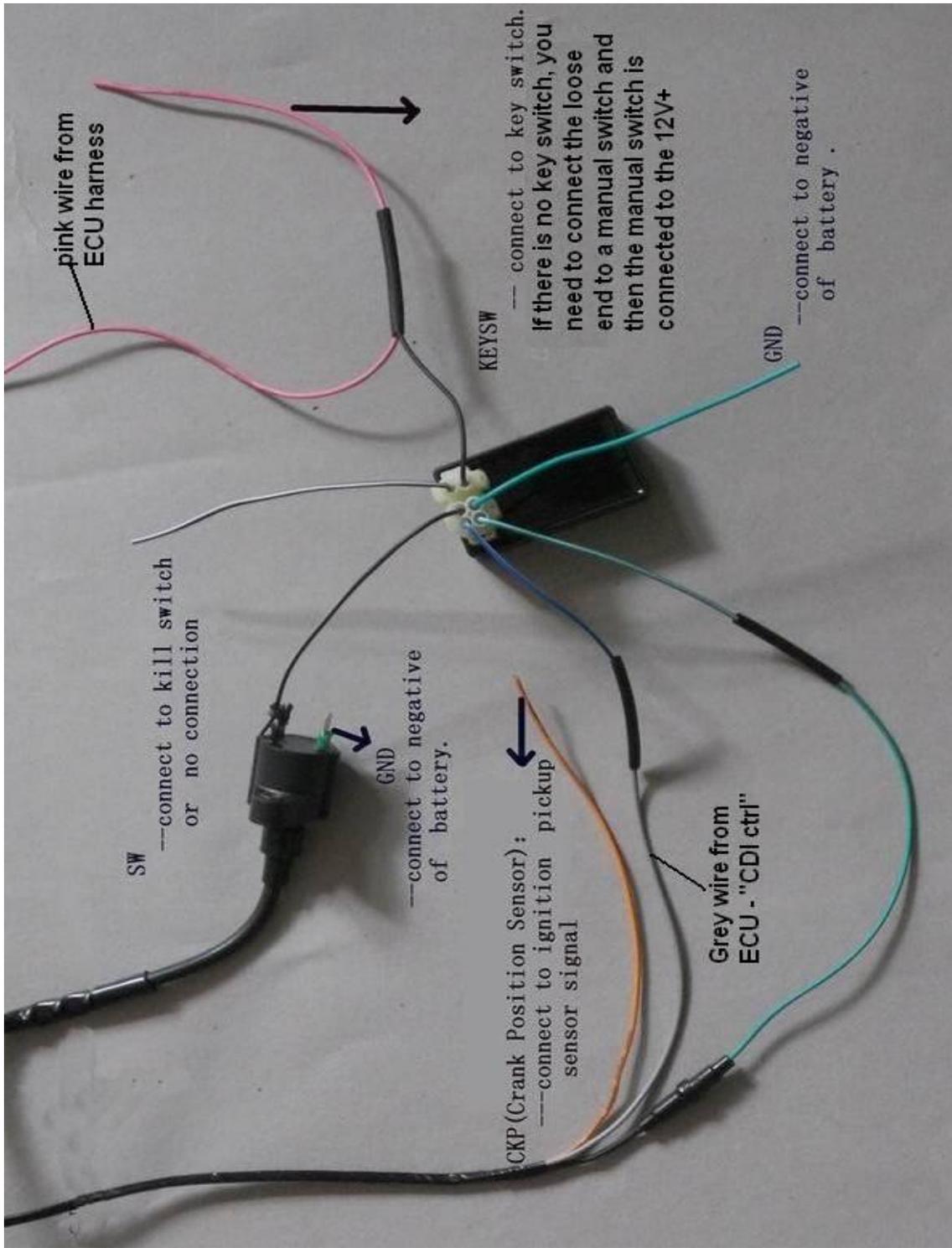
To do that, you need to confirm with us that you need a Hall-effect sensor, an Ecotrons CDI, and an ignition coil from us. These 3 components will replace the stock integrated ignition module. You will need to install the Hall effect sensor at the same location of stock ignition module. It seems complicated. But it gives the ECU the critical pickup input (from the Hall sensor); also, you get the fully programmable ignition control system as a result!

**The Hall effect sensor and ECU harness will be connected as below:**



### **6.8 Ignition controls with Ecotrons CDI.**

Use below picture on how to connect Ecotrons CDI and control the ignitions.

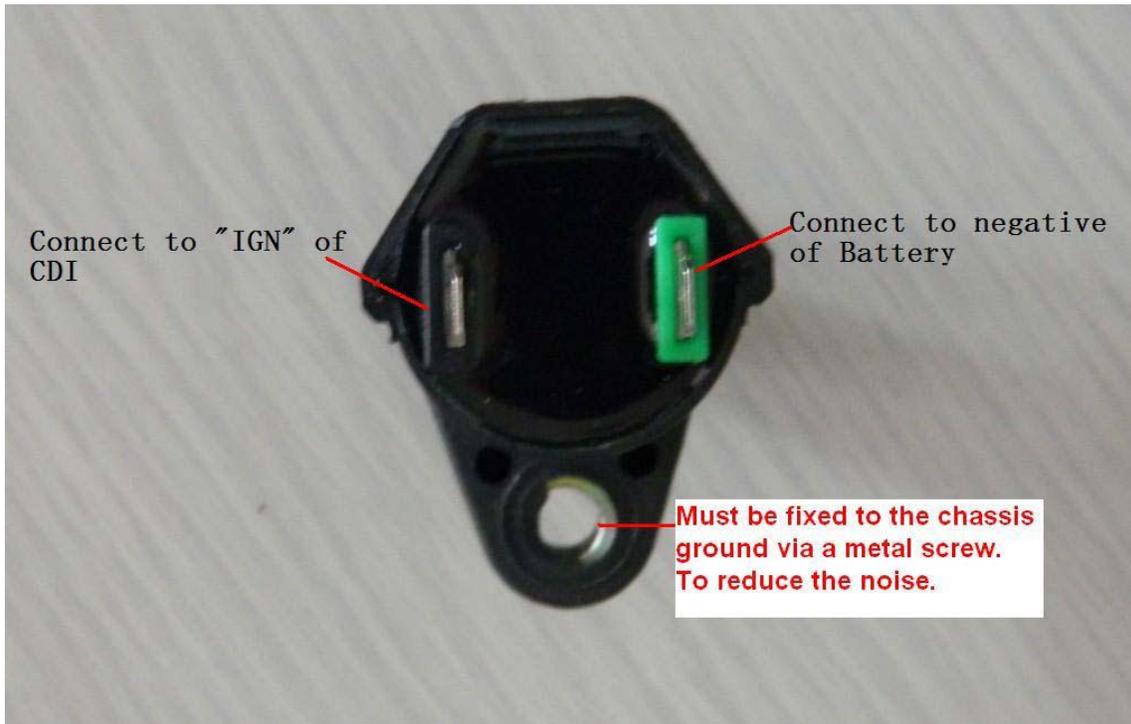


## 6.9 Install Ecotrons ignition coil.

The Ecotrons ignition coil shall be installed as below, if you have one included.

Note: most Carburetor engines have a spark plug with no internal resistance. This type of spark plug generates a lot EMI noises which can easily interrupt the ECU's normal running. If you experience severe ECU resetting, or misfiring events with no clue; and you have checked everything, this may be the cause. Contact us to confirm.

To fix this issue, you can put the ignition coil into a metal box, so that the EMI noise is emitted less. You can also put ECU into a metal box, so it's less affected. But if it still does not work, you may have to replace the spark plug to one that has a built-in resistance. As a matter of fact, all OEM engines with EFI system use the spark plug with resistance built-in.



## 7. 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.

“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 wire. For some customers, we pre-install a manual switch between KEYSW wire and 12V+ wire as requested.

8. Install the ECU in a safe place (it should be close to the EFI components, for example, under the seat or in the trunk.).
9. Connect all EFI components to the ECU with the provided harness (all connectors are included).
10. Connect the ECU to the 12V battery + and battery -.
11. Make sure your 12V battery minus is connected to the chassis ground! If your engine or vehicle did not have a 12V battery before, and you just added one, in this case,  
**you must connect the 12V – to chassis ground.**
12. Double check and make sure all wires are connected as they should be.

## 13. O2 sensor installations

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



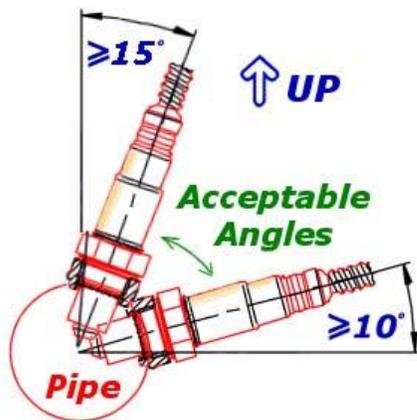
O2 sensor installation for vertical engines (3-4" downstream of exhaust port)



O2 sensor installation for horizontal engines (> 10 degree tilt angle)

13.1 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.

13.2 The sensor needs to installed with a tilt angle, meaning **the sensor head must point down with certain degree**, see the picture below. Otherwise the condensation could damage the sensor.



13.3 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.

13.4 install the sensor in the bung. Connect the O2 sensor cable.

## Initial test

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.
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 next step.

## Install the provide ProCAL software into your computer:

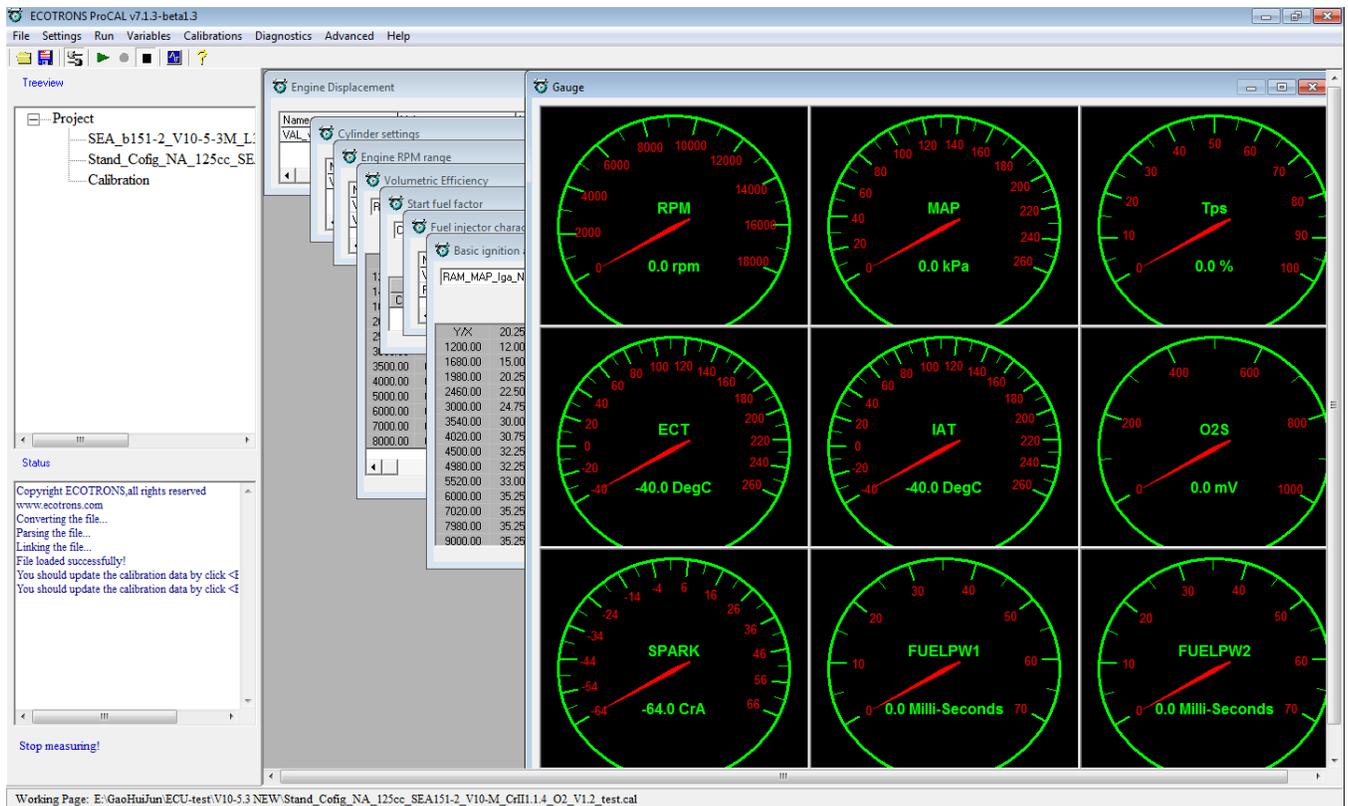
(for details on how to use ProCAL software, please refer to the ProCAL manual, downloadable from our website).

## If your computer is installed with Windows Vista or Win7, do below:

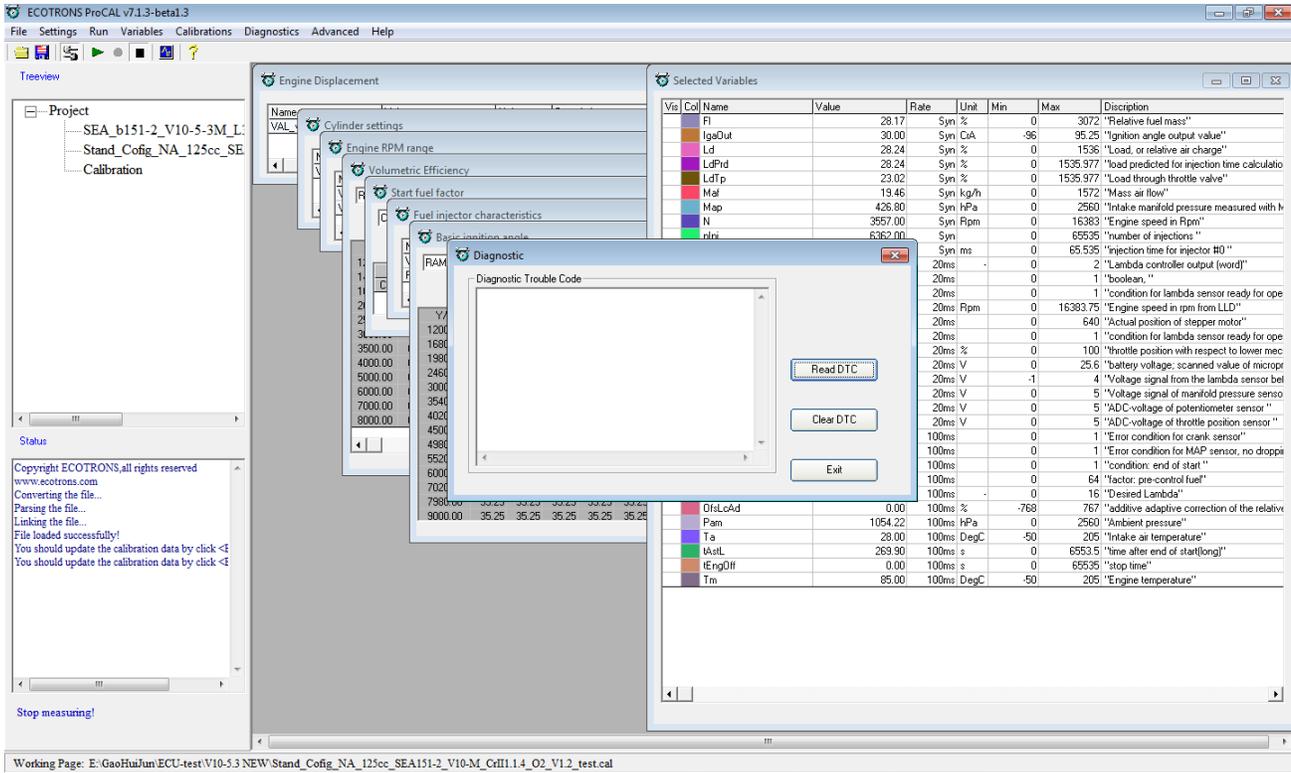
1. Right click on the ProCal icon
2. Choose properties
3. Click compatibility tab
4. Check: Run this program in compatibility mode
5. Choose XP service pack 2 or 3.
6. Check: run this program as administrator
7. Apply

**Note:** please do the same to “Data-Analyzer” in the “start → Program Files → ProCAL → Data-Analyzer”, because it is a standalone program.

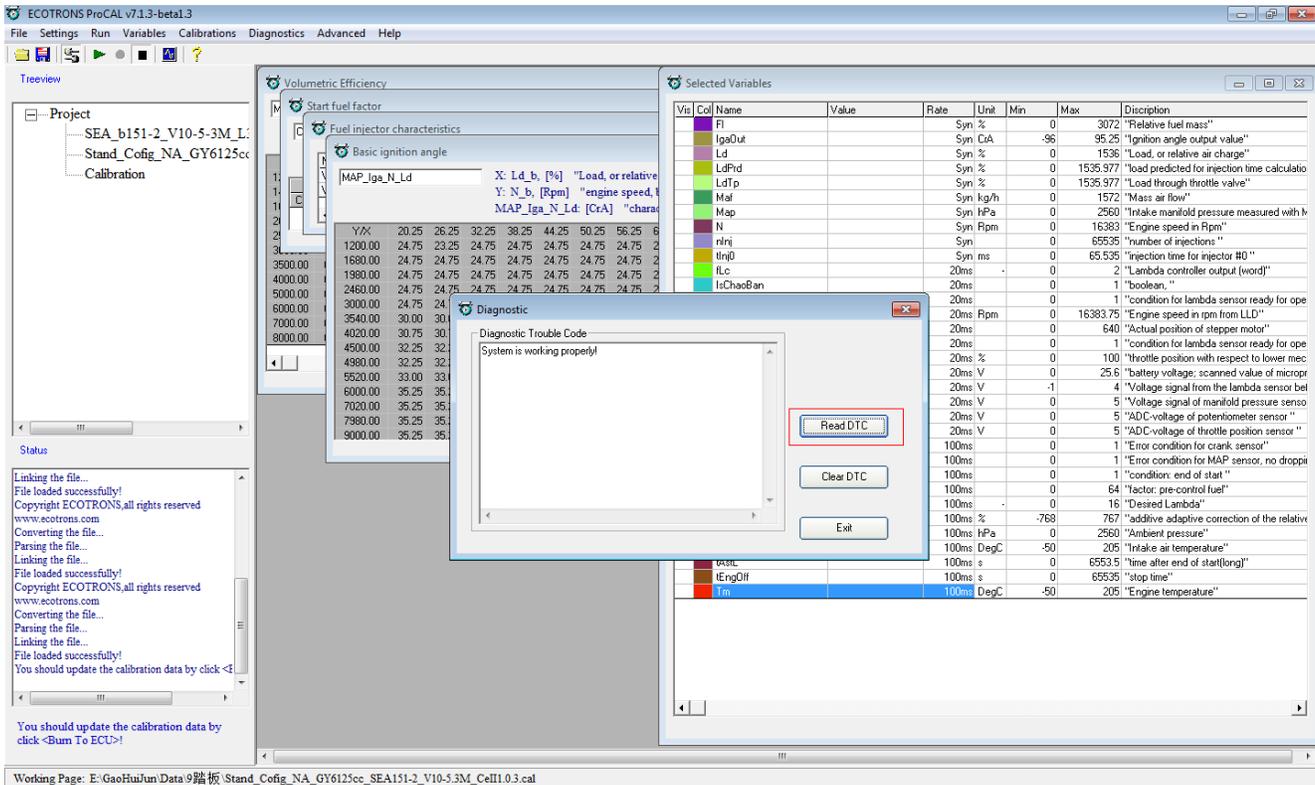
## Run ProCAL, you will see below windows:



## Small engine EFI conversion kits - installation manual-v2\_1



Click "Read DTC"



Supported DTC list (TBD)

3) Install the ProCAL (coming in the CD, or download at our website for the latest version):

- 3.1) ProCAL does not support Windows Vista at this moment. Please use Windows XP (the most tested environment), or Win7. With Win7, please set ProCAL in compatibility mode.
- 3.2) You installed the ProCAL into your computer, but it does not talk to the ECU: please check your USB adaptor and the required USB driver. Or better: use an old computer which has a built-in COM port to rule out the USB converter problem.
- 3.3) Establish the communication between the ProCAL and the ECU: menu → run → connect ; then menu → run → start measuring; you should see the gauges starting to show values.
- 3.4) Read diagnostic trouble codes by goto: menu → diagnosis → run diagnosis → read DTC.

## 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 → setting → communications” select correct port: USB or COM port.
- 1.5 Click “Connect” button in ProCAL.

4) With the ProCAL communicating with ECU, do the below tests:

- 4.1) Try to start the engine ( with the engine spinning), Read the variables in ProCAL:
  - 4.2) Does the signal “N” changing from 0 to some value > 300rpm?
  - 4.3) Does the “Map” signal drops from about 1000hPa to below 600hPa? If either of the above 2 is NO, you could have some wiring problem. If both the above are YES, you could have fuel supply issue: air bubbles in the fuel lines, or fuel clogged somewhere.
- 5) To rule out the problem of the ignition pickup sensor, do the below tests:
  - 5.1) Disconnect both CKP wire and GND wire from the ignition pickup sensor and tape them;
  - 5.2) Make sure the stock ignition system is untouched;
  - 5.3) Try to start the engine, and check the below :

5.4) Does the signal "N" changing from 0 to some value > 300rpm?  
5.5) Does the "Map" signal drops from about 1013hPa to below 600hPa? If either of the above 2 is NO, you could have some wiring problem. If both the above are YES, you could have fuel supply issue: air bubbles in the fuel lines, or fuel clogged somewhere.

6) With all the above questions and tests done, you still can not figure out why the engine does NOT start, please contact us directly:

[info@ecotrons.com](mailto:info@ecotrons.com)

## 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 ProCAL and send us with your questions:

## How to use ProCAL to log data:

- 1) Run ProCAL (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: "...\record"; that's where the logged files are.
- 9) Note, every time, the ProCAL can log 3 .csv files, with the same name except the different suffix: \_20ms, \_100ms and/or \_syn; These files are logged at the same time, but at different sampling rates. You will need to copy all those 3 log files, and send them to us.(don't change file names)

## 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 stoicometric 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.

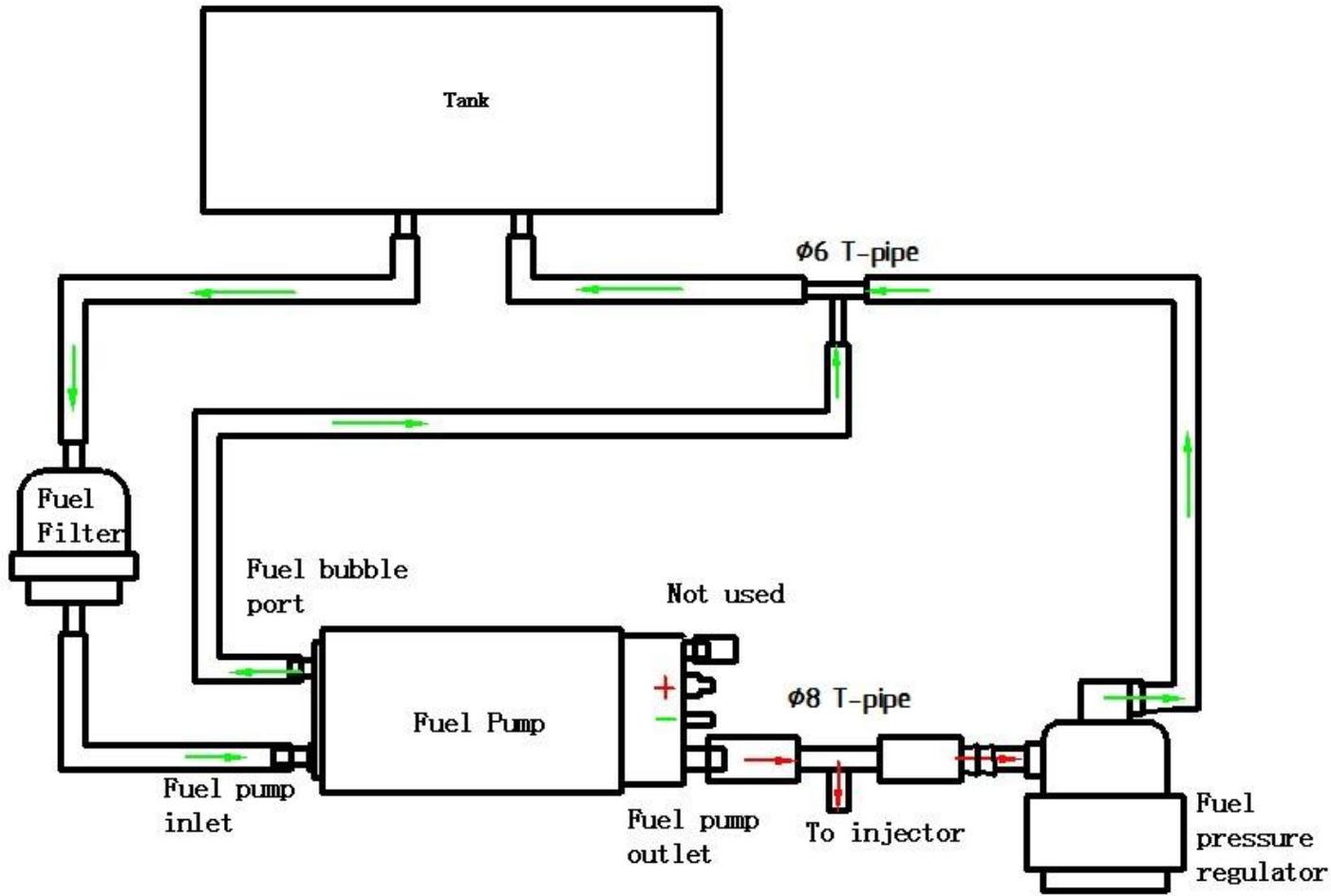
OFF -> ECO -> STOIC ON ->  
RICH -> POWER

Appendix: fuel supply systems,

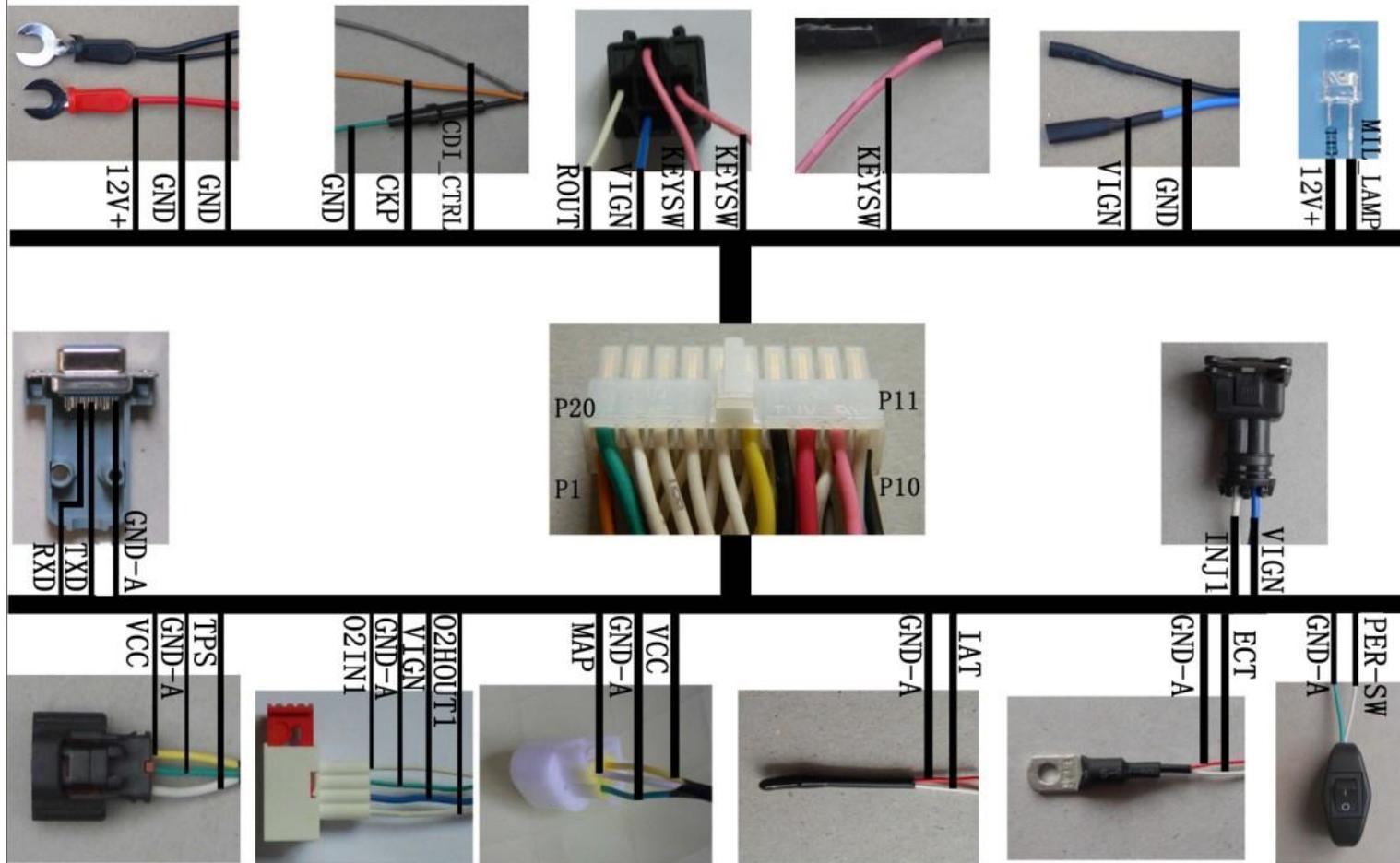
Appendix: Wiring harness diagram

Appendix: ECU pin-out

Appendix I: Fuel supply system schematics:



## ECU main connector pin-out (20-pin)

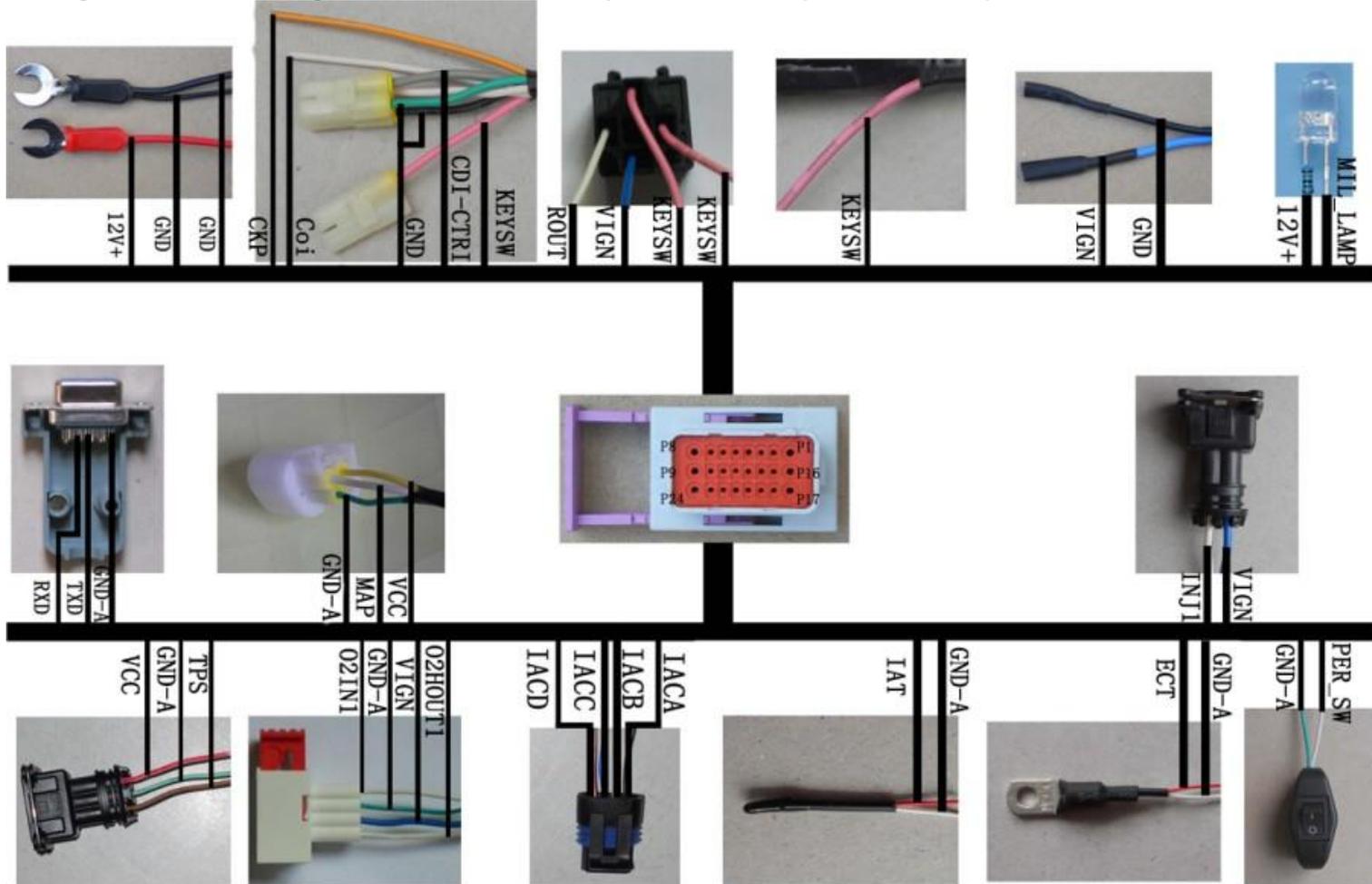


This wiring schematics is for 4-stroke 1 cylinder engine (1 injector, 1 O2 sensor) settings.  
 For different engines, like 2-stroke, 1 cylinder, w/ 2 injectors, some pin-out definitions are different.

P1	CKP		P11	O2HOUT1
	-- Crank Position Sensor, connect to ignition pickup sensor signal			--O2 Sensor Heater LS Driver output
P2	MIL-LAMP		P12	KEYSW
	--Malfunction Indicator Lamp			--Key On Switch
P3	MAP		P13	12V+
	-- Manifold Air Pressure Sensor input			--Reverse Battery Protected Supply
P4	IAT		P14	GND
	--intake air temp			--Power Ground
P5	RXD		P15	VCC
	--Send Data to RS232			-- +5 Volt supply output
P6	TXD		P16	ECT
	--Receive Data from RS232			-- engine (coolant) temp
P7	ROUT		P17	TPS
	--Power Relay LS Driver output			--Throttle Position Sensor input
P8	CDI-CTRL		P18	O2IN
	--CDI control output from ECU			-- Oxygen Sensor input
P9	INJ1		P19	PER-SW
	--Injector 1 LS Driver output			-- Performance Switch
P10	GND		P20	GND-A
	--Power Ground			-- Analog Ground

## Appendix: ECU main connector pin-out (24-pin)

This wiring schematics is for 4-stroke 1 cylinder engine (1 injector, 1 O2 sensors) with idle control motor (4 wires) settings. For different engines, like 2-stroke, 2 cylinders, w/ 2 injectors, some pin-out definitions are different.



P1	O2HOUT1	P13	IAT
	--O2 Sensor 1 Heater LS Driver output		--intake air temp
P2	12V+	P14	KEYSW
	--Reverse Battery Protected Supply		--Key On Swith
P3	GND	P15	MIL-LAMP
	--Power Ground		--Malfunction Indicator Lamp
P4	VCC	P16	INJ1
	-- +5 Volt supply output		--Injector 1 LS Driver output
P5	RXD	P17	GND
	--Send Data to RS232		--Power Ground
P6	PER-SW	P18	CDI-CTRL
	-- Performance Swith		--CDI control output from ECU
P7	TPS	P19	IACC
	--Throttle Position Sensor input		--Idle Air Controller C
P8	GND-A	P20	ROUT
	-- Analog Ground		--Power Relay LS Driver output
P9	IACA	P21	ECT
	--Idle Air Controller A		-- engine (coolant) temp
P10	MAP	P22	IACB
	-- Manifold Air Pressure Sensor input		--Idle Air Controller B
P11	IACD	P23	O2IN1
	--Idle Air Controller D		-- Oxygen Sensor 1 input
P12	TXD	P24	CKP
	--Receive Data from RS232		-- Crank Position Sensor, connect to ignition pickup sensor signal