RC engine EFI installation manual

- For 20cc to 300cc engines

Installation Manual

V2.0

Http://www.ecotrons.com

Note: If you are not sure about any specific details, please contact us at info@ecotrons.com.

Index	Page	Revision	Date	Note
1		**First Edition**	5.3.2015	V1.0
2		**Second Edition**	9.5.2016	V2.0

Content

Introduction

RC EFI is an Electronic Fuel Injection conversion kit for the RC engine. It is a bolt-on EFI kit to a lot of small engines. For example: 3W-28, 3W-56, DLE-40, DLE-60, DLE-120, DLE-170, DA-120, DA-150, etc. We can supply the suitable RC EFI kit for the most of UAV engines. The displacement of the engines can be in the range of 20cc to 300cc, and even larger engines.

This RC 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
- OBD - on board diagnosis
- Performance tuning for advanced users.
- Altitude compensations
- Transient fuel compensations
- Servo motor control (optional)
- Ignition control (optional)

Parts:

1. ECU
2. Harness (including the connectors)
3. Throttle Body
    - Throttle body
    - TPS sensor (optional)
    - Fuel injector (mounted on the throttle body)
4. Fuel pump assembly
    - Rotary fuel pump with pressure regulator (outside of the tank, 25L/h))
5. Baro sensor (integrated in ECU)
6. Engine temperature sensor
7. Intake air temperature sensor
8. CDI - ECU controlled (optional, you can use your own CDI).
9. Serial communication cable (to a computer)
10. USB adaptor - included
11. CD for tuning software (downloadable from our website)

Note: The kit requires a 12V battery by default.

25-pin ECU and Harness

Fuel pump group

Engine temperature and intake air temperature

CDI Unit

Chapter 1 EFI installation

1.1 Remove the stock carburetor and install the throttle body

Note: Ecotrons Small throttle body is designed to replace the stock carburetor and has the same or similar spacing as the carburetor, so that you can bolt on the throttle body. Ecotrons throttle body is designed to mount the Futaba servo motor easily. So the complete throttle body / servo is compact and light.

Ecotrons Small throttle body is designed to mount Ecotrons' small engine injectors. It comes with the injector fittings and thread-on fuel lines. The injector flow rates: 30g/min, 38, 60, 80, 128, 190, 248g/min etc.

And we also have 14mm, 18mm, 22mm, 28mm throttle body for RC engines, so we can provide the RC EFI kit for different engines with different displacement.

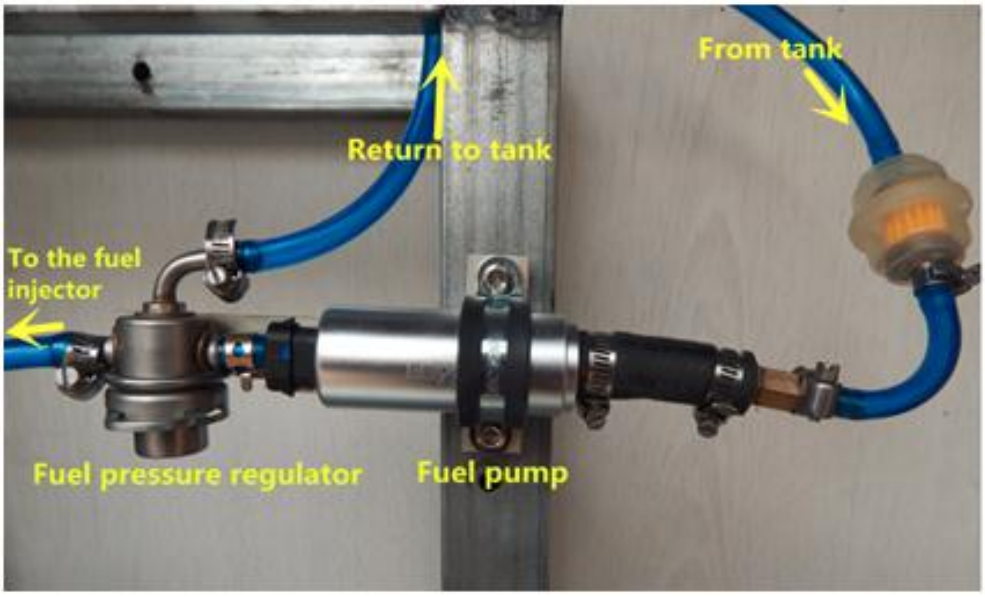
Some engines, you can use the throttle body to replace the carburetor completely, and for some engines, you need make the adapter to bolt on the throttle body.

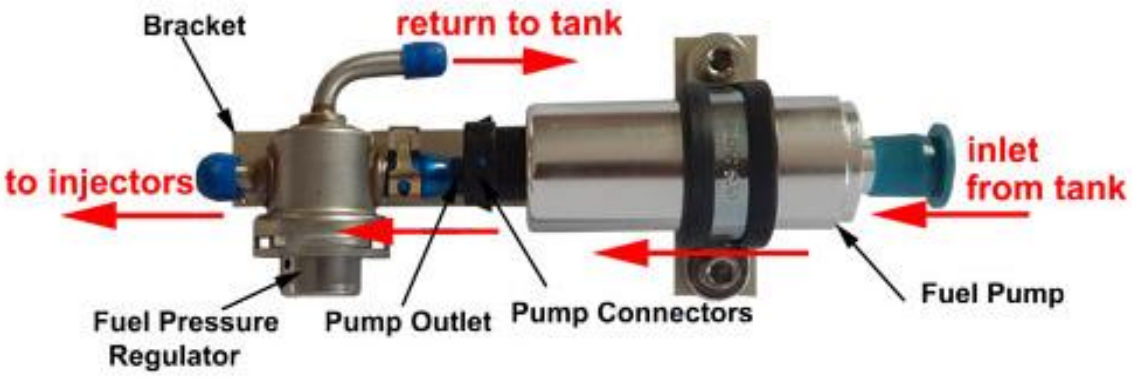
1.2 Install the fuel supply system

Customers 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 feed inlet in the tank should be submerged in the fuel all the time. There should be an inline fuel filter.

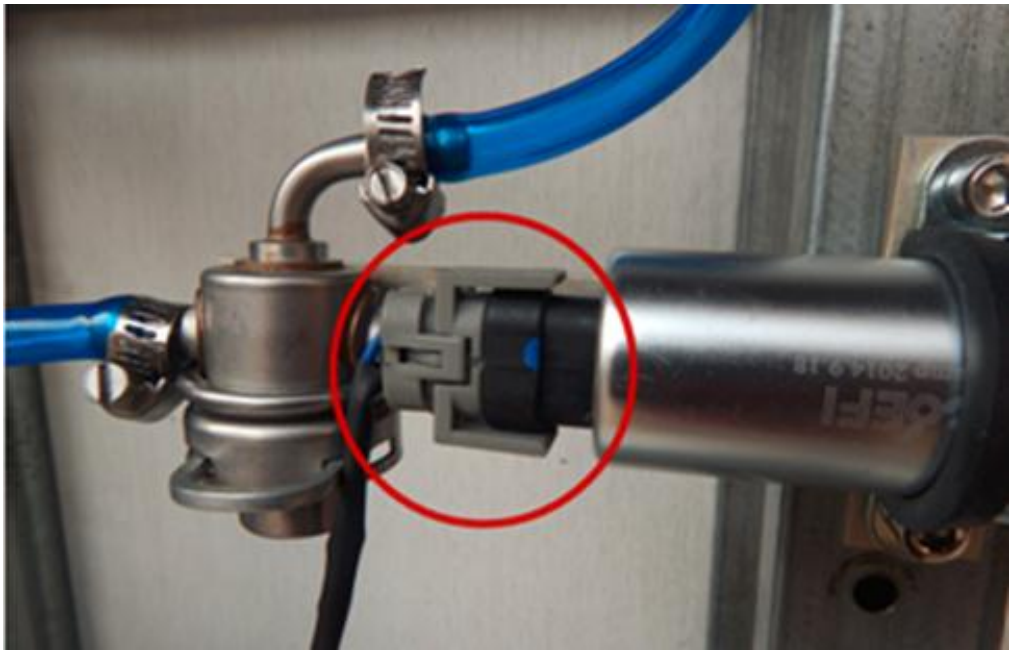
Note: The EFI has a fuel pressure regulator which requires a fuel return line back to the fuel tank.



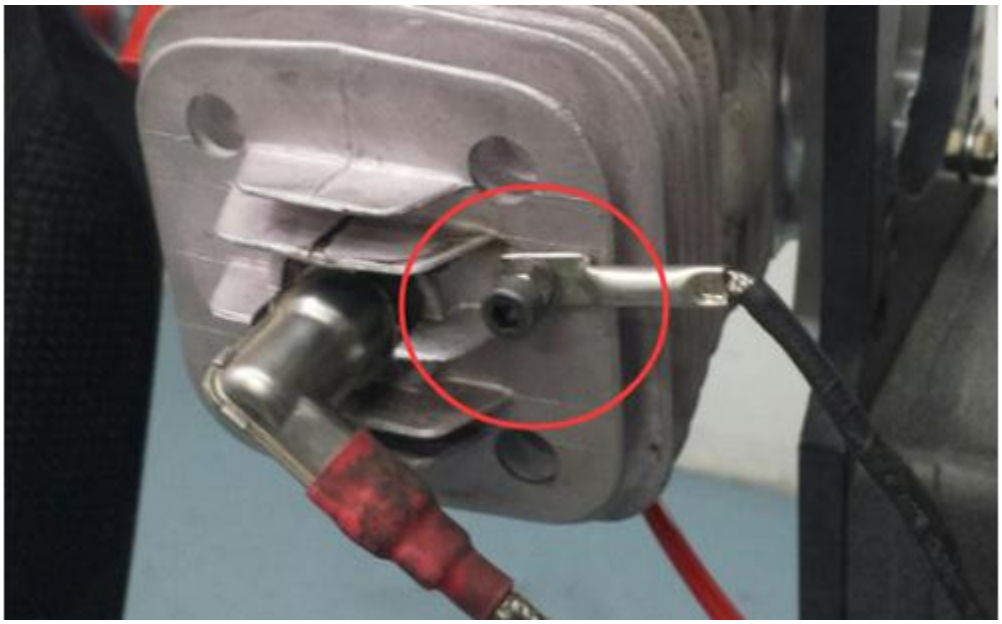


Note: The fuel pump is a rotor type, has 25L/h flow rate. It has only limited sucking power. If there are too many air bubbles in the fuel lines, the pump will not work.

Connect the connector to the fuel pump



1.3 Install the cylinder head temperature sensor (ECT)



Note: The ECT sensor must be installed at the cylinder head, closed to spark plug. If you can place it under the spark plug, it is also OK.

1.4 Install the intake air temperature sensor (IAT)

Install the intake air temperature sensor (IAT) in the intake air channel or install it in the air box.

1.5 Install ignition system

1.5.1 Connect the ECU harness to the Ecotrons' CDI and Hall sensor.

If you use the stock ignition system and don't use Ecotrons' CDI, please skip this chapter.

For some engines, we provide the CDI to control the ignition timing. So you need to know how to install the CDI and harness.

1) **Connect the CDI connector from the harness to Ecotrons' CDI.**

CDI Unit

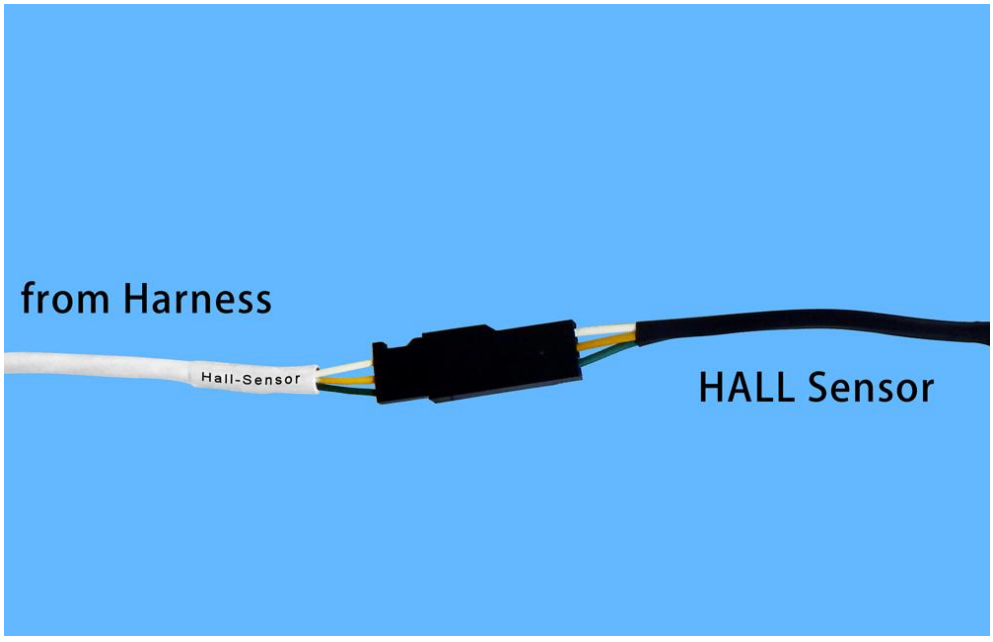
Connect the "CDI-POWER" from the ECU harness to the red connector of CDI.

Connect the connector with single white wire to the black connector of CDI.

The connector which is labeled "Tachometer" can be connected to your own Tachometer.

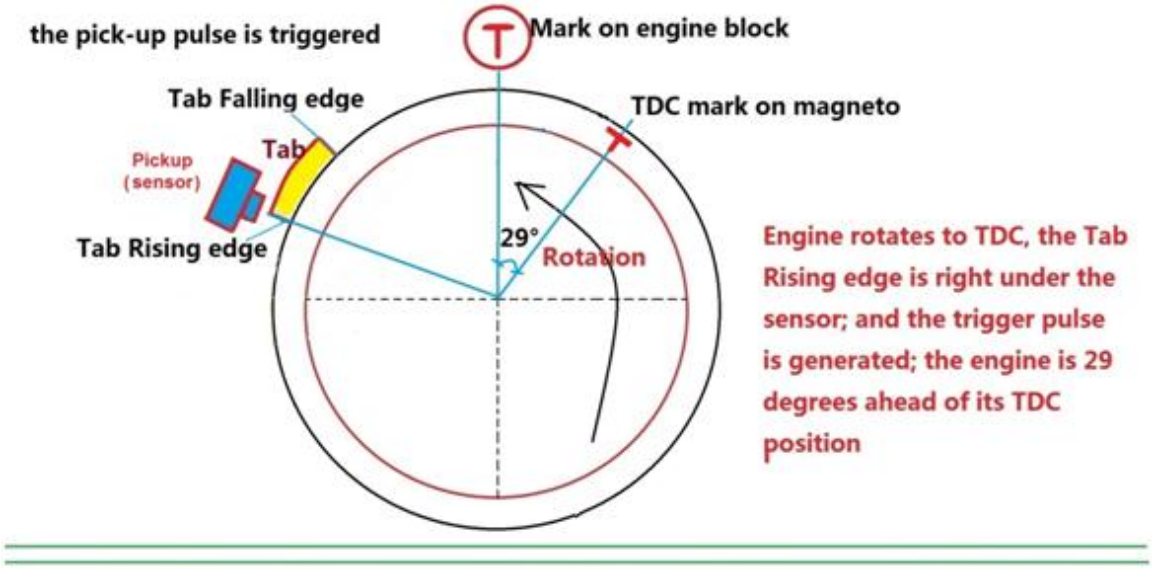
Note: Do NOT plug the connectors in the wrong direction.

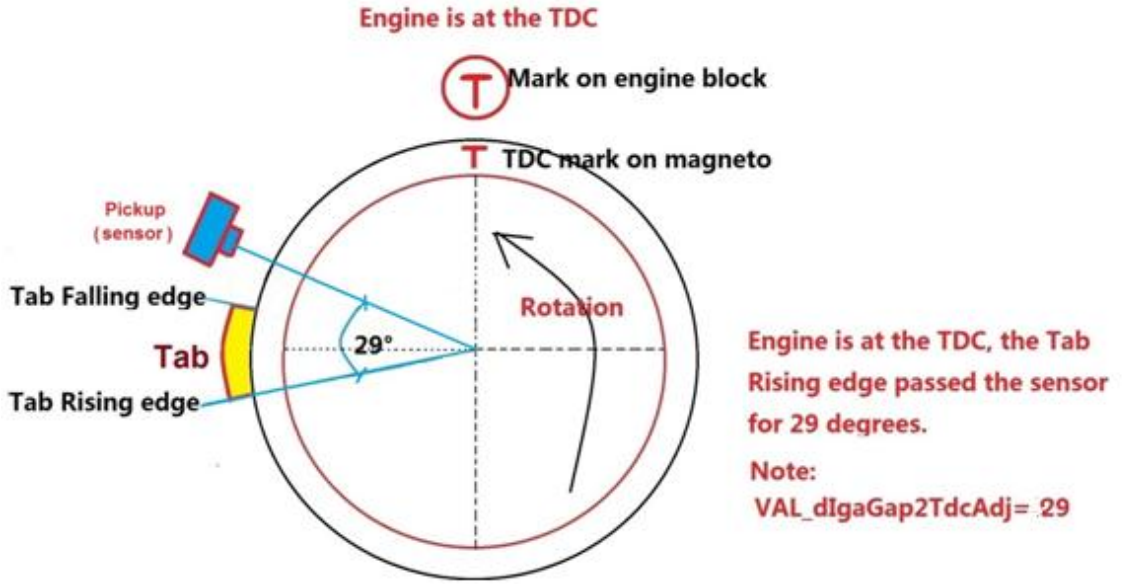
2) Connect the Hall-Sensor connector to the Hall sensor.



For ignition control, you need find the offset angle for ignition angle output.

The method to find the angle from the pickup to TDC





Note: It is a constant value. It is different than the ignition angle table.

For example, when you command 0 degree ignition angle, you should see the 29 degree between the trigger pulse and the ignition pulse.

So, you should find this angle before to control the ignition, VAL_dIgaGap2TdcAdj=29.

1.5.2 DLE series engine

For DLE series engine, Ecotrons CDI is compatible and can be installed directly. So the EFI will control both fuel and sparks in standard EFI kit.

If you want to use the EFI to control the CDI ignition timing, and if you have Ecotrons CDI included in the kit, you need to do this.

1.5.2.1 Connect the ECU harness to the CDI

Please connect the CDI connector from ECU harness to the Ecotrons' CDI unit.

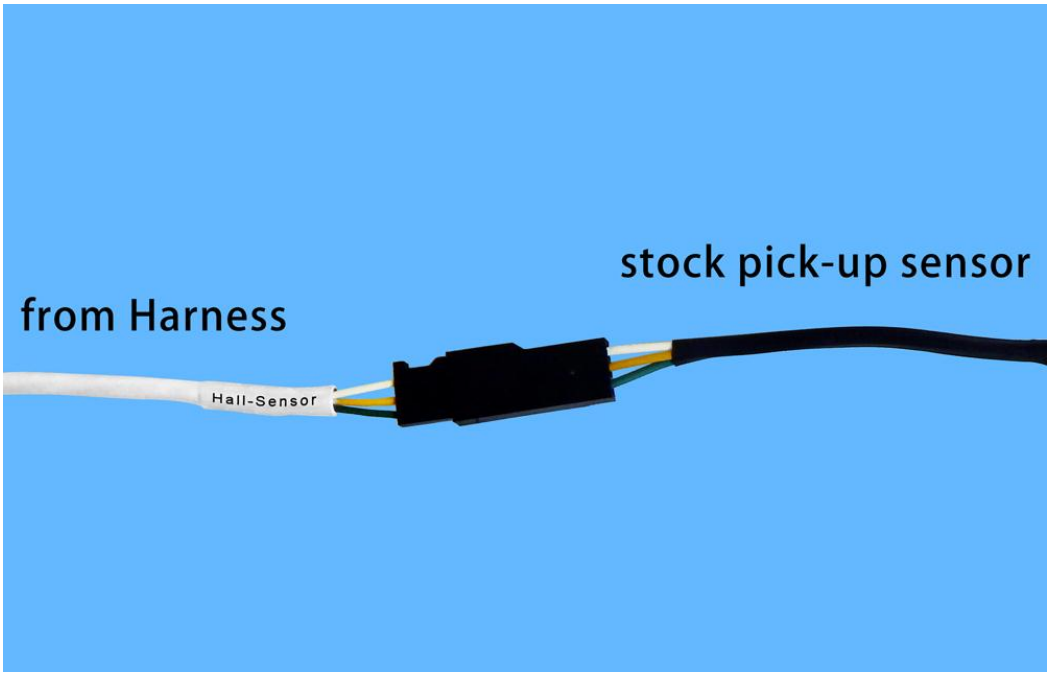
Connect the "CDI-POWER" from ECU harness to the red connector of CDI.

Connect the connector with single white wire to the black connector of CDI.

The connector which is labeled "Tachometer" can be connected to your own Tachometer.

Note: **Do NOT plug the connectors in the wrong direction.**

1.5.2.2 Connect the Hall-Sensor connector to the stock Hall sensor.



1.5.3 DA series engines

For DA series engines, you can choose the EFI to control ignition. You need re-align the pickup sensor and the magnet, so that the trigger pulse is happened at 40 degree ahead of the TDC.

Use Ecotrons' CDI for ignition control

Ecotrons supplies the Hall Effect sensor (with one magnet) to replace your stock "VR" type pick up sensor. So you need to install the Ecotrons' Hall Effect sensor before you install the EFI kit.

1.5.3.1 Install the new magnet and Hall Effect sensor

Remove the stock magnet and VR sensor, and Install the new magnet and Hall Effect sensor.

Ecotrons' Hall Effect sensor is triggered by S-Pole magnet, so you need to install the S-pole magnet first. It should align with the Hall Effect sensor.

Make one new flywheel or drill the hole in the stock flywheel so that you can install the magnet, which should face toward the Hall Effect sensor with the S-pole side.

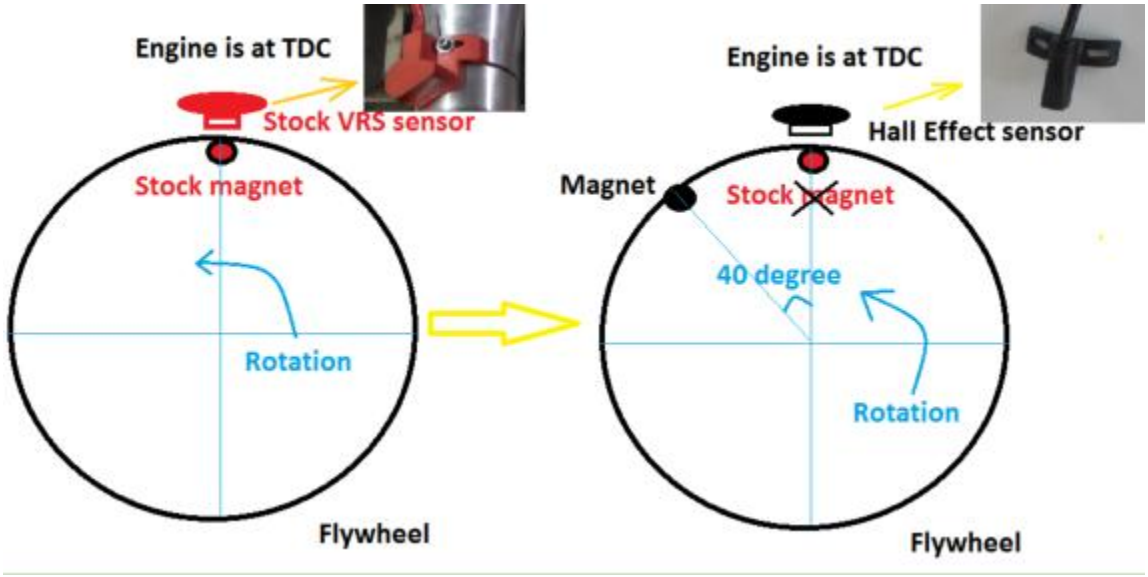
Remove the stock VR sensor, and install the Hall Effect sensor at the same place.

Make one new flywheel or drill the hole in the stock flywheel so that you can install the magnet which should face toward the Hall Effect sensor with the S-pole side.

Note: The magnet was marked by red and blue, the red is N pole, the blue is S pole. The red (N pole) was set in the flywheel, and the blue (S pole) is faced to the hall sensor.

Note: if you drill the hole in the stock flywheel, please remove the stock magnet, and there is only one pulse to trigger the ECU.

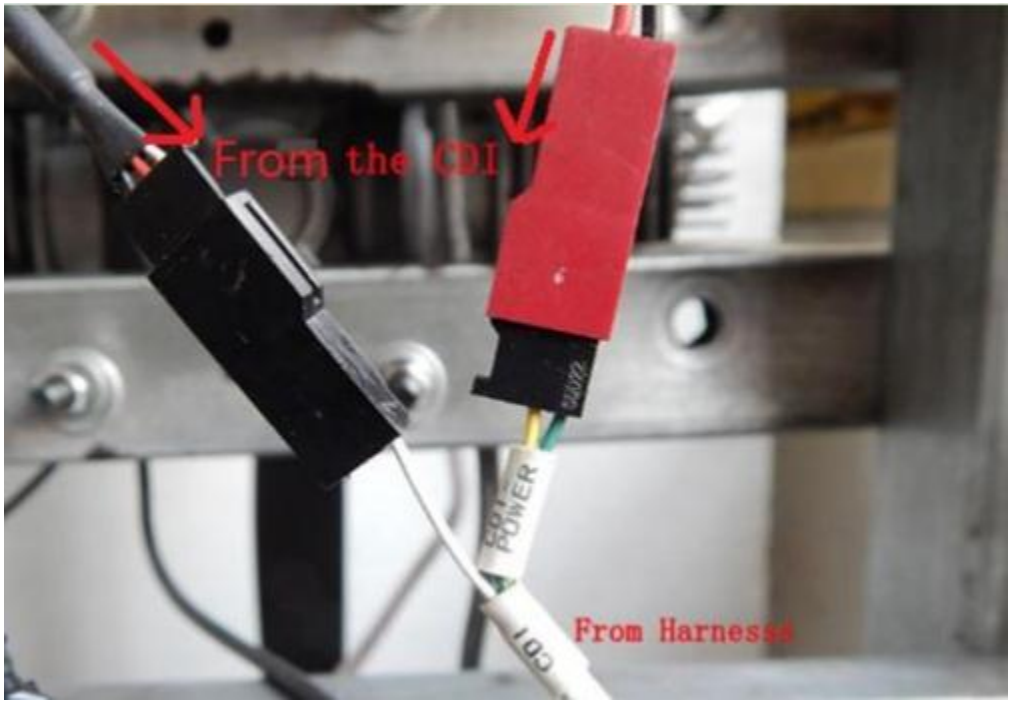
See below picture.



Install the Ecotrons' CDI ignition system

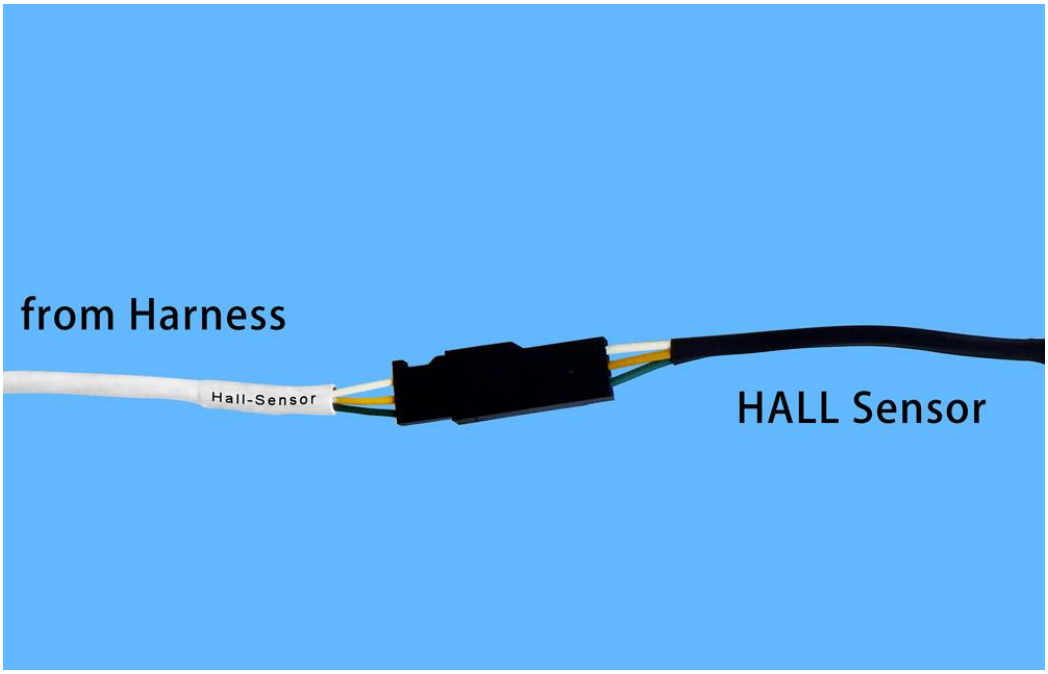
1.5.3.2 Connect the CDI connector from the harness to Ecotrons' CDI.

Connect the “CDI-POWER” from ECU harness to the red connector of CDI.
Connect the connector with single white wire to the black connector of CDI.
The connector which is labeled “Tachometer” can be connected to your own Tachometer.



Note: **Do NOT plug the connectors in the wrong direction.**

1.5.3.3 Connect the Hall-Sensor connector to the Hall Effect sensor.



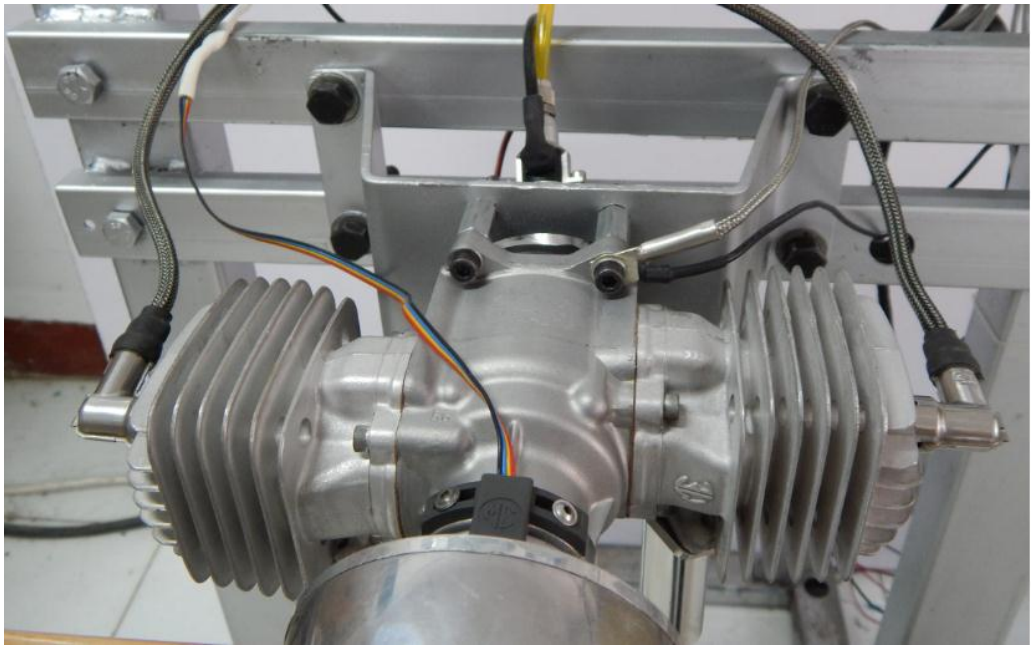
Note: Tune the calibration variable, "VAL_dIgaGap2TdcAdj" to be 40 for ignition control.
VAL_dIgaGap2TdcAdj=40

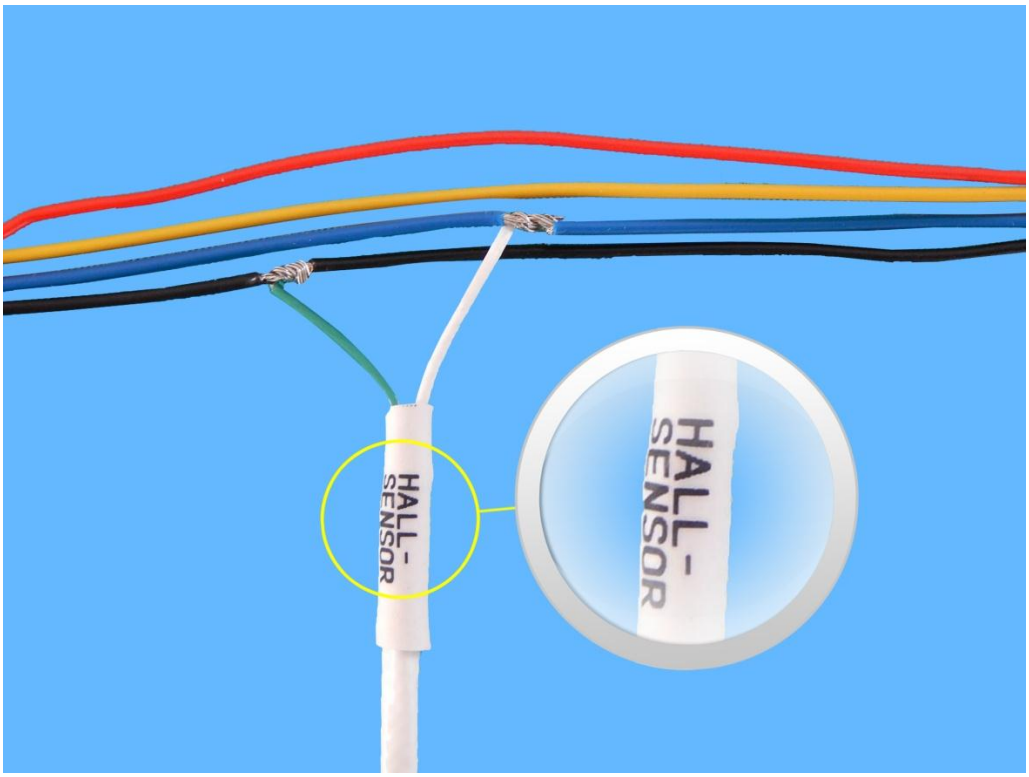
1.5.4 3W series engines

1.5.4.1 Connect the ECU harness to the stock CDI and pickup sensor

For 3W engines, you can choose that the EFI only controls the fuel injection, and keep the stock CDI system, you only need to tap the stock pick-up signal wire to ECU harness.

You need to connect the white wire of harness to the blue wire (signal wire) of stock hall sensor, then connect the green wire of harness to the black wire of stock hall sensor.





Note: if the ECU controls the fuel injection and use the stock ignition module, you just need to connect the pick-up wire to ECU harness, like above pictures.

1.5.4.2 Use Ecotrons' CDI for ignition control

You can use ECU to control ignition module with Ecotrons' CDI and stock pickup sensor.

a. Connect the pickup connector from harness to the pickup sensor

For 3W series engines, EFI can control both the fuel injection and ignition. You can choose use the stock pick-up sensor and use Ecotrons' CDI to control ignition system, but you need use the connector adaptor which was provided from us.

There are 4 wires from the stock Hall sensor. They are the red, yellow, blue, and black wires. The red wire is power+, and the black wire is ground. There are two signal wires, blue and yellow wires.

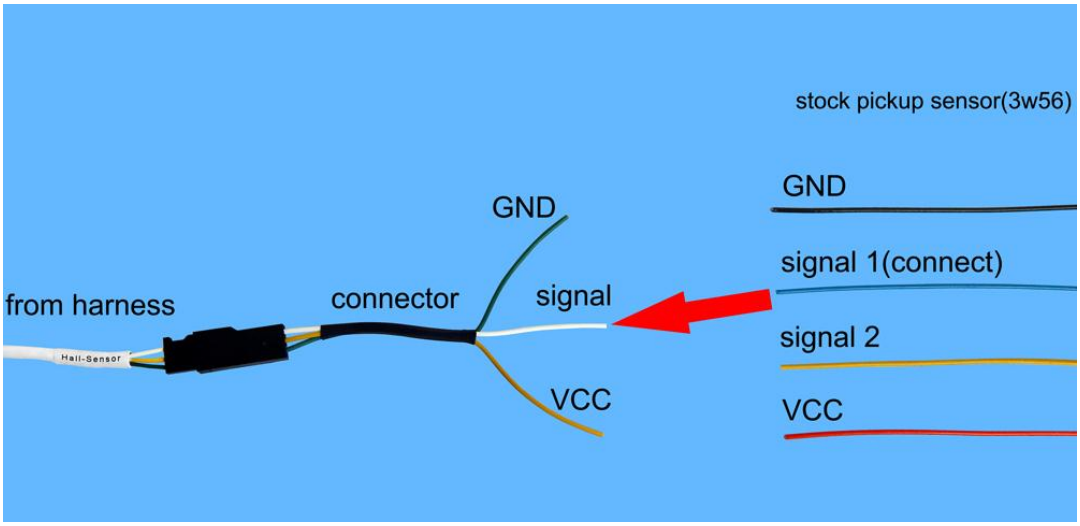
There are 3 wires from the adapter. They are the green, white, and yellow wires. The yellow wire is VCC (5V), the green wire is GND (ground), and the white wire is signal.

The green (GND) wire from harness is connected to the black (GND) wire of stock pickup sensor.

The white (signal) wire from harness is connected the blue (labeled "signal 1") wire of stock pick-up sensor.

The yellow (VCC) wire from harness is connected to the red (VCC) wire of stock pick-up sensor.

The below picture is the connections of harness, connector, and stock pick-up sensor.



b. Connect the CDI connector from harness to Ecotrons' CDI

Connect the "CDI-POWER" from ECU harness to the red connector of CDI.

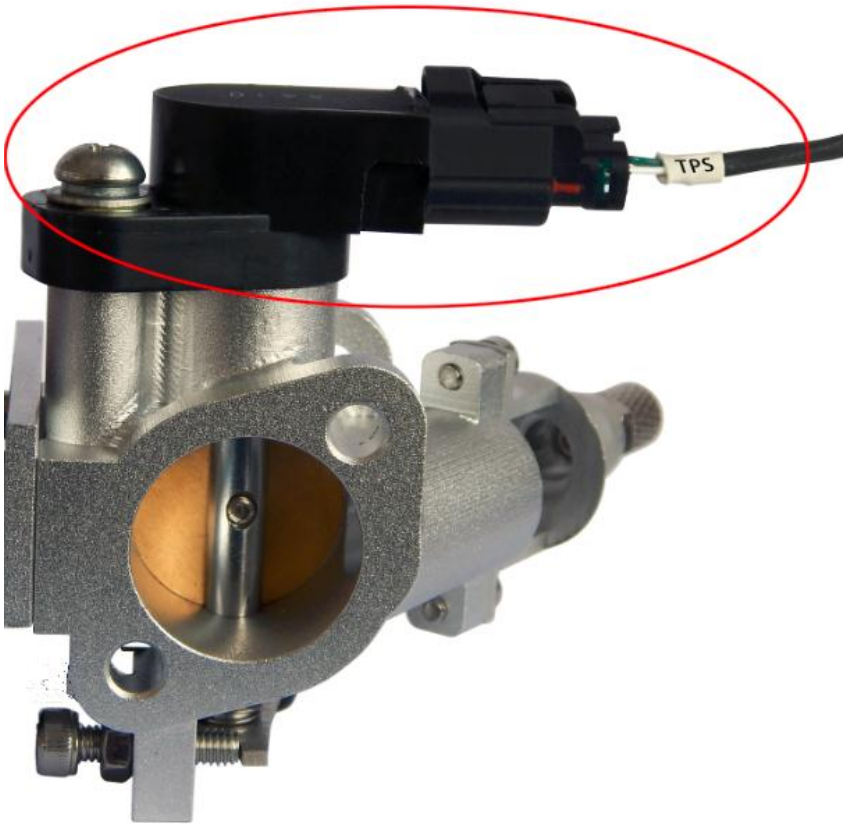
Connect the connector with single white wire to the black connector of CDI.

The connector which is labeled "Tachometer" can be connected to your own Tachometer.

Note: Do NOT plug the connectors in the wrong direction.

1.6 Connect the TPS sensor connector

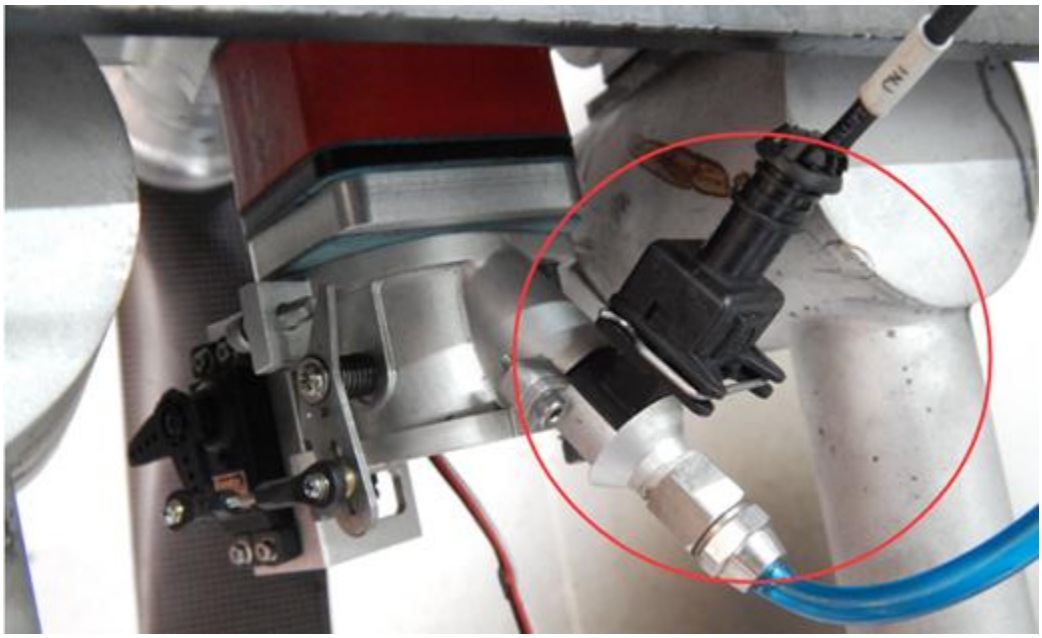
For some large displacement engines, larger than 60cc, we provide the TPS sensor. So you need connect the TPS connect to the TPS sensor which is mounted on the throttle body.



If there is no TPS sensor when you order the EFI kit, and you add the TPS sensor by yourself later, you need to do some tuning (usually, we will pre-set the setting when you order the EFI system with TPS sensor, or send the Calibration data file to you by emails).

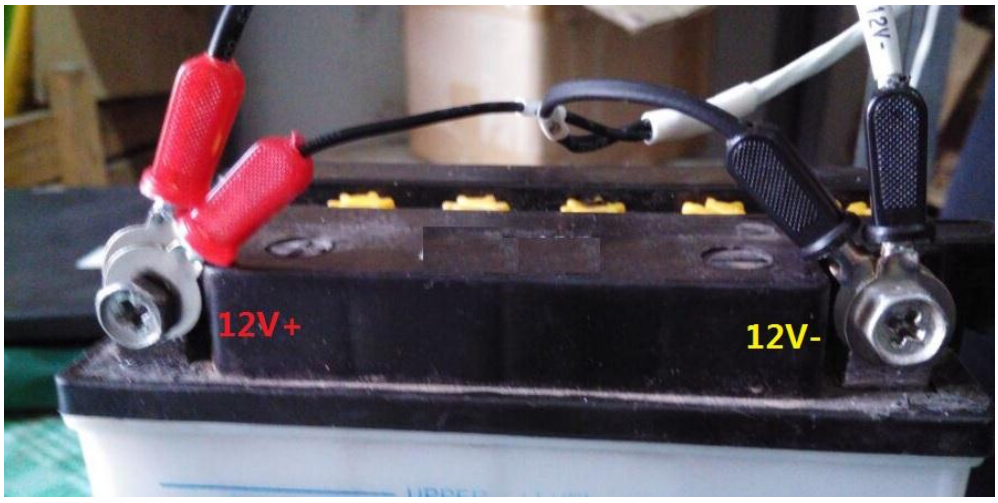
Please set VAL_TpsSource to be 0.

1.7 Install the fuel injector and connect the connector

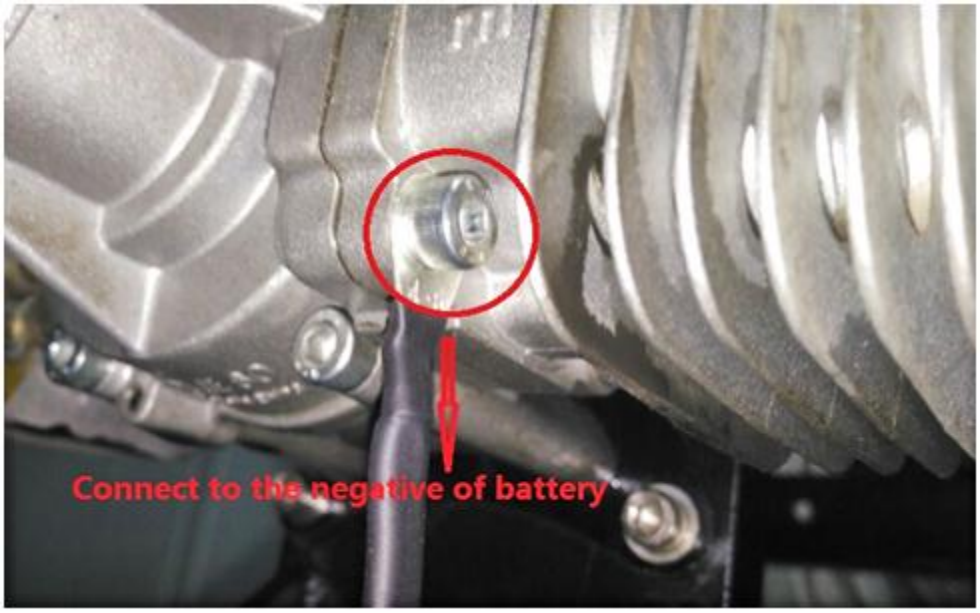


1.8 Connect the harness to 12v battery

Note: the red is to the positive of battery; the black is to the negative of battery. There is one manual switch on the power wire; you can use this switch to power on EFI, or power off.



Note: connect the negative of battery to the engine block. All ground wires should be common.



Note: The black wire goes to negative of battery.

1.9 Mount the ECU

Find a safe place to mount the ECU, avoid the severe vibration and severe hot conditions. Do not expose it to water / fluids. This ECU is NOT water proof.

Parameters of ECU:

- Aluminum case, light weight: 110 gram total;
- Mini size: 80x66x24mm dimensions;
- DB25 connector (25 pin);
- built-in baro pressure sensor, automatic altitude compensation;
- controlling 1 or 2 cylinder engines, both fuel injection and ignition controls;

Pictures of ECU

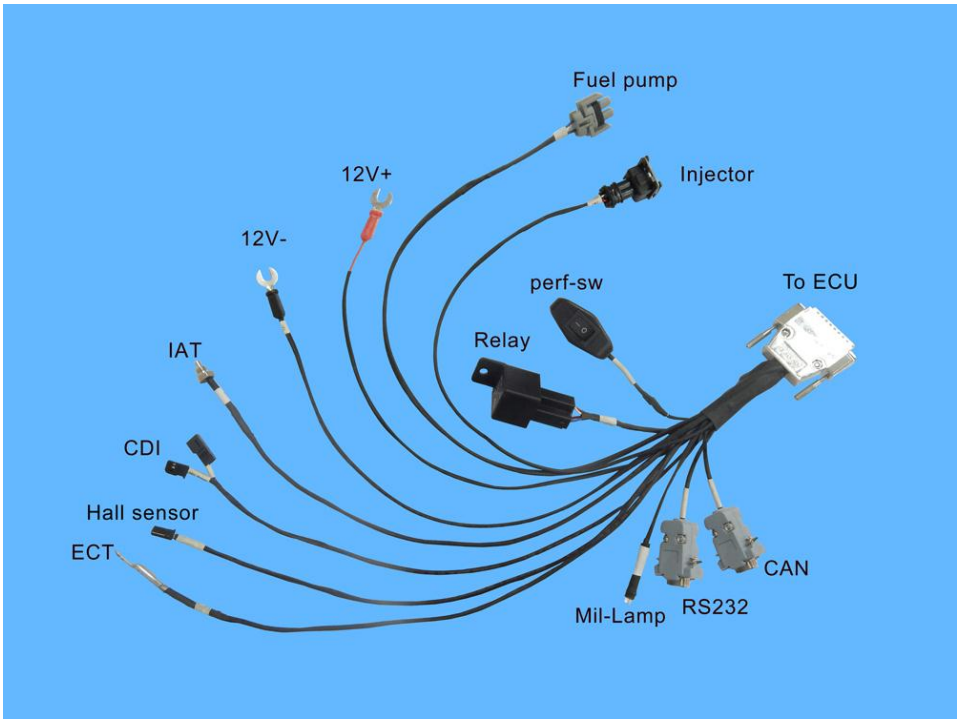
Definition of pins:

Pin #	Name	Color	Note
1	FFP-	White	Gear fuel pump control output
2	GNDP	Black	Power Ground
3	Mil-Lamp	White	Malfunction indication Lamp (optional: #2 injector)
4	CDI_PG2	White	#2 CDI control

5	FFP+	Blue	Power of gear fuel pump
6	KEYSW	Red	Reverse Battery Protected Supply
7	ECT	White	Engine (coolant) Temperature sensor
8	GND	Black	Power Ground
9	IAT	White	Intake Air Temperature Sensor
10	MAP	White	Intake manifold pressure sensor
11	CKP	White	Crank Position Sensor input (pickup)
12	PWMOUT	White	Servo motor control PWM output
13	AGND	Green	Analog Ground
14	Inj1	White	Injector #1 LS Driver Output
15	ROUT	White	Relay control
16	VCCM	Yellow	Power of Servo motor
17	CDI_PG1	White	#1 CDI control
18	NULL	----	----
19	NULL	----	---
20	TXD	Yellow	Receive data from RS232
21	RXD	White	Sent Data to RS232
22	TPS	White	Throttle position sensor
23	PERSW	White	Prime Switch
24	VCC	Yellow	+5V
25	PWMIN	White	Servo signal input

1.10 Mount the Harness

Please find the suitable place to mount the harness.



1.11 Optional prime switch function

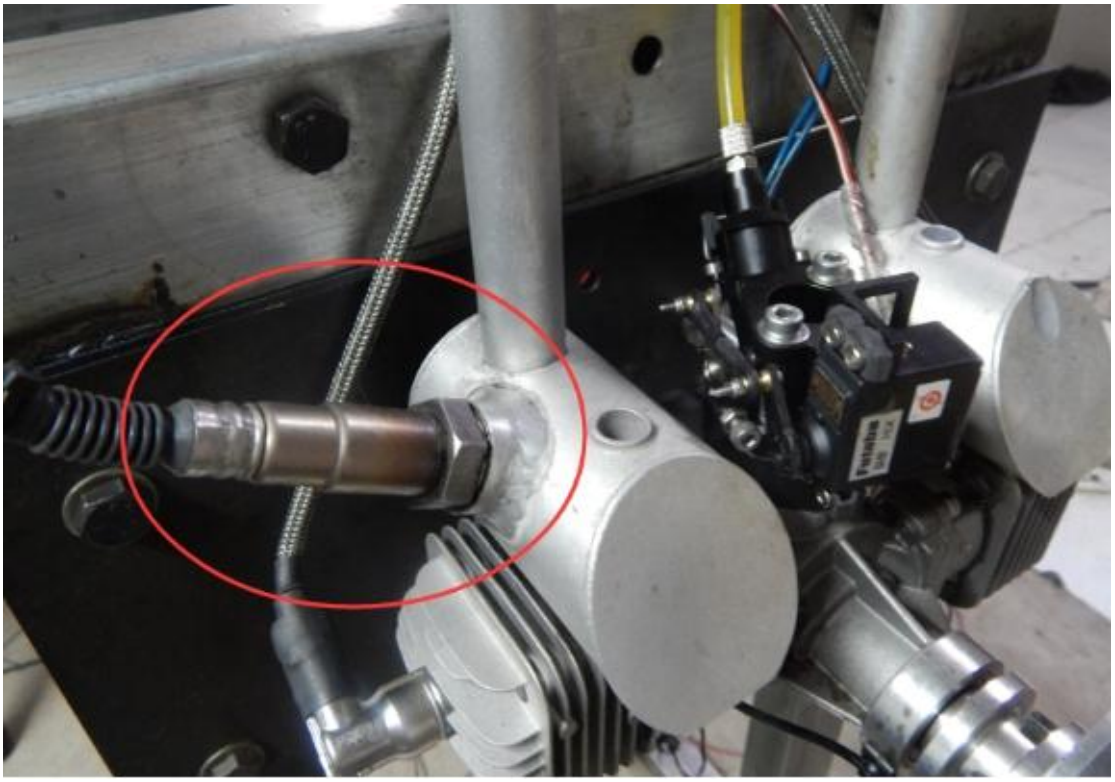
There is a prime switch on the EFI harness. The function is to manually trigger the EFI to inject a little fuel before you start the engine by hand. This is like the carburetor prime.

When engine is ready to start, you press it to the “I” position, it will inject a little starting fuel. It only injects one time even if you leave it at “I” position. If you want to inject more fuel, you can cycle this switch, meaning back “O” position, and then press it again to “I” position.

Chapter 2 ALM-ECU integration for tuning

2.1 Install the wideband O2 sensor

You need drill the hole and weld the bung in the exhaust and to install the O2 sensor.



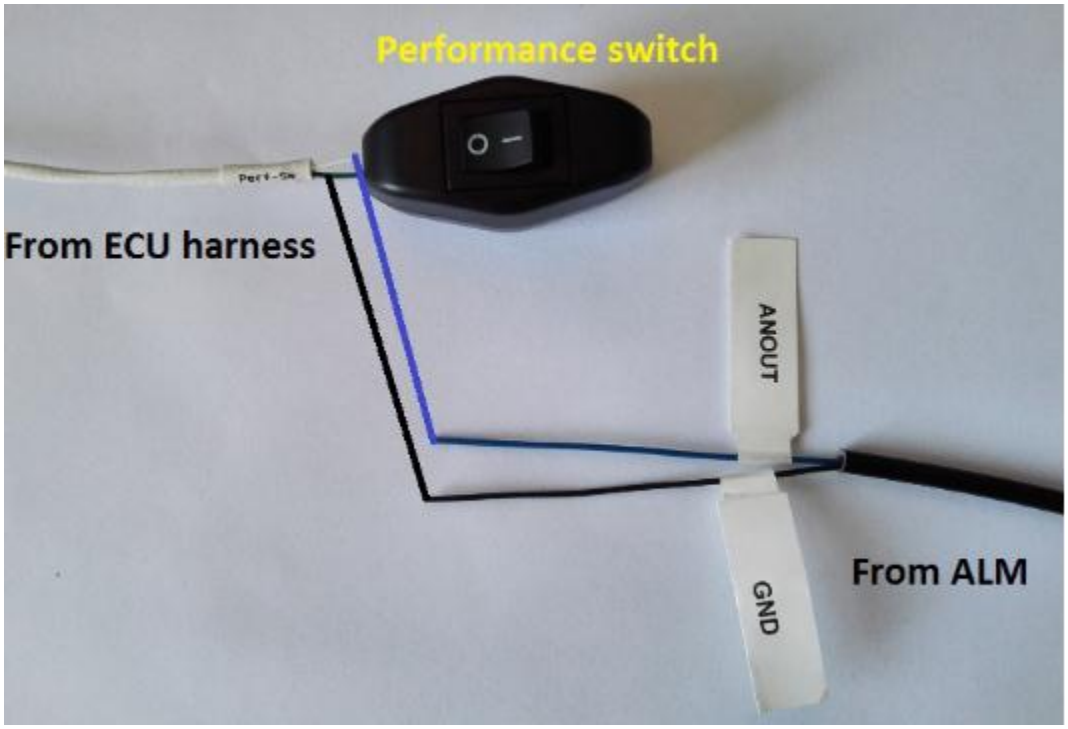
2.2 Connect the ALM to ECU

2.2.1 Connect the ALM to ECU via ANOUT

ECU can read the Lambda (AFR) from the wideband controller with LSU4.9 sensor, you need connect the linear analog output of wideband controller to the ECU, then ECU can read the real-time lambda, and you can use the lambda to tune the fuel mapping of EFI.

We use the "Perf-SW", performance switch, wire to connect the ALM input. Most of EFI has this “Perf-SW” switch, you need tap the linear output of wideband controller to the wires of performance switch.

Please connect it by using following pictures.



Connection

Connect the ANOUT to the white wire of performance switch

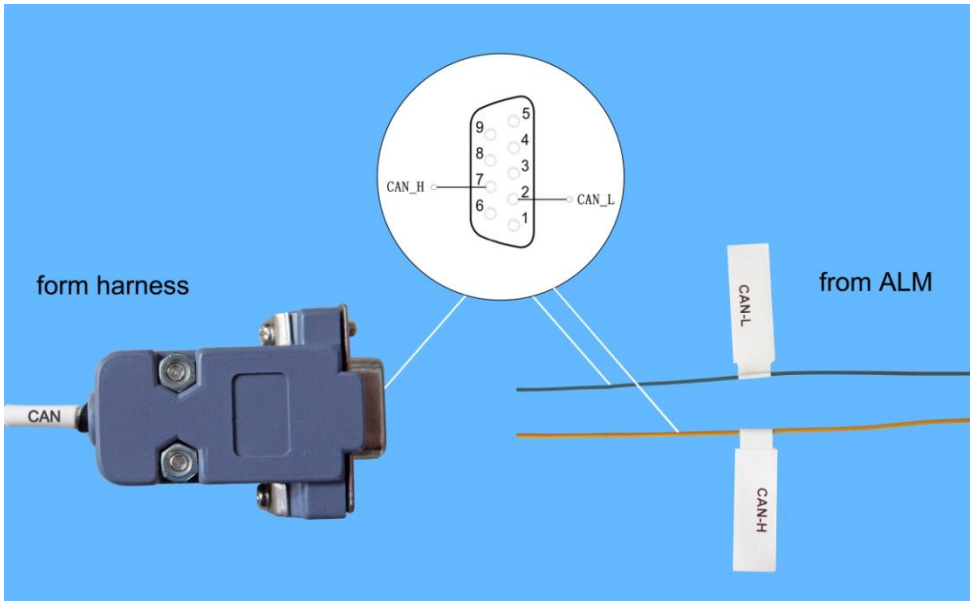
Connect the GND to the green wire of performance switch.

Warning: You need set the performance switch be “O” side, if not; it will not read the real-time lambda correctly

2.2.2 Connect ALM-CAN to ECU via CAN channel

ALM-CAN units can be connected to ECU. Users should connect the CAN-H and CAN-L to ECU CAN-H and CAN-L. ECU can receive the data from ALM-CAN by broadcasting and analyze the data to get the value about Lambda, AFR and O2%.

You can modify a calibration value CV_SSWO2 to setup the communication. “0” is ANout input, and “1” represents CAN communication.



2.3 Use ALM to log lambda (AFR) and do Auto-Tuning

Auto-Tuning means ALM and ECU will work together and tune the AFR as you want. In ECU, AFR is represented by Lambda (equivalent AFR). Lambda = 1 means AFR 14.7 for gasoline.

The default target Lambda is 1.0 across the board. You can define your own desired Lambda dependent on the RPM and TPS. Usually, a little rich AFR at high RPM / high TPS is preferred to have a better performance as well as engine cooling effect. A

typical desired Lambda table could be 0.85 at high RPM and high TPS (>90%); and 1.0 everywhere else. The desired Lambda table should be engine specific. Some engines don't like 14.7 AFR at idle, and can only be stable if it is a little rich. In that case, you should define the desired Lambda to match the engine characteristics.

With the Auto-Tuning feature, ECU will read the ALM's real-time lambda input, and automatically adjust the fuel towards the desired Lambda at that RPM and TPS status. ECU will store the learnt data in its own memory. After you run the engine at different operating conditions (RPM vs TPS) for a while; it will eventually learn most of operating points. And the engine is tuned then.

All you need to do is to drive your vehicle in different throttle positions and different RPM in “steady state driving”. (Steady state means holding throttle position at a certain RPM for about 10 seconds.) , ECU-ALM will take care of the rest.

First, you need connect the ALM or ALM-S to ECU as above connection method. And you need get special CAL files for auto-tuning, please connect Ecotrons.

Warning: Auto-Tuning only works in steady-state driving. Also only use auto-tuning feature after you have a stable running engine. Use auto-tuning with unstable engine running may cause the worse result.

Read the tuning Guide manual about details of Auto-tuning.

Chapter 3 Broadcast protocol

3.1 ECU broadcast data list on RS232

You can read some parameters of engine from the RS232 serial cable by using your equipment.

So we provide the protocol to you for using this function.

Variables: RPM, MAP, TPS, ECT, IAT, O2S, SPARK, FUELPW1, FUELPW1, UbAdc.

Note: Enable the broadcast data function; please tune the CV_APP to be 128, then burn to ECU.

Calibration: CV_APP=128

If you don't have this variable, please connect us.

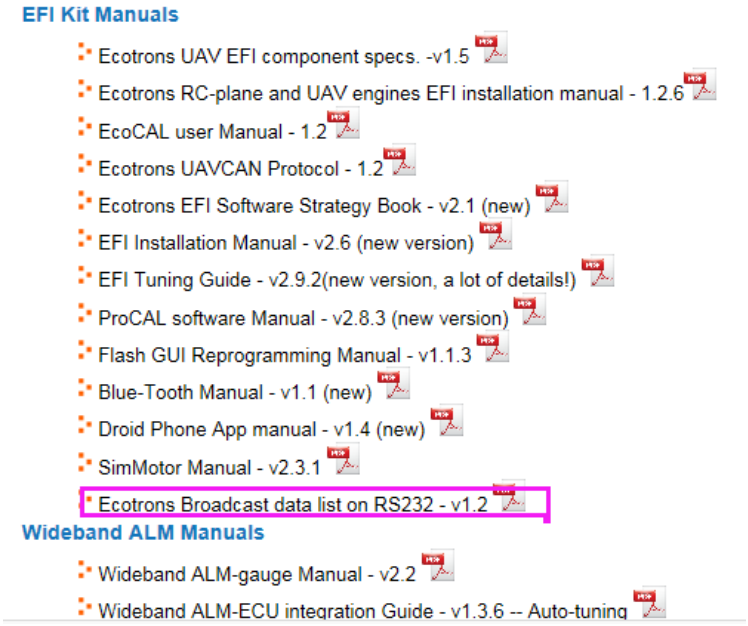
The data format is hex, the baud rate is 115200, no parity bit, 8 data bits, 1 stop bit, time interval 100ms.

Please go to our website to download the document:

http://www.ecotrons.com/support/

Download the Ecotrons Broadcast data list.

See the mark of the Ecotrons Broadcast data list as shown below.

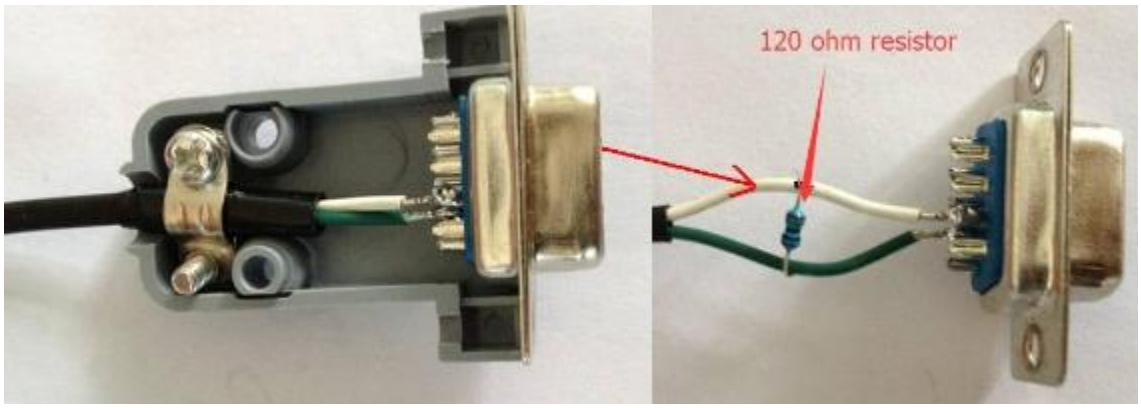


3.2 ECU broadcast data list on CAN bus

3.2.1 The CAN Baud rate setting of ECU

Our ECU and tuning software (EcoCAL) support the CAN communication, you can change the baud rate by yourself.

Note: There should be a 120 ohm resistor between the CAN wires, and our ECU doesn't have the 120 ohm termination resistor, so you need add it by yourself in the CAN connector, see below picture,



The calibration variable is "**VAL_CAN0_BaudRate**", you can find this variable in Advanced.

The default is 250k, so **VAL_CAN0_BaudRate = 4**.

VAL_CAN0_BaudRate

/* CAN bus baud rate 3--500k, 4--250k, 5--125k, 6--100k, 7--50k, 8--20k, 9--10k, 10--5k */

3.2.2 Can bus broadcast

Please go to our website:

http://www.ecotrons.com/support/

Download the Ecotrons UAVCAN Protocol.

See the mark of the Ecotrons UAVCAN Protocol as shown below.

EFI Kit Manuals

- Ecotrons UAV EFI component specs. -v1.5
- Ecotrons RC-plane and UAV engines EFI installation manual - 1.2.6
- EcoCAL user Manual - 1.2
- Ecotrons UAVCAN Protocol - 1.2
- Ecotrons EFI Software Strategy Book - v2.1 (new)
- EFI Installation Manual - v2.6 (new version)
- EFI Tuning Guide - v2.9.2(new version, a lot of details!)
- ProCAL software Manual - v2.8.3 (new version)
- Flash GUI Reprogramming Manual - v1.1.3
- Blue-Tooth Manual - v1.1 (new)
- Droid Phone App manual - v1.4 (new)
- SimMotor Manual - v2.3.1
- Ecotrons Broadcast data list on RS232 - v1.2

Chapter 4 Communication Settings

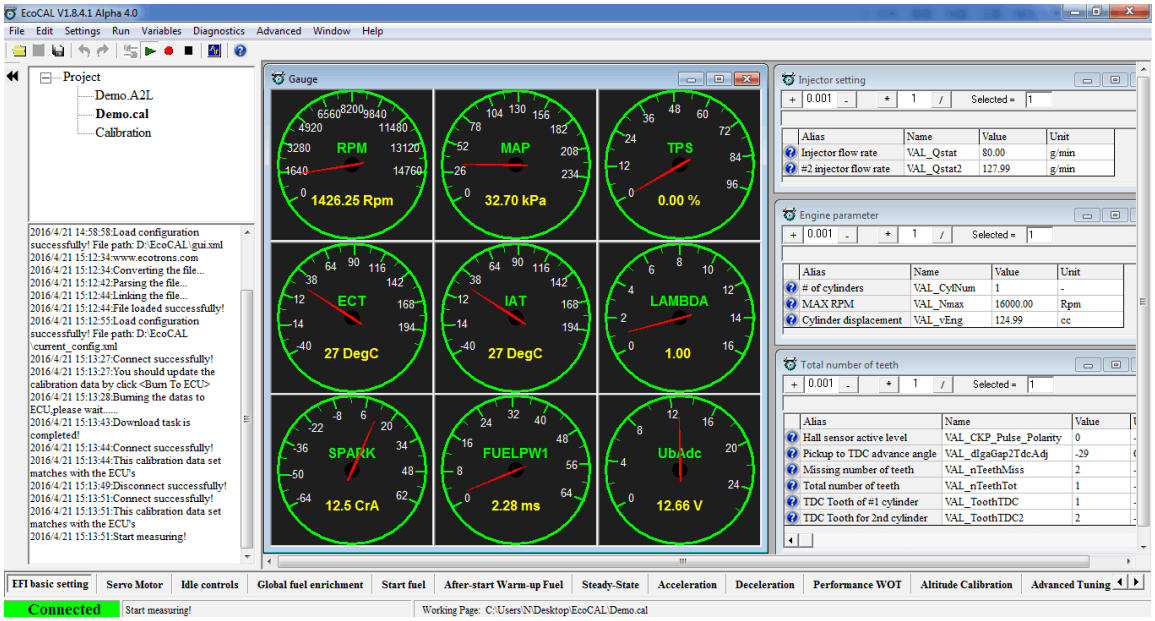
How to install the provided EcoCAL software to your computer?

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

www.ecotrons.com/support

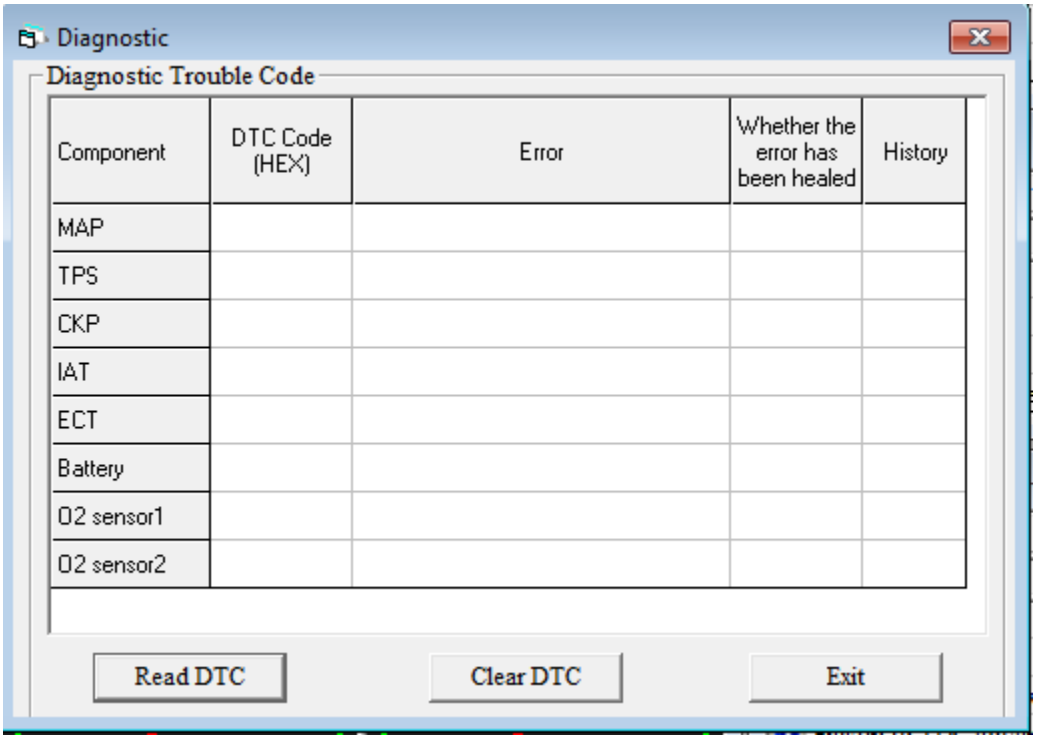
Run EcoCAL, you will see below windows:

Connect ECU to laptop:

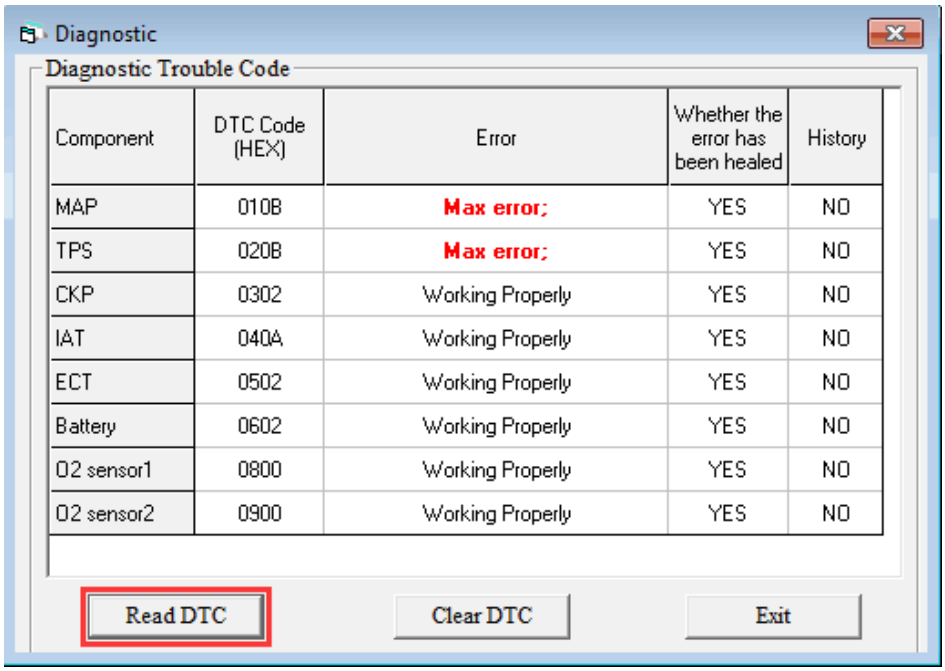


Read DTC:

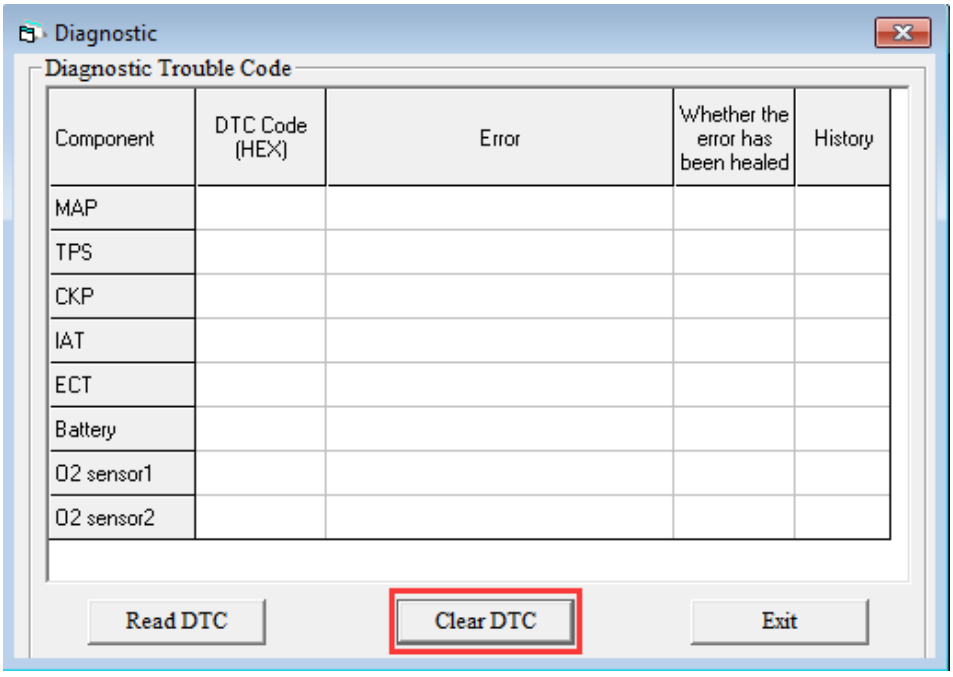
Go to Menu à Diagnostics ->ECU Diagnostics



Click "Read DTC":



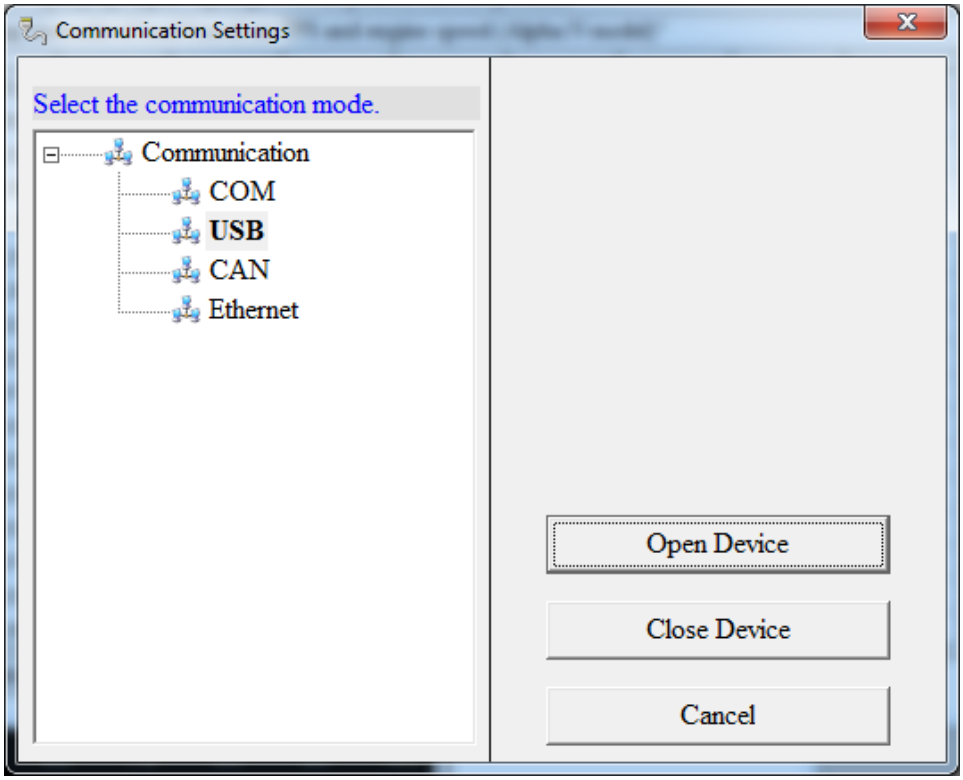
Click "Clear DTC":



You should select the communication mode first based on which way you use COM , CAN or Ethernet.

In default, we provide the COM RS232 cable and USB adapter, so you can use the COM or USB for communication.

Go to menu->Settings->Communication Settings:

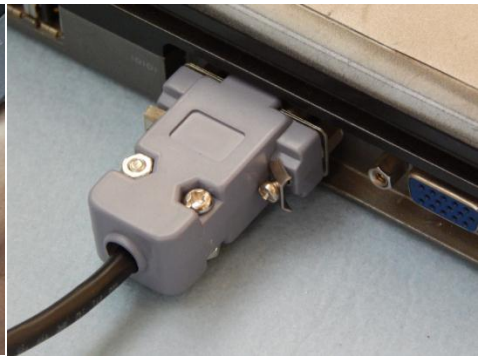


Note: By default, EcoCAL uses USB communication mode (**Note: insert the Ecotrons' USB adaptor into the laptop first for USB mode**). This configuration is consistent with most of the computers.

4.1 COM communication mode

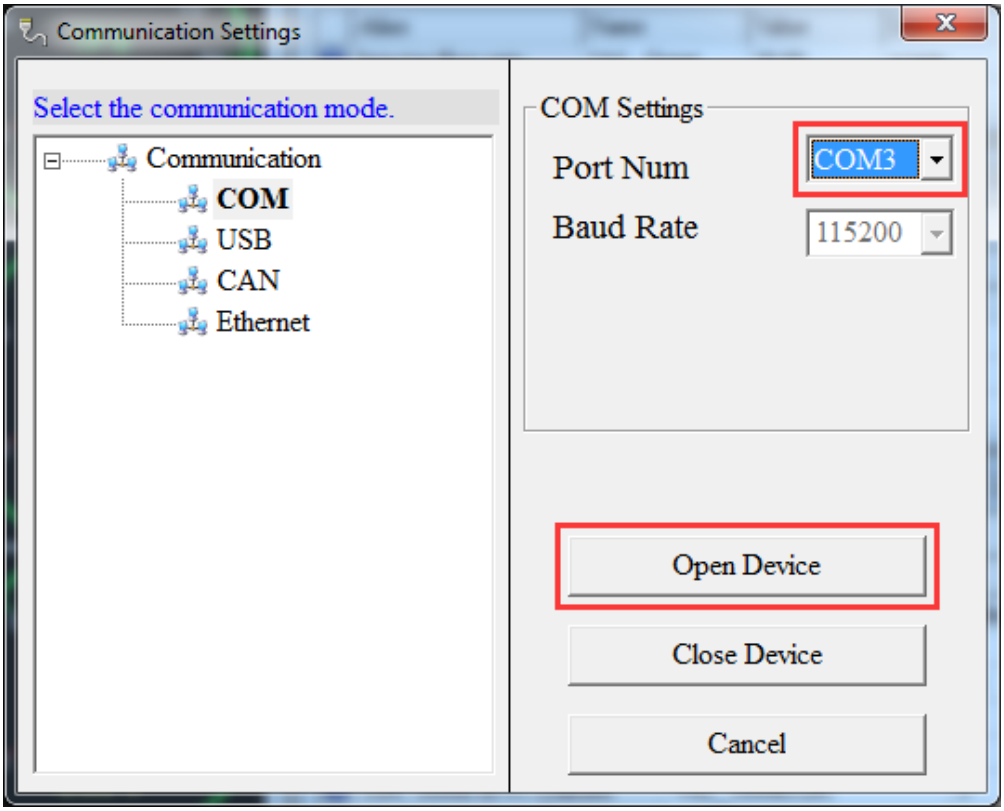
If the user is using the **COM** mode (**Note: for this mode, your laptop need to have a built-in COM port**). Select COM and set the COM port, the default COM port is **COM1**.

Built-in COM port (9-pin)



RS232 cable

The default baud rate is 115200, which the fastest of the serial comm. rate of the PC. It is not supposed to change.

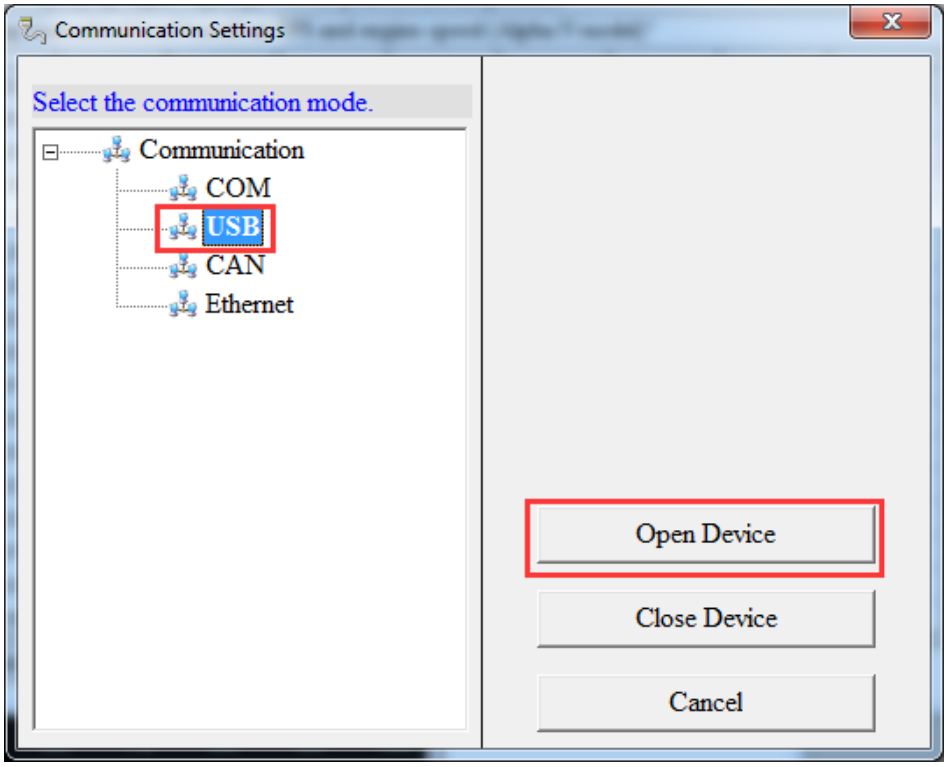


4.2 USB communication mode

Most new computers do NOT have a built-in COM port any more. You should insert the USB adaptor (Ecotrons' USB Adaptor) to the laptop, and then select the **USB** in the communication settings window of EcoCAL.

Note: We do not support the 3rd party USB-RS232 adapters, even though they might work sometime. The problem is that those consumer electronics rated USB adapters only works in a noise-free environments. This means, once the engine is running, it generates a lot of electronic magnetic noises. And those USB adapters, though looking pretty, will not stay working when you are driving. That's why we developed our own.

Note: Make sure the connection between laptop and USB adaptor (Serial communication cable) is **FULLY** plugged in.



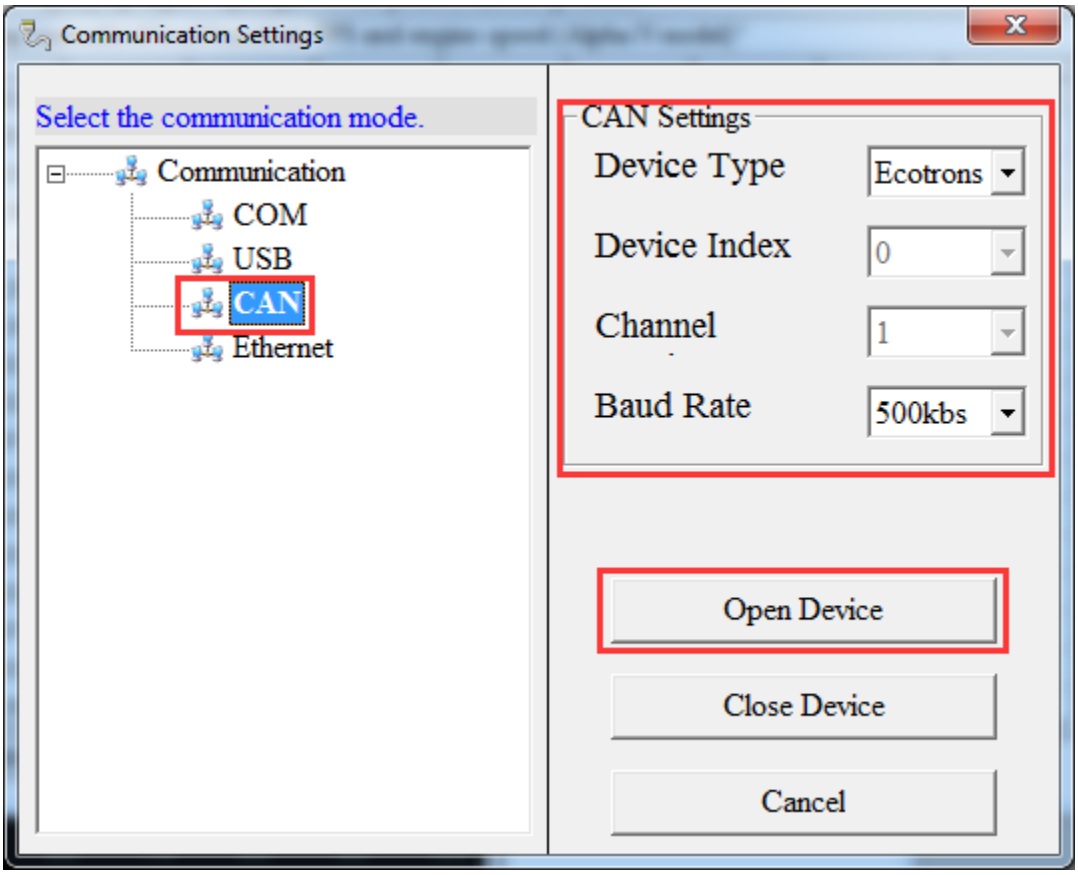
Choose the USB first, and then click “Open Device”.

4.3 CAN communication mode

Our custom ECU support the CAN communication, if the ECU of EFI system supports the CAN communication, you can use this communication mode to connect ECU.

You need to choose the CAN device Type, Baud Rate, after finishing setting, then click “**Open Device**” to open the CAN device.

And if you don’t want to use the CAN, you also need to click “**Close Device**” to close the CAN device.


Communication Settings
Select the communication mode.
Communication
COM
USB
CAN
Ethernet
CAN Settings
Device Type
Ecotrons
Device Index
0
Channel
1
Baud Rate
500kbs
Open Device
Close Device
Cancel

Chapter 5 Initial test after the installation

Before you do the initial test of the EFI kit, make sure the installation is done as the previous section.

Key-on and **KEY-ON ONLY**!

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.

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.

Repeat the above step 3 times, to make sure the fuel supply lines are filled up with fuel. No air pocket! No bubbles!

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.

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.

After you make sure the fuel supply system is working normally, try to rotate the propeller to start the engine.

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.

If the engine does not start, go to the next section for diagnosis.

After the engine starts, if it's rough idling; please open a little throttle, make the engine is at idle, then tune the fuel injection.

After the idle stabilizes, run the engine in a steady state (constant throttles or constant speeds) at different throttle/speeds. Then to tune the fuel maps to get the best performance.

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

My engine does not start, why?

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.

1.2) 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) is there bubbles in the fuel line? If yes, please move the bubbles out of the fuel line first.

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 (Hall sensor) 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 whey you try to start?

2) Do you have the MIL Lamp on (if your harness comes with a MIL Lamp installed)? If yes, go to "EcoCAL installation".

3) Install the EcoCAL (coming in the CD, or downloadable at our website):

3.1) EcoCAL does not support Windows Vista at this moment. Please use Windows XP (the most tested environment), or Win7, Win8.

3.2) you installed the EcoCAL into your computer, but it does not talk to the ECU: please check your USB adaptor is fully plugged in. And EcoCAL communication setting is set as USB.

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 EcoCAL and the ECU: **Go to menu->Run->Start Measuring**, you should see the gauges starting to show values.

3.4) Read diagnostic trouble codes by go to:

Go to menu->Diagnostics->ECU Diagnostics

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

4.1) Try to start the engine (with the engine spinning), Read the variables in EcoCAL:

4.2) Does the signal "RPM" changing from 0 to some value > 300rpm?

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 "RPM" changing from 0 to some value > 300rpm?

5.5) if the above is NO, you could have some wiring problem. If the above is YES, you could have fuel supply issue: air bubbles in the fuel lines, or fuel clogged somewhere.

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

info@ecotrons.com

Chapter 6 How do we know the fuel injector flow rate

See the mark of the fuel injector as shown blew,

This fuel injector flow rate is 248g/min. Note: It does not recommend removing the injector cap, as it may lead to damage the injector cap.

Refer to the comparison table,

Item	MEV1-030	MEV1-038	MEV1-060	MEV1-080	MEV1-128	MEV1-190	MEV1-248
Flow (g/min)	30	38	60	80	128	190	248

If there is no mark on the fuel injector, contact us for more information about the fuel injector.

Chapter 7 RC EFI Maintenance

RC EFI check list before flight:

a. 12v power supply
    i. Before each flight, check the 12V power supply to EFI, and make sure the voltage is 12V or higher.
    ii. Check the 12V negative wire is grounded and shares the same ground as the engine block.
    iii. Check the charging system is functioning, and no deficiency (with the engine running).

b. EFI
    i. Check the main connector plugged in and secured by screws, before each flight;
    ii. Check all wires are neat and secured, before each flight;
    iii. Check the ECU is mechanically secured; cushioned from severe vibration, not directly exposed to water or contamination, etc.
    iv. Before each flight, check the correct version of software, and correct version of calibration by connecting to the laptop and start the measuring. If the firmware is incorrect, you will be warned by "software mismatch …". If the calibration is incorrect, you will be popped up with "burn to ECU …". Make sure your laptop has the CORRECT software (A2L file) and correct calibration (CAL file) opened in EcoCAL before you do this check.

c. Hall Effect Sensor
    i. Check the sensor wires and sensor connector before each flight;
    ii. Check the RPM reading before each flight, in EcoCAL, by spinning the propeller and read the RPM gauge. If the engine starts and runs stably, the Hall sensor is OK.
    iii. If there is no RPM reading, and/or there is no injection, the first thing is to check the Hall sensor. You may need to swap a new Hall sensor to verify.

d. BARO Sensor

i. Before each flight, check the brass tube on the ECU is not blocked (which is for the on-board Baro pressure sensor)
ii. Before each flight, check the “MAP” gauge reading, in EcoCAL. It shall match the ambient pressure, like 101kPa, or 14psi.

e. TPS Sensor
   i. Check the sensor wires and sensor connector before each flight;
   ii. Check the TPS reading before each flight, in EcoCAL. Use servo to move the throttle from 0-100% and back to 0% and verify in EcoCAL the TPS gauge is following.

f. IAT
   i. Check the sensor wires before each flight;
   ii. Check sensor reading before each flight, in EcoCAL. IAT gauge reading should match the engine surrounding temperature. Note, you can change the reading to Fahrenheit by going to menu -> setting -> toggle units.
   iii. Check the sensor integrity physically every 50 hours, make sure no crack, and no carbon residual, etc.

g. Temp Sensor (ECT)
   i. Check the sensor wires before each flight;
   ii. Check sensor reading before each flight, in EcoCAL. ECT gauge reading should match the cylinder head temperature. Note, you can change the reading to Fahrenheit by going to menu -> setting -> toggle units.
   iii. Check the sensor integrity physically every 50 hours, make sure no crack, and no carbon residual, etc.

h. Fuel Injector
   i. Check the injector wires before each flight;
   ii. Check the fuel injection atomization every 50 hours. This means, pull out the injector from the throttle body, spin the engine, check the injection squirt and make sure it is “misty”.
   iii. If it is not misty, check 2 things: #1: check the fuel pressure, with a fuel pressure gauge ; #2: if fuel pressure is stable at 3 bar or 43psi, then swap the injector and check again from step (i).

i. Fuel Pump

i. Before each flight, check the fuel pump wires and connector before each flight;
ii. Before each flight, check the fuel tank which should have enough fuel, and fuel lines are fulfilled with fuel and no air pocket. If you see any air pocket, disconnect the fuel line, and purge it out.
iii. Visually check fuel lines, and make sure no severe bending or kinks in the lines.
iv. Key-on, you should hear some fuel pump running noise for a few seconds, and you shall visually see the fuel is flowing through the whole fuel supply system. Or simply, you shall see fuel returning back to the tank (at the fuel pressure regulator returning line). If you hear the fuel pump running noise but no fuel flowing, you shall check the fuel supply to the pump, or air pocket in the lines.
v. Every 50 hours, check the fuel pressure with a fuel pressure gauge, and make sure the fuel pressure can be maintained at 3 bar or 45psi at all RPMs, including the WOT (wide open throttle running).

j. Fuel pressure Regulator
i. Check the same thing as you check the fuel pump;

2. Throttle body, what needs to be maintained.
i. Before each flight, check the throttle body is mechanically secured to the engine , no cracks, no loose bolts;
ii. Every 50 hours, take off the throttle body, and visually check the integrity of the throttle body, no cracks, no carbon, no loose parts, etc. Clean it if there is any residual.
iii. Every 50 hours, check the throttle body gaskets, no worn, no leaking.
3. Ignition module (CDI).
i. Before each flight, check the wires and connector to the CDI module.
ii. Before each flight, if the engine does not start, and you know the fuel system is OK, then check the ignition system: pull out the spark plug(s), hold it against the engine block, spin the engine, and check whether there is spark. If there is no spark at all, and the

spark plug looks clean, then check the CDI module. You may need to swap to a new CDI module to verify. If the spark is too weak, then swap to a new spark plug and check again, if still the weak spark, then check the CDI module.

iii. Every 50 hours, check the spark plugs. If dirty or worn, swap them.

4. Air filter.
   i. Change Air Cleaner every 50 hours or sooner as needed;
5. Engine life
   i. Typically a RC engine has a life expectancy of 200 hours, check the engine manufacture data;
6. Clean engine
   i. Need to de-carb engine every 50 hours when using 100LL Fuel;
7. Engine exhaust and muffler
   i. Mufflers should be soaked in cleaner every 50 hours and dry before use;
   ii. Exhaust(s) inspected after and before each flight