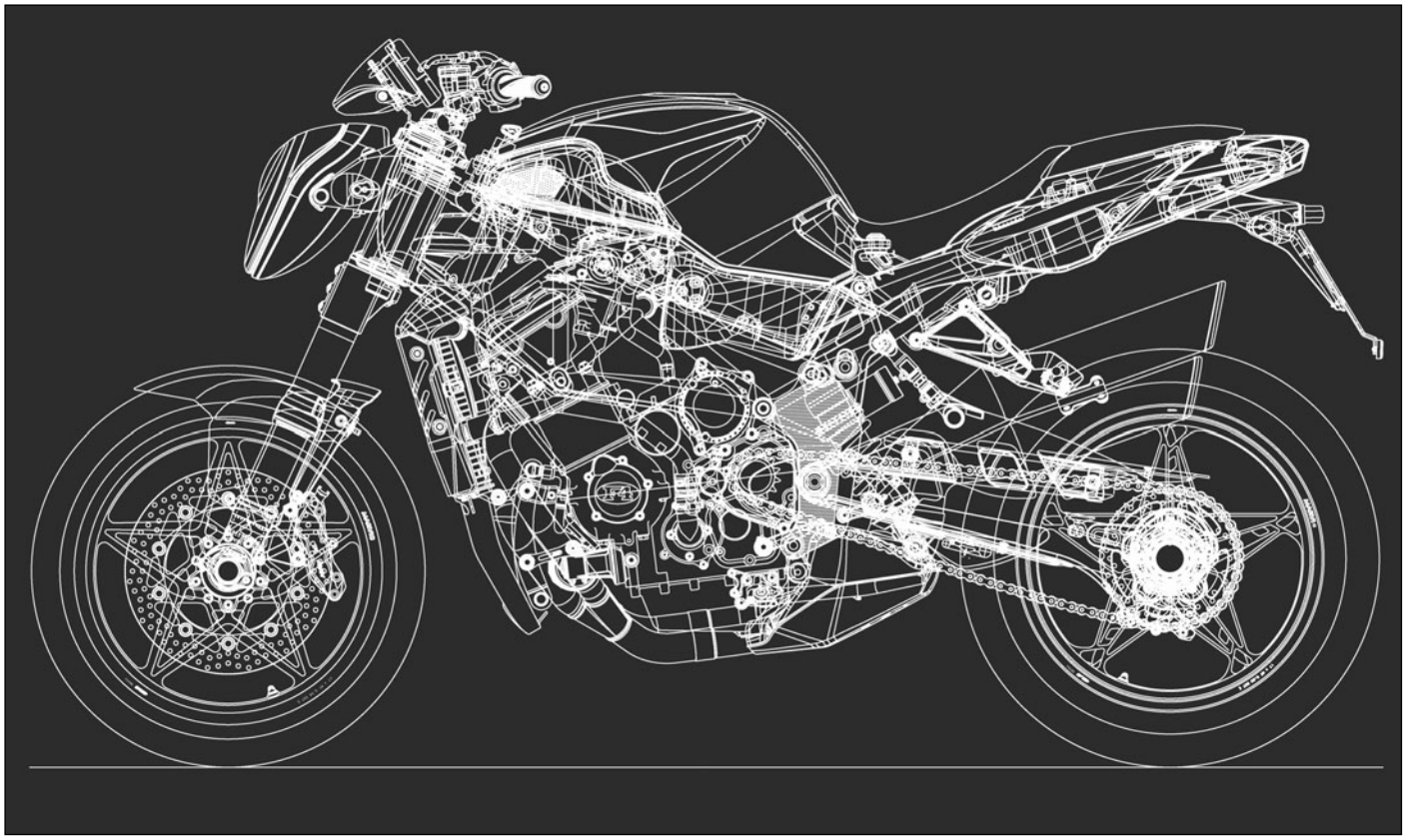


SECTION D

Revision 0

D

SUMMARY

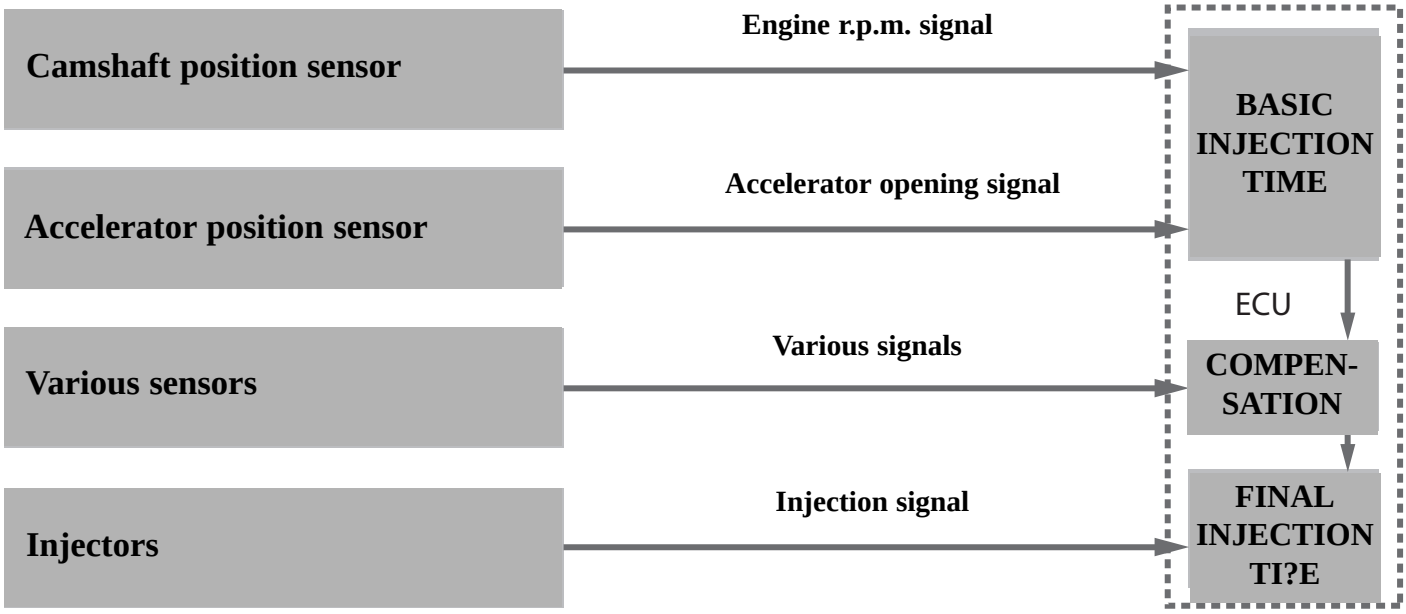
INJECTION-IGNITION SYSTEM

The injection-ignition system is of the "alpha/N" type. The motor r.p.m. and the throttle position are used as main parameters to measure the amount of intake air to find the amount of fuel to be injected.
The amount of intake air for each cycle depends on the density of the air in the intake collector, the single displacement and the volumetric efficiency: this last is determined experimentally on the engine for the entire functioning range (rounds and engine load) and it is stored in the dimensioned plans (maps) inside the EPROM of the electronic CPU.
The motor r.p.m. and the throttle angle also allow to calculate the ignition advance best suited for any functioning condition.
The other system sensors (atmospheric pressure sensor, air temperature sensor, water temperature sensor and trimmer sensor) allow to adjust the basic strategy, in specific functioning conditions.
The injector control is of a semi-sequential type, that is to say, the four injectors are controlled in couples according to the intake sequence.
The ignition is of the static inductive charge type with control of coil charge time integrated into the power modules inside the CPU.

INJECTION SYSTEM TECHNICAL CHARACTERISTICS

INJECTION TIME (INJECTION VOLUME)

The factors for the determination of the injection time are the basic injection time that is calculated on the basis of the r.p.m. of the engine, the opening of the accelerator and various compensations that are determined according to signals coming from various sensors that reveal the condition of the engine and the riding conditions.



INJECTION TIME COMPENSATION

The various sensors allow the injection time (volume) compensations to be carried out on the basis of the following signals.

SIGNAL	DESCRIPTION
ATMOSPHERIC PRESSURE SENSOR SIGNAL	When the atmospheric pressure is low, the sensor sends a signal to the ECU to reduce the injection time (volume of the fuel injected) to compensate the lower presence of oxygen in the atmosphere.
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL	When the temperature of the engine coolant is low, the injection time (volume) is increased to sustain the minimum r.p.m. and to compensate the part of the fuel which condensates along the intake conduits.
AIR INTAKE TEMPERATURE SENSOR SIGNAL	When the temperature of the intake air is low, the injection time (volume) is increased to compensate the higher presence of oxygen.
BATTERY VOLTAGE SIGNAL	The battery voltage signal is supplied to the ECU for the functioning of the ECU and this voltage is revealed and utilised as a signal for the compensation of the injection time (volume). A low voltage determines a longer injection time for adjustment of the volume of the injection.
STARTER SIGNAL	When the engine is switched on, during craking a greater volume of fuel is injectedto make starting easier.
ACCELERATION/DECELERATION SIGNAL	During acceleration, the injection time of the fuel (volume) is increased in proportion to the opening of the accelerator and the r.p.m. of the engine. During deceleration, the injection of fuel is diminished in proportion to the speed of closure of the accelerator handgrip and of the engine r.p.m.

INJECTION ARREST CONTROL

SIGNAL	DESCRIPTION
R.P.M. LIMITER SIGNAL	The functioning of the fuel injectors is interrupted when the level of engine r.p.m. reaches its limit.

IGNITION SYSTEM

DESCRIPTION

The system belongs to the family of integrated systems of digital electronic ignition with advance static timing and electronic fuel injection of the semi-phased intermittent type (injected and ignition simultaneously to cylinders 1-4 and 2-3).

This ignition system consists of an engine crankshaft position sensor (pick-up), an ECU, four ignition coils of the top plug type and four spark plugs.

The feed of the ignition coil is supplied by the battery via the power relay and is controlled by the ECU with regards to the position of the switches of the side stand and the gearchange.

The ignition timing is precisely controlled with regards to the engine r.p.m. and the position of the accelerator. Other than this basic condition, also the temperature, intake air pressure and the temperature of the engine coolant influence the ignition timing.

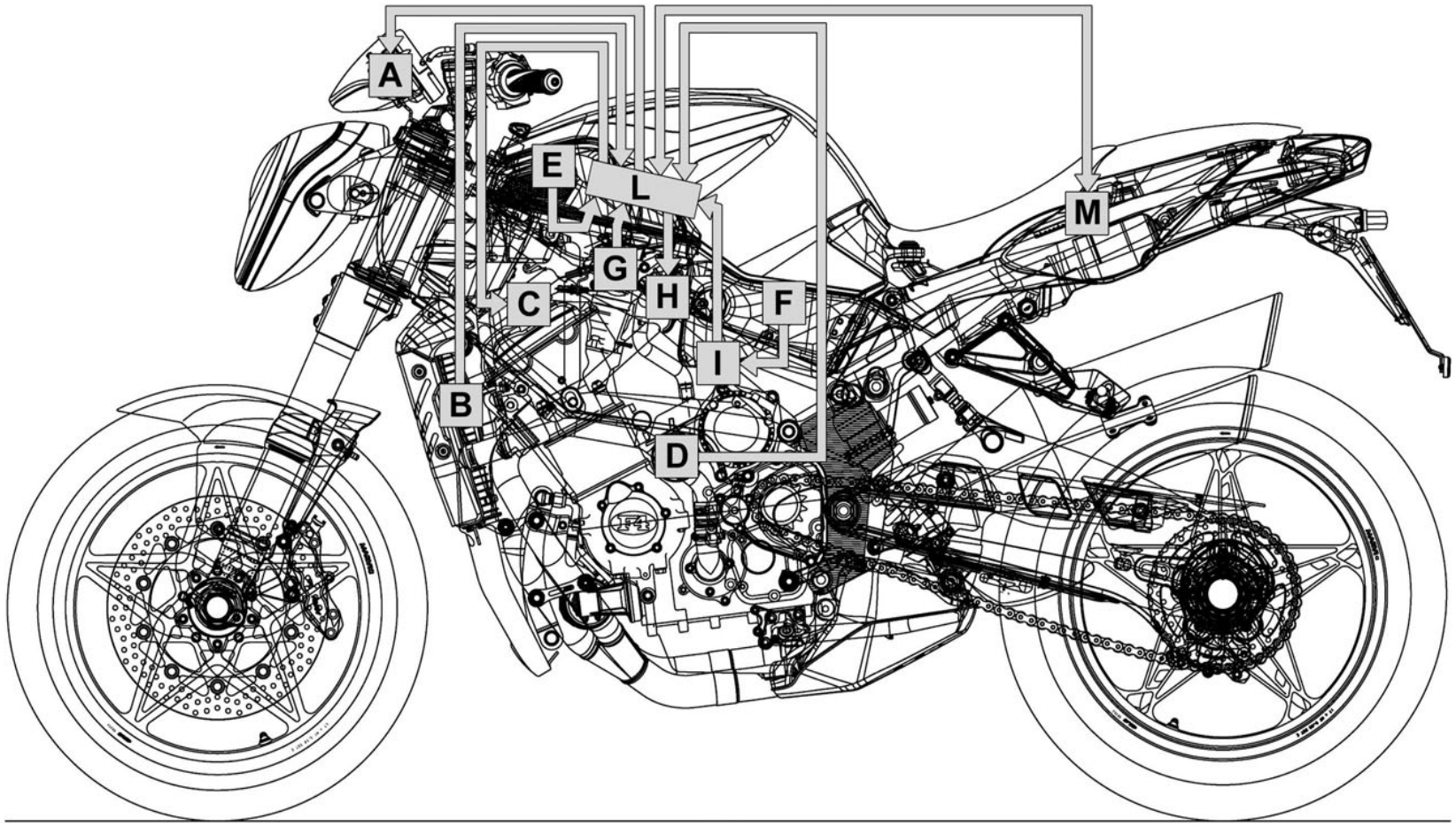
N.B.

The ignition interruption circuit is incorporated in the ECU to avoid over-revving the engine. If the motor reaches 12100 r.p.m., this circuit prevents the ignition for all cylinders.

WARNING

The engine could function at more than 12100 r.p.m. without a load or when changing down, even if the interruption circuit functions and therefore could damage the engine. Never spin the engine at more than 12100 r.p.m. in any conditions.

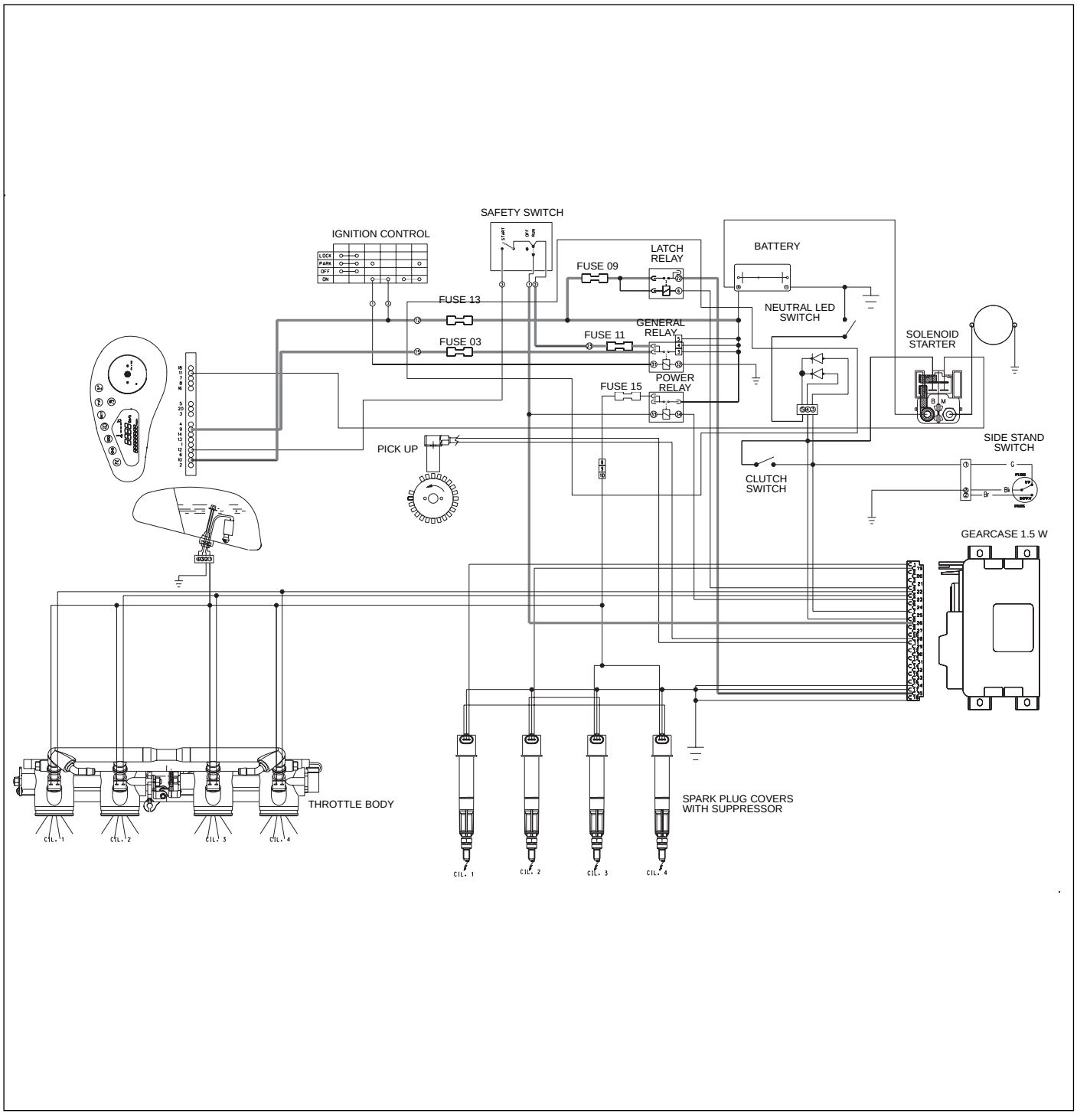
MOTOR CONTROL - POSITION OF THE PARTS



A	Instrument panel	E	Intake air pressure/temperature sensor	I	Service unit
B	Engine coolant temperature sensor	F	Fuel pump	L	Motor control unit
C	Ignition coil	G	Accelerator position sensor	M	Starter switch
D	Camshaft position sensor	H	Fuel injectors		

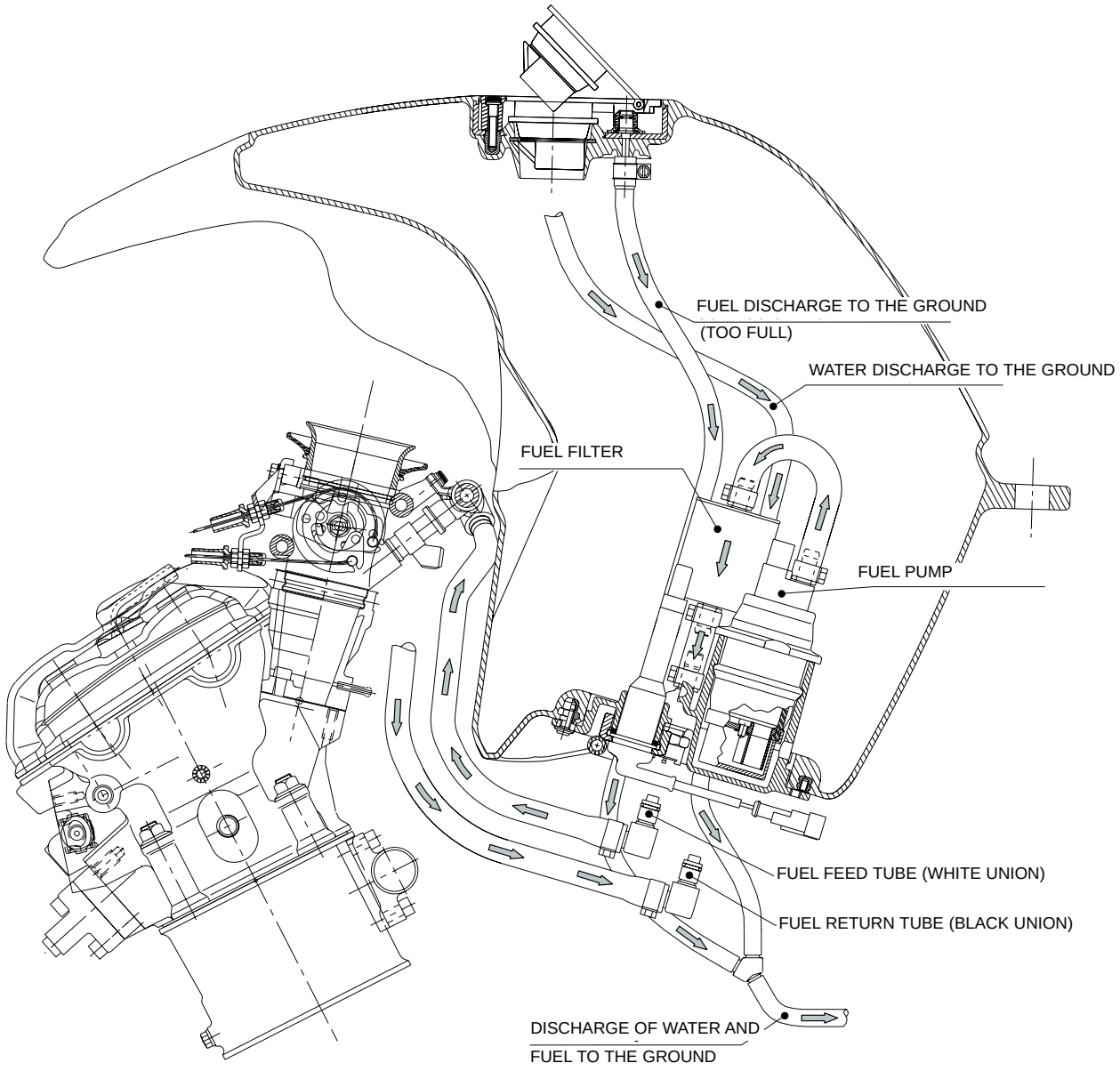
FUEL PUMP CONTROL SYSTEM

When the ignition switch is switched to the "ON" position, the current from the battery reaches the motor of the fuel pump via the side stand relay and the pump relay thereby switching on the motor.
As the CPU possesses a timer function, the pump motor stops turning three seconds after the ignition switch has been brought to the "ON" position. If the starter motor turns the electric motor shaft during or after the three seconds, the motor rotation signal is sent to the CPU that, by controlling the pump relay, makes the pump motor function continuously. When the ignition switch is switched to the "OFF" position, the control of the pump relay is interrupted and contemporaneously also the control of the injectors and the ignition coils, thereby causing the engine to switch off.



Fuel feed system

The fuel feed system consists of the tank, pump, filter, feed tube, feed tubes (including the fuel injectors), regulator of the pressure and the fuel return tube. The fuel in the tank is pumped into the feed tubing at a controlled pressure by the relative regulator and maintained at a certain constant value higher than the suction generated by the motor. The fuel is injected into the air intake conduit when the injector opens, following a law generated by the ECU. The excess fuel is not consumed and returns to the tank via return fuel tube.

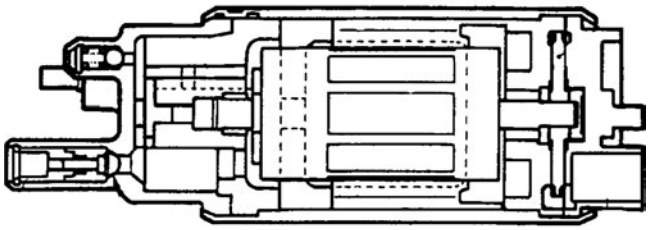


COMPONENTS

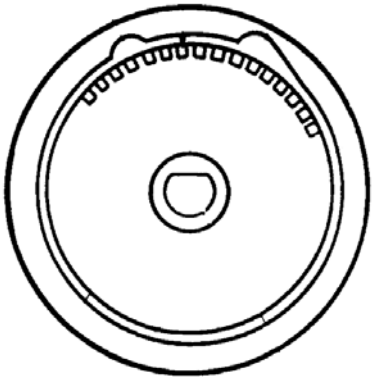
Fuel pump

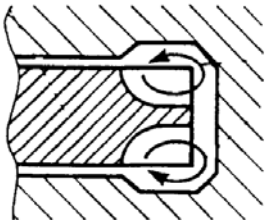
The electric fuel pump that is situated inside the fuel tank consists of an electric motor, of the rotor, impeller, control valve and pressure release valve.
The ECU controls the ON/OFF condition as described in the section FUEL PUMP CONTROL SYSTEM.
When electrical energy is supplied to the pump, the motor switches on and the impeller activates. This causes a difference in pressure on both sides of the impeller because the paddles of the impeller are grooved. The fuel is therefore sucked towards the output passage. The pump possesses a control valve to maintain a certain pressure in the fuel feed tube even when the pump is stopped and the pressure release valve opens to send fuel back to the tank when the pressure of the feed fuel increases to 4.5 - 6.5 kg/cm2.

Absorbed current: 6 – 6.5A at a 13.5V voltage input

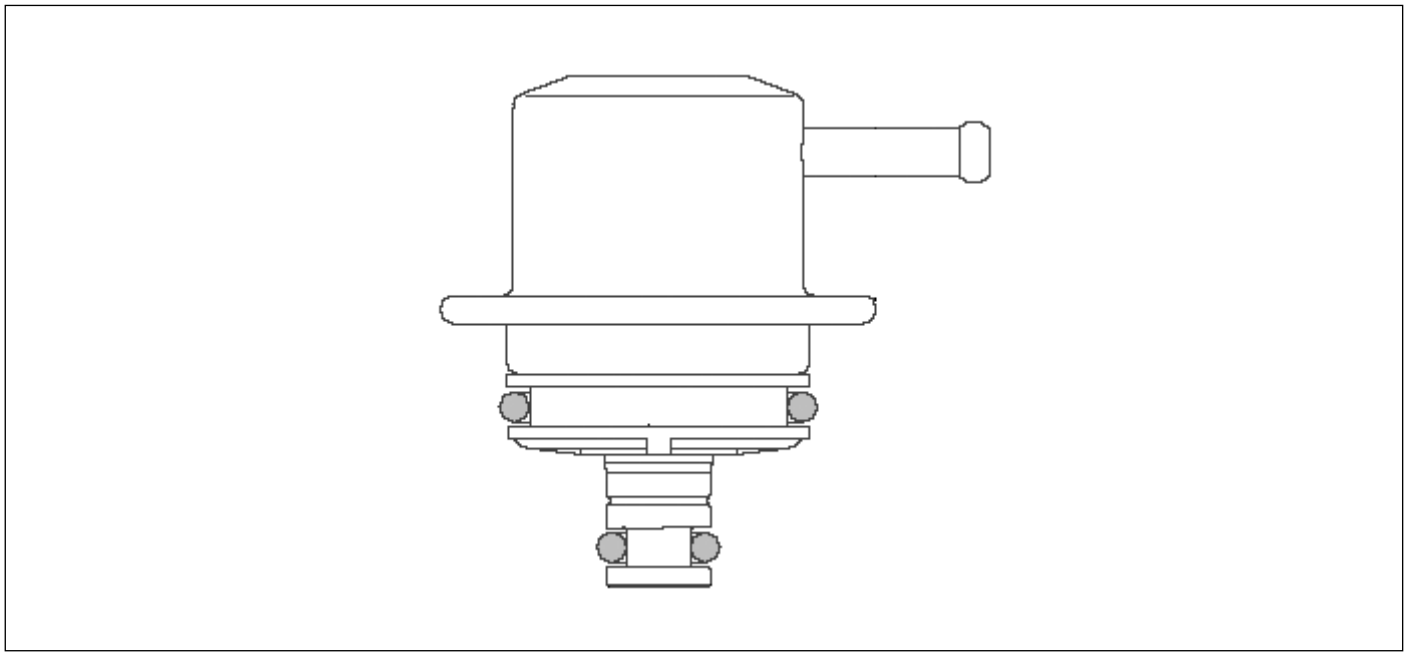


When the motor activates the impeller there is a difference in the pressure between the front part of the paddles and the rear part with the grooves, seen from an angular direction, because of the friction of the fluid. This process is continuous, thereby causing the increase in the fuel pressure. The pressurised fuel therefore leaves the pump chamber and is discharged towards the section of the motor and the control valve.





Fuel pressure regulator
The fuel pressure regulator is a diaphragm pressure release valve that consists of a diaphragm, spring and valve. It always maintains the pressure of the fuel sent to the injector at 3.0 kg/cm2 (300 kPa).
When the pressure of the fuel rises above 3.0 kg/cm2 (300 kPa) the excess fuel opens the valve of the regulator and therefore can return to the fuel tank.



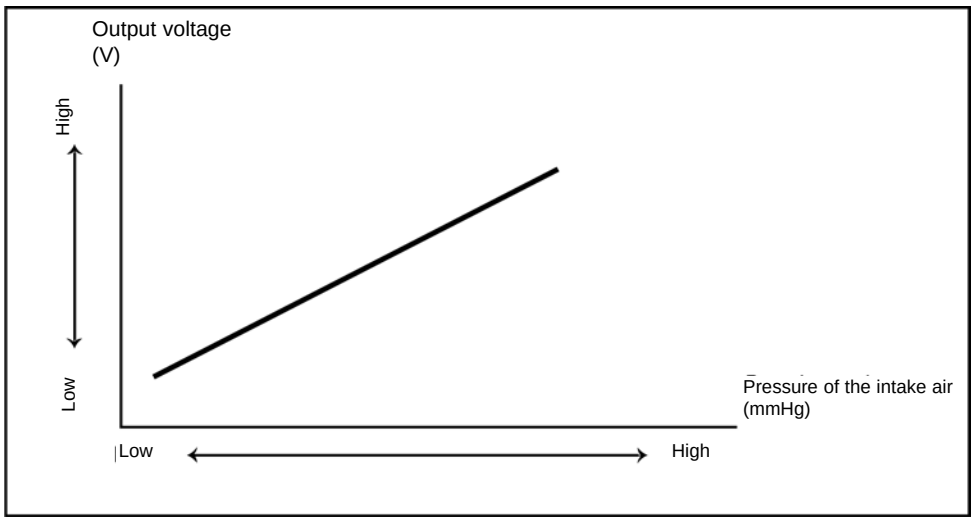
SENSORS

Atmospheric air temperature/pressure

The air intake sensor is situated on the right side of the air filter compartment and indicates both the atmospheric pressure and the air temperature.

Intake air pressure sensor

The sensor reveals the pressure of the intake air and this pressure is therefore converted into voltage that is sent to the ECU.
The basic injection time (volume) of the fuel is determined according to the voltage of the signal (output voltage).
The voltage increases when the pressure of the intake air is high.



Intake air temperature sensor
The temperature of the intake air is found measuring the resistance of the Thermistor. The resistance value read is proportionate to the voltage read by the ECU.
The volume of fuel injected increases when the intake air temperature is low.
The resistance of the Thermistor increases when the air temperature is low and diminishes when the temperature is high (NTC type sensor).

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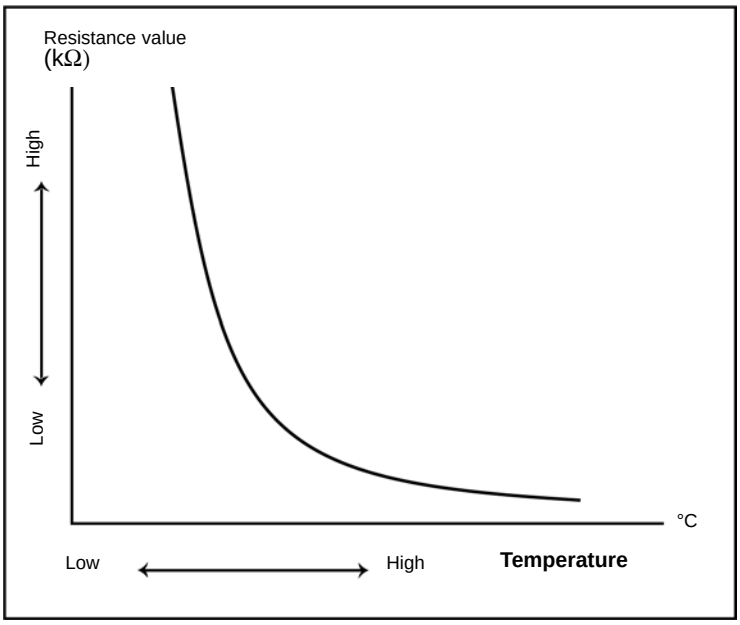
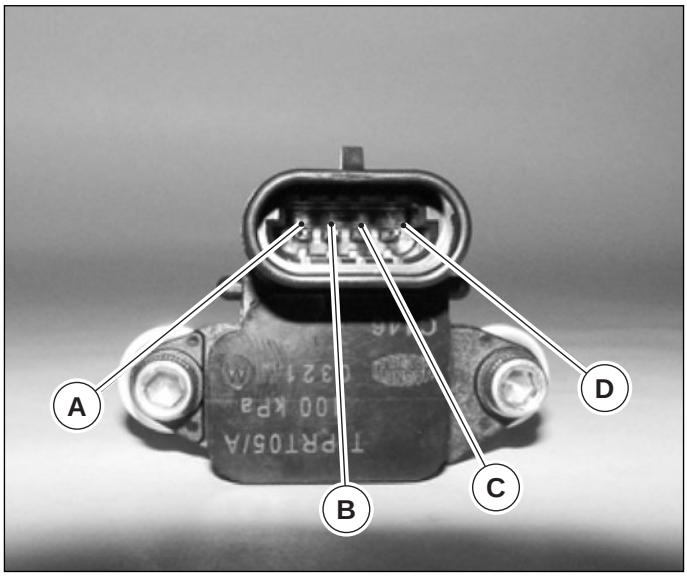


AIR TEMPERATURE ➔ D - C

Air temperature sensor characteristics	
Temperature (°C)	**Resistance (kΩ)**
-10	9.5
0	6
10	3.8
20	2.5
30	1.6
40	1.1
60	0.6

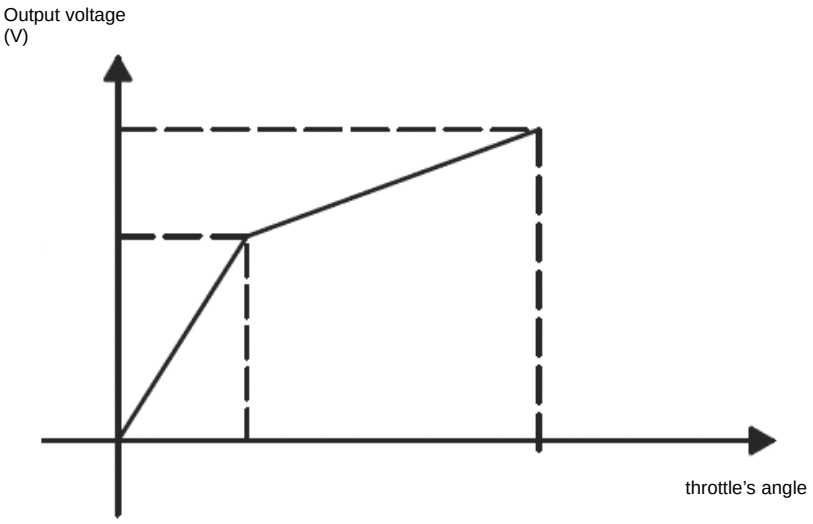
AIR PRESSURE ➔ D - A

VOLTAGE FEED TEST
➔ D - B (~ 4,9 ± 0,1 volt)



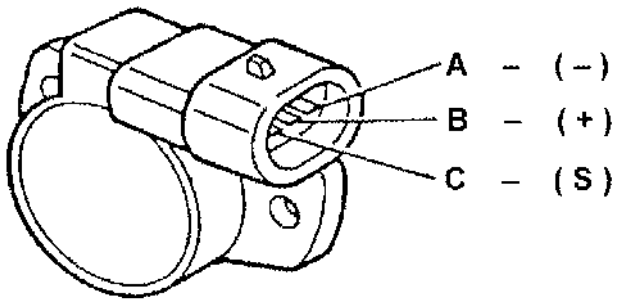
Throttle body position

The sensor of the throttle position is situated on the right side of the throttle body.
This sensor is a potentiometer with a resistance which varies according to the opening angle of the accelerator.
The sensor is supplied by the ECU at a stabilised voltage of 5V and supplies an output voltage proportionate to the throttle angle.
The basic injection time of the fuel (volume) is determined according to the output voltage of this sensor.
The voltage increases when the accelerator opening is increased.



RESISTANCE TEST ➔ A - C

FEED TEST ➔ (~ 4,9 ± 1 volt)

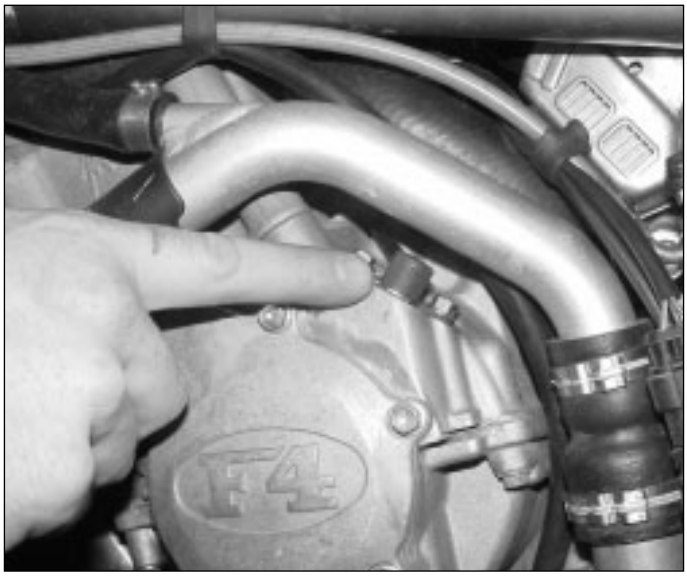


A	–	–	(pin 16)
B	–	+ 5V	(pin 14)
C	–	Signal	(pin 30)

ENGINE PICK-UP

The r.p.m./TDC sensor is of an inductive type and is situated on the left side of the motorcycle.

To check this component it is necessary to identify the relative connector positioned as shown in the figure, inside the frame on the right side of the motorcycle.



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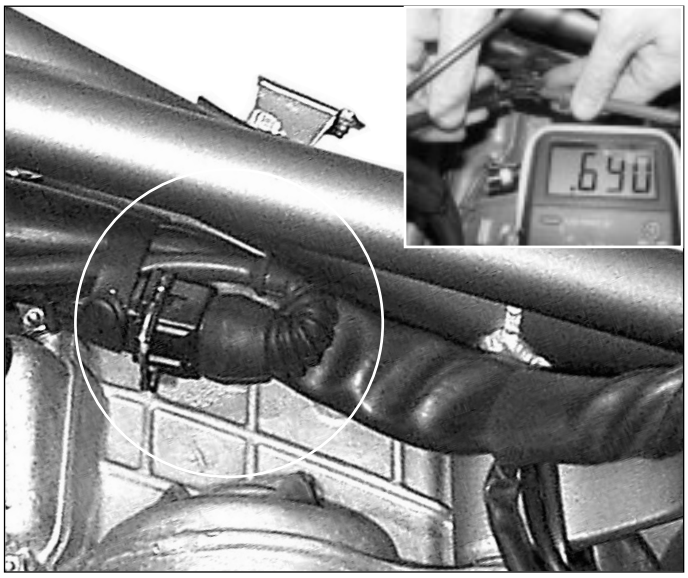
After having disconnected the pick-up connector, measure the resistance between the two points identified by (+) and a (-) that are indicated on the connector.

Pick-up resistance value: ~ 680 ÷ 700Ω

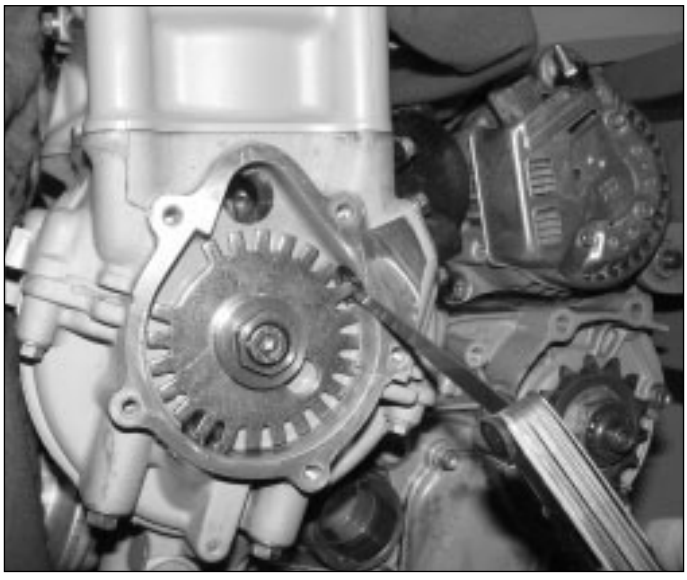


TIMING WHEEL GAP

To guarantee the correct functioning of the pick-up it is necessary to measure the gap between the pick-up and the timing wheel, that is to say the distance between the pick-up and the timing wheel by utilising a feeler gauge as shown in the figure.

GAP width: 0,6 ÷ 0,7 mm

To carry out this check it is necessary to remove the cover of the timing wheel by consulting the Workshop Engine Manual.

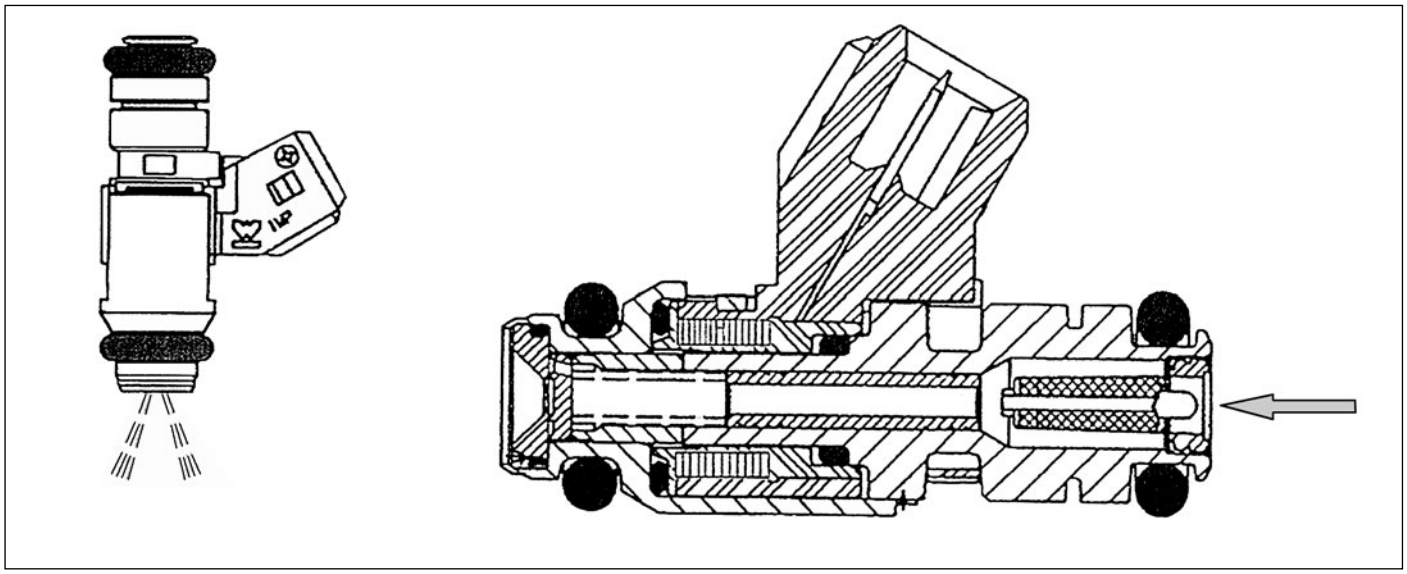


ACTUATORS

Fuel injector

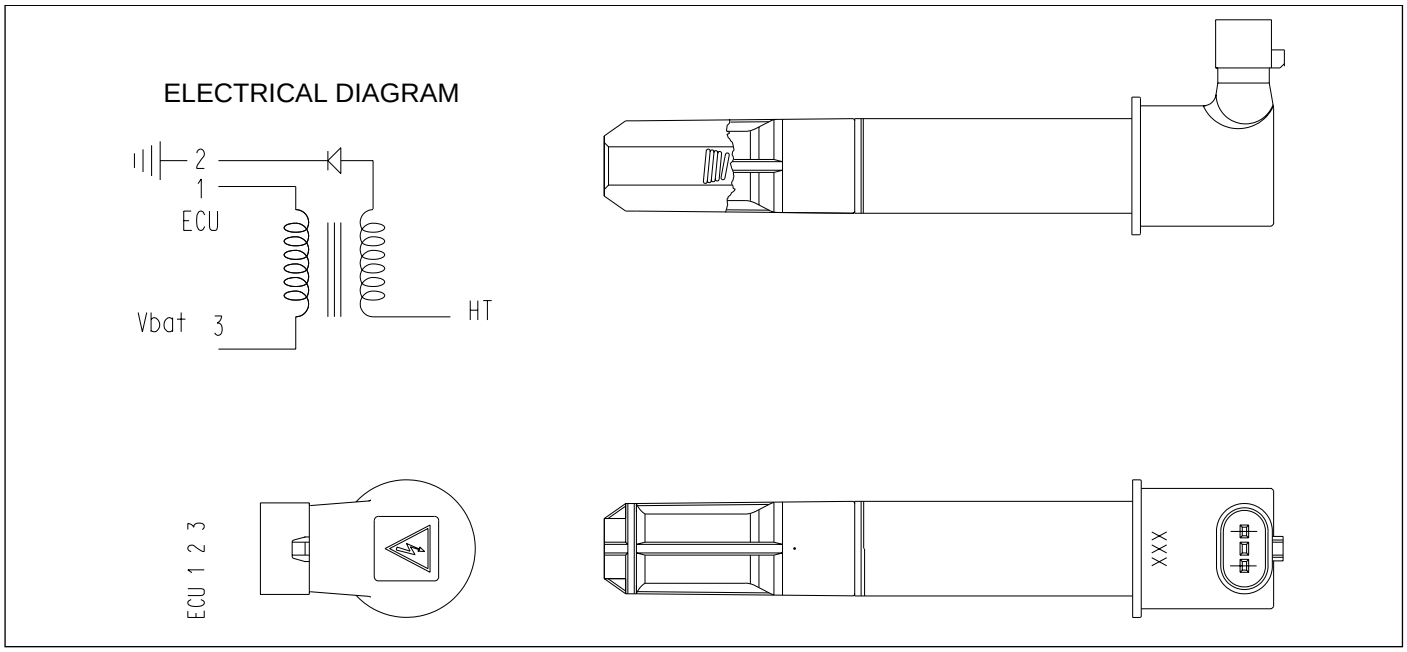
The fuel injector consists of a solenoid, piston, needle valve and a filter.
The injector is a small electromagnetic injection nozzle that injects fuel into the carburettor according to the signal coming from the ECU.
When the solenoid is agitated by the ECU, it becomes an electromagnet and attracts the piston. At the same time, the needle valve incorporated in the piston opens and the injector, under pressure of the fuel, injects the fuel in a conical dispersion. Given that the opening of the needle valve is constant, the volume of fuel injected at any one time is dependent on the time that the solenoid is agitated (injection time).

TECHNICAL DATA: Winding resistance 14.5 Ω



Ignition coils

The ignition coils are of the top plug type (they are assembled directly on the spark plugs. This avoids the use of the HT leads and enhance the overall system reliability.



DIAGNOSTICS SYSTEM

Ignition and injection system diagnostics
For the diagnosis of the ignition and injection system A Weber-Marelli diagnostic software is available which is capable of identifying and recording the faults present or that were present previously on the motorcycle. This software is equipped with a guide book for the use of the software itself to carry out checks on each individual component of the system.

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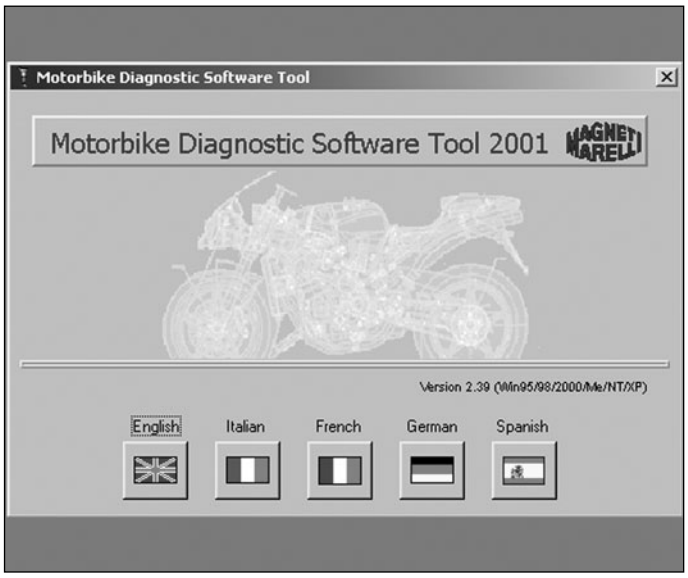
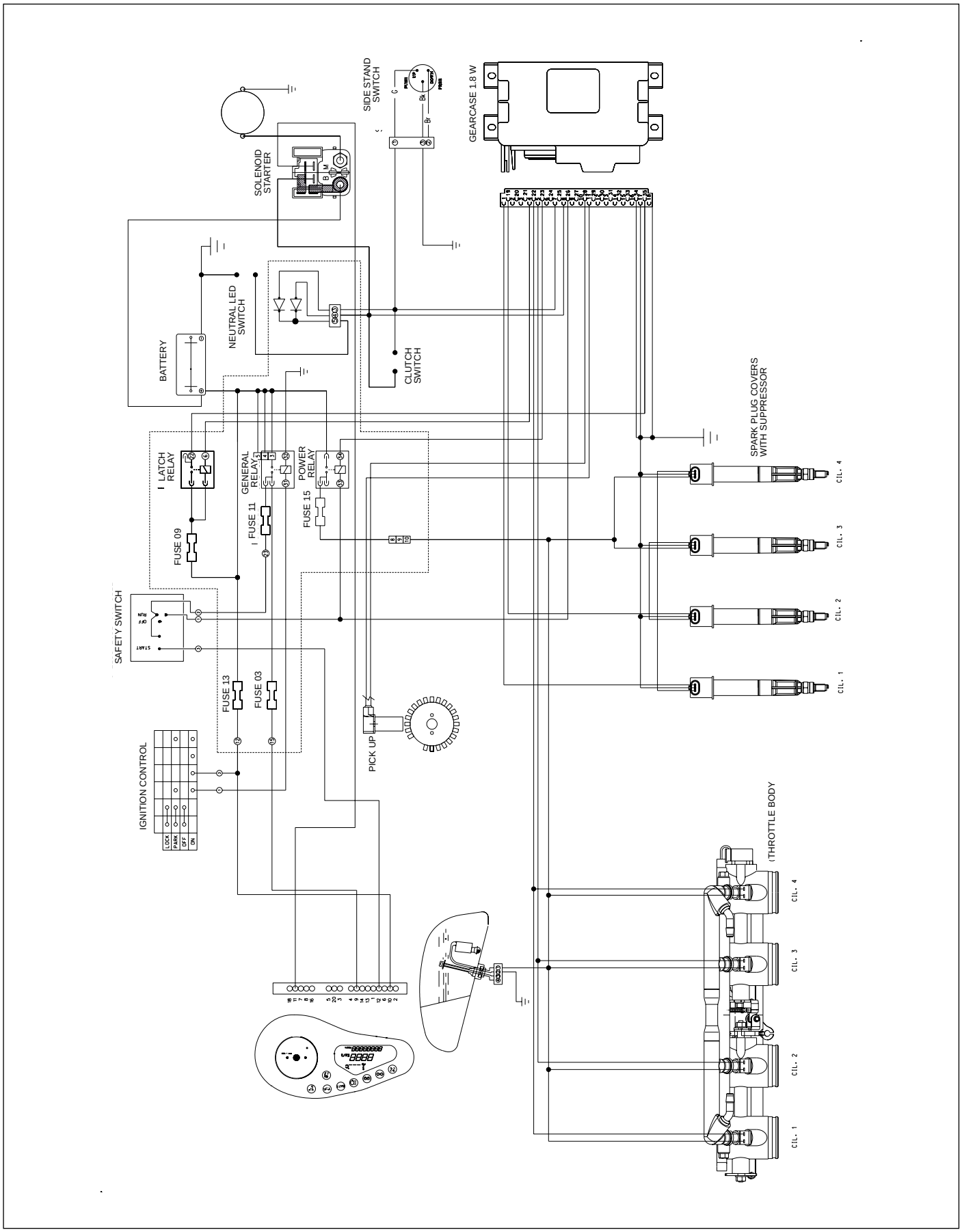
the MDST software allows to carry out the following operations:
- reading of engine parameters
- reading of faults and their deletion
- active diagnosis



INJECTION SYSTEM - ELECTRICAL DIAGRAM



MV Agusta Brutale Oro – S Engine control unit pinout

Pin	Description	Type of signal
01	cylinders 1-4 coil control	power output
02	nc	
03	nc	
04	Latch relay control	digital output
05	Injectors 2-3 control	power output
06	nc	
07	engine enabling from safety logics	digital input
08	aknowledgment of gear not engaged	digital input
09	nc	
10	K rx line	communication line
11	r.p.m./tdc sensor (pick up)	frequency input
12	nc	
13	water temperatue sensor signal	analogue input
14	sensor reference voltage	power output
15	K tx line	comunication line
16	sensor gnd	power output
17	power gnd	power input
18	nc	
19	cylinders 2-3 coil control	power output
20	fan control	
21	nc	
22	injectors 1-4 control	power output
23	power relay control (fuel pump of coil injectors)	digital output
24	revcounter control	frequency output
25	nc	
26	on key input	digital input
27	nc	
28	r.p.m./tdc sensor (pick up)	frequency input
29	nc	
30	throttle potentiometer signal	analogue input
31	air temperature sensor signal	analogue input
32	air pressure signal	analogue input
33	nc	
34	power gnd	power input
35	enabling from latch relay	