M. MARELLI DIGIPLEX STATIC ADVANCE ELECTRONIC IGNITION

Introduction

The DIGIPLEX electronic ignition system eliminates the conventional distributor and the centrifugal and automatic advance system replacing them with an electronic control unit which carries out all the functions normally performed by the distributor.
Unlike conventional systems in which the advance is mechanically obtained by means of centrifugal masses according to linear laws, the DIGIPLEX system is capable of providing advance values calculated with experimental data taking into account the various possible operating conditions of the engine, both from the point of view of consumption and exhaust gases emitted and from the point of view of performance.
The DIGIPLEX device can choose the optimum value from the 512 advance values stored in its memory to suit any engine operating condition (load and revs).
The system control unit is constantly informed of all the current operating conditions, load and engine speed by two electro-magnetic sensors and a vacuum sensor.
The system comprises:

- Two electro-magnetic sensors (S1, S2) which pick up the information concerning rpm and TDC directly on the crankshaft thereby eliminating any inaccuracies of a mechanical mature due to the transmission of power between the distributor and crankshaft.
- A vacuum sensor in the control unit (2) which transforms the inlet manifold vacuum mechanical information into an electric signal.
- A control unit (2) which selects the optimum advance angle on the basis of actual input parameters.
- A closed magnetic circuit resin coil (3) which guarantees a constant, high spark energy due to the low primary winding resistance.
- A distributor cap (4) and a rotor arm (5) to be directly mounted on the camshaft to distribute the high tension to the spark plugs (10).

The ignition advance is obtained by digitally processing the information on engine speed and vacuum supplied by the sensors and by reading the corresponding advance angles stored in the memory for each value.
Since the information is taken directly on the crankshaft via electro-magnetic sensors the following advantages are obtained compared with conventional, "breakerless" systems:

- The advance values are consistent throughout the life of the system since there is no wear of the mechanical components.
- Errors caused by vibrations and the mechanical coupling of the crankshaft and distributor shaft are eliminated.

The DIGIPLEX ignition system ensures a high spark energy owing to the low primary winding resistance and also keeps the charging current constant due to an internal feedback circuit.
This allows high energy sparks to be provided as the battery voltage varies therefore even during starting when the battery is being charged or in unfavourable climatic conditions or even when the engine revs are high.

Advantages

The advantages of the DIGIPLEX ignition system compared with conventional systems or the most recent innovations (breakerless ignition) can be summed up in:

- Best engine performance in all operating conditions.
- Minimum pollution.
- Low fuel consumption.
- No maintenance required.
- Constant performance throughout the life of the vehicle.

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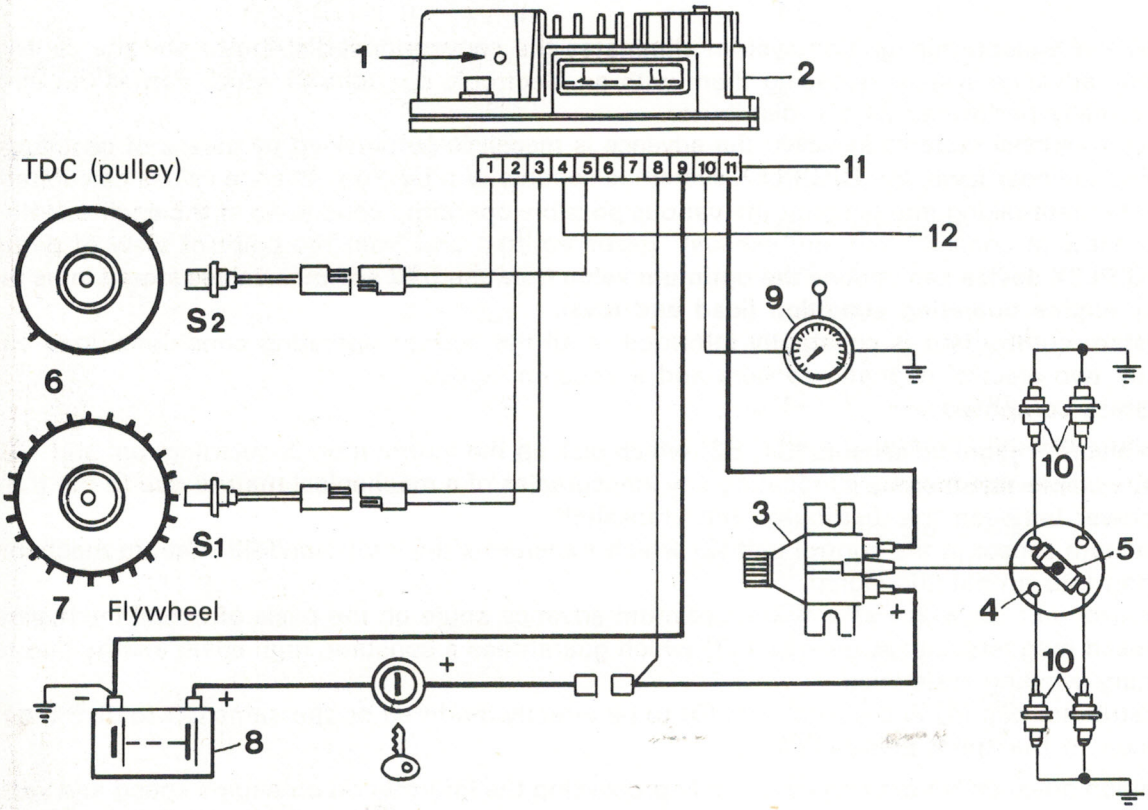
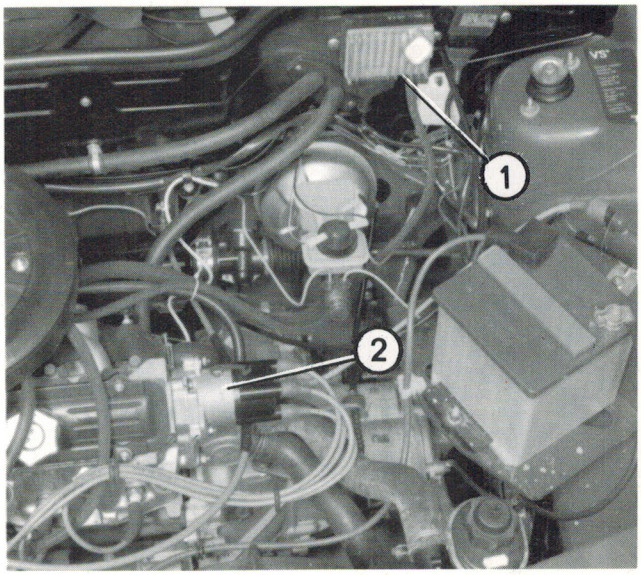
DIAGRAM SHOWING DIGIPLEX IGNITION SYSTEM



1 — Vacuum sensor pickup
2 — Control unit
3 — Coil
4 — Cap
5 — Rotor arm
6 — Crankshaft pulley
S1 — Rpm sensor on flywheel
7 — Flywheel
8 — Battery
9 — Rev counter
10 — Spark plugs
11 — Ignition circuit multiple connecter
12 — to the economy meter
S2 — TDC sensor on the pulley

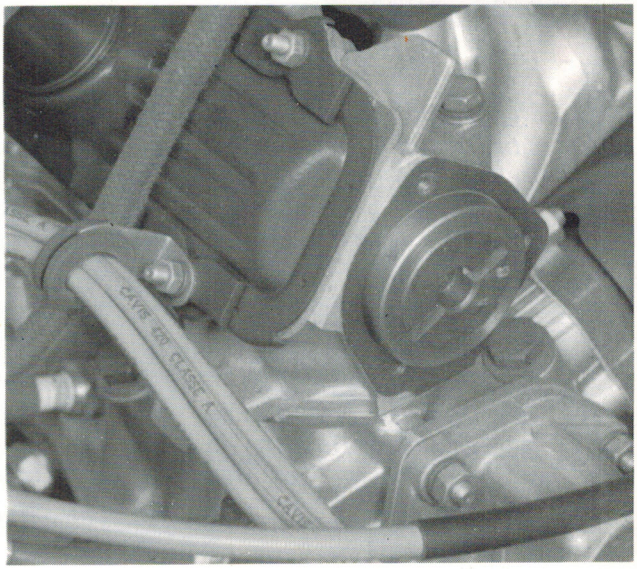
Operation

The electro-magnetic sensor S2 provides a signal corresponding to 2 reference marks or teeth on the front pulley thus indicating TDC.
The electro-magnetic sensor S1 which is facing the flywheel teeth, supplies information on the rpm and the angular position which is used to advance the spark as required.
A transducer supplies the signal proportional to the absolute pressure in the inlet manifold.
The three signals, processed in the control unit, supply the information to the memory which selects the appropriate advance for current cut out in the ignition coil primary winding.
The engine speed range can be divided, by the system, into 64 parts; up to 8 advance values can be programmed corresponding to 8 different conditions of the vacuum.
To sum up, this ignition system is capable of providing 512 advance points depending on the control unit input parameters.



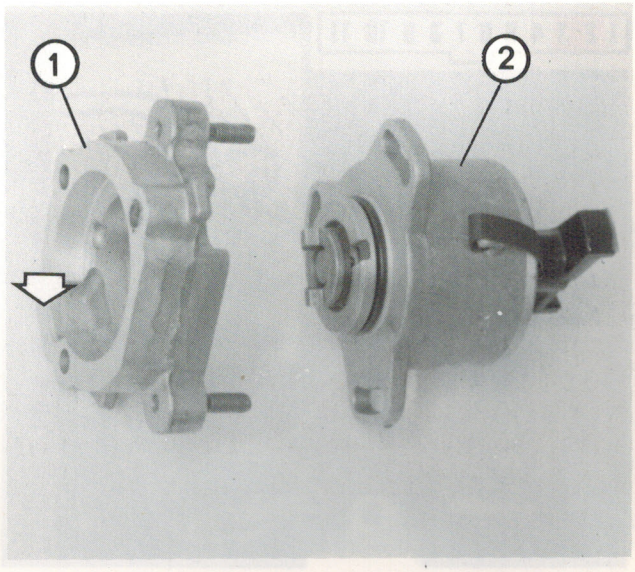
Location of static electronic ignition device

1. **Static advance ignition control unit** with absolute pressure pickup in inlet manifold.
2. **High tension distributor.**



High tension distributor attachment on camshaft

NOTE *The reference mark is offset to prevent the high tension distributor being incorrectly fitted.*



1. Spacer for attaching high tension distributor to cylinder head. Turn the notch downwards (→).
2. High tension distributor casing and rotor arm, without cap.

NOTE *The slots in the distributor casing act only to position the rotor arm in relation to the distributor cap contacts and* **not to vary the advance.**

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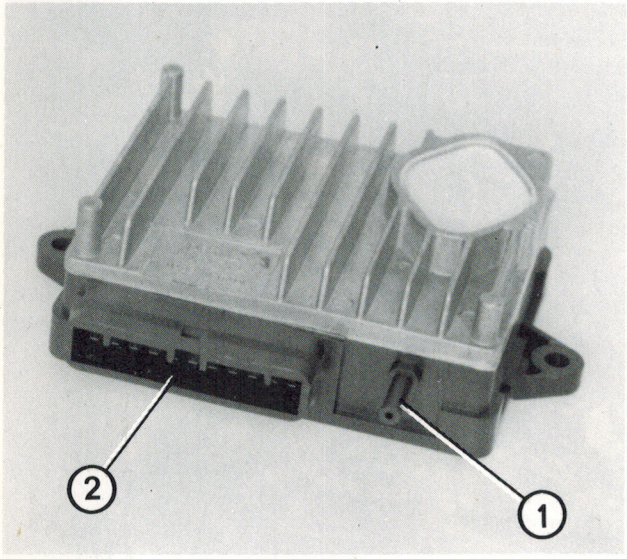


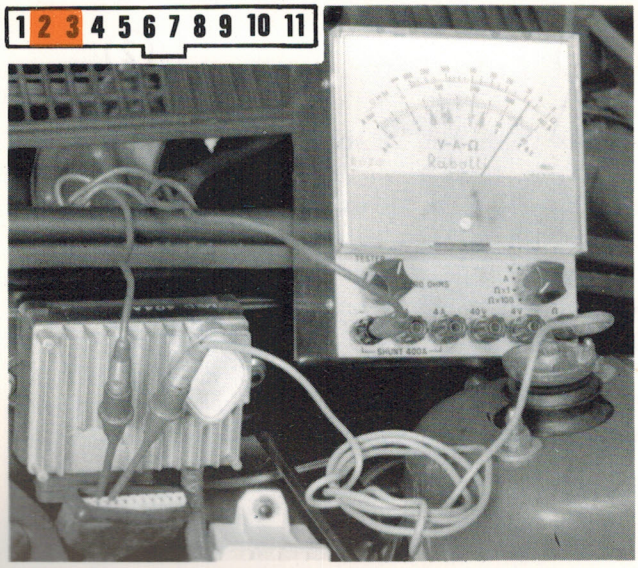
M. Marelli DIGIPLEX electronic ignition control unit

1. Socket for connecting inlet manifold vacuum.
2. Attachment of multiple connecter to ignition cables.

WHEN WORKING ON A VEHICLE EQUIPPED WITH DIGIPLEX ELECTRONIC IGNITION, OBSERVE THE FOLLOWING PRECAUTIONS:

a) Do not start the engine when the battery cables are loose or badly connected.
b) Do not use a fast charger to start the engine.
c) Never disconnect the battery with the engine running.
d) Disconnect the battery before fast charging it.
e) If the vehicle goes in a drying oven after painting where the temperature is above 80°C, remove the control unit.
f) Do not connect or disconnect the multiple connecter from the control unit with ignition switch in the ignition on position.
g) Always disconnect the negative battery terminal before carrying out welds on the vehicle.

When carrying out all the diagnostic checks listed below NEVER FIT the ohmmeter probes down between the control unit multiple connecter plates because they could remain expanded and no longer ensure the electrical contact of the multiple connecter. This would cause damage to the ignition system which would deceive even the most sophisticated diagnostic equipment.



CHECKING COMPONENTS

Before disconnecting the multiple connecter from the control unit, ensure that the ignition switch is in the OFF position.

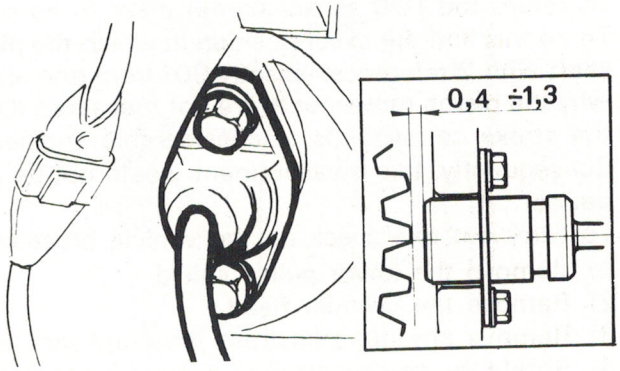
Checking rpm sensor on flywheel on gearbox casing support

Insert the probes of an ohmmeter set to a scale of Ω x 100 between contacts 2 and 3 of the connecter (see Digiplex wiring diagram).
Check the value of the resistance which should be between 618 and 748 Ω.
If this is not the case, replace the sensor.

Value of gap between rpm sensor and flywheel teeth

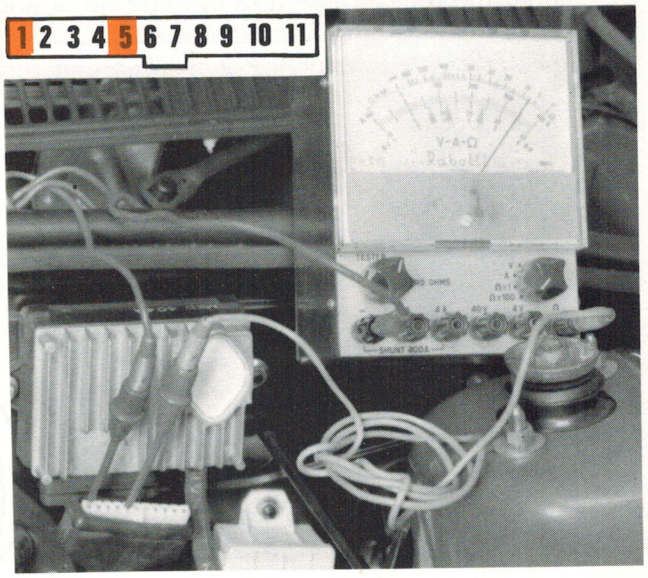
If the distance between the teeth and the sensor is excessive, the rpm signal produced would not be sufficient for the operation of the ignition system.
In addition, since the advance angle is read from the ignition system through the distance in degrees between the flywheel teeth, the advance angle would be incorrect if one or more of the teeth were broken.

NOTE *As far as the rpm sensor is concerned, no adjustments can be carried out as it is fixed directly on the bell housing.*



Checking TDC sensor on bracket near crankshaft pulley

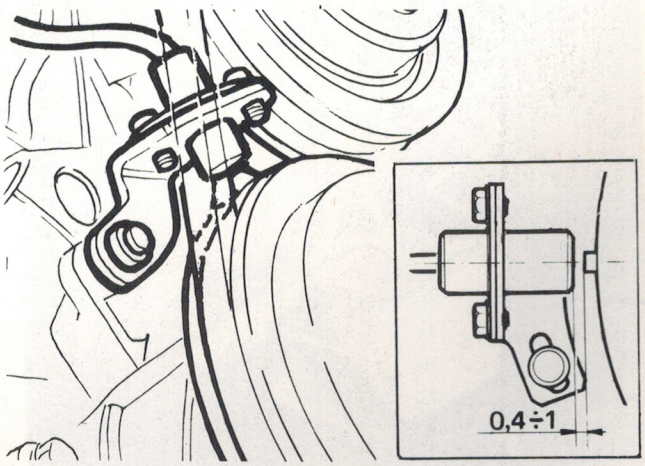
With the multiple connecter disconnected from the control unit, check the resistance of the TDC sensor by inserting the probes of an ohmmeter between contacts 1 and 5 of the multiple connecter.
The resistance value should be between 618 and 748 Ω.
If this is not the case, replace the sensor.



Checking value of gap between TDC sensor and crankshaft pulley

Position the crankshaft at TDC.
Check the gap between the sensor and one of the 2 TDC reference marks on the crankshaft pulley.

NOTE *Any mistake is due to the sensor carrier plate which may be distorted or loose: if this is the case, use tools A.95876 or A.95887 to reposition it or replace it.*
An excessive gap may cause the malfunction of the engine.



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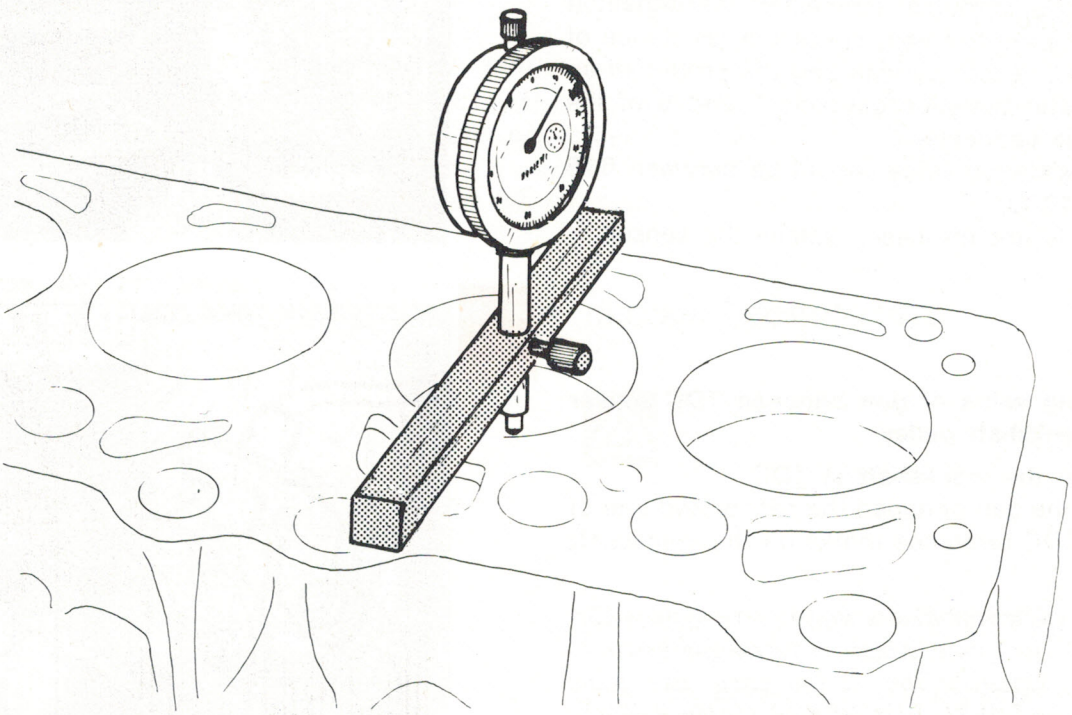
Checking position of TDC sensor carrier plate

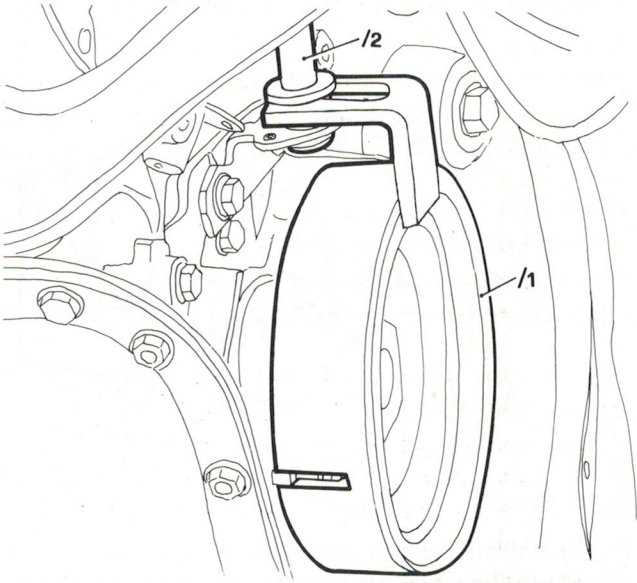
Since the correct operation of an engine with static electronic ignition depends on the **exact positioning** of the TDC sensor on the crankshaft pulley, if the sensor carrier plate has been knocked or tampered with causing an alteration to its fixed position, **the performance of the engine will be considerably impaired.**
To return the TDC sensor carrier plate to its correct position it is vital to locate TDC for piston no. 1.
To do this find the exact position in which **the pistons are in line** and then, using a tool fitted on the crankshaft with 2 references exactly 90° from one another, the TDC can be accurately determined. The reason why the piston movements are not measured directly near the TDC is that slight piston travel at the end of the stroke corresponds to considerable angular variations in the crankshaft.
Consequently, this measurement would not be accurate enough given the precision of the static ignition device.
To carry out this check on the vehicle proceed as follows:

1) Remove the lower pulley shield.
2) Remove the cylinder head.
3) Remove any deposits from the crankcase and the crown of pistons 1 and 2.
4) Rotate the crankshaft until pistons 1 and 2 are at about the same height (around halfway through the stroke).
5) Fit tool A.95876 with dial gauge A.95882.
6) Repeat the measurement in cylinder no. 2 and note the difference compared with cylinder no. 1, correcting it by turning the crankshaft.
7) Measure the height of the 2 pistons and repeat the adjustment until the reading is correct.



Then, taking care not to move the crankshaft:

- Position ring A.95887/1 on the crankshaft pulley in such a way that the two grooves and the two projections on the pulley fit together.
- Using centering pin A.95887/2 check the alignment of the hole on the sensor carrier plate with the slot in the tool.

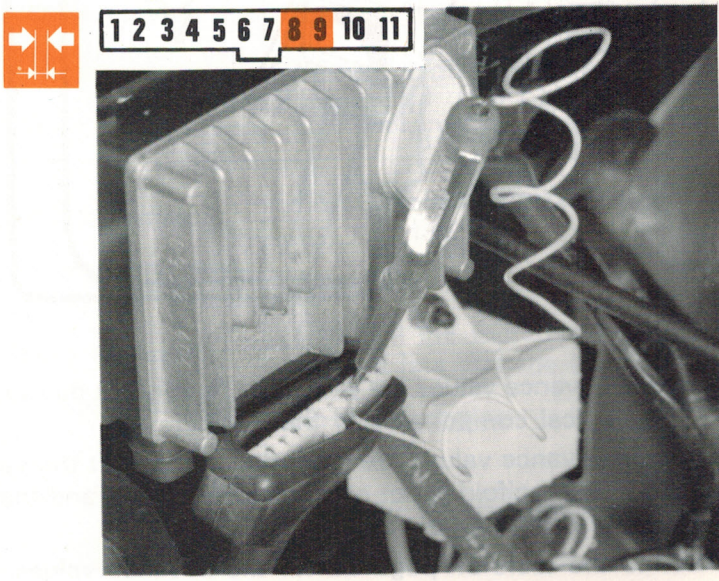


If the above mentioned condition does not occur, adjust the plate until it does.

Then check the distance between the sensor and the pulley using a feeler gauge.

Checking electronic ignition supply circuit and continuity of coil primary winding

Connect a test light between contacts 11 and 9 of the multiple connecter disconnected from the control unit.
Turn the ignition key to the ignition on position: the warning light should come on. If it does not, either the connection at the positive pole of the control unit or the coil primary winding is open (see Digiplex wiring diagram on page 279).



Checking control unit supply circuit earth cable

Connect a test light between contacts 8 and 9. Turn the ignition key to the ignition on position: the test light should come on. If it does not, there is something wrong with the earth which should be replaced.

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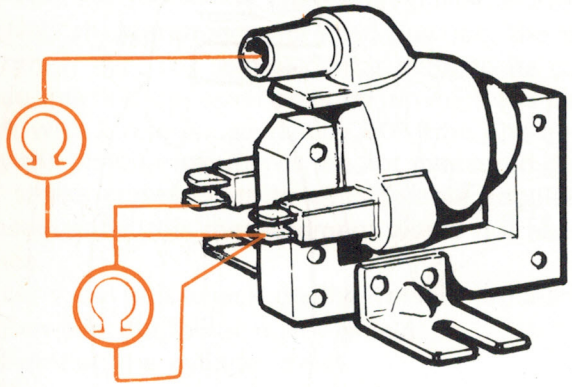


Checking coil primary and secondary windings for continuity and leakages to earth using an ohmmeter

The resistance value of the primary winding should be between 0.30 and 0.37 Ω at 20°C.
The resistance value of the secondary winding should be between 3330 and 4070 Ω at 20°C.
Using the tester also check the continuity of the high tension cables:
- between the distributor and the coil
- between the distributor and the spark plugs.

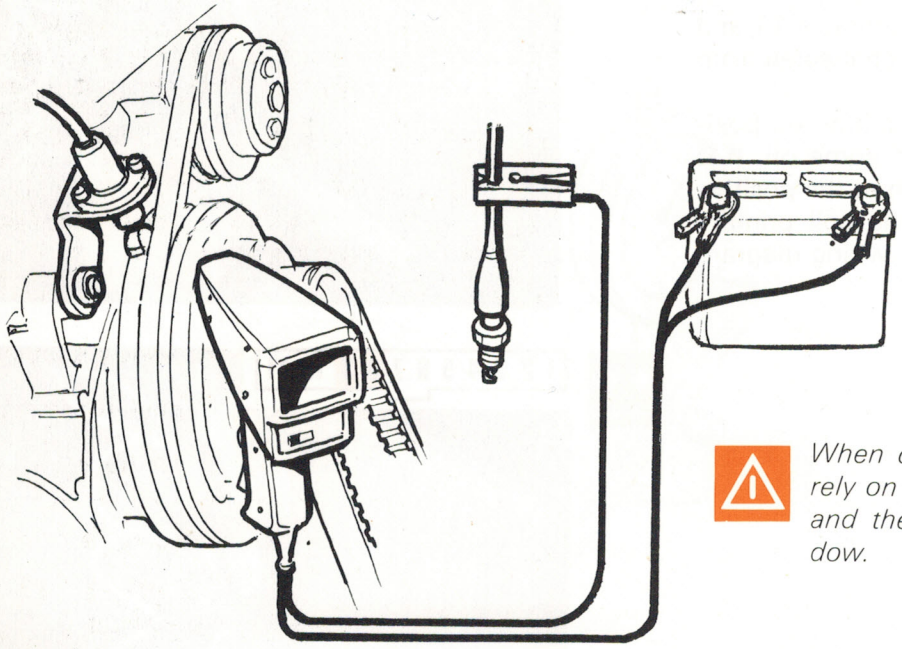
Check the state of the distributor cap (for oxidation and cracks).
Check the continuity of the rotor arm resistance which should be between 800 and 1200 Ω.

If any anomalies are discovered during the above mentioned checks, replace the defective component. **If no anomalies are discovered during the checks described above, replace the DIGIPLEX control unit.**

Rough check of ignition advance angles at different engine speeds using normal equipment

Connect a stoboscopic light of the inductive probe type with a built in graduated scale to the engine. Connect a rev counter and a vacuometer to the inlet manifold.

By making the reference on the pulley coincide with the reference on the TDC sensor support bracket the exact position of the TDC is obtained to refer to when measuring the engine advance:



When carrying out this check do not rely on the references on the flywheel and the bell housing inspection window.

a) If the advance values are exact, the fault is not due to the static ignition: check the fuel system and the mechanical components of the engine.

b) If the advance values are incorrect, check that the vacuum tube which connects the control unit with the inlet manifold is not obstructed or broken and that none of the flywheel teeth are broken. If this is not the case, replace the control unit.

Refer to the table on page 52 for the advance values.

FAULT DIAGNOSIS FOR ENGINES FITTED WITH M. MARELLI DIGIPLEX ELECTRONIC IGNITION SYSTEM

Problem	Causes	Remedies
Starter motor turns, engine won't start	Excessive gap on TDC sensor.	Reset the gap.
	TDC sensor or rpm sensor short circuited, to earth or open.	Check the sensor connecting cables and/or replace them.
	Static ignition control unit defective.	Replace the control unit.
	Contacts connecting multiple connecter with control unit oxidized or open.	Clean or renew.
	Coil defective with windings open, short circuited or to earth.	Replace coil.
	Carburettor flooded or air drawn into the inlet manifold.	Overhault the carburettor and/or level the manifold attachment planes.
	Fuel pump defective.	Replace fuel pump.
	Water in the fuel.	Clean the fuel tank, the carburettor and the relevant pipes.
	Tank breather pipes obstructed.	Correctly position breather pipes.
	No compression in engine (valves burnt, piston rings broken).	Overhaul the cylinder head and/or the engine.
Engine fires on three cylinders	Defective spark plug.	Replace spark plug.
	High tension cable open.	Replace high tension cable.
	High tension distributor cap cracked.	Replace high tension cap.
	Valve burnt out.	Overhaul cylinder head.
Engine lacks power, poor performance and excessive fuel consumption	Incorrect ignition advance.	Flywheel teeth broken or control unit faulty.
	TDC sensor incorrectly positioned.	Reposition the sensor.
	Carburettor badly adjusted.	Overhaul the carburettor checking the jets and the level.
	Engine with excessive compression leaks.	Overhaul engine.
	Control unit vacuum tube obstructed.	Replace the vacuum tube.