

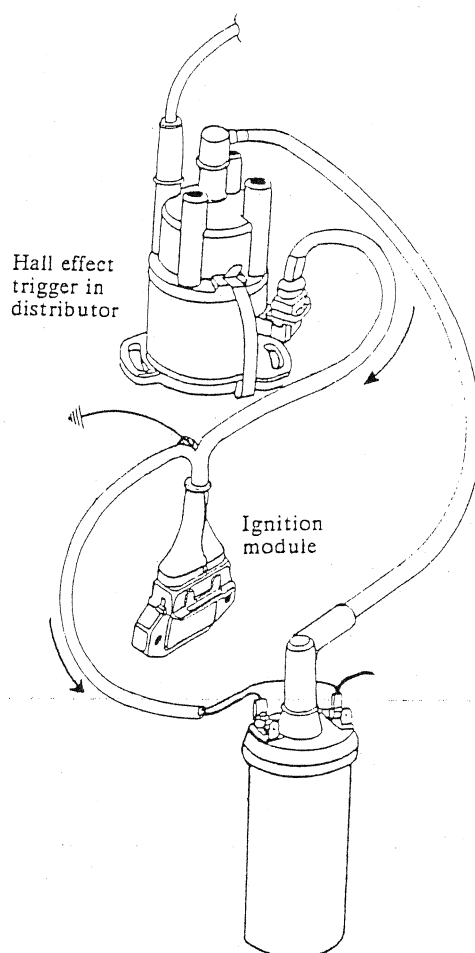
BOSCH HALL EFFECT IGNITION

SYSTEM FEATURES

The Hall Effect system was fitted to many mass produced family saloons during the 1980's, perhaps most notably to the Vauxhall/Opel range of products and many VAG vehicles.

The Bosch Hall Effect ignition system makes use of three separate main components ie, ignition coil, ignition module and a distributor located Hall effect trigger unit. The coil and module are usually mounted on a bracket which acts as a heat sink for the module.

The Hall Effect trigger supplies a trigger signal for the ignition module, the trigger signal issued as a timing reference point. Ignition timing alterations for speed and load are taken care of in the traditional way by use of a mechanical advance mechanism and a vacuum advance capsule fitted to the distributor. The advance/retard mechanisms affect the positions of the mounting plates for the Hall trigger components (similar to the base plate and cam movement on points systems), thus altering the timing of the trigger signal.



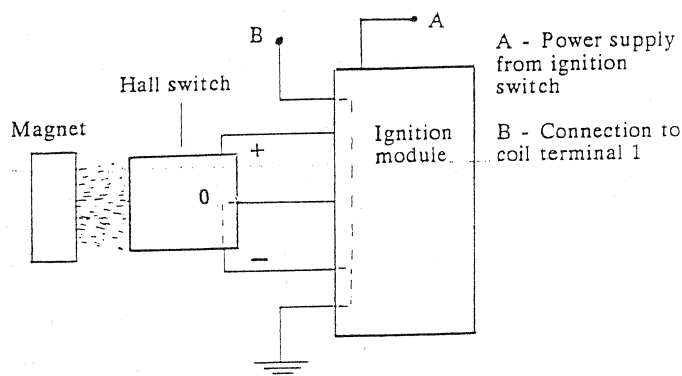
The Hall effect trigger located in the distributor passes a trigger or timing reference signal to the ignition module. In turn, the module switches on and off the coil primary circuit by switching on and off the circuit through to earth.

HALL EFFECT SYSTEM

The trigger or reference signal from the Hall trigger unit is passed to the ignition module, which in turn switches on and off the ignition primary circuit and causes the ignition coil to produce the high voltage in the normal way. The module also controls the dwell angle, which is the case with nearly all modern electronic systems, the dwell being altered in conjunction with engine speed changes and current flow changes in the primary circuit.

HALL EFFECT TRIGGER

The Hall Effect trigger is effectively an electronic switch which provides a clean on/off switching action. The Hall switch forms part of a circuit which originates from the ignition module, the circuit passes through the Hall switch and then to earth, although it does in fact pass back through the module to earth. The Hall switch therefore completes or breaks the earth circuit which will allow or prevent current to flow from the module through to earth. This switching on and off of the current flow is used by the module as a reference or trigger for switching off the ignition primary circuit.



When a magnetic field is alternately allowed to affect and then prevented from affecting the Hall switch, the Hall switch makes and breaks the circuit passing through

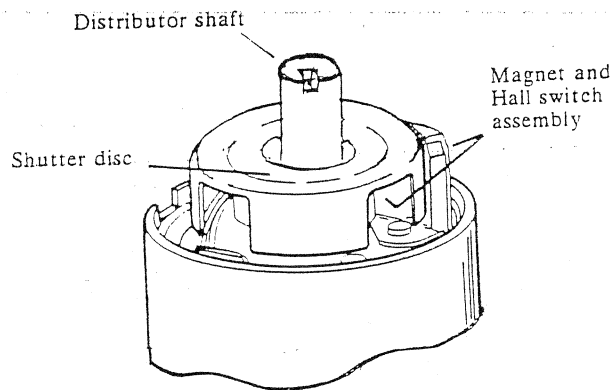
SCHEMATIC LAYOUT OF HALL TRIGGER

The Hall switch relies on an electronic component acting as a switch, and its operation is dependant on whether magnetism is able to affect the component. Note that there are no moving parts to the switch, it is a solid state electronic device. The magnetic field can cause the switch to function ie, to effectively be on or off, depending on whether the magnetic field is reaching the component or not. On the Hall Effect switches used on the Bosch system, a magnet is located close to the Hall switch and a shutter disc is used to interrupt the magnetic field. The shutter has one slot or cut out for each cylinder and as the shutter disc rotates, each cut out passes between the Hall switch and the magnet. Whilst a cut out is in place between the magnet and the switch the magnetic field is able to affect the Hall switch. When the solid portions of the shutter disc are between the magnet and the Hall switch, the magnetic field is diverted away from the Hall switch. The rotation of the shutter therefore causes a regular interruption of the magnetic field thus affecting the Hall switch, and this results in an on/off pulse being passed through the circuit to the module.

The Hall switch used on the Bosch system has three electrical connections. One connection carries a power supply to the Hall switch of typically 11 volts or more when the engine is running. This connection is normally marked with a + sign on the distributor connector plug and originates from the ignition module.

A second connection carries the signal or trigger circuit from the module to the Hall switch, this connection to the distributor plug is normally marked O.

The third connection to the Hall switch is the completion of the trigger circuit after it has passed through the switch, it passes back through the module to earth. The connection is marked with a - sign on the distributor plug and is then connected to the ignition module terminal 3 which has an internal connection to the module earth terminal 2.

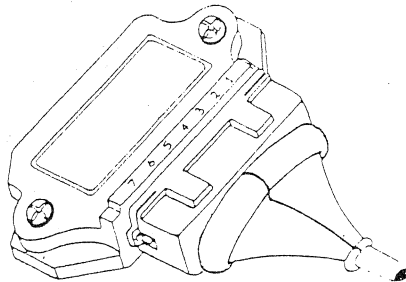


Shutter disc with a shutter situated between the magnet and the Hall switch. In this position, the shutter diverts the magnetic field away from the Hall switch.

HALL EFFECT TRIGGER AND SHUTTER DISC

IGNITION MODULE

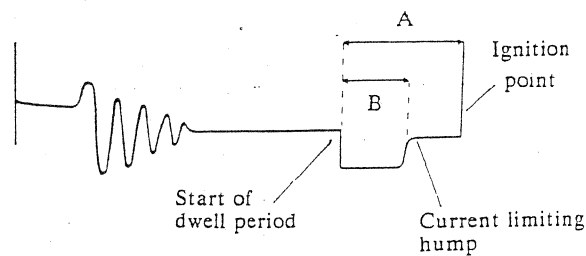
The ignition module is in fact an electronic switch which switches on and off the ignition primary circuit, this is directly a replacement of the function carried out by the points on a contact breaker system. The obvious differences are that the ignition module has no moving parts and it makes use of a signal from the Hall switch as a reference for when to switch off the primary circuit, this is equivalent to the points opening.



IGNITION MODULE

The ignition module also controls the dwell angle, depending on engine speed and the current flow in the circuit. In order to ensure that the dwell time or period is correct at all engine speeds, the dwell angle has to be altered. On a contact breaker system, dwell angle relate to degrees of distributor shaft rotation and if the dwell angle is constant eg, 45 degrees, as the engine speed increases, the time taken for the distributor shaft to turn through the 45 degrees gets shorter. This could result in not enough dwell time for the ignition coil to build up energy on modern high revving engines. However, at slow engine speeds the time taken for the distributor shaft to rotate through 45 degrees is relatively long and if the dwell angle is increased to overcome the high engine speed problem, this could result in the coil overheating at low engine speeds. On contact breaker systems however, a fixed dwell angle is used that is a compromise between high and low engine speeds. On modern engines where a good quality spark is necessary at high speeds the electronics in the module are able to provide a large dwell angle at high rpm and at slow engine speeds the dwell angle is reduced. In fact, in normal circumstances the dwell angle will increase in proportion to the increase in engine speed which means that the time taken for the dwell angle to occur will be the same at any engine speed.

The module also has another facility which can affect the dwell angle. The facility is known as current limiting and it prevents excessive current flows occurring in the primary circuit. The ignition coil is designed so that a rapid build up of energy can occur and to achieve this, the resistance of the primary winding in the coil is very low. This would result in the current flow through the primary circuit being high which could cause damage. The module therefore allows the current flow to reach a pre-determined level and then it prevents this level from being exceeded. The restricted level is typically 6 to 8 amps but without the limiting device, the level could exceed 16 amps.

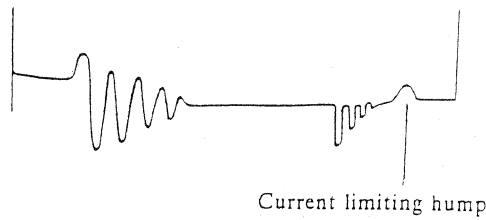


A - The full dwell period

B - Effective dwell period when current limiter is operating

PRIMARY WAVEFORM

The limiting action obviously occurs during the dwell period when the current is flowing, and it continues to take place until the module breaks the current flow in the circuit. The module breaks the current flow to create the same effect as the points opening on a contact breaker system, ie, to cause the coil to release its energy to the plugs. The limiting action can be clearly seen on both primary and secondary waveforms and note that the limiting action will affect the dwell angle reading.



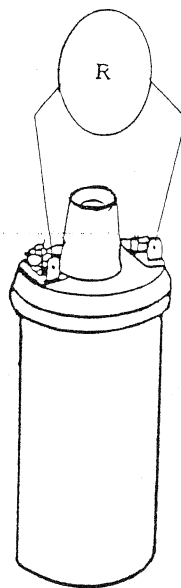
SECONDARY WAVEFORM

IGNITION COIL

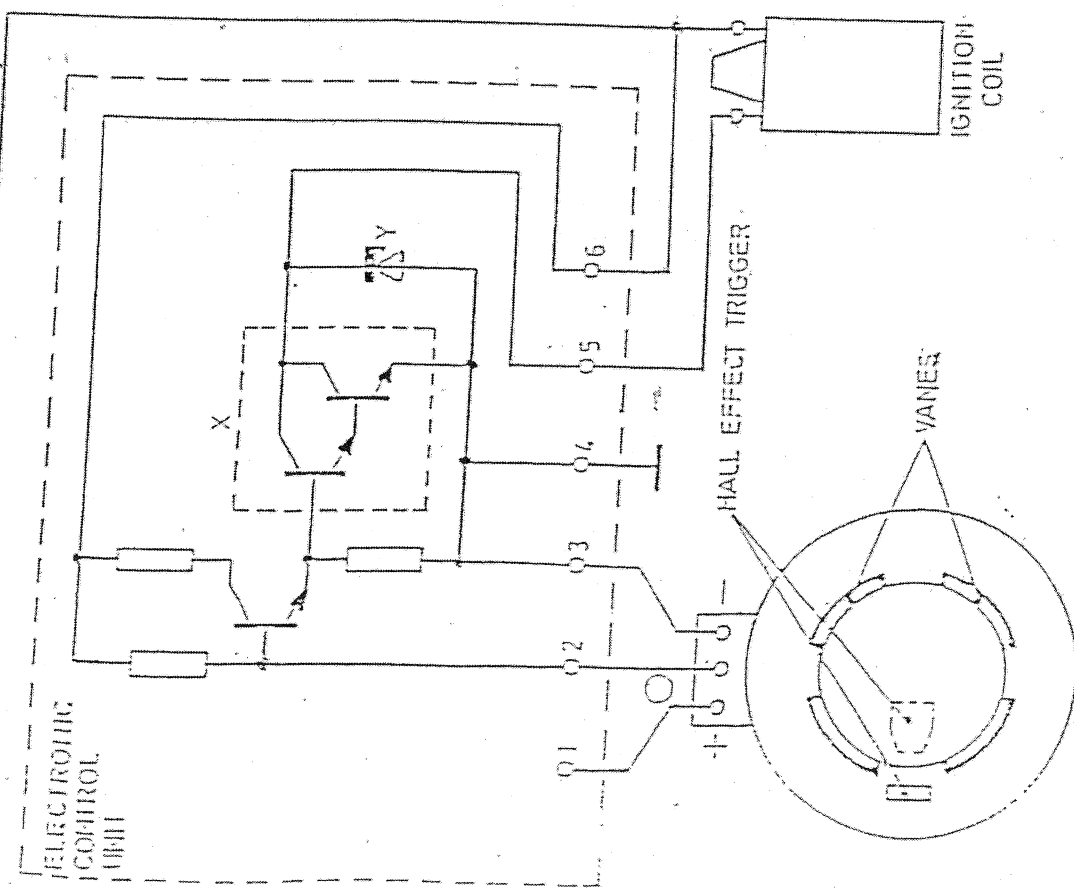
The ignition coils used on the Bosch Hall Effect systems are effectively the same as those used on conventional contact breaker systems but are adapted to function on the higher output electronic systems. Two types were commonly used (especially by Vauxhall/Opel), one was a traditional type coil enclosed in a case which contained oil or bitumen for cooling, the second type used was an open coil which relied totally on contact with the mounting bracket and vehicle body for dissipation of heat. In both cases however, the coils functioned in the normal way.

Both types of coil are constructed with a relatively low resistance for the primary winding, typically 0.6 to 0.9 ohms compared with typically 1.5 ohms for coils used on ballast resistor type contact breaker and early electronic systems. The lower resistance allows a rapid build up of current flow to occur in the primary winding which results in the coil achieving high energy levels in a shorter time.

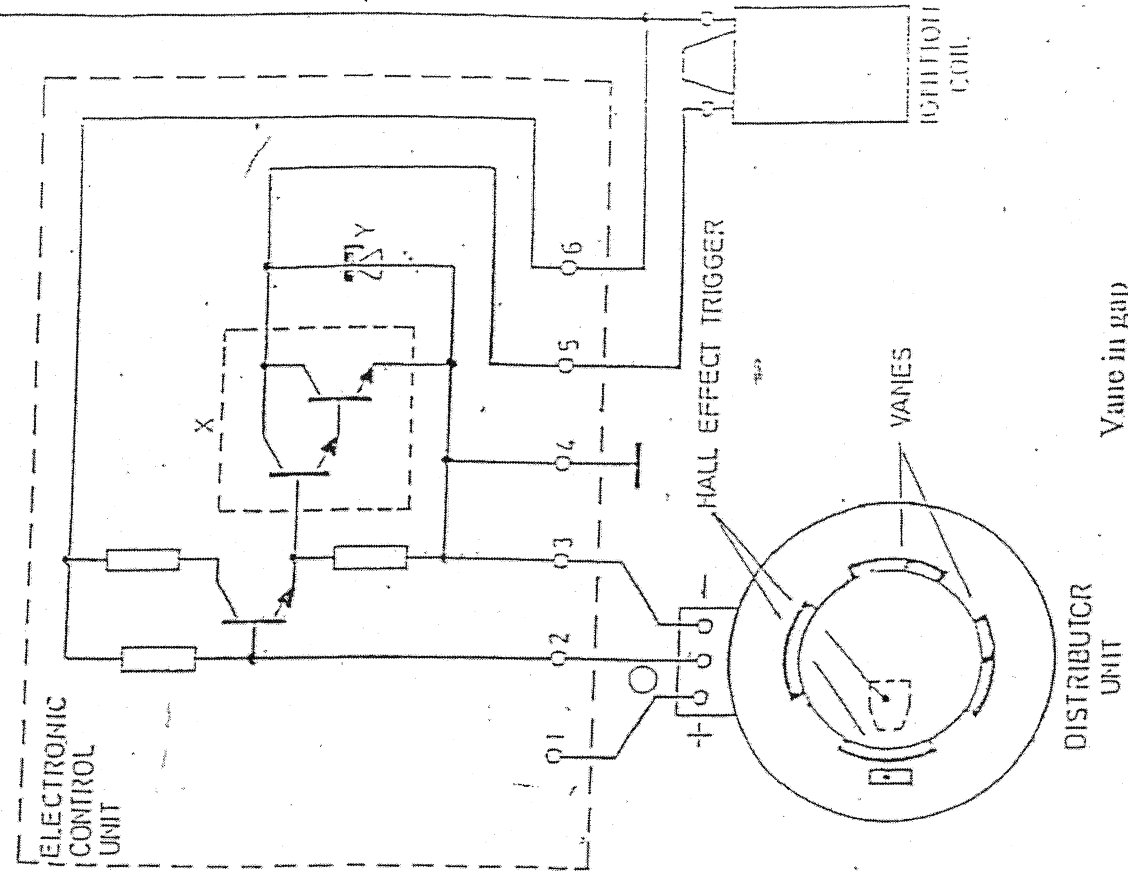
R - The ignition coil primary resistance is low by comparison to non electronic and ballast resisted electronic systems. Typical value of between 0.6 and 0.9 ohms



COIL PRIMARY RESISTANCE



Vane out of gap
Hall voltage on
Primary circuit off



Vane in gap
Hall voltage off
Primary circuit on