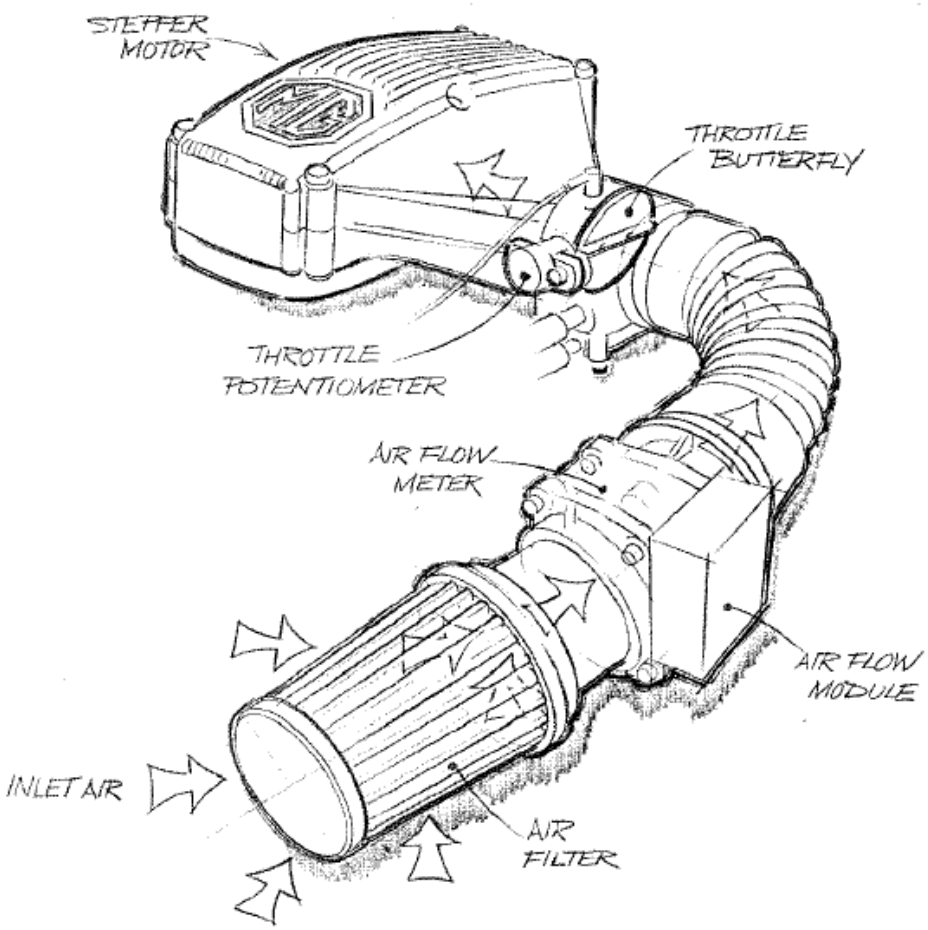


Tracing an engine misfire on an RV8

Oilver Libuda posted a query on the V8BB seeking help solving a misfire problem on his RV8. After a lengthy and expensive series of tests and replacement parts by his local distributor, the problem was traced to a failure of the RV8 mass airflow sensor resulting in negative exhaust emission values when the engine is at normal operating temperature and causing misfiring when accelerating. Here Oliver and Peter Garton explain how the problem was solved.

Oliver Libuda posted his query saying when the engine is cold, everything functioned normally, but as soon as the cooling fan cut in, there was misfiring in the first two gears and the engine didn't readily develop power on acceleration. The engine was limited to approximately 3500 rpm in first and second gears but in third gear everything appeared normal again. On checking the emission values after a few minutes of driving, they were not within the set limits. The temperature gauge moved to the middle position very rapidly after less than a kilometre.

Initially we checked the complete ignition system (spark plugs, leads, coil and distributor module) without success. The injectors were also cleaned and tested but here again without positive results. We also replaced the fuel pressure regulator, fuel filters, fuel pump and the fuel temperature sensor. The injectors were also cleaned and tested but without success in curing the misfire. The spark plugs are white coloured suggesting the mixture was too lean.

When the engine was cold, everything functioned normally so as the problem occurred when the cooling fan was running, we also checked the coolant temperature sensors but they were not defective.

The situation now entailed a deeper, thorough search for the cause of the problem. After checking again for any air leaks in the system, we took off the air filter unit and the engine was run without it and the problem had disappeared! We reassembled the air filter unit and the problem reappeared again, thus we could pinpoint the area causing the problem even though there were no air leaks to be seen anywhere. The mass airflow sensor was exchanged and after refitting the air filter unit again, the engine ran perfectly and the emission values were within the tolerance limits. The old part number for the mass airflow module was ERR5198 and the new one is ESR1057 - see the photo below.

What does the mass air flow sensor actually control?

The MAF sensor converts the amount of air drawn into the engine into a voltage signal. The ECU needs to know the intake air volume to calculate the engine load. This is necessary to determine how much fuel to inject, when to ignite the cylinder and when to change gears on a car with an automatic gearbox. The MAF is located directly in the intake air stream, between the air filter and the throttle body where it can measure incoming air. There are two sensing wires one of which heats up (the "hot wire" or "hot sensing wire") and the other, called the thermistor or unheated sensing wire, measures the temperature of the incoming air. The hot wire is maintained at a constant temperature in relation to the thermistor wire. Thus, an increase in airflow will cause the hot wire to lose heat faster and the electronic control circuitry will compensate by sending more current through the wire. (Source for this MAF explanation is Toyota USA)

Conclusion

The reason for the misfire was a defective RV8 mass airflow sensor which made itself apparent not only at idle but also on acceleration in the first two gears, and not showing up in the ECU itself. The failure of the RV8 mass airflow sensor resulted in negative exhaust emission values when the engine is at normal operating temperature and caused misfiring when accelerating.

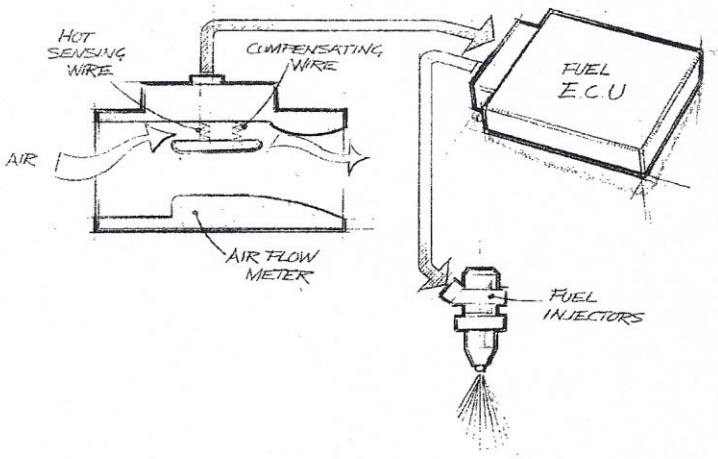
Mass airflow meter was part number **ERR 5198** and is now **ESR 1057** for a new one

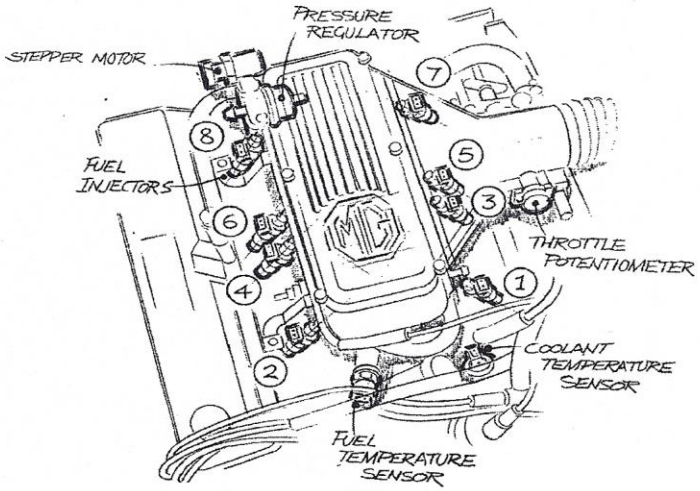
ENGINE MANAGEMENT

Introduction

Fuelling on the MG RV8 is controlled by the well proven Hot-Wire system. The Hot-Wire system gained its name because it controls fuelling by measuring the resistance of a pre-heated wire located in the air inlet system. As the amount of air passing across the wire increases, so its temperature decreases. This decrease in temperature causes the wires resistance value to increase.

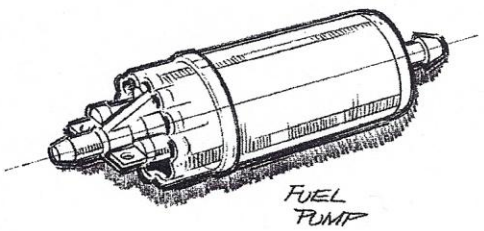
This increase in resistance is registered by the ECU, which then alters the fuelling accordingly. This isn't the only reading taken by the ECU though. In this section we'll look at the complete fuel management system; its components, and their operation.





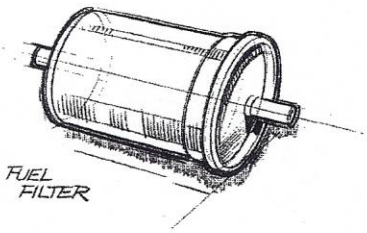
The Fuel System

Fuel is drawn from the tank by an electrically driven pump located below the right hand rear wing.
The pump also increases the pressure of the fuel.



Now at high pressure, the fuel travels along the fuel supply line and enters a fine mesh (2 Micron) filter. The filter is a vital part of the fuel system as it protects the finely machined injectors against small particles that may be present in the fuel. If these particles were allowed to reach the injectors, their lifespan and operating efficiency would be seriously affected.

When fitting a new fuel filter, make sure the arrow on the filter body is pointing in the correct direction. i.e. in the same direction as the flow of fuel.
The filter is located forward of the fuel tank.



After leaving the filter, the fuel travels towards the left hand fuel rail (cylinders 1, 3, 5, & 7).
The injectors open alternately in groups of four. Injectors 1, 3, 5, & 7 all open at the same time, followed by injectors 2, 4, 6, & 8.

Not all the fuel entering the fuel rail is injected into the inlet tracts. Some is used by the injectors as both a coolant and lubricant. The remainder of fuel continues to travel along the fuel rail until it reaches the Pressure Regulator. The Pressure Regulator, as its name suggests, controls the pressure within the fuel rail.

When inlet manifold depression is high, it tries to suck fuel from the injector. In this case, the Pressure Regulator will lower the pressure in the fuel rail, to ensure that the correct amount of fuel is injected.

As depression inside the inlet manifold reduces, the Pressure Regulator raises the pressure inside the fuel rail. This extra pressure is needed to help "push" the correct amount of fuel into the inlet manifold.

Injector opening time is controlled by the ECU. Located under the glovebox, it uses readings sent from several sources (see Electronics section) to determine when, and for how long, to open the injectors. As we have just mentioned, each bank of injectors opens alternatively, with each bank firing once per engine cycle (two engine revolutions).

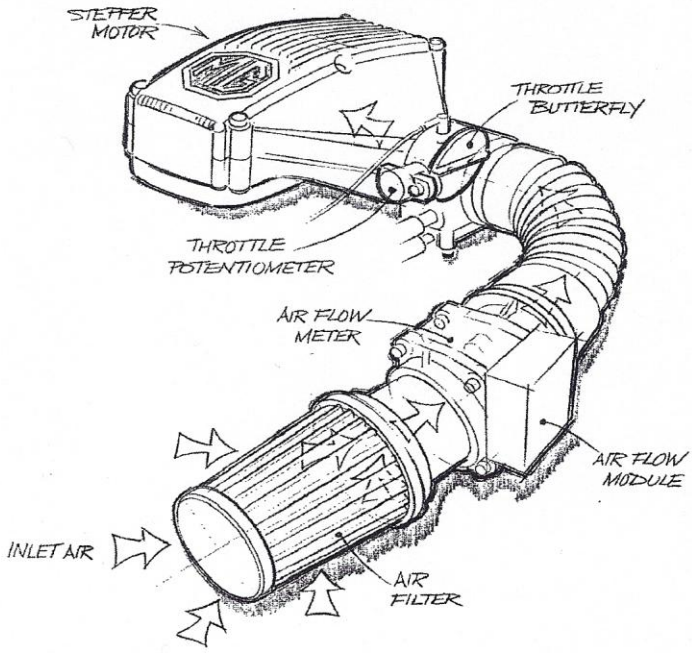
Fuel that hasn't been used by the injectors is allowed to pass through the Pressure Regulator and returns to the fuel tank via the aptly named Fuel Return Pipe.

The Air System

In addition to controlling the amount of fuel that enters the combustion chamber, we also need to control the amount of air. If the correct volume of air isn't drawn into the combustion chamber, the fuel will not burn efficiently.

Inlet air enters the system through the air filter located at the front of the engine bay. From here it enters the Air Flow Meter. The Air Flow Meter is perhaps the most important component in the whole engine management system.

It is the Air Flow Meter that contains the heated sensing wire we mentioned earlier.



Inside the Air Flow Meter is a by-pass port. The heated wire runs across the port, and is accompanied by an un-heated "compensating" wire. Both have a small electric current running through them, and are connected to the Air Flow Module on top of the meter.

As air flows into the meter, a proportion of it is allowed to flow through the by-pass port. The un-heated "compensating" wire now registers the temperature of the inlet air, which is sent to the ECU via the Air Flow Module. The heated "sensing" wire is used to find out how much air is entering.

As we mentioned earlier, inlet air cools the heated wire as it passes over it. The greater the volume of air passing over, the cooler the wire gets. As the temperature of the wire goes down, its electrical resistance increases. This change in resistance is registered by the Air Flow Module and the information sent up to the ECU.

After leaving the Air Flow Meter, the inlet air travels towards the Throttle Butterfly. The Throttle Butterfly is controlled by the accelerator, and controls the amount of air allowed to enter the Plenum Chamber. The further down the driver presses the accelerator, the further the butterfly opens.

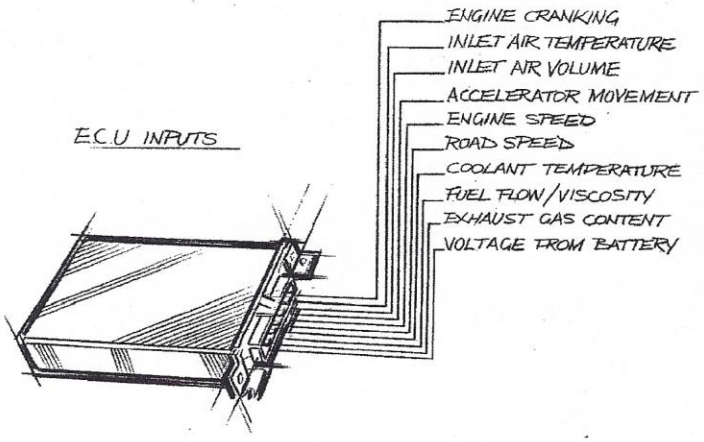
At idle, the butterfly is fully closed. In this condition, air is supplied to the Plenum Chamber via the air by-pass valve. The by-pass valve itself is mounted on the side of the Plenum chamber and is controlled by the stepper motor.

The stepper motor controls the amount of air allowed to pass through, keeping the idle speed stable. If the engine is fully warmed, and there are no additional loads, the stepper motor will create a small opening.

When the engine is cold, or there is a load acting on it, the stepper motor widens the opening, and in so doing, raises the idle speed. The stepper motor is controlled by the ECU.

Once in the Plenum Chamber, the air is drawn down into the inlet manifold, where it is mixed with the correct amount of fuel before entering the combustion chamber.

The Electronics System.



The "brains" behind the Hot-Wire system is the ECU. It receives the following inputs:

- An engine cranking signal from the ignition barrel.
- An inlet air temperature signal from the compensating wire.
- An inlet air volume signal from the sensing wire.
- An accelerator movement signal from the throttle potentiometer.
- An engine speed signal from the coil.
- A road speed signal from the speedo cable transducer.
- A coolant temperature reading from the coolant temperature sensor.
- A fuel flow/viscosity signal from the fuel temperature sensor.
- An exhaust gas content signal from the oxygen sensors.
- A voltage signal from the battery.

Using these signals, the ECU controls the opening times of the injectors, the idle speed (via the stepper motor), and exhaust emissions. In the event of a problem with the Hot-Wire system, the ECU can be interrogated using Microcheck and an updated Hot-Wire card (SMD 4072/12). The diagnostic port is next to the ECU.