



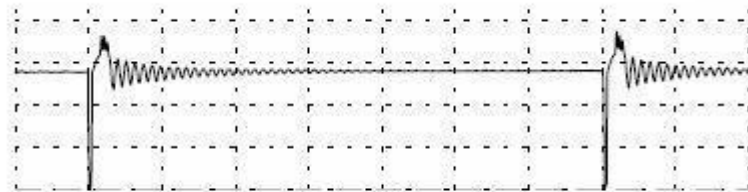
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## ExtraEFI.co.uk Reset Problems

UPDATED!

### MS1-Extra and MS2-Extra

If you are suffering from the odd reset during cranking / running then this is highly likely to be caused by noise getting back to the MS ECU. This can be caused by bad grounding or noisy components (items that produce spikes in the power) such as alternators, injectors, idle valves, etc. Everything that switches causes noise to some degree, the slower the noise is grounded out, the more interference it makes.

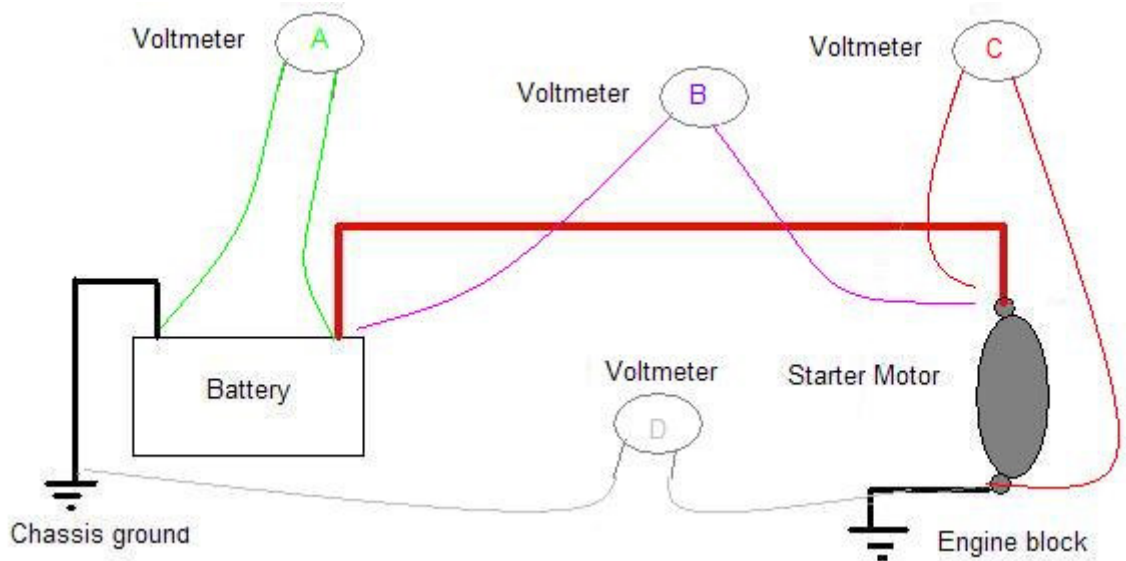


Example of noise

To check your grounds and main power cables there are a few tests you can perform using a Volt meter.

Using basic  $\text{Voltage} = \text{Current} \times \text{Resistance}$  you can soon tell if theres a resistance at any point by reading a voltage drop. So if you have 9V (A) at the battery during cranking and 6V (C) at the starter you are losing 1/3rd of the power (6Vstarter - 9Vbat = 3Vdrop) across the grounding points or the power cables. Anything more than a 1V difference is cause for concern.

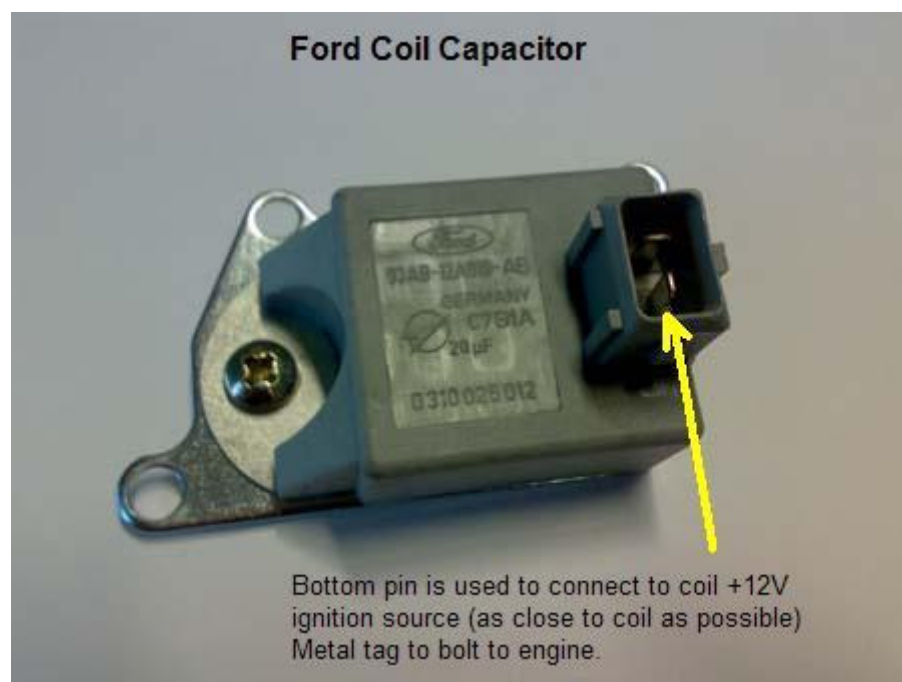
To tell if you are losing it across the power cable or across the grounding points you can simply measure the voltage at the starter ground and the battery ground (D). If you get any voltage across the grounds when cranking, then that is a good starting point. Clean all the grounds, work out if you need to increase the cable size from the engine block to the chassis, do you need to add more cables, etc.



To try to source any noise whilst the engine is running, you can use a radio that's not tuned into any station, this will buzz like mad when put near anything that's radiating noise. Alternators, starters, injectors, the ignition, etc., are all noisy equipment that can cause issues that are seen as resets, etc.

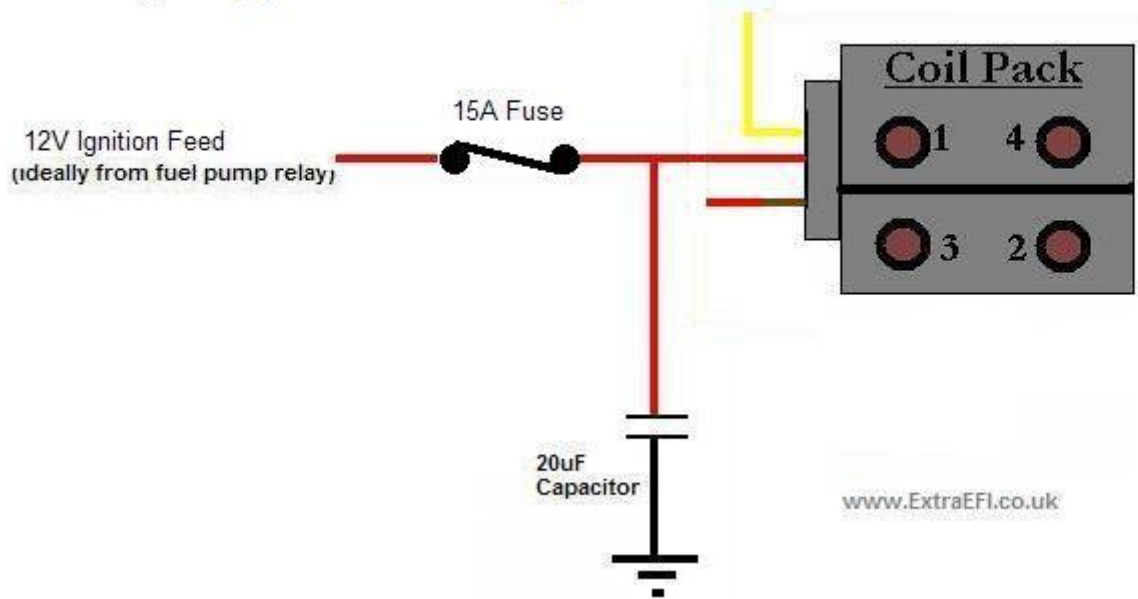
There are several things you can do to help cut the noise getting through to the ECU during the wiring stage:

- i) My latest wiring looms come with multiple ground cables, one for the trigger ground, (helping keep noise away from the sensitive low voltage trigger input) one for the spark driver(s) (this is a noisy signal, so having its own ground helps get the noise away from the box) one for the sensor grounds (helps stop the sensors spiking from any noise) and one for the rest of the ECU. These must all go back to a clean ground on the engine block.
- ii) The sensor grounds, etc., should all be connected to the same point that the main ECU ground is connected to. If using the original ECU loom then ensure that the grounds go to the engine block. If they go to the chassis then move them, having grounds at different places on the car will cause current loops and that's a main source of noise.
- iii) Fit resistive spark plugs. These are usually marked with an "R" suffix on the plug. See your spark plug manufacturer's website for more details on resistive plugs. This is very important when running a coil pack directly from the ECU.
- iv) Fit a 20uF suppresser to each coil pack. These are available at scrap yards on Ford Zetecs, etc. When removing them get the plug and some of the lead that's attached as they are a special plug (1 lug at 90deg to the other) The suppresser needs to be bolted to the engine (ground) and wired as close to the coil pack as possible.



The suppresser needs to be wired to the +12V ignition supply of **each** coil pack:

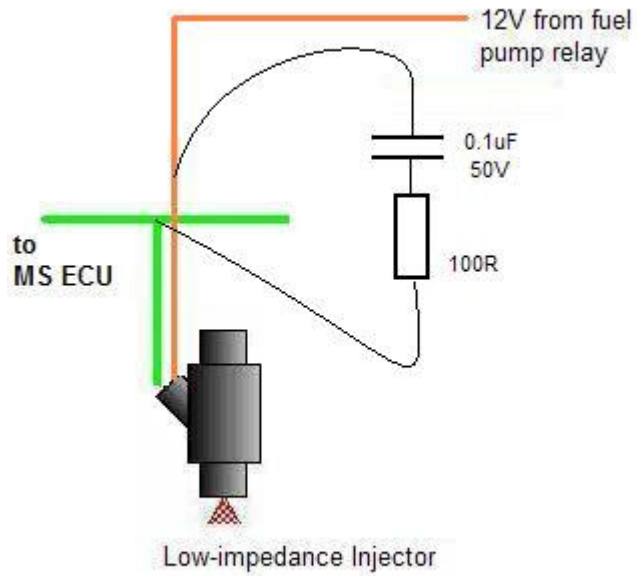
## Fitting Suppressor to coil packs



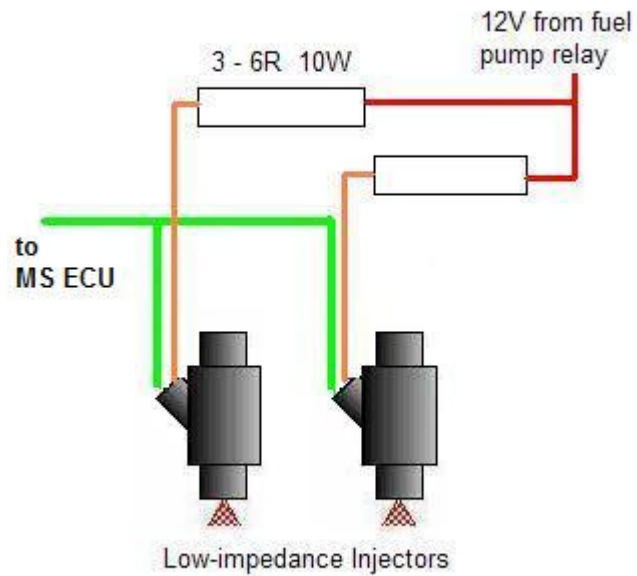
v) Other considerations include good condition resistive HT leads, clean plugs and a good engine ground. (**Note: Do not use solid strand HT leads!**)

vi) Low impedance injectors are very noisy due to the PWM control they need to hold them open. There are a few options with these. One is to fit a 0.1uF 50V cap across each one with a 100R resistor in series with the cap. Another option is to add a 3-6R 10W resistor in series with each injector, thus making them high impedance. This option is the best one as you then don't need the complexity of PWM (the injector becomes a high impedance type as far as the ECU is concerned) and you will eliminate any noise from them.

### Snubber fitted to each Injector



### In-Line Resistors for Lo-Impedance Injectors



vii) Another source of noise is the Idle Valve, especially if using it in PWM mode. My ECU's have the protection diode in place in the circuitry for these, but you could try disconnecting it to see if this cures any reset issues.

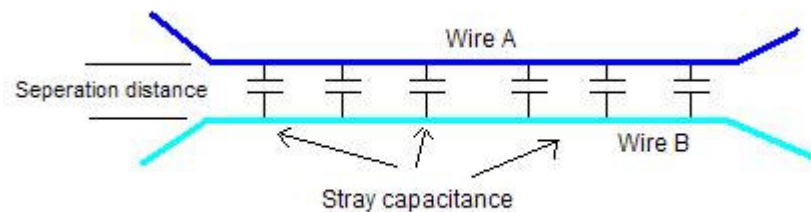
viii) If all else fails then it could be the VR sensor ground causing the noise. If this is the case then there is a small mod that can be done to the board to eliminate this. Simply solder a wire from the top of C31 on the board to one of the SPR pins in the ECU, use a spare one though!! Then remove the ground cable inside the 37pin connector for the screened cable. (Blue or Black if using one of my looms) Solder it back onto the relevant pin in the 37pin connector for that SPR you used. (SPR1 = Pin3, SPR2 = Pin4, SPR3 = Pin5, SPR4 = Pin6) This now means the VR circuit uses the actual VR sensor as its ground reference rather than the cars ground. (If necessary I can do this mod to my boards free of charge)

## In Deeper:

To have a better understanding of why grounds can eliminate noise, we first need to understand how the noise is transferred to the ECU.

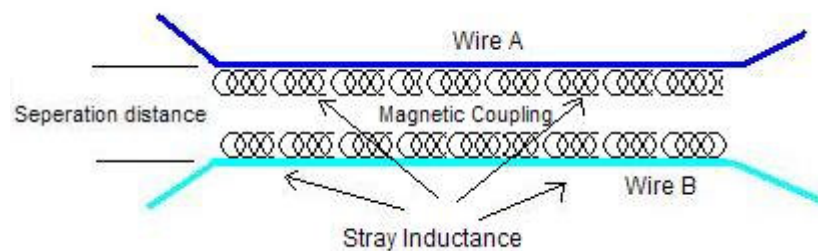
### Stray capacitance:

At high frequencies (the frequencies electrical noise is most likely to occur) wires laying close together have capacitance. The capacitance of 2 insulated wires touching each other over a 1 meter distance can have the capacitance of 100pF, that's an impedance of 200 Ohms at 10MHz!! The great thing is, the effect is reduced at the square of the separation distance.



### Stray inductance:

Like capacitance, inductance can allow noise through it. Straight wires laying beside each other are worst effected, a 1 meter cable laying beside another can give an inductance of 1.0uH, that's 60 ohms impedance at 10MHz! Again, the greater the distance, the less effect this has.



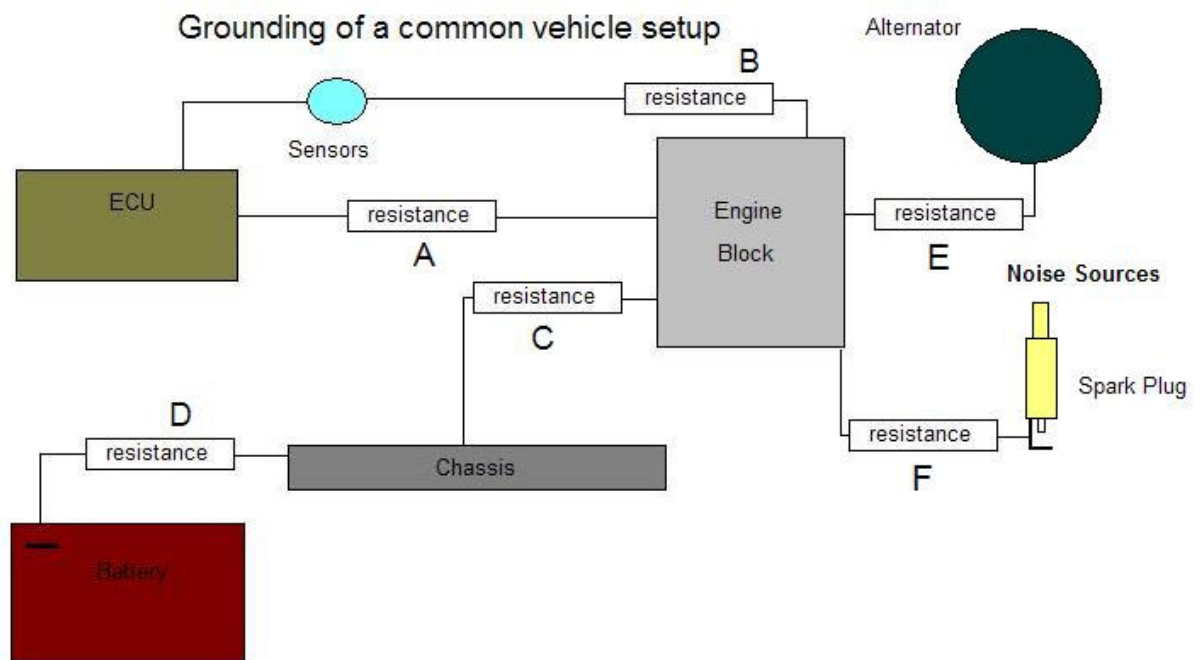
Now we can see how the noise is getting to the ECU, we need to find ways to stop it.

Keeping wires apart where possible! Its very important to keep noisy wires like the spark output leads, alternator leads, injector leads, etc, well away from the signal leads (sensor cables) and the trigger input wires.

Another method of preventing noise getting through to signal cables is to shield them. The trigger input wires I supply in my looms have a grounded sheath around them to help prevent noise penetrating to the signal cable.

### Grounds:

Basically if we have some resistance (a bad ground) and a current (noise) we get a voltage ( $\text{Volts} = \text{Current} \times \text{Resistance}$ ), decrease the resistance and you decrease the voltage, which is what effects the ECU.



The above drawing shows the layout of most common ground setups, indeed this is how my car is layed out.

The Resistance is the resistance of the cable (where applicable) + the resistance of the connections.

Any noise will flow through the stray capacitance / inductance, resistance and back to stray capacitance/inductance. Take the noise of the alternator, it will have an ampiltude of Volts across E ( $V_E$ ) + Volts across A ( $V_A$ ).

$V = \text{Current} \times \text{Resistance}$ , so get resistance to zero and the voltage will be zero.

With the ECU grounded to the engine block, the True Ground (as far as the ECU is concerned) is the engine block. As all the noisy components are grounded to the engine block, the ECU see's that as ground.

The engine block is the path that has less resistance than using the Chassis or the Battery, as can be see above, because it only has Resistance A and B to cause issues. If you used the battery, then youd have C and D thrown in too, which would cause greater issues due to higher resistances, therefore a higher voltage.

This subject is massive and there is so much more to it than I can understand, I just hope this helps those with noise issues to see why it is important to sort grounds out.

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