

## Stepper Motor Diagnostic Page

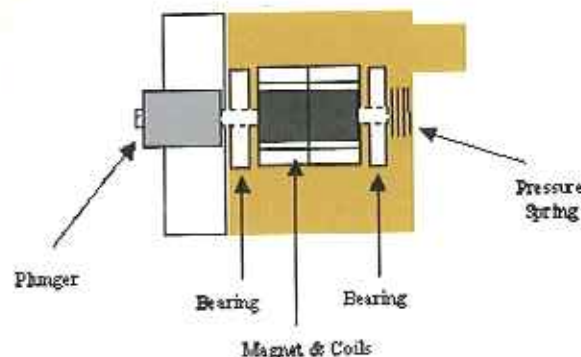
The stepper motor can be problematic on the FTO model and this page's purpose is to aid in the fault diagnostic of that motor. I wrote this because it drove me mad when I started having problems.

First my problem was hunting at idle (cleaned the plunger and then reset the ECU) next it was ok some times and at other times the idle would be low at start-up and then high at idle. So armed with a little knowledge I set out to discover how the stepper motor worked.

### Description of operation

The stepper motor is used to control the idle speed according to revs and idle switch position. The throttle body has a throttle plate (butterfly valve) that is levered open by use of cable and returned by a spring. A spigot on the other side of the throttle body drives a resistor / switch to tell the engine ECU what position the accelerator pedal / throttle plate is in. When the accelerator pedal is not depressed and the throttle plate is closed the idle switch is made and the revs of the car are controlled by the Idle stepper motor.

The idle stepper motor is simply a plunger that moves in and out of a recess in the throttle body and the movement in and out increases and decreases the revs accordingly. See below for cut away side view of the stepper motor



From this picture the plunger can be seen to be mounted on a shaft that passes through two bearings and is held in place by the pressure spring. On the shaft of the plunger is a ferrite core which is affected by magnetism. Around this ferrite core is two coil arrangements. The coil arrangements are made up of two copper wires wrapped around a bobin in both directions and terminated to the electrical connector.

The engine ECU controls the stepper motor by four transistors, two for inwards movement and two for outwards movement. By the ECU switching these transistors to 0V, a current is induced in the coil which creates an magnetic field and forces the ferrite core to move in one

Bulb replacement with LEDs

direction or another, either inwards or outwards. The ECU makes repeated "Steps" to maintain the revs according to load and temperature of the engine. When the engine is fully up to temperature the ECU makes very little adjustment at all.

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### **Symptoms of Faulty Stepper Motor**

- 1) Low Idle at cold - no apparent choke
- 2) High idle at warm - revving at 2000+ rpm
- 3) Intermittant idle at other time (hunting)

All or both of the above sometimes.

Of course many other things can cause these same symptoms but the guide below is to determine IF IT IS THE STEPPER MOTOR.

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### **Mechanical**

Remove the whole stepper motor from the throttle body by removing the air intake to the throttle body and unscrewing the TWO bolts/screws on the body of the stepper motor.

- 1) First thing to do is clean the plunger head and the recess it goes into - as carbon deposits on the plunger tip can prevent it from seating properly - WD40 is supposed to be good for this. Note: Make sure you use a lint free cloth or bits are going to end where they shouldnt be.

Carry out an ECU reset by removing the battery power to the car for a time of approximately 30-45mins. This will cause the ECU to re-learn the action of the Stepper motor.

Re-assemble stepper motor to throttle body and re-connect the air intake

No good - Next step

Remove the electrical part of the stepper motor (brown cover) secured by three cross head screws and carefully withdraw the unit, ensuring the spring does not drop out and bounce away.

- 2) Check that the plunger moves on the bearings



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3) Get the car warm with the temperature needle in the middle of the gauge and twist the black ferrite core fully one way or another to get the idle speed required. If there are stable revs (not hunting) at this point you have proved the fault is more than likely electrical.

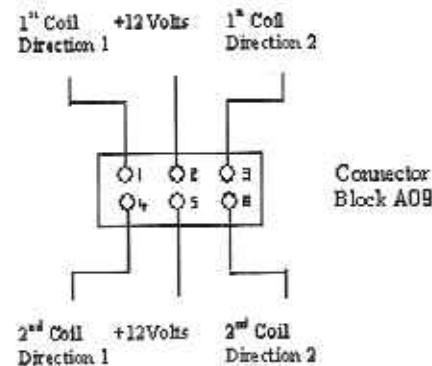
*Note: This is exactly how my car was and I actually re-assembled everything and left the electrical connection dis-connected until a new stepper motor could be sourced. Just meant it stalled a lot when cold, but once warm it was fine.*

If it is not stable then the stepper motor plunger may be worn and it is worth getting a Mitsubishi dealer to check it out.

## Electrical connection of Stepper motor

Having done the mechanical bits and everything is stable the fault is probably electrical.

First place to check for any fault is the connection block wiring. Being an electro mechanical device the The stepper motor is connected to the engine ECU by a six way block located in the engine compartment. See below for drawing and connection detail.

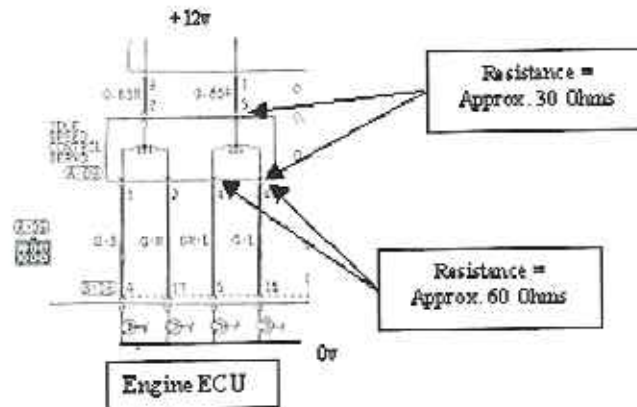


Ensure the connection is clean and wiggling the wires with engine at idle does not affect anything.

.....with the electrical part still removed of the stepper motor

Use a multimeter and measure the resistance between the middle pin and the outer pin and repeat for the other outer pin. Now repeat for the other middle pin to the outer pins. Readings should be in the order to 30 ohms from outer to middle and 60 ohms from outer to outer. If > 45 ohms between outer and middle then the connection on the coil is breaking down and the coil in question may not be driving the plunger in and out all the time.

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If the measurement is fine then a final test is remove the plunger body and re-assemble the whole stepper unit. Take a wire connected to the battery +ve and connect to the centre pins and another wire to 0V (chassis ) to one set of the outer upper and lower pins and dab on and off these pins. The motor should move the plunger in one direction and then check the other two outer pins moves the stepper in the other direction.

If OK then check for 12v on the centre pins of the wiring loom connector. Also compare a reading of resistance of the outer pins to chassis when hot and when cold. The readings taken should be the same for two pairs of outer pins when hot and the other two pairs when cold.

Other problems associated with the stepper are incorrect temperature reading to the ECU and the switching of these four signals from the ECU.

Hope this helps - if you Need help with this then email me [john@jcom-services.co.uk](mailto:john@jcom-services.co.uk)