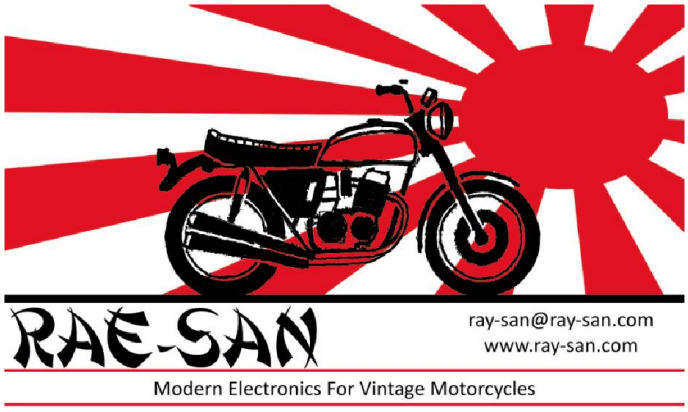


V2.11 CX TAI Ignition Module

Installation Manual

Rae-San

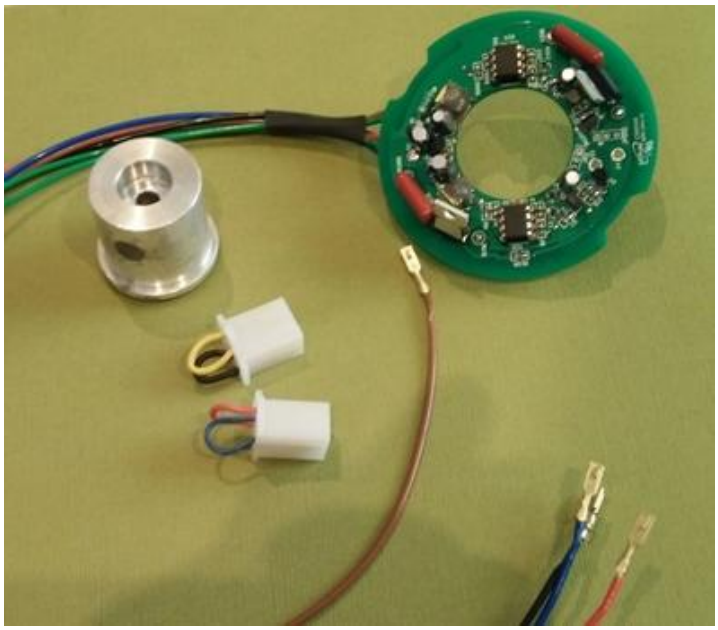
14/12/2016

Rae-San Ignition Module V2.11 CX_TAI

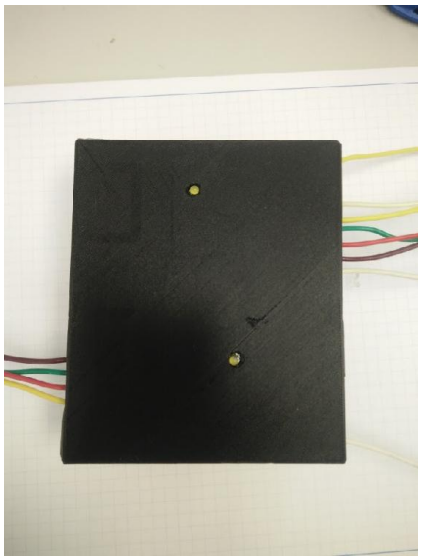
Congratulations on your purchase of a new ignition setup for your CX motorcycle.

Your Kit should be as depicted in one of the pictures below.

TAI Kit Standard

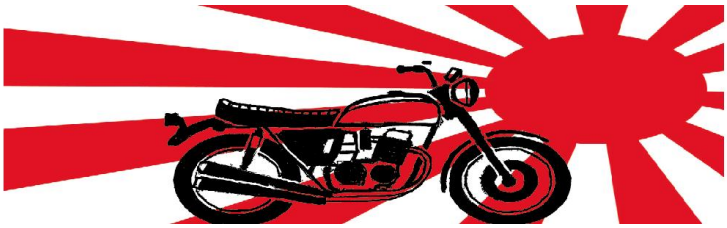


TAI kit + CDI drive gets and extra module shown below



The TAI Ignition kit is available in two options –

RAE-SAN
ray-san@ray-san.com
www.ray-san.com
Modern Electronics For Vintage Motorcycles



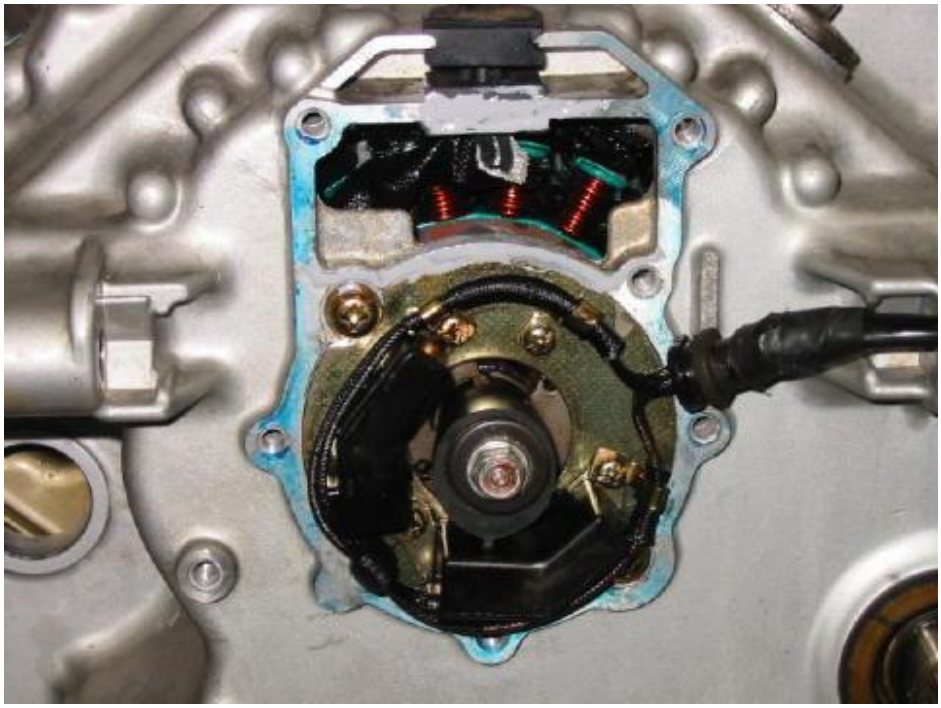
The Standard TAI kit that is able to drive 12V Coils and CDI Coils but without the CDI coil driver.

The CDI option kit – this is a standard kit but comes with a CDI driver for the use of CDI coils. It is able to drive CDI coils and 12V coils depending how its wired up.

> The spark generation / CDI driver assembly is commonly used for converting a TAI engine to drive CDI bike such as when fitting a cx650 engine into a CDI style cx500 frame. The driver module uses commercially available GY6 –DC-CDI modules to create the high voltage and spark in to the CDI coils. These are quite readily available and inexpensive compared to most of the alternatives, or to a custom design.

The Original System

This module is intended to provide you with a replacement to the original TAI system that was fitted *from the factory.*



The original system has two pickup coils that contain a magnet and a wire coil. When the little bump on the rotor passes the pole face (the small metal bit in the middle of the black pickup) the magnetic flux through the coil changes due to the nearby presence of the steel rotor.

This change in flux causes a voltage to be generated in the coil.

As the bump comes in a voltage of one polarity is generated and as it leaves the opposite polarity is generated.

So we get a double voltage spike – one way and then the other, with the crossover marking where the two align.

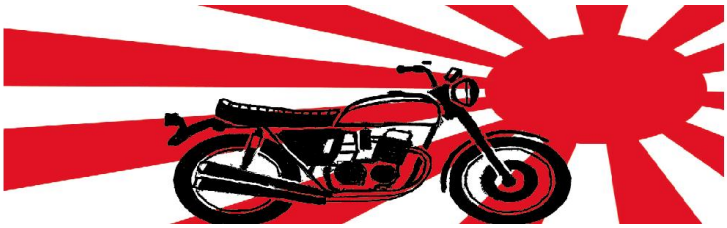
This voltage feeds the coil drivers (essentially a few transistors) that charge and fire the coil. (the grey NEC boxes below.

The first edge of the voltage spike is used to turn the coil on – and then the zero crossing turns the coils off and causes the spark to fire. The dwell is fixed but is sort of controlled a bit by the shape of the rotor with the bump.

This would all be fine – but we need to advance where the spark occurs over a range of RPM to allow for the finite combustion time in the cylinder and to make best use of the peak cylinder pressure.

The stock system does this through a mechanical advance unit or ATU (Advance Timing Unit).

This is essentially a set of weights and springs configured to move the rotor (with the bump) to advance where the spark fires with increasing RPM using centripetal force.



The Replacement System.

The Rae-San hall effect system replaces the original ignition with new components

The ATU is replaced with a aluminium rotor containing a magnet at the right spot.

The original pickups and mounting plate are replaced with a circuit board that contains hall effect sensors to detect the passing of the magnet on the new rotor, and computers to calculate the required dwell & timing to generate the spark pulses. The board also contains the drive electronics for the coils – replacing the NEC igniter modules.

All Rae-San versions have the following features:

- Operates from 12V only
- Provides electronically controlled advance and dwell .
- Provides ability to choose from 4 standard advance profiles.
- Contains two completely independent circuits – one for each cylinder to provide failsafe redundancy.
- Provides Higher spark energy than original.
- Existing CDI kill switch functionality is retained so there is no need to rewire switches when fitting to a CDI harness. TAI kill switch functionality retained on TAI bikes.
- Provides the option to drive CDI coils via a CDI driver rather than expensive 12V coils.
- Option to provide additional spark delay during cranking to ease starting and protect the starter clutch – start assist.
- The tall ignition advance cover from the TAI bike may be able to actually be removed and the low profile cover from a CDI bike used – this also should allow the use of a CDI style coolant reservoir bottle if desired. – But the wires will need to be routed out through the top rubber bung in this case. The metal tab in the centre of the shallow cover will need to be bent out of the way in this case.

Installation – Hall Effect Sensor

The process is easiest if starting with the engine out of the bike. It is possible to do the install in the bike with a lot of fiddling and removal of the water bottle – or swinging the engine down at the rear maybe – but I'll show he process with the engine removed as this allows for easy access and photography.

It's recommended that a dry run of the installation be performed first – without thread-locker or epoxies, so you can get a feel for the adjustment and see how the alignment stacks up.

Once you've done the dry run it will only take a few minutes to perform the final installation.

Lets begin:

- Remove the engine from the bike – see the service manual if you need to for your particular bike.
- Remove the ignition advance cover.

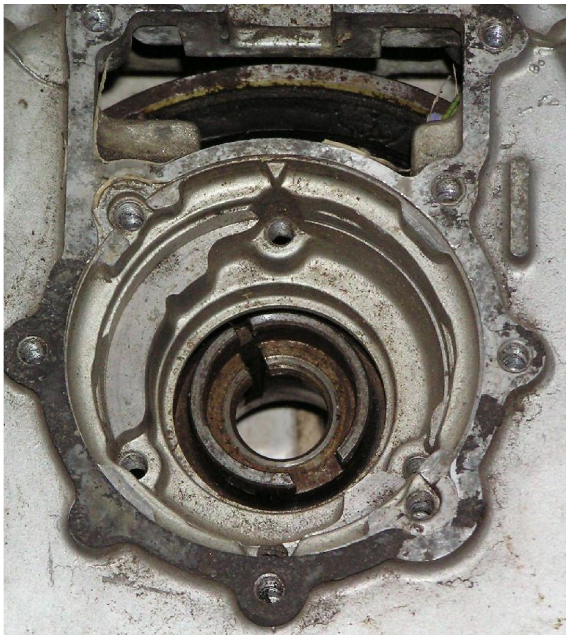
- Remove the timing sensor coils plate – undo the two philips head screws – pull out the assembly. – Note that these screws can be in quite tight.
- Remove the bolt in the centre of the rotor and remove the rotor –

- Sell the removed rotor and advance pickup on ebay ;)

The photo below shows the rear of the engine, ready for the installation.

Note that this is obviously missing the rest of the engine – but is setup to show what is needed. The narrow slot should be near where shown when at the left FI mark.

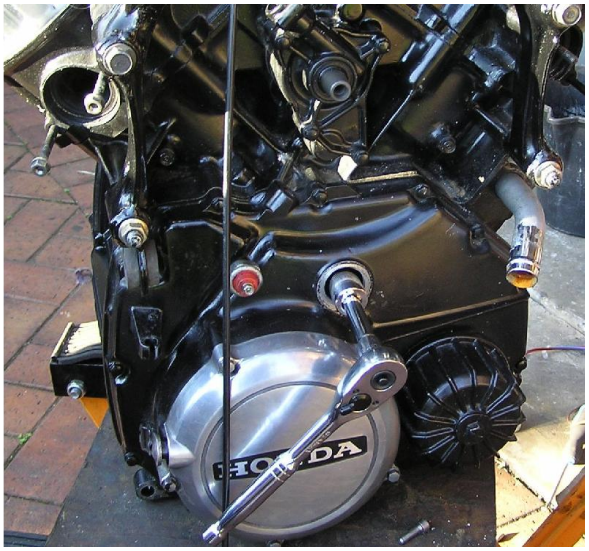
There is some difference possibly between the 500 and 650 TAI engines as to which way around the large tang is located (180 degree difference)



The next picture shows the crank access needed to be able to set the timing

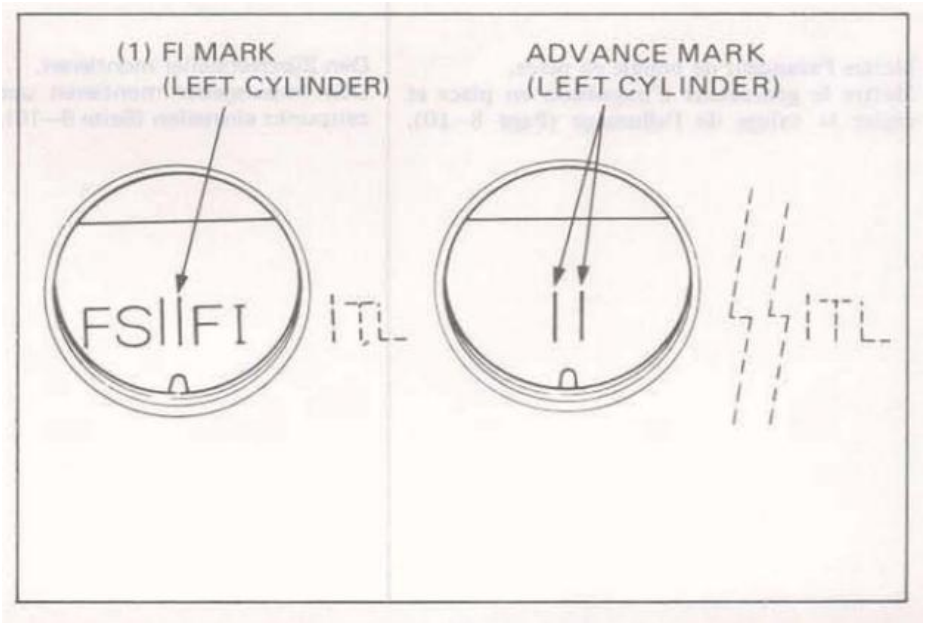
- Unscrew the 17mm bolt on the access cover on the front of the engine

- Attach a 17mm ratchet or similar to the front of the crank.
- Unscrew the timing access port on the side of the engine.



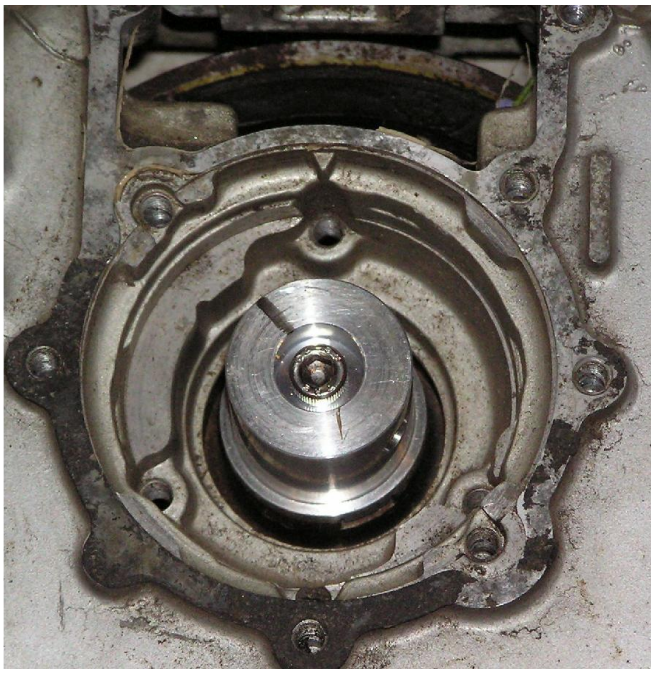
The next step is to install the rotor onto the rear of the crankshaft.

First set the timing to the **FI** mark for the Left cylinder.



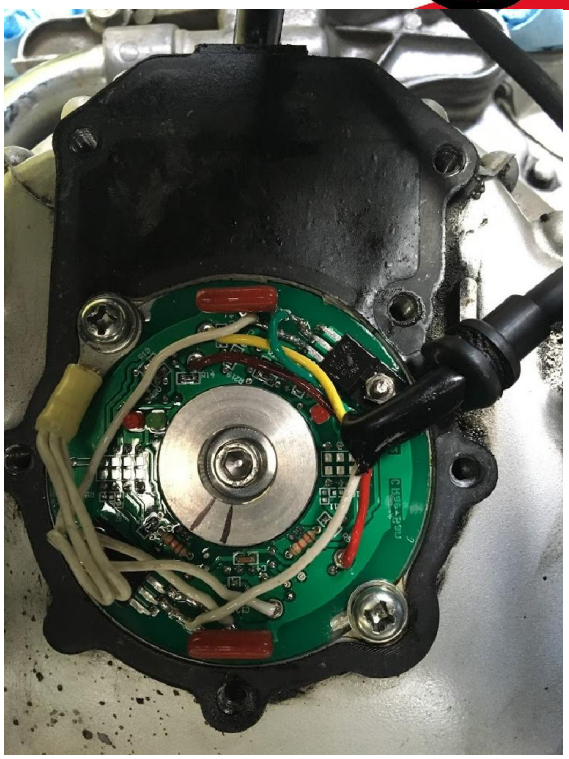
- **If there is not already a line marked on the top of the rotor – in line with the trailing edge of the magnet – then it will make things easier if one is marked now – just use a felt tip marker.**
  There are two magnet holes – only one will have magnet fitted into it – mark this one.
  The rotor rotates anti-clockwise viewed from the rear of the engine.

- **Place the rotor on the rear of the crank with the tang in the slot – It will only fit in one position.**
- **Put a small amount of thread-locker on the bolt and screw into place with a washer fitted. (intermediate strength is fine)**
- **Do up snug with an hex key/ socket as appropriate.**



The next step is to put the hall pickup and advancer circuitry in place – The LEDS and wires face outward.

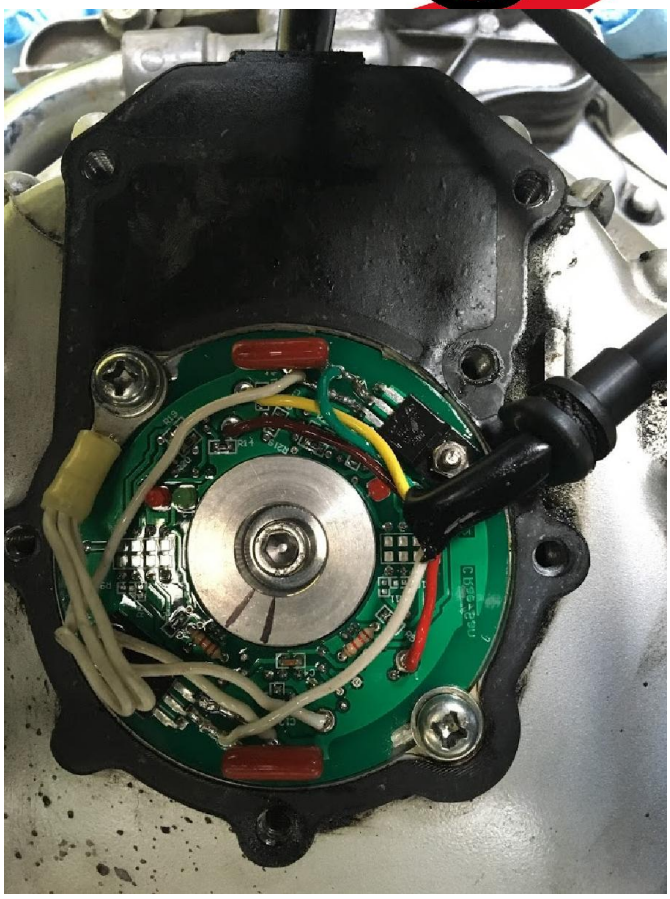
You can see two lines drawn on the rotor to mark the leading and trailing edge of the magnet.



The rotor is in a fixed location so it is necessary to rotate the Hall Advancer circuit to achieve the required timing result.

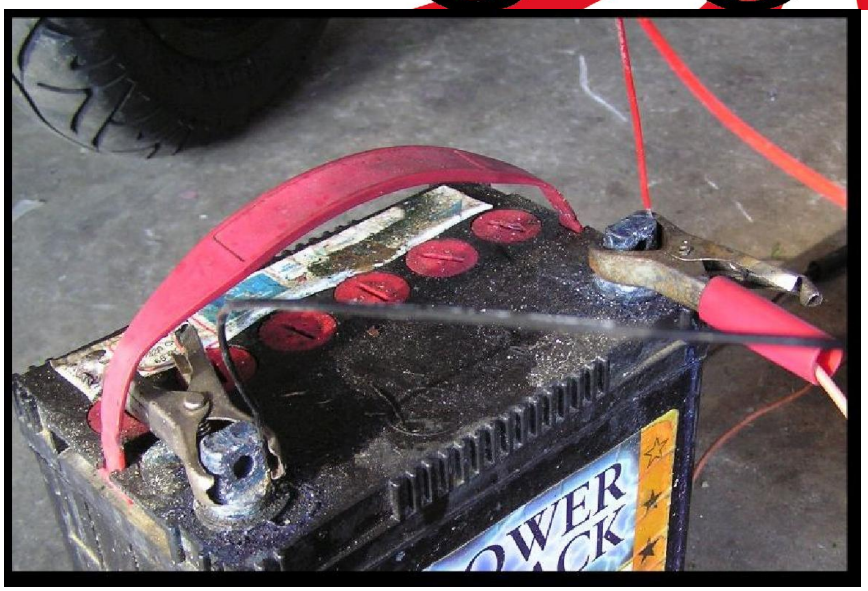
- Mount the board as shown below
- Put some thread-locker on the screws before doing the two M5 screws up – only gently at this stage –
- Note the orientation – the hall sensors are at the bottom left and right with the wires to the RHS. (for this particular setup)
- The trailing edge of the magnet in the rotor – should line up with the hall effect pickup – You can see the two rear black lines aligned in the photo below with the RHS hall pickup (on the left.
- Note that the hall sensors line up with the cylinders across the crank – ie they are on the opposite side of the crank to the cylinder. (for this particular setup). In the photo – it is lined up on the RHS cylinder.
- The two resistors on the outward facing side of the board are where the hall effect sensors are located – there are three close together contacts just next to the resistors and the centre contact marks the centre of the hall effect sensor.

As an initial timing setup – place the board so that the mark for the rear side of the magnet drawn earlier goes through the centre of the 3 pins of the hall sensor – or though the centre of the resistor as show below. This should be very close to the correct timing.



Now it is time to apply power to the Hall Advancer so we can observe the LEDS and set the timing up

- If the CDI driver module has already been installed then the Hall Advancer can be connected to this for power
- If the bikes battery is available then connection can be made to it
- If not an external battery can be used as shown below
- **RED (+)** is **POSITVE**
- **CASE CONNECTION IS GROUND. – The THREE WHITE WIRES to the lug is grounded to the case**
- **TRIPLE CHECK THE POLARITY – DON'T connect any other wires yet.**



Once again – **RED = +ve LUG is GROUND**
Don't get it wrong or the unit will be damaged.

As a final check before setting the timing – check that the rotor and the hall advancer are con-centric with a consistent gap all the way around – the rotor should rotate without touching anything.

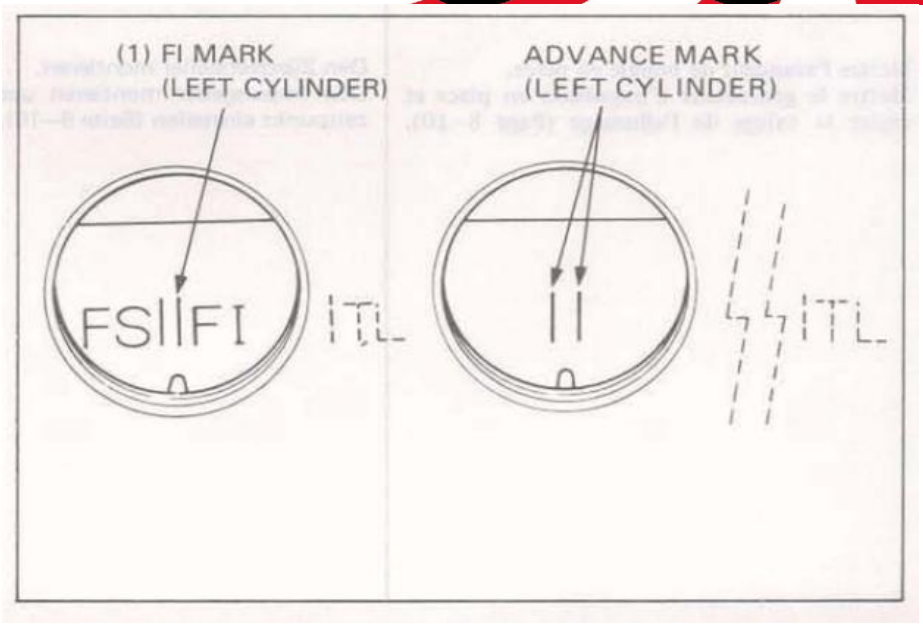
There are two LEDS on the Hall Advancer for each side – a Green LED and a Red LED

- **GREEN LED** – This lights to show when the magnet is detected by the Hall effect pickup – so the aim is that this led should be ON between the full advance and the FI marks – It should turn off as close as possible to the FI mark for the RIGHT side and as close as possible to the FI mark for the LEFT side.
- **RED LED** – This flashes to indicate when firing driver to generate a spark.

Set the Timing

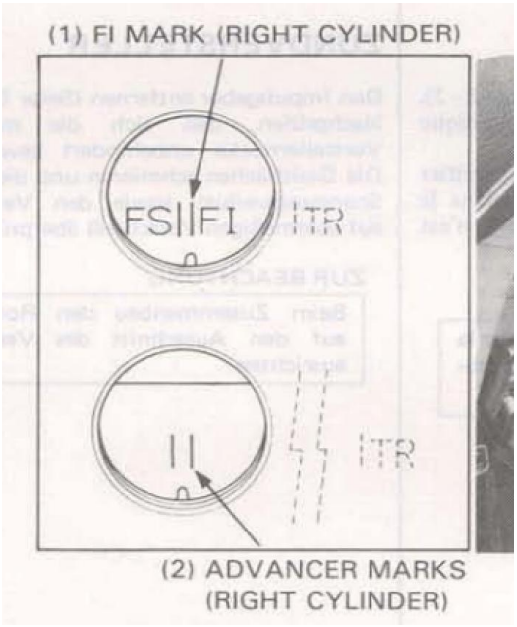
Lets start with the Left Cylinder.

- Set the crank to the FI position as shown in the photo below for the Left cylinder.

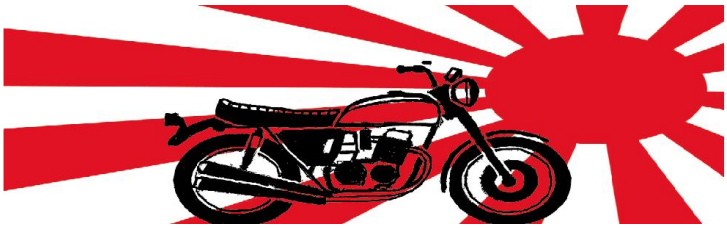


- Loosen the M5 bolt(s) to adjust the timing –
- By moving the Hall Assembly back and forth slightly – set the position so that the Green Led for the LEFT side turns OFF as near as possible the current position.
- Tighten the bolt(s) slightly – just enough to hold.

Next set the crank to the FI for the RIGHT cylinder position – as shown below.



- Loosen the M5 bolt(s) to adjust the timing –



- By moving the rotor or Hall Assembly back and forth slightly – set the position so that the Green Led for the RIGHT side turns OFF as near as possible the current position.
- Aim to have any errors shared equally around the FI LEFT and FI RIGHT marks.

Once the first pass timing has been done as above – it should be checked and fine-tuned a little more.

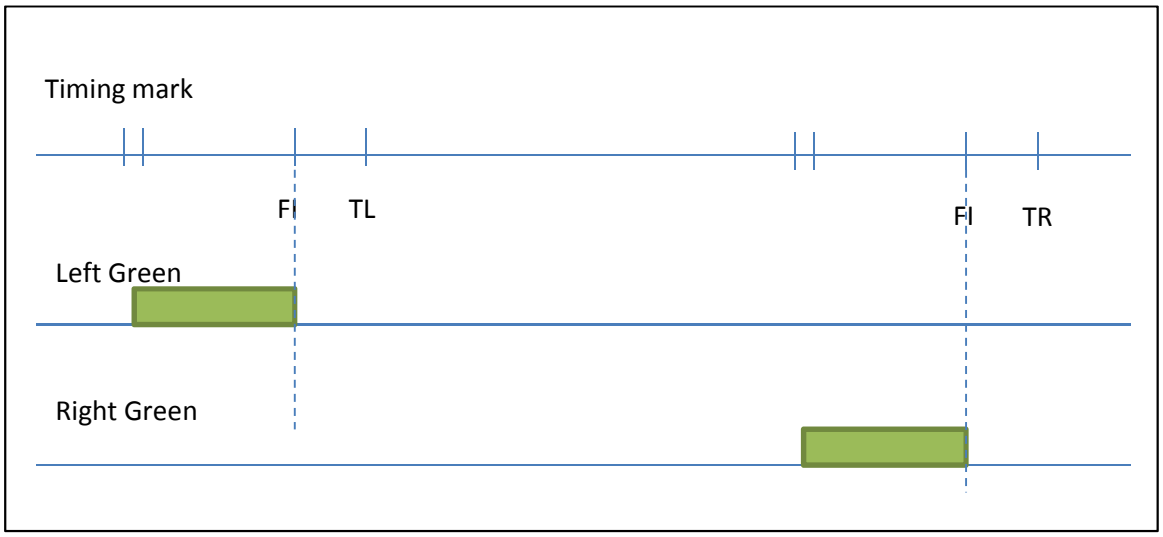
To Summarise:

Rotate the engine and note where the left and right green LEDs turn ON with regard to the advance marks and turn OFF with regard to the FI LEFT and FI RIGHT marks.

Due to the residual magnetism of the flywheel there is some variation – the best approach is to ensure that the LED turn off points are equally spaced either side of the FI LEFT and FI RIGHT marks.

This can take a couple of goes and is not super critical – reasonably close is fine.

What you are trying to achieve is shown in the diagram below. Where the Green blocks show where the green leds would be on. Really we are looking for turn OFF at the FI mark as we rotate the engine slightly forwards.



Rotate the engine and check that the turn ON of the Green LED occurs near the Full Advance marks – these are a pair of lines || before the FI LEFT and FI RIGHT marks that indicate the stock full advance range.

The turn OFF location is more important than the turn On location, as the OFF location affects starting and idle.

When happy with the location – do the screw (bolt(s)) up snug – but not too forcefully that the board breaks – be gentle – the thread-locker will help ensure things stay done up.

Notes:

Due to the slight asymmetry in the turn off position – you might need to tweak the idle up slightly – to get back to the stock idle speed – this is because one cylinder will be firing a touch late at idle. You may also notice a bit of additional vibration at idle as a result – neither of these is harmful and once you move off idle all is smoothed out.

If you really need to smooth this out –then rotating the pickup slightly so that the latest turn off is on the FL or FR mark is an option. Rather than ½ late ½ early balance between the sides around the FL and FR marks, put the latest one on the respective FR/FL mark and the other in advance of its mark.

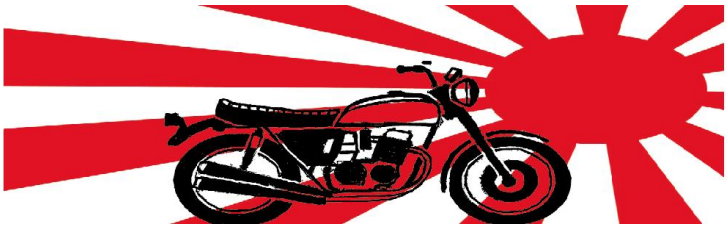
Run the Wires

Now that the timing position is set lets run the wires.

The best option for the TAI engine is to run the wires out through the existing bung – the top rubber bung will be occupied with the stator wires.

Position the wires out of the way of the spinning rotor and clear of sharp edges on the case and install the rear cover.

You may now install the engine back into the frame and proceed to the installation of the CDI Coil Driver or jumper plugs as detailed in the next section..



Installation 12V coils.

Connection of the 12V system is quite straightforward once the connections at the bottom end are done.

Simple Install

Most users have elected to wire straight to the coils or to the driver unit and not use the existing harness as this is probably simpler

The information needed is in the schematic diagrams at the end of this document - but

TAI setup

- Run the red wire to power.
- Green wire to the Right coil.
- White wire to the Left coil.
- Insulate the other wires – a terminal block and insulation tape works well.

CDI Driver

On the 4 wire side

- Red wire to Red wire on driver
- Yellow to Yellow wire on driver
- Brown to Brown on driver

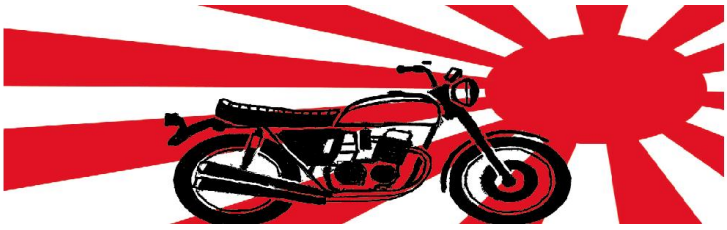
On the 8 wire side

- Earth LUG to chassis
- Red wire to power in
- Yellow wire to left CDI coil
- Brown wire to right CDI coil
- Tacho wire – optional to electronic tacho – insulate if not used
- Kill Switch wire – to kill switch if CDI Harness – Insulate and not used otherwise.

Re-using the Harness

Bottom end connection

The ignition controller/sensor is supplied with 6 flying leads - this is designed to mate with the 4 pin connector on the bike with the 2 spare wires being unused, – but depending on which option is used there are two different wirings –



- In all cases the 2 power wires are the same – Red +12V, LUG to GROUND
- For the 12V coil setup – the **WHITE (LEFT)** and **GREEN(RIGHT)** wires should be configured
- For the CDI coil setup – the **YELLOW(LEFT)** and purple wires **BROWN(RIGHT)** be configured
- Setup the 4 pin connector
    - Grab the 4 pin connector from the OEM sensor plate.
    - Using tweezers or a small screwdriver – depress the locking lugs on the pin
    - Slide the pins out so you have the connector body.
    - Slide the new pins on the flying leads into the connector until they lock with a click as shown in the pictures below.
- Insulate and protect the 2 spare wires.

Top end connection

- Unplug the two NEC (or similar) igniter boxes

STOCK 12V coils

- Plug in the two supplied 6 pin jumper plugs – these are configured so that it doesn't matter which way around they go the power is correct .
- The left and right side cylinders can be swapped by swapping these plugs over – so this should be tested – if the bike doesn't start – swap the plugs around.
- Nominal plug positions shown.

CDI OPTION

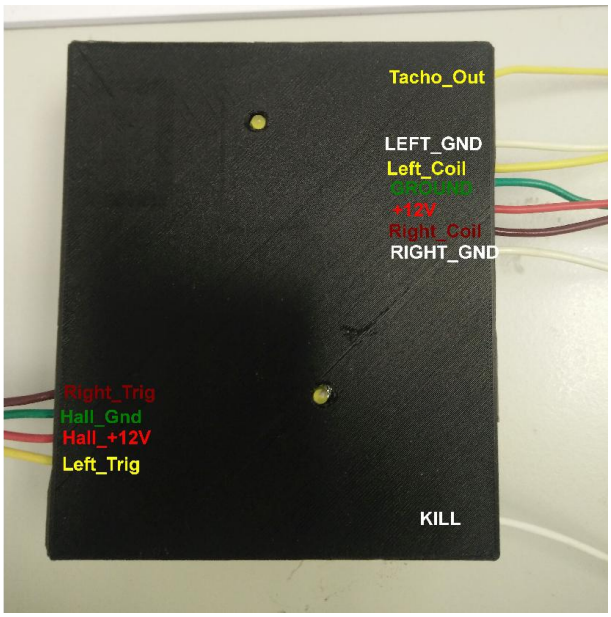
- Two 6 pin connectors are supplied with flying leads – these need to be wired to the CDI spark boxes as shown below.
- Plug in the two supplied 6 pin jumper plugs – these are configured so that it doesn't matter which way around they go the power is correct .
- The left and right side cylinders can be swapped by swapping these plugs over – so this should be tested – if the bike doesn't start – swap the plugs around.
- Nominal plug positions shown.

Installation – CDI Drive Version

The CDI Driver module consists of two GY6 DC_CDI modules mounted to a circuit board with connectors. This provides connection for the Hall Advancer power and trigger signals on the input side, and the connections to power, grounds and the CDI coils on the output side.

This module internally generates the high voltage used to drive the Ignition coils from 12V. Two modules are used- one for each cylinder to provide for Redundancy and so that normal diagnostic swapping of the sides can be performed for diagnostic purposes as per the original setup.

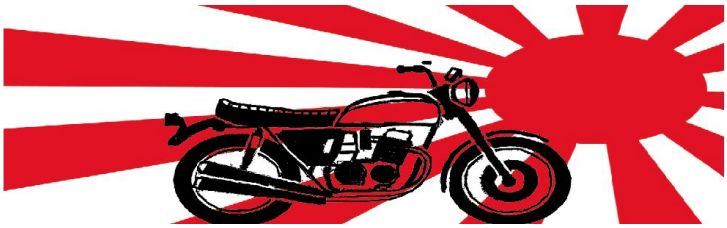
The CDI driver module is pictured below with connections labelled and coloured.



This needs to mount somewhere near where the NEC igniter modules were placed or under the seat (space permitting).

Connect the stripped wires by putting into the terminal and doing up the screw until the wire is securely held.

- Connect the left and right CDI coil wires – brown and yellow
- Remove the 12V stock ignition coils and replace with the CDI coils of your choice – generally these might only have a single connection – this should go to the coloured coil wire on each side – that is NOT the Black with a white stripe.
- Connect the GROUND LUG with a direct connection to the Chassis or Battery negative.
- Connect the Power input (Red) to the Switched power in the Loom – the Black wire – this is often accessible at the rear brake switch.



Jumper Settings

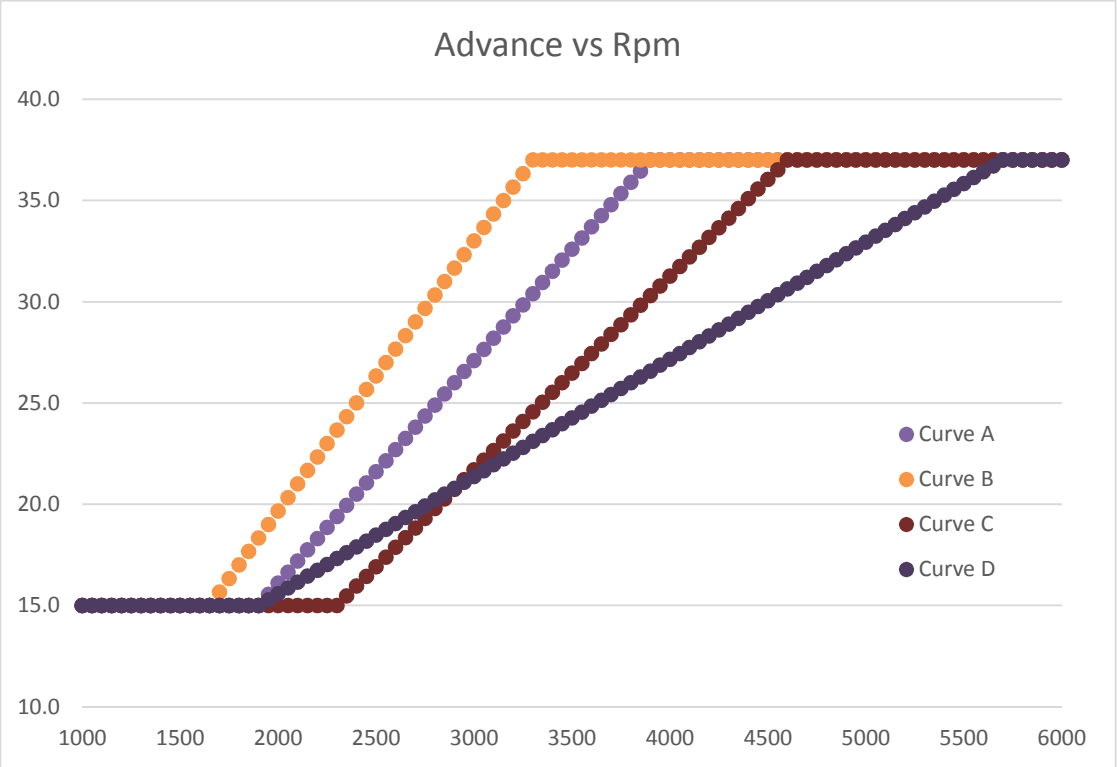
The Rae-San ignition Module contains a small number of configuration options.

For the TAI version there are 4 ignition timing curves that may be selected from on the board.

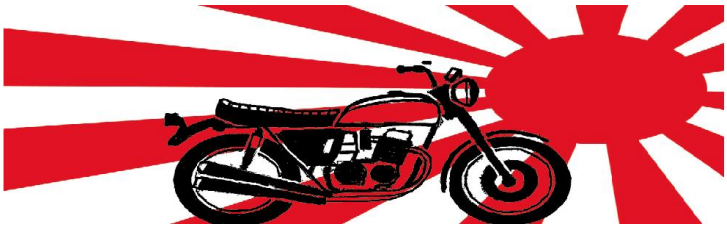
Jumper Settings for the Hall Module

Jumper A	Jumber B	Function	Comment
Off	**Off**	**Curve A**	**Default 15 @ 1900 – 37 deg @ 3900.**
On	**Off**	**Curve B**	15 deg @ 1630 – 37 deg @ 3300.
Off	**On**	**Curve C**	15 deg @ 2300 - 37 deg @ 4580
On	**On**	**Curve D**	15 deg @ 1900 – 37 deg @ 5700

Timing Curves



Curve A (Purple) 15 deg @ 1900 – 37deg @ 3900. The new default setting – better than original but still safe for higher altitude.



Curve B (Orange) 15 deg @ 1630 – 37 deg 3300 @ : This Is more aggressive advance option – worth trying with better fuels.

Curve C (Brown) 15 deg @ 2300 - 37 deg @ 4580 : A little more aggressive than the original.

Curve D (Dark Blue) 15 deg @ 1900 - 37 deg @ 5700 : Conservative original CDI spec.

About Advance Timing –

A number of factors should be considered in your choice of advance curve, the most significant of these is the overall carburetion.

Stock OEM carbs -

The Original Honda Keihin carbs are arranged to run fairly lean – to get the best fuel economy and reduce emissions – This gets worse as altitude increases – or the air temperature rises due to the reduction of the oxygen density – hence the need to adjust the pilot screws for higher altitudes found in the manual

The problem with lean running is heat – the fuel burns hotter, your valves and pistons get hotter – too lean and you melt / break exhaust valves or burn holes in your pistons.

Re-jetted Stock with Pods?

The “standard” 120/90 is on the rich side and often is attempting to compensate for turbulent flow in the carburettor throat caused by the lack of an intake runner to the carb, and for partially blocked intake ports due to the cheaper pod filters design.

With correct pods – the suggested jetting is around 115-118 / 85 – 88. A larger pilot could also be beneficial – stock is 38, a 40 would be a good choice.

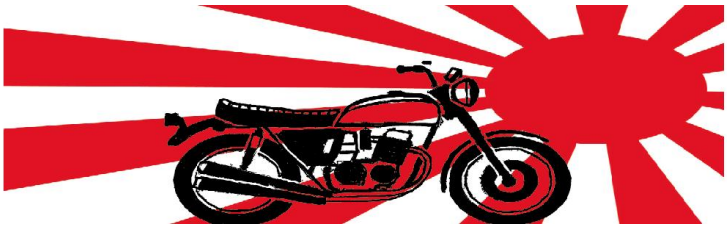
Running rich will keep things cooler, and allows the more aggressive curves to be run more safely.

Murrays Mikuni Carbs

These are set to run on the richer side – to get more HP rather than worry about fuel economy – so again the aggressive curves may be run.

Summary

Running **stock carbs**, with **stock advance** is just that – Stock. It is what Honda determined to be safe and conservative for most situations, with the advice to turn out the pilot jet screw for higher altitude running. This is **safest** but won’t get you any gains.



As soon as you change the carbs, intake filters/ air-box, or advance curves you are in modified territory. What this means is you take the responsibility if something breaks, burns, explodes or does anything you don't expect or desire.

I provide you with tools that you may use at your own discretion and which may give you more horsepower or drivability but it is your responsibility as to how you use them.

Curve A is fitted as the default.

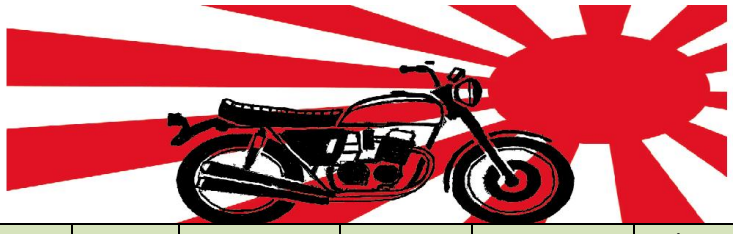
Factory Original Settings

There are a large number of CX variants with some variation in timings – the factory published timings are in the table below. Suitable Bikes for the modules in this manual are shaded in green.

You will need to check which motor you have fitted as many swaps have been performed – but if you have a TAI ignition the Rae-San system can be fitted.

It is also possible to fit the hall effect system to the CDI bikes – but that is beyond the scope of this document. – a slightly different setup is needed. These are shaded amber.

Model Name	Model nos	Base Adv Value	@ RPM	Final Adv value	@ RPM	No of boxes and locations	Connectors
CX400	CX500-	15	Up to 1500	45	3000	2 NEC igniters sidepanel	2 x 6 pin
CX500 ABZ	78-81 CX500-	15	Up to 1750-2250	37	5600-6000	CDI box under seat	8 pin CDI + 2 pin CDI power
CX500 Custom	80-81 PC01	15	Up to 1750-2250	37	5600-6000	CDI box under seat	8 pin CDI + 2 pin CDI power
CX500 C	82 CX500-	15	Up to 1500	45	3000	2 NEC igniters sidepanel	2 x 6pin
CX500 Custom	82 PC01-	15	Up to 1500	**40**	**2780**	2 NEC igniters	2 x 6pin



						sidepanel	
CX500E	PC06-	15	Up to 1500	45	3000	2 NEC igniters sidepanel	2 x 6pin
GL500		15	Up to 1500	45	3000	2 NEC igniters sidepanel	2 x 6pin
CX650E	RC12-	15	Up to 1500	45	3000	2 NEC igniters sidepanel	2 x 6pin
CX650 Custom		15	Up to 1500	**40**	**3500**	2 NEC igniters sidepanel	2 x 6pin
GL700		15	Up to 1500	45	3000	2 NEC igniters sidepanel	2 x 6pin

Operation

In operation there should be nothing to do – the module should behave similarly to the original ignition. (or better)

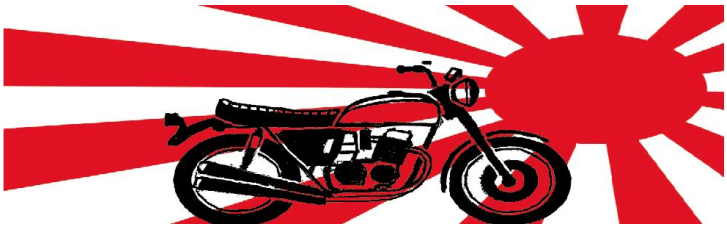
Recommended Coils

CDI OUTPUT

The ignition module is suited to CDI coils in the < 1 ohm range. The Original coils fitted to the CX CDI models are suitable candidates. There are also a number of aftermarket replacement coils that are suitable and readily available on Ebay – pitbike type coils are cheap and work well – they are also physically smaller.

CDI Coil On Plugs – with a resistance less < 1 ohms may be able to be used with some change of wiring.

TAI OUTPUT

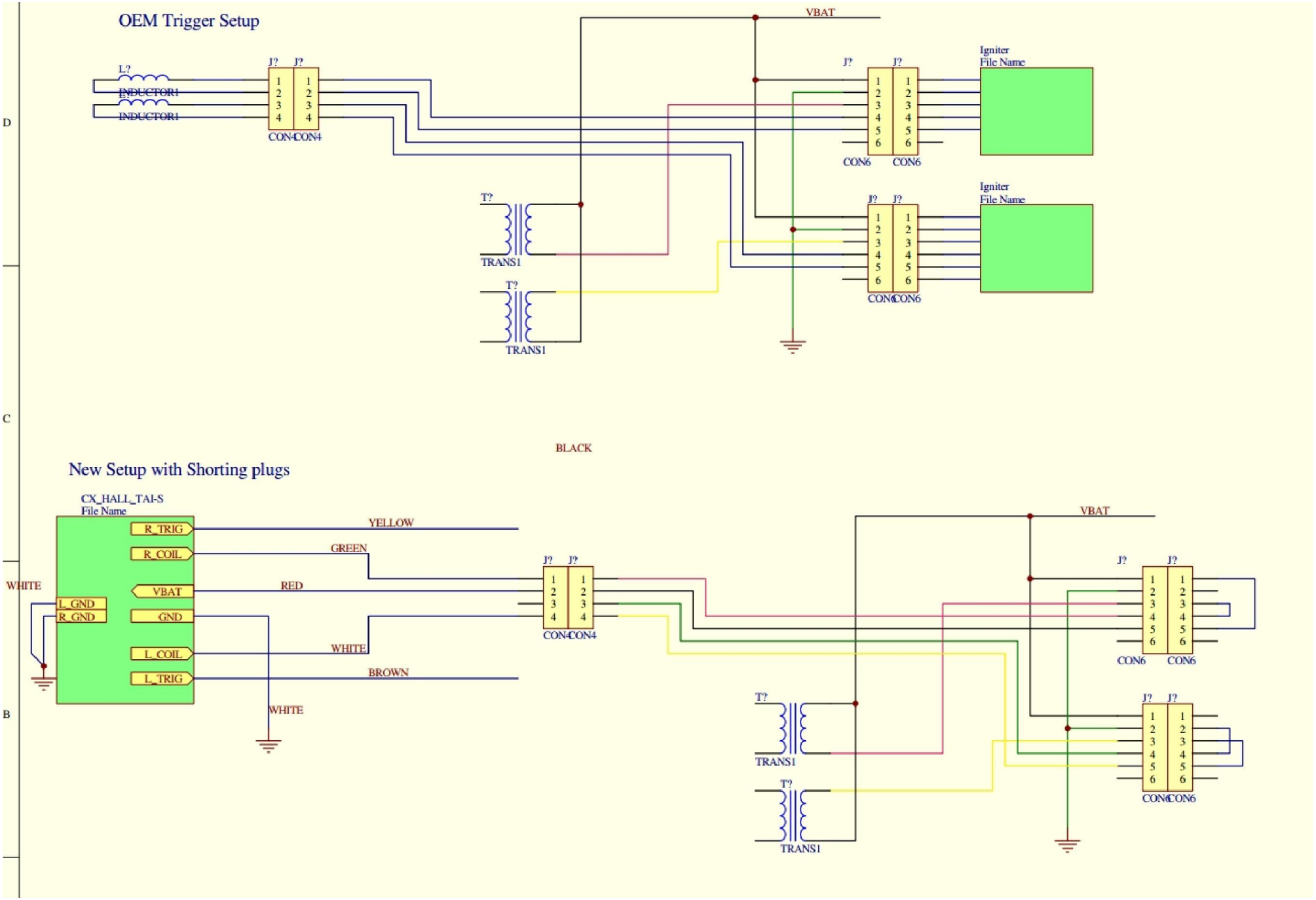


The OEM coils are about 3.3 ohms – many aftermarket coils are also available in the 4.0 to 3.0 ohm range and are suitable – High output coils are available down to about 2.3 ohms – lower than this should not be used with TAI output as unnecessarily high current will result – the dwell has been set on the system around the 4 – 5 mS mark to give best results with OEM or similar coils.

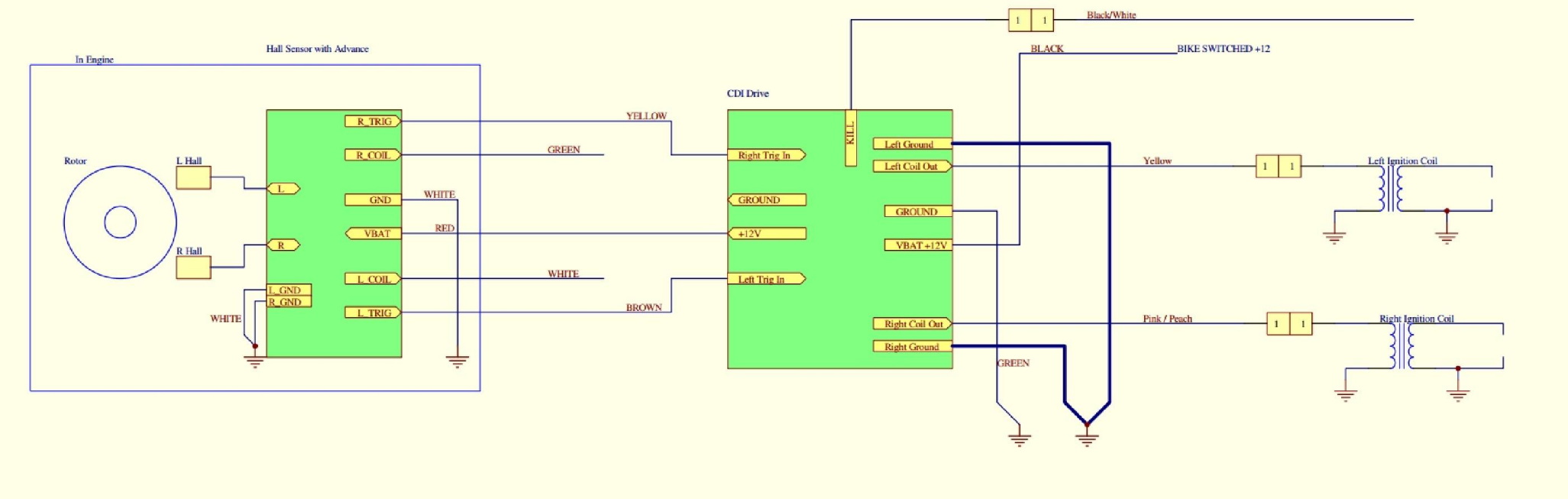
Connections

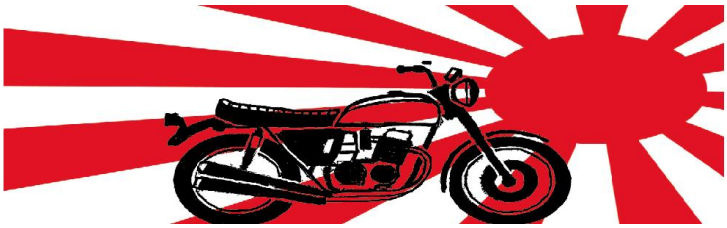
The connection information is shown on the diagrams – note that a GOOD ground to chassis should be provided to the main power connection – this carries the coil current and the shorter the better.

A ground connection should also be provided to the Chassis Ground connection – this is not a high current connection but is important to minimise noise and cross-firing as it provides a ground to the metal case of the module and shields the electronics from the spark noise generated – especially on systems where no plug resistors are fitted.


OEM Trigger Setup
VBAT
L?
INDUCTOR1
INDUCTOR1
J? J?
CON4 CON4
J? J?
CON6 CON6
Igniter
File Name
T?
TRANS1
T?
TRANS1
J? J?
CON6 CON6
Igniter
File Name
BLACK
New Setup with Shorting plugs
CX_HALL_TAI-S
File Name
R_TRIG
R_COIL
VBAT
L_GND
R_GND
GND
L_COIL
L_TRIG
YELLOW
GREEN
RED
WHITE
BROWN
WHITE
WHITE
J? J?
CON4 CON4
VBAT
J? J?
CON6 CON6
T?
TRANS1
T?
TRANS1
J? J?
CON6 CON6

TAI PICKUP TO CDI DRIVER





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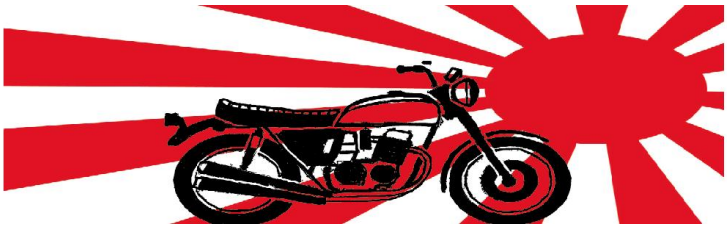

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