

HONDA VFR 800

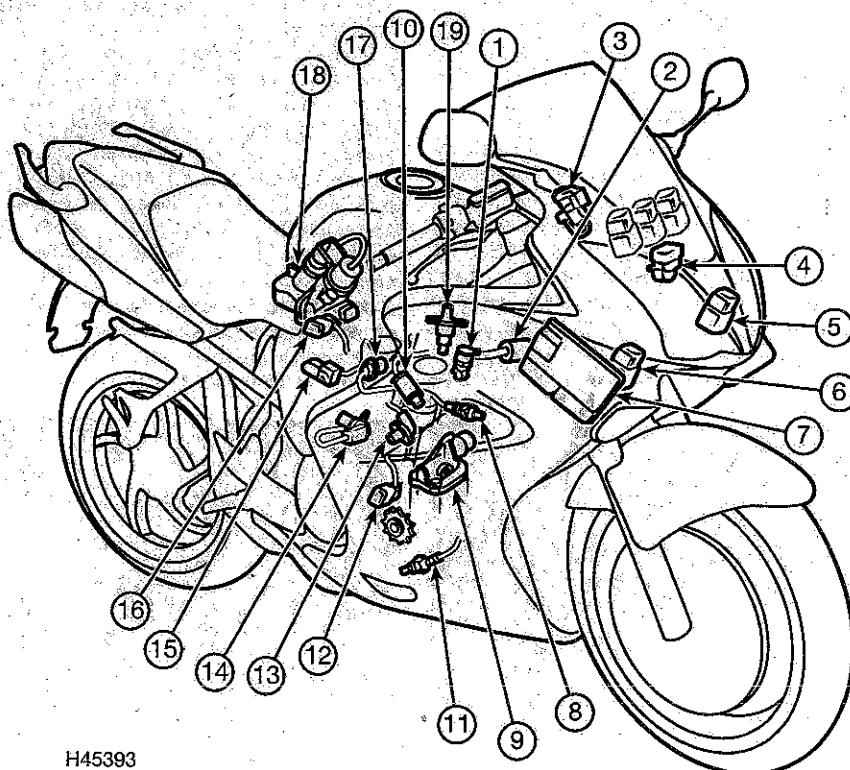
The VFR800 inherited its position as class leader in the sports-touring sector from its 750cc predecessor. Although its roots go back to the first VF750 of 1982, the latest VFR800 is one of the most accomplished and advanced motorcycles produced.

The V-4 engine at the heart of the VFR uses a VTEC variable valve system which alters the valve opening behaviour to give different power characteristics depending on engine speed. Below 7000rpm, only two of the four valves in each cylinder are opened by the camshafts. This two-valve layout gives superior torque and power production at low revs, where intake gas velocity is more important than large valve time-area values. But at higher revs (above 7000rpm) a computer-controlled valve pushes locking pins into place.

These pins engage the remaining two valves in each cylinder, and the engine takes on the characteristics of a four-valve design. The extra valve time-area is perfectly suited to high-speed power production.

The VFR also features Honda's PGM-FI fuel-injection system, which boosts power, economy and clean-running, as well as a catalysing element in the exhaust system to further reduce pollution.

Engine Management System Component Location



- 1 Variable intake system solenoid valve
- 2 Variable intake system vacuum chamber
- 3 Ignition switch/immobiliser receiver
- 4 Bank angle sensor
- 5 Engine stop relay
- 6 Fuel cut-off relay
- 7 Engine control module (ECM)
- 8 Coolant temperature sensor
- 9 VTEC spool valve
- 10 Injector
- 11 Oxygen sensors
- 12 Ignition pulse generator
- 13 Speed sensor
- 14 Cam pulse generator
- 15 Throttle position (TP) sensor
- 16 Manifold absolute pressure (MAP) sensor
- 17 Fuel pressure regulator
- 18 Fuel pump assembly
- 19 Intake air temperature (IAT) sensor

Honda Terminology

Abbrev. term

Full term

CKP sensor	Crankshaft Position sensor
CMP sensor	Camshaft Position sensor
DCT (VFR1200FD)	Dual Clutch Transmission
DLC	Data Link Connector
DTC	Diagnostic Trouble Code
ECM (VFR1200F)	Engine Control Module
ECT sensor	Engine Coolant Temperature sensor
ECV	Exhaust Control Valve
ECV POT	Exhaust Control Valve Potentiometer
EEPROM	Electrically Erasable Programmable Read Only Memory
EGCA	Exhaust Gas Control Actuator
EOP sensor	Engine Oil Pressure sensor
EOT sensor (VFR1200FD)	Engine Oil Temperature sensor
HDS	Honda Diagnostic System
HISS	Honda Ignition Security System
IAT sensor	Intake Air Temperature sensor
MAP sensor	Manifold Absolute Pressure sensor
MIL	Malfunction Indicator Lamp
PAIR	Pulse Secondary Air Injection
PCM (VFR1200FD)	Power Control Module
PGM-FI	Programmed Fuel Injection
SCS connector	Service Check Short connector
TBW	Throttle By Wire
TCP sensor	Throttle Control Position sensor
TP sensor	Throttle Position sensor
TR sensor (VFR1200FD)	Transmission Range Sensor
VS sensor	Vehicle Speed sensor

AC – CDI Ignition System

- Principles of CDI Ignition systems

The term CDI is an abbreviation for "Capacitive Discharge Ignition." The CDI produces quick and stable secondary voltage and is resistant to spark plug fouling. It is also designed to increase its secondary voltage as rpm increases. The CDI is used mainly on small engine displacement models.

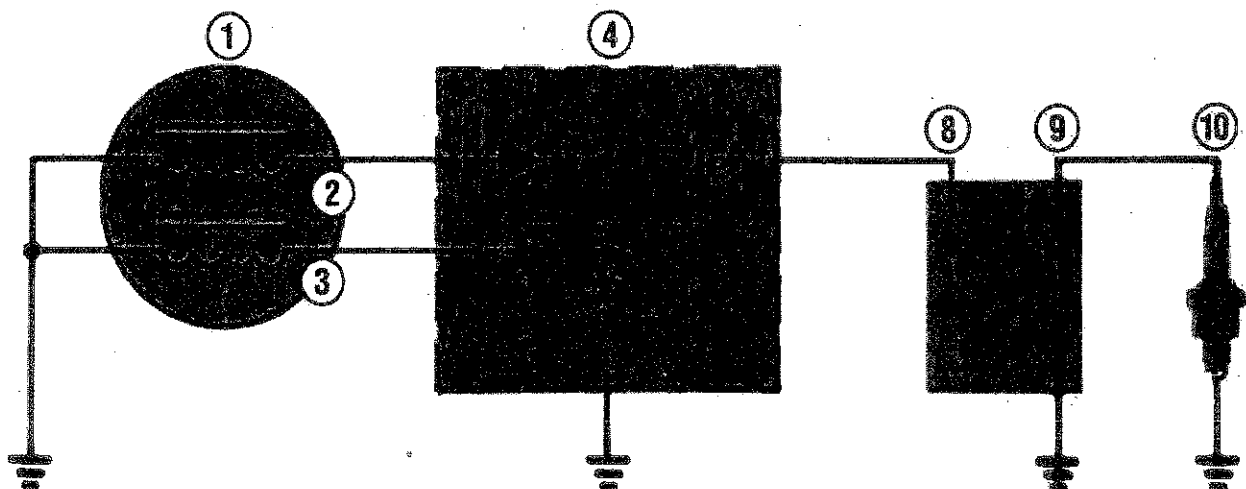
There are 2 types of CDI systems used on Honda motorcycles, one using an A.C. generator as the source of primary voltage, and the other using the motorcycles battery as the primary voltage source.

In this resource we will be addressing the workings of the A.C. system or AC - CDI system.

To obtain the high voltages and firing speeds required for small capacity high performance displacement engines used in Honda motorcycles, an ignition system that is able to deliver to this high specification is the CDI system.

A capacitor has the ability to temporarily store and quickly discharge electrical energy. Any ignition system which discharges a capacitor into the primary windings of the ignition coil for the purpose of inducing secondary voltage is by definition a capacitor discharge ignition (CDI) system. Capacitor discharge system can be operated by a batteryless A.C. electrical system.

2. A.C. Generator (voltage source), 3. Trigger windings, 4. CDI unit, 8/9. Ignition Coil, 10. Spark Plug.



Honda motorcycles systems use the A.C. generator as the primary voltage source to charge the capacitor, and the capacitor discharges whatever voltage is received.

Capacitor discharge ignition systems customarily uses an electronic switch to trigger the capacitor instead of contact points.

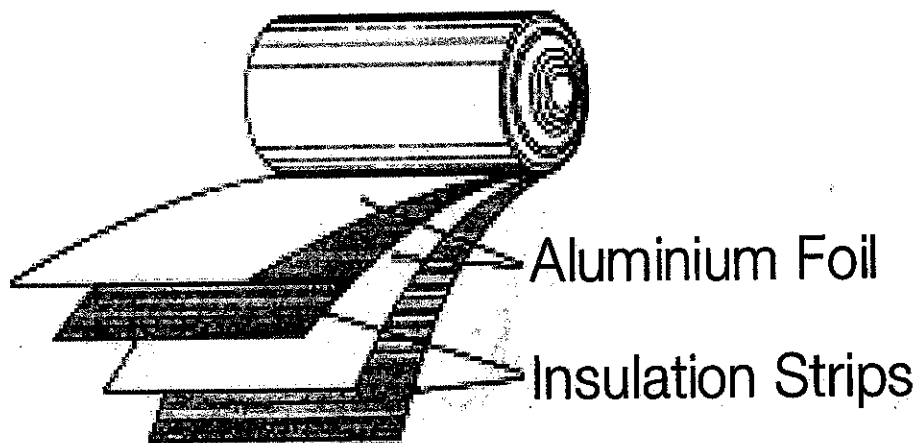
- Principles of a capacitor

A capacitor (sometimes known as a condensor) is a component which will store an electrical charge and give it out again when required and finds it way into ignitions systems. The most basic capacitor consists of 2 parallel metal plates insulated from each other. Applying a voltage between the two plates will result in a surge of current to the plates. the amount of charge stored depends on three factors:

The area and spacing of the plates

The applied voltage

The type of insulator between the plates



In order to make the physical size of a capacitor smaller, the plates may consist of two long rectangular aluminium strips of foil separated by a slightly wider strip of impregnated insulation paper rolled up like a swiss roll. Wires are attached to the two strips of foils and the whole assembly is encapsulated in some form of plastic or metal container. The metal container is often connected to one of the foils and the case connected to the circuit.

In the case of a AC - CDI system the capacitor is connected to the primary side of the ignition circuit and therefore the voltage source, in the case of the AC - CDI system a Alternating generator.

As with alternating generators the peak voltage can be a lot higher than a battery voltage, and as the capacitor will give out the same maximum voltage as it has been charged with, then the firing voltage of a AC - CDI system has a far higher ability than that of a conventional ignition system due to the capacitor voltage being greater when operated.

- Construction and Function of a AC - CDI Ignition Circuit

The AC - CDI system consists of the following components, A.C. Generator which contains the Exciter coil (2) and the Trigger windings (3), the CDI unit (4) which contains a Diode (5), capacitor (6) and the electronic switch (7), the primary (8) and secondary (9) windings of the ignition coil and the spark plug (10).

As the alternator rotor turns (1), current is induced in the alternator (exciter coil '2'), This current (AC) is fed to the CDI unit with a voltage of 100-400 volts. This AC current is half-wave rectified by a diode (5) and is stored in the capacitor (6) inside the CDI unit.

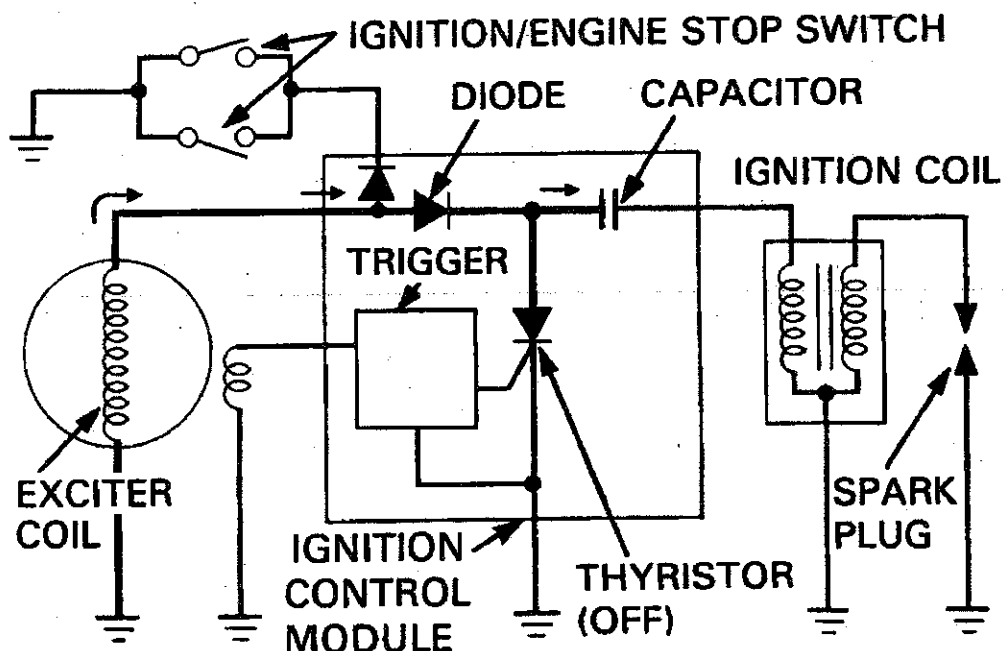
The capacitor cannot discharge until the electronic switch(7) is turned ON. The electronic switch is turned ON as the ignition pulse generator (3) sends pulses to the trigger circuit which, in turn, feeds current to the gate of electronic switch (7).

When the gate of the electronic switch is turned ON, the capacitor discharges voltage to the ignition primary coil (8), a high voltage surge induced in secondary coil (9) which in turn jumps the spark plug gap (10).

- Operation of a AC - CDI system

Due to the construction and operation of an AC - CDI system it is important to note how the system is switched on and off and the way in which the coil is fired.

As the voltage source is supplied from the exciter coil, then as soon as the engine rotates the system will operate. With this in mind the way in which the engine is stopped is to earth or short circuit the exciter coil output, this is operated through the ignition/engine stop switch. It is also important to note that if a short occurred in the exciter coil circuit, this would prevent the ignition system from working and thus the engine running.



Due to the way the igniton coil is fired by the capacitor, by releasing its voltage over a very short period of time, then it is the creation of the magnetic field that induces the secondary voltage. This is the opposite to the breaking of the primary circuit and the collapse of the magnetic field as mention in the module 'Principles of ignition'.

It is important to remember this basic principle of operation when checking and troubleshooting a CDI system, as there will be no voltage applied to the coil when the ignition is switched on, only pulses of voltage when the capacitor is swithced by the CDI unit whilst the engine is turned over.

DC – CDI Ignition System

- Principles of DC - CDI Ignition system

The disadvantage of a AC - CDI ignition system is that the starting-up spark voltage depends on how fast the engine can be turned over. Likewise at low rpm when the engine is running the spark will be weaker than at high rpm, therefore there are weaknesses in the ignition circuit then misfiring at low rpm will occur as well as poor starting.

With a DC - CDI system the exciter coil is replaced by the motorcycle's battery or DC voltage supply. This gives far greater voltage stability at cranking and start up speed and an overall improvement in voltage stability to charge the capacitor.

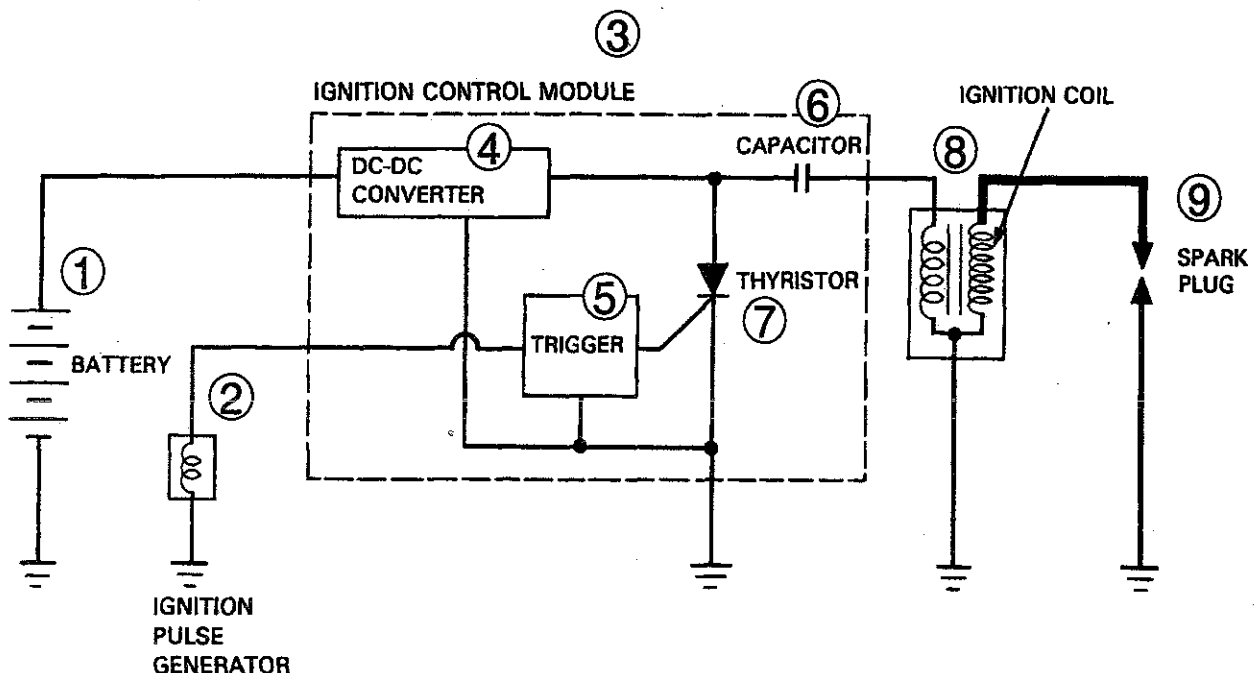
However, as described in the AC - CDI system a battery voltage is far lower than that of an exciter's peak voltage, and this would be insufficient to supply a capacitor to fire an ignition coil in a CDI system.

Therefore a method has been found to convert the 12 volts DC of the motorcycle's battery up to the high voltage (100-400volts) required to charge the capacitor.

- Layout of a DC - CDI Ignition system

The DC - CDI Ignition system consists of the following components:

1. Battery, 2. Ignition Pulse Generator, 3. CDI unit (Ignition Control unit), 4. DC-DC Converter, 5. Trigger unit, 6. Capacitor, 7. Thyristor, 8. Ignition Coil and 9. Spark Plug.



The basic layout and construction is the same as a AC - CDI ignition system, except that as the voltage source is supplied by the motorcycles battery there is an additional unit intergrated into the CDI unit called a DC-DC convertor.

- Construction and Function of a DC - CDI Ignition Circuit

The DC-CDI ignition system is basically a AC-CDI system except that the battery is used for the source. The DC-CDI ignition control module includes a DC-DC converter which amplifies the battery voltage to about 220V, which is then stored in the capacitor. Except for the DC-DC converter, the DC-CDI ignition control module is identical to the CDI unit. Compared to conventional exciter coil-powered CDI, the DC-CDI provides greater spark energy at low rpm since the power source is stable battery energy.

First, the 12volts is applied to a transistor circuit designed to occilate, ie to generate an alternating voltage. Within this circuit there is a built in Transformer that transforms the alternating voltage from the oscillator up to the required peak voltage for the capacitor, which is rectified by the diode to produce the require direct voltage.

- Operation of a DC - CDI system

Due to the construction and operation of an DC - CDI system it is important to note how the system is switched on and off and the way in which the coil is fired.

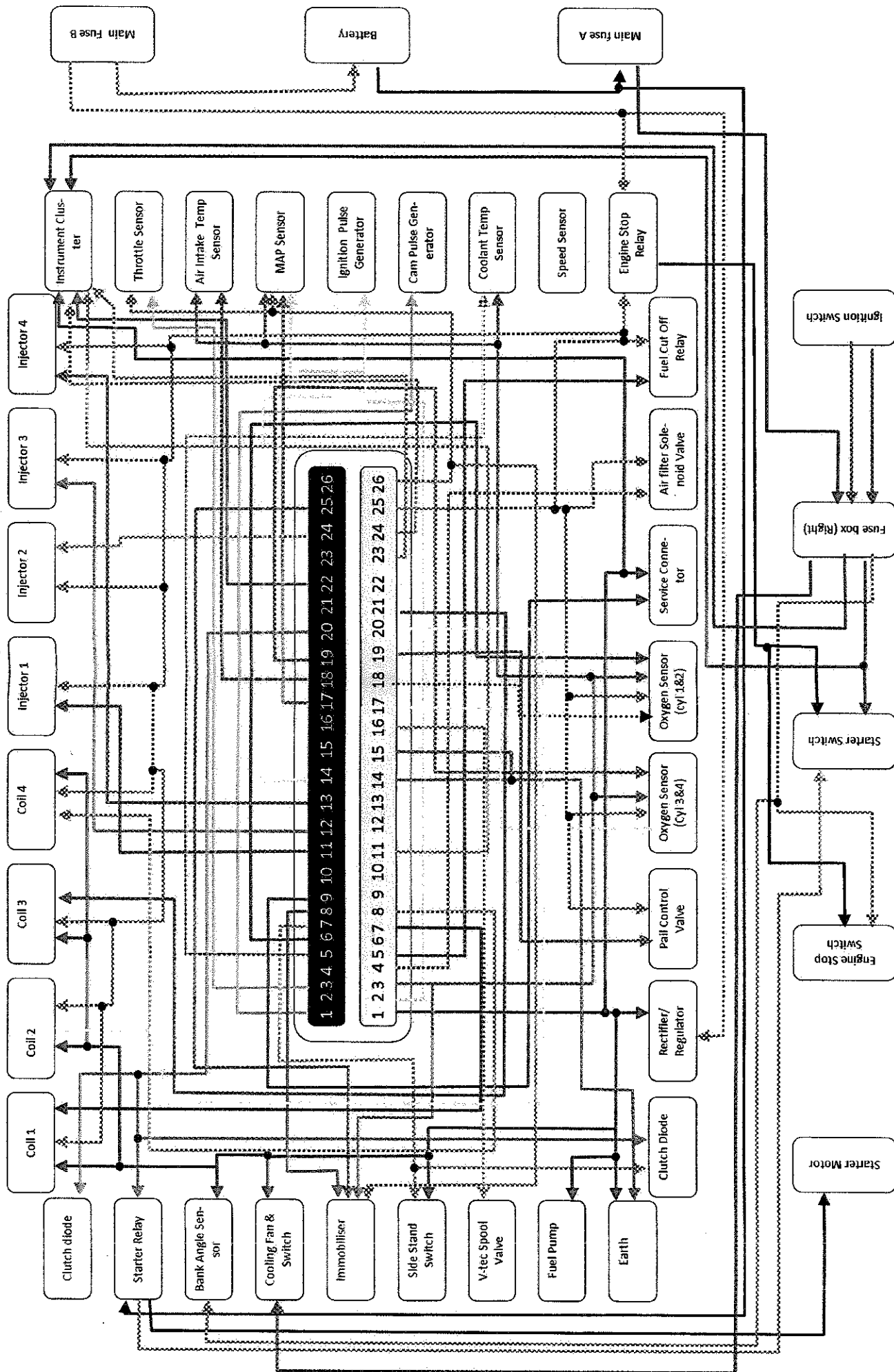
Unlike the AC - CDI system whereby the engine is switched off by the earthing (short circuiting) of the exciter coil and thereby preventing the charging of the capacitor, the DC - CDI system has a battery to provide the voltage source for the charging of the capacitor. With this basic difference in the construction of the circuit to a DC - CDI system then it is important to remember that when the engine is switched off, it is the cutting of the voltage source rather than the short circuiting of it that that prevents the capacitor from becoming charged.

So whenever dealing with a DC - CDI system always pay particular attention to identify which type of ignition system it is your dealing with and how the system is switched on and off, with this in mind erroe in troubleshooting can be avoided.

Otherwise the construction and operation of the DC - CDI system is identical to the AC - CDI system, therefore once the the understanding of the AC system is understood, this principle can be applied to the DC system.

This type of system can be commonly found on small capacity motorcycles that are fitted with a battery.

VFR 800 A—3, 4, 5 Europe Models Wiring Schematic



Honda VFR 800

Black ECU Pin Identification

1. Cam Sensor
2. –
3. Throttle Sensor
4. –
5. Coolant Temp Sensor
6. Oxygen sensor 1 & 2
7. Side Stand & Clutch Switch
8. Immobiliser 5V
9. Service Connector 5V
10. –
11. Injector 1
12. Injector 3
13. Injector 4
14. Crank Sensor
15. –
16. –
17. MAP Sensor
18. Air Temp Sensor
19. Oxygen sensor 3 & 4
20. Clutch Switch
21. –
22. Speed Sensor (Instrument Cluster)
23. –
24. Injector 2
25. Immobiliser
26. –

Grey ECU Pin Identification

1. Earth
2. Earth
3. Earth
4. Supply to Air Filter–
5. Fuel Cut Off Relay
6. –
7. Ignition Coil 1
8. Ignition Coil 4
9. –
10. –
11. Supply Instrument Cluster
12. –
13. –
14. Earth
15. Earth
16. V-tec Spool Valve
17. Lambda Heater 3 & 4
18. Lambda Heater 1 & 2
19. Pair Control Valve
20. Ignition Coil 2
21. Ignition Coil 3
22. –
23. Supply Instrument Cluster
24. RPM Instrument Cluster
25. Supply
26. Supply