

Adaptronic eSel002 Select ECU for RX8 Series 1



Applicable vehicles / engines:

- Mazda RX8 series 1 (2003 – 2008) – 1.3L RENESIS 13B-MSP and non-MSP engines

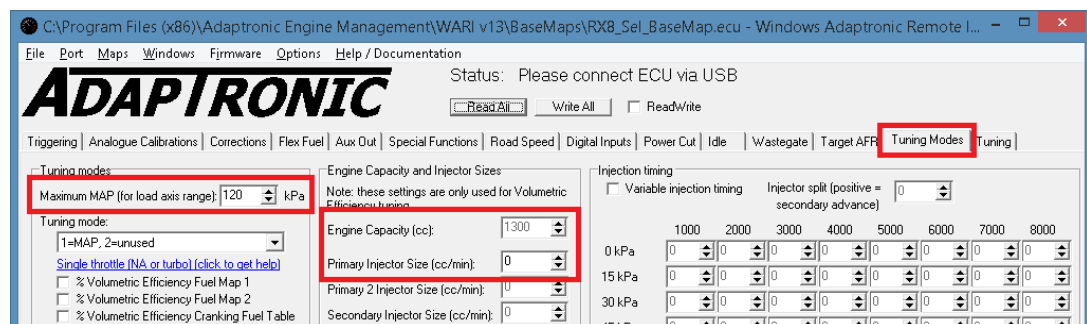
Setup / installation procedure

Notes:

1. If you're doing your own tuning, we recommend replacing the front O2 sensor with a wideband lambda sensor.
2. The factory ECU requires the airflow meter for idle control.
3. If the idle speed needs to be changed due to porting, we recommend using a reflashing tool e.g. MazdaEdit from Epifan.com to do this.

1. Making a basemap for your car

1. Download and install the WARI software from <http://adaptronic.com.au/downloads>
2. Connect the ECU to the laptop, and configure the communications as detailed in the separate USB communications setup guide
3. Once the ECU is communicating with your PC, it will read all the settings out of the ECU to give you a starting point.
4. Go to File -> Open, and navigate to C:\program files (x86)\Adaptronic Engine Management\WARI\Basemaps, and choose 'RX8_Sel_Basemap.ecu', and then click 'Open'. The basemap is then loaded into the ECU.
5. Then Go to the "Tuning modes" tab in the software and update any changes you have made to the engine capacity and injector size.



6. Change the "Maximum MAP" value to a bit higher than the maximum MAP that you will be using. For example if you think in PSI, and you will be running 20 PSI of boost, then enter 25 PSI as the maximum MAP to scale the maps appropriately. If you think in kPa, then if your maximum is 250 kPa then enter 270 or 300 kPa as your maximum.

2. Connect the ECU

1. Locate the factory ECU and remove the cover of the box.



Remove these 3 screws and the retaining clips to expose the factory ECU. If the car is already fitted with the interceptor ECU, it will look like this:



2. Disconnect the interceptor plugin and connect the Adaptronic ECU and factory ECU. To fit both ECUs into the factory enclosure, the factory ECU brackets must be removed, and the ventilation duct sawn off at the air inlet:



The factory loom (5 plugs) must be disconnected from the factory ECU, and plugged into the Adaptronic ECU. The Adaptronic ECU then plugs into the factory ECU, and the factory ECU placed back in the enclosure with the Adaptronic ECU on top. This is what it will look like with the ECUs laid out flat.



3. Put it all back together. The two ECUs in the factory ECU location should look like this before the lid is replaced.



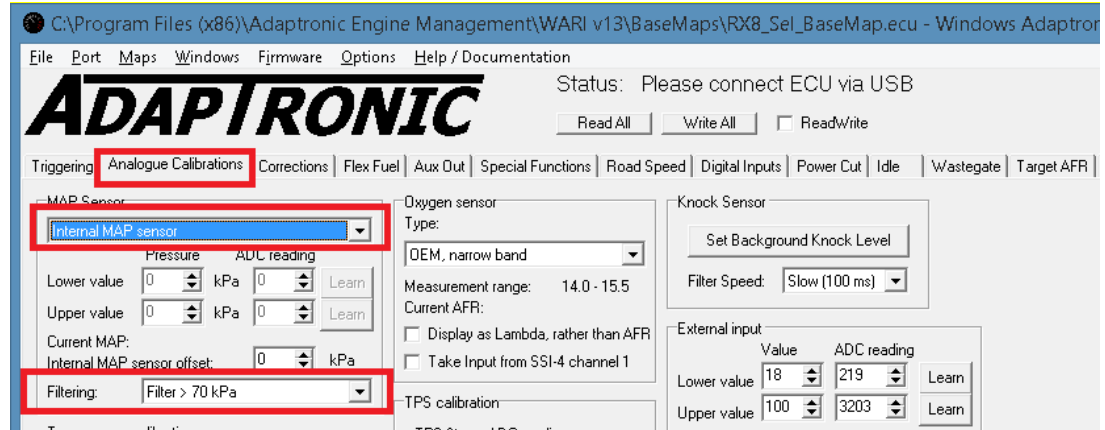
4. Connect MAP sensor hose. The MAP sensor should be connected just after the throttle body on the intake plenum. The MAP sensor hose should be run through the rubber grommet at the back of the factory ECU enclosure to the barb on the Adaptronic ECU.



3. Calibrate MAP Sensor

When you're using the internal MAP sensor (in the ECU)

1. Turn the ignition key on (engine not running).
2. On WARI software, go to Analogue Calibrations.
3. Choose 'Internal MAP sensor' from the dropdown list for the MAP sensor.
4. Check if it reads close to 101kPa (or close to 0 psi/inHg).
5. Adjust the up/down arrow of the internal MAP sensor offset to have a MAP reading of 101kPa at atmospheric pressure



4. Configure Injector Current (if using > 4 injectors)

All the RX8 series 1 need 1.9A setting, and this is in the base map. The 4-port only has 4 injectors but 2 injectors are connected to Injector output 4.

1. Under Triggering tab, click Triggering settings.
2. Set injector current setting to 1.9 Amps

The screenshot shows the 'Trigger Setup' software interface. The 'Injector Control' section is highlighted, showing the 'Injector Current' dropdown menu set to '1.9 Amps'. The 'Ignition Control' section is also visible, showing 'Ignition Output Sense' set to 'Falling Edge (Normal igniter)' and 'Ignition Output Pattern' set to 'Direct Fire 2-Rotor'. The 'Ign3 output' is set to 'Ign 3'. A note in red text states: 'Note: Aux 1 will not be available (used internally for timing)'. The 'Apply' and 'OK' buttons are visible at the bottom right.

3. Click OK.

5. Optional: Connect a boost control solenoid

Because most people are using our ECUs for turbo applications, we highly recommend using a 3 port MAC valve to control boost.



a. Installing MAC Valve

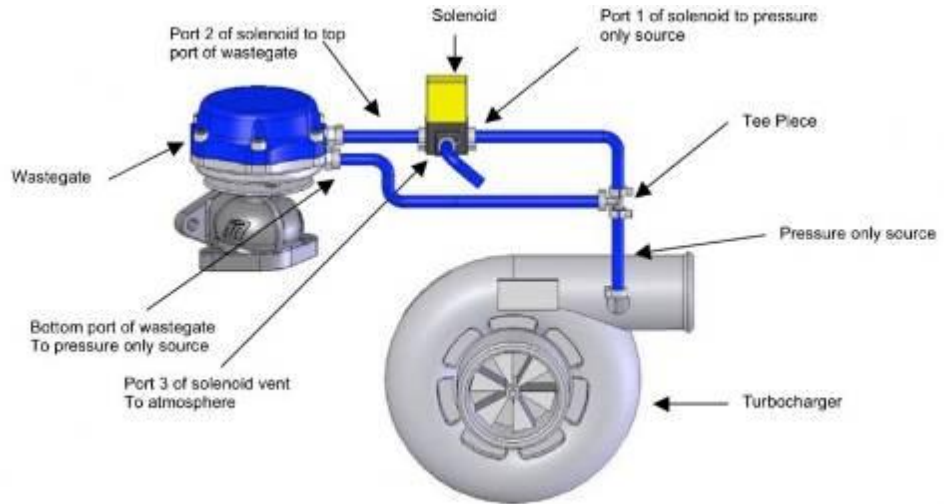
i. With a single port actuator

1. Remove the vacuum line between the compressor exit and wastegate actuator.
2. Connect compressor exit to port 3 on MAC valve with a vacuum hose
3. Connect port 2 (MAC valve) to the wastegate actuator



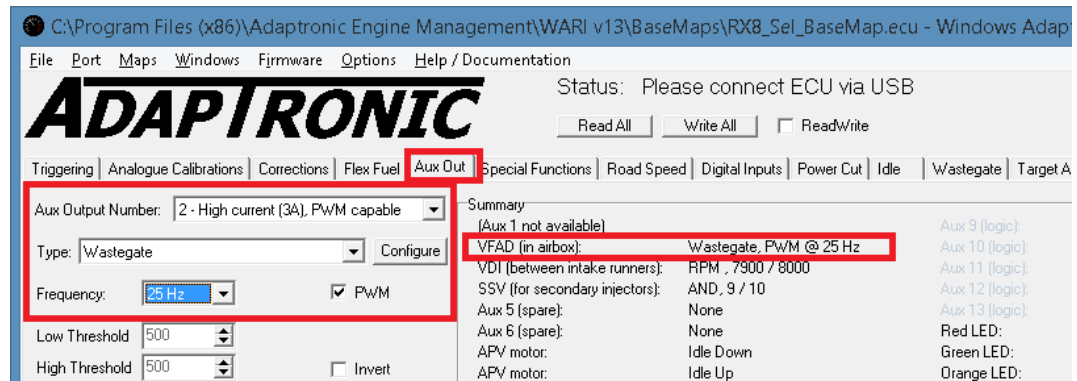
ii. With a dual port actuator

1. Remove the vacuum line between the compressor exit and wastegate actuator.
2. Connect compressor exit to both the underside of the diaphragm and port 1 on the valve using a T-piece.
3. Connect port 2 on the valve to the top side of the diaphragm

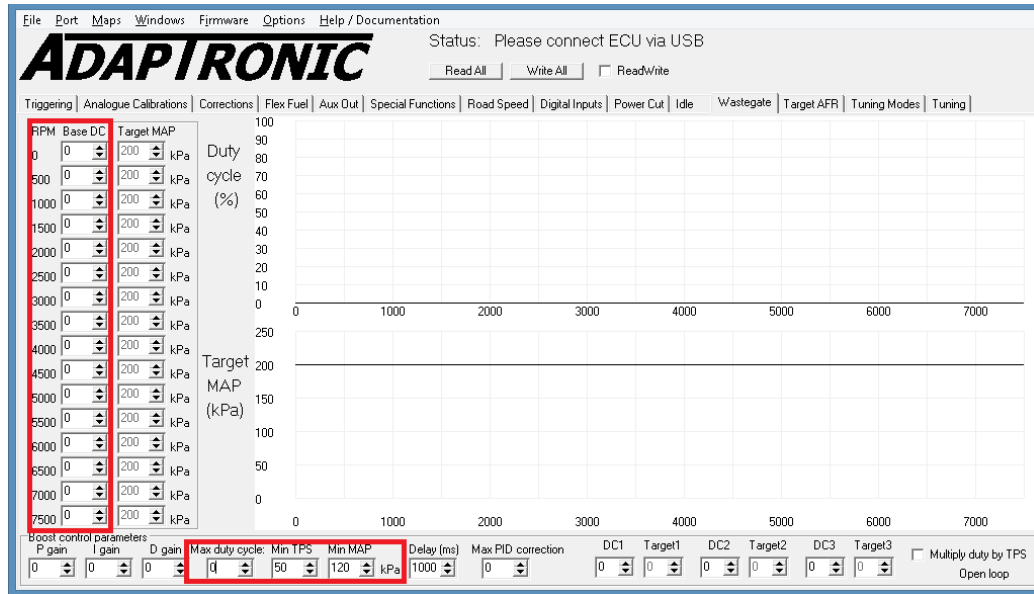


b. Set up MAC valve on the ECU and software

1. Take the two wires that go to the VFAD (variable fresh air duct) control solenoid, cut those and connect the MAC valve instead.
2. On WARI software, set Aux output 2 to 'Wastegate, PWM @ 25 Hz'.



3. Go to Wastegate tab on the software, then set the minimum throttle to 50, and MAP to 120kPa.



- Adjust the duty cycle at each RPM to obtain the desired boost curve later during tuning. Do the initial tune with the max duty cycle = 0.

6. Optional: Connect a Flex Fuel Sensor

The RX8 plugin ECU uses the CAS3 input as the flex fuel input. This pin is located in the 6-pin header inside the ECU enclosure. You need to open the ECU enclosure in order to access the pin.

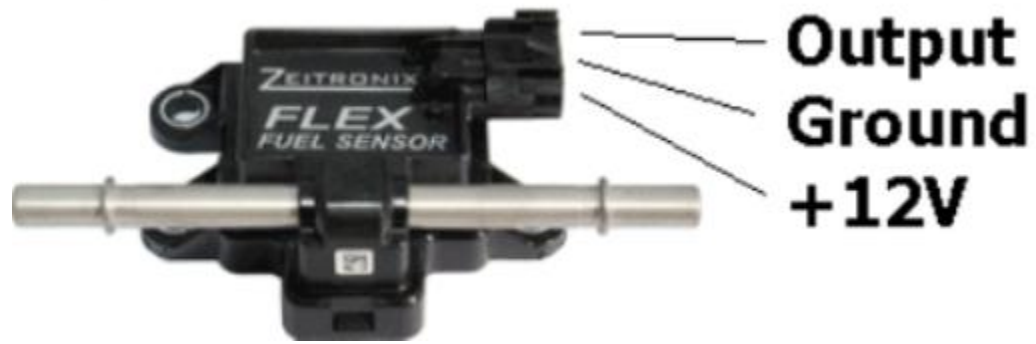
A. Open the ECU enclosure

- Remove the 8 x Philips head screws at the ends of the ECU (PH1 screwdriver required)
- Remove the endplates
- Remove the 4 x 2mm hex head screws or PH2 Philips screws in the lid of the ECU (2mm hex head / Allen key required)
- Slide out the circuit board assemble slightly (so that the MAP endplate comes away from the body) by about 4mm, so we can slide out the lid.
- You can now access the 6-pin header.

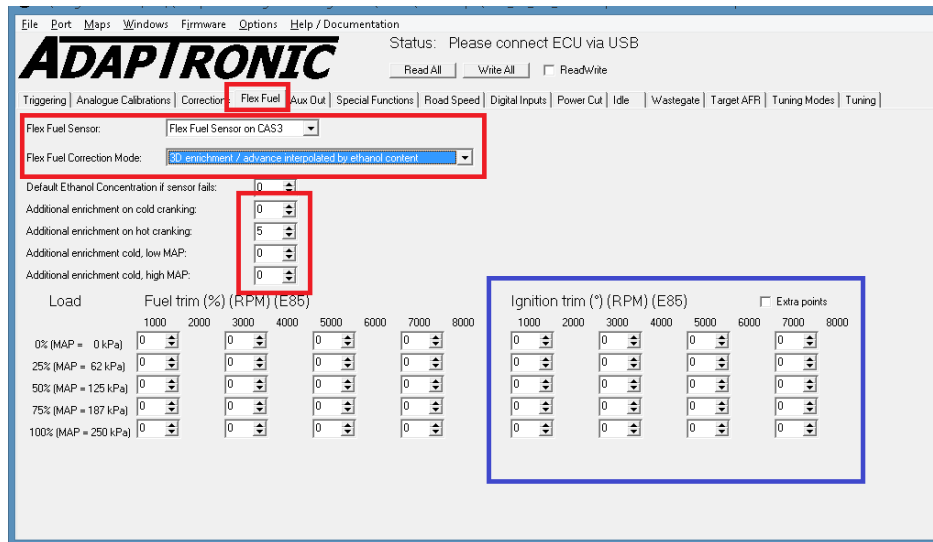


B. Connect and set up the Flex Fuel sensor

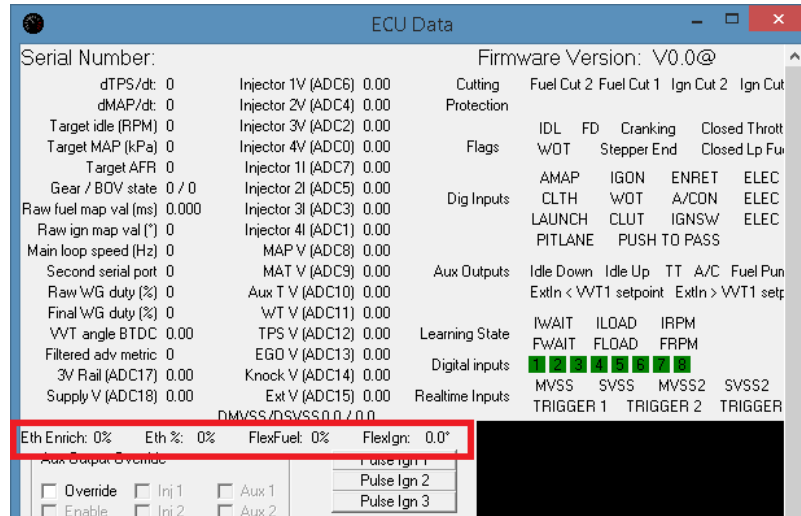
- Connect the sensor to ignition switched +12V and ground.



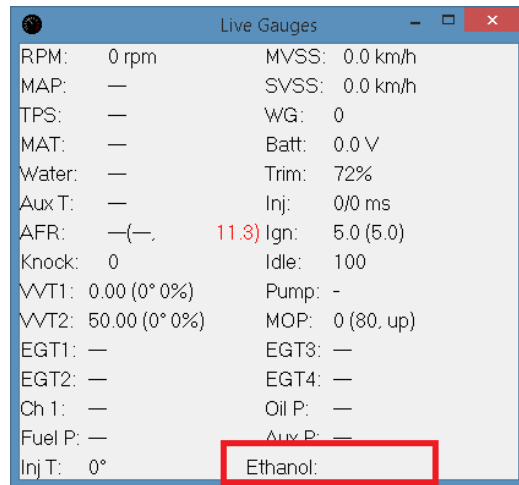
2. Connect the Flex Fuel sensor output to pin 1 – CAS3 (Flex fuel)- on the 6-pin header.
3. On WARI software, go to Flex Fuel tab, and then select ‘Flex Fuel Sensor on CAS3’ for the sensor. And then set the correction mode to ‘3D enrichment based on ethanol content’ - this allows you to map the additional ignition timing and fuel corrections against RPM and load. There are also additional enrichments for cold starting, cold throttle pump and so on.



4. When it is connected and set up, you can see in F11 window the ethanol content, the additional fuel due to the stoichiometric ratio change, and the additional fuel or ignition trim based on the correction maps. In theory the fuel correction should be zero, and this is a fine tuning adjustment, so it should be within plus or minus 10%. For more information, see <http://www.adaptronic.com.au/flex-fuel-setup/>



The Ethanol % data is also shown in F2 live gauge window and on the logs.



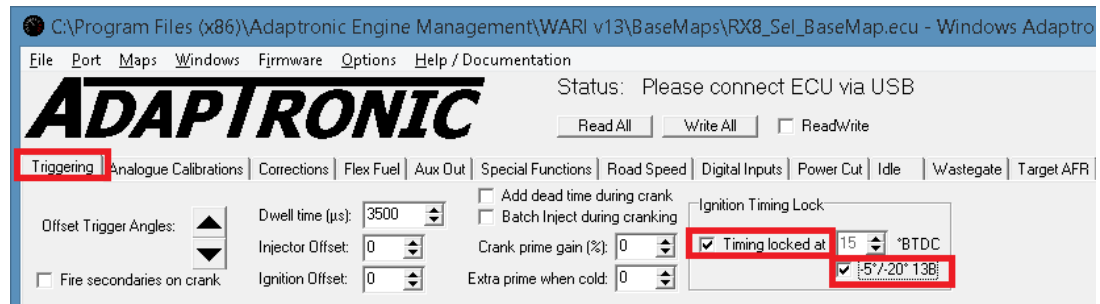
Note:

Start off with the corrections (fuel/ignition trims) at zero and adjust them later during tuning. The ECU automatically compensates for the change in stoichiometric ratio in VE tuning mode. Do the tune with E0 (petrol / gasoline) initially and then do the changes for E85.

7. Set the base timing

As important as other functions, the base timing has to be checked and adjusted as part of the setup procedure.

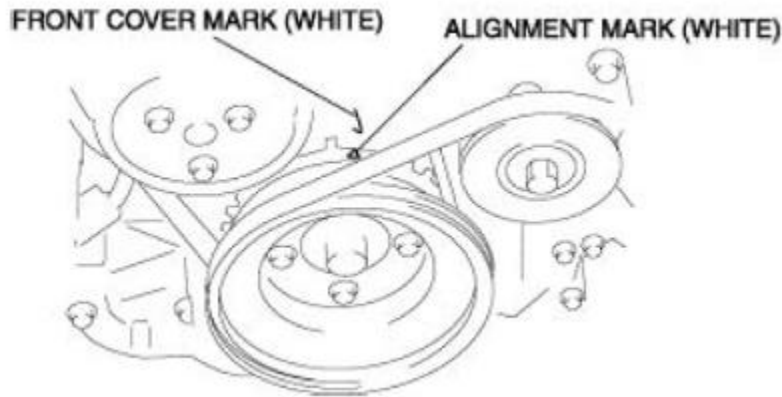
1. Check that the leads are on the correct spark plugs.
2. Get a timing light; if it requires 12V power then connect it to a 12V power source.
3. Start the engine. Use the master fuel trim up / down or throttle to allow it to idle if required.
4. Lock the ignition timing. Lock the ignition timing to “-5°/-20° BTDC” in WARI, by enabling the timing lock function and enabling tick box for 13B, as shown below. Please note that this feature is only available on WARI and firmware version 12.012 and above.



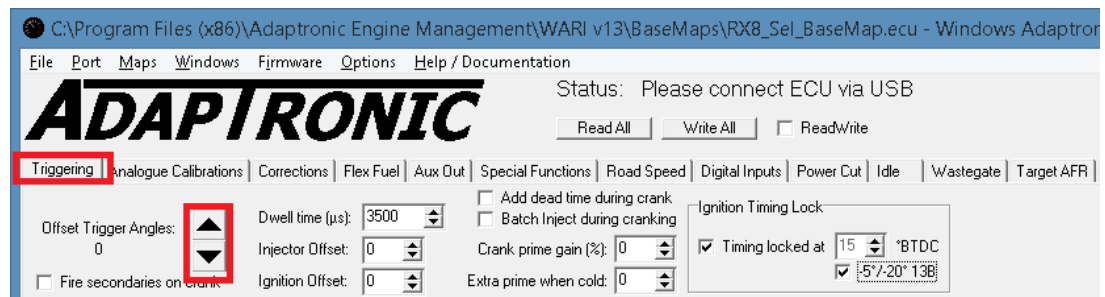
5. Clamp the timing light clamp to the high-tension lead of the front leading plug.



6. Locate the eccentric shaft position plate alignment mark (white) and the front cover mark (white).



7. Illuminate the alignment mark on the engine's crankshaft pulley, with the engine running. The mark should appear stationary when the timing light flashes.
8. Verify that the eccentric shaft position plate alignment mark and the front cover mark are aligned.
9. Adjust the timing in WARI with the trigger offset up/down arrows until the timing mark on the engine matches the ignition timing of the leading plug at 5° ATDC (-5° BTDC) using factory triggers.



10. Unlock the timing when finished.

8. Tuning

For articles about general ECU setup and tuning, see <http://adaptronic.com.au/articles>
Ensure that you set the target AFRs before you begin tuning.

The screenshot shows the Adaptronic software interface. The 'Target AFR' tab is selected and highlighted with a red box. Below it, a table shows target AFR values for different engine speeds and loads. The table is highlighted with a red border. To the right of the table, there are four red warning messages. At the bottom right, there are color-coded RPM labels: 1000 RPM (blue), 3000 RPM (green), 5000 RPM (yellow), and 7000 RPM (red).

Load	Engine speed (RPM)			
	1000	3000	5000	7000
0% (MAP = 0 kPa)	14.2	14.3	14.3	14.3
25% (MAP = 30 kPa)	14.2	14.3	14.3	14.3
50% (MAP = 60 kPa)	14.3	14.3	14.3	14.3
75% (MAP = 90 kPa)	14.0	14.0	14.0	14.0
100% (MAP = 120 kPa)	13.0	13.0	13.0	13.0

Warning: 1000 RPM, 75% load, setpoint richer than can be sensed
Warning: 3000 RPM, 75% load, setpoint richer than can be sensed
Warning: 5000 RPM, 75% load, setpoint richer than can be sensed
Warning: 7000 RPM, 75% load, setpoint richer than can be sensed

1000 RPM
3000 RPM
5000 RPM
7000 RPM

NOTE: Currently set to run open loop above 95 kPa

When tuning single throttle engines, use fuel map 1 and ignition map 1, referenced to MAP.

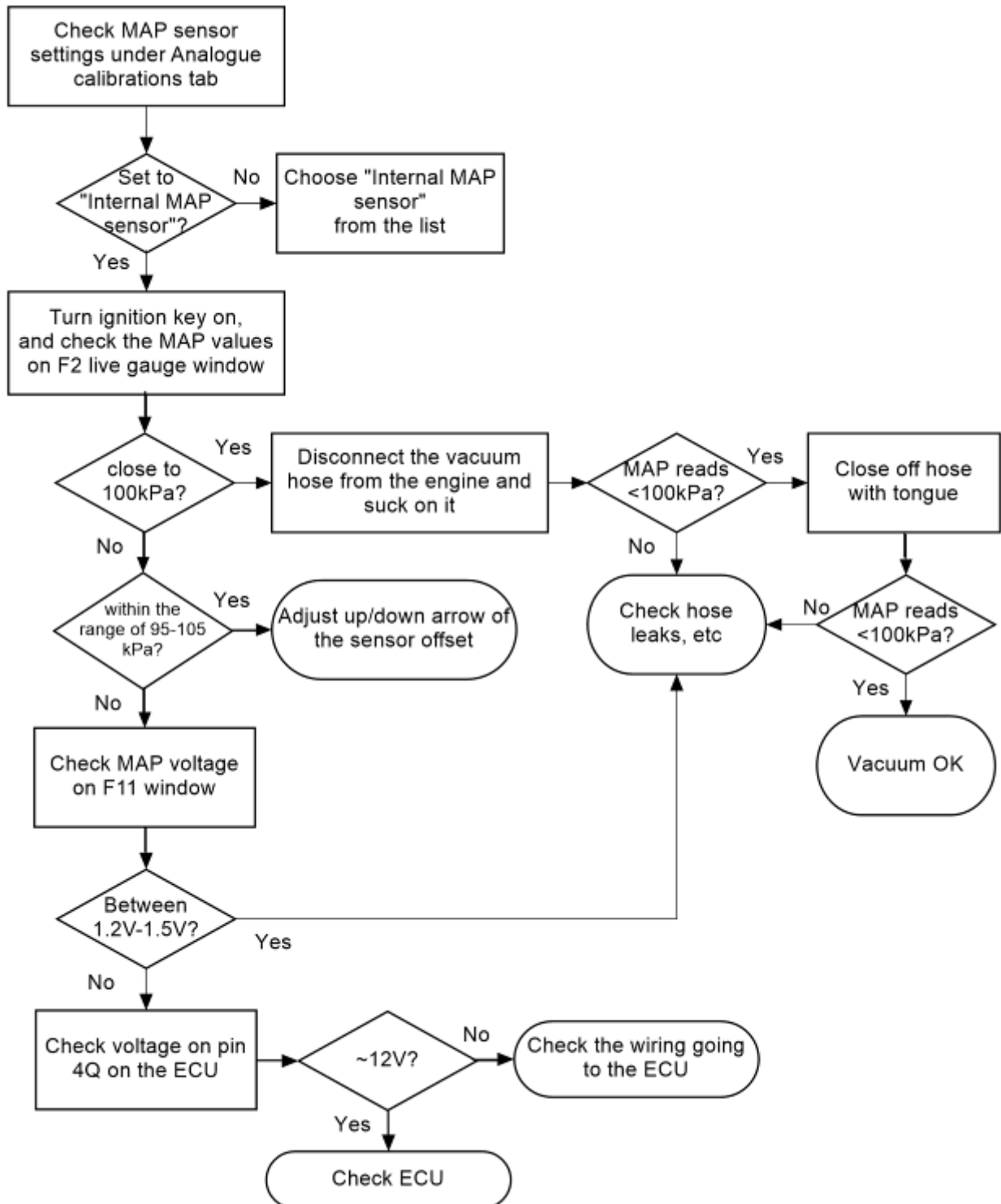
To learn more about other tuning modes, see <http://www.adaptronic.com.au/tuning-modes-and-how-to-set-them-up/>

Troubleshooting

A. Vacuum / Boost reading

With the ignition on, MAP should read about 100 kPa (or about 0 inHg / PSI)

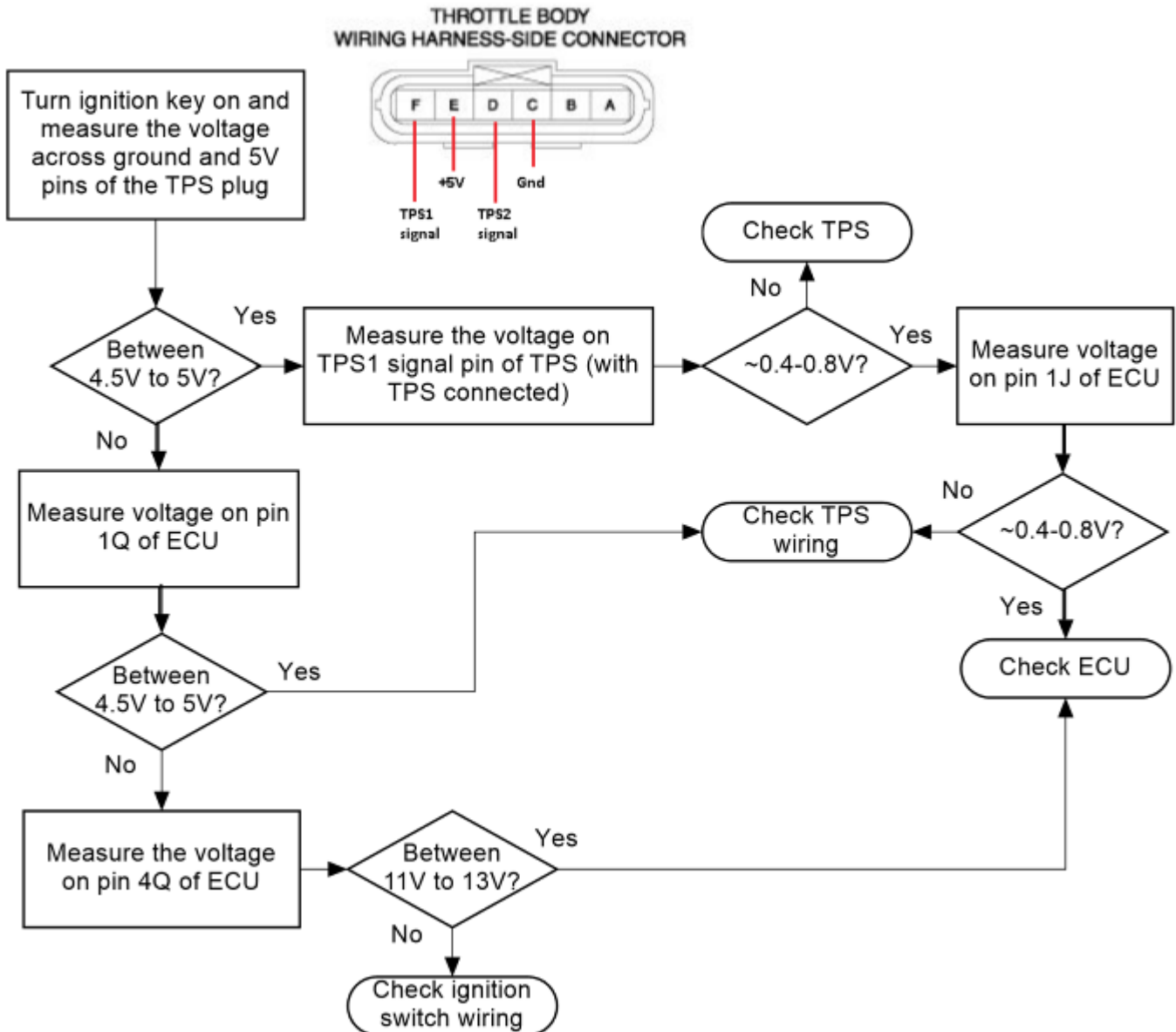
Internal MAP Sensor



B. Other Analogue Inputs

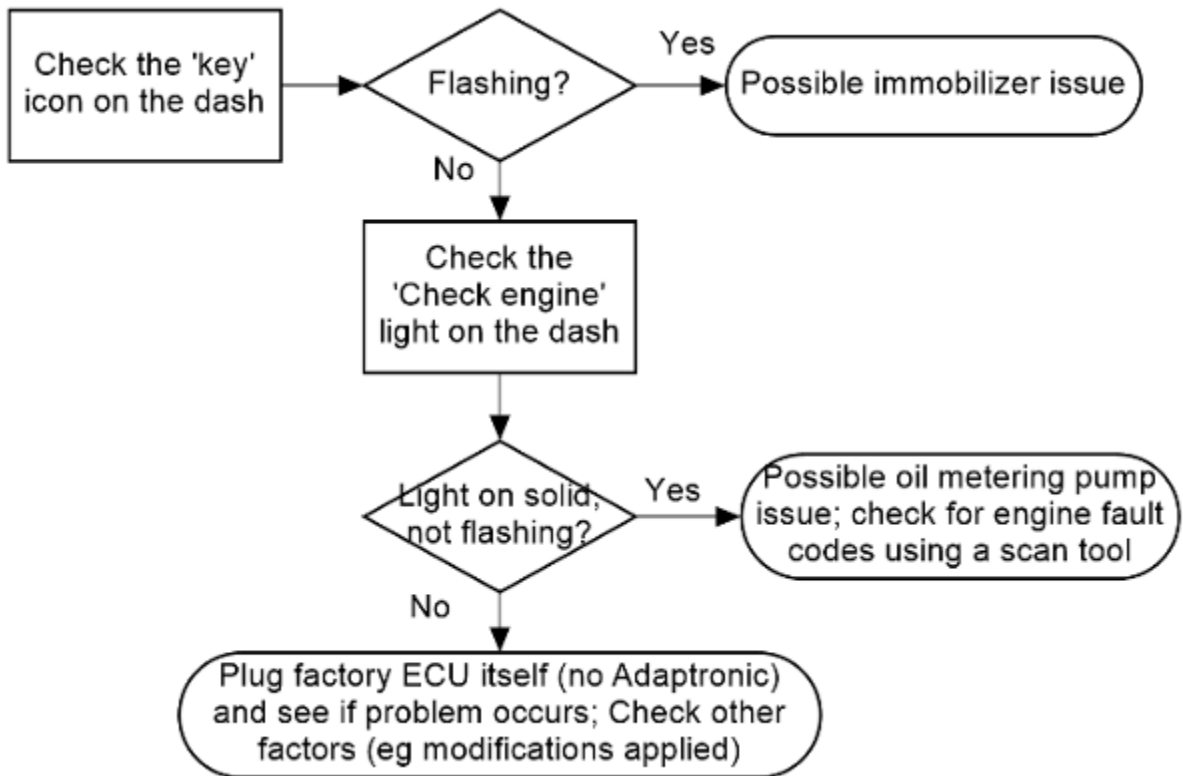
The TPS, ECT (coolant temperature), MAT (air temperature) and battery voltage should all read correctly in the software. If not, the pinouts on the later section will help you isolate the problem, and you can hit F11 in the software and see all the input voltages (to save backprobing ECU pins with a multimeter).

1. Individual sensors not reading – TPS (shows a dash)

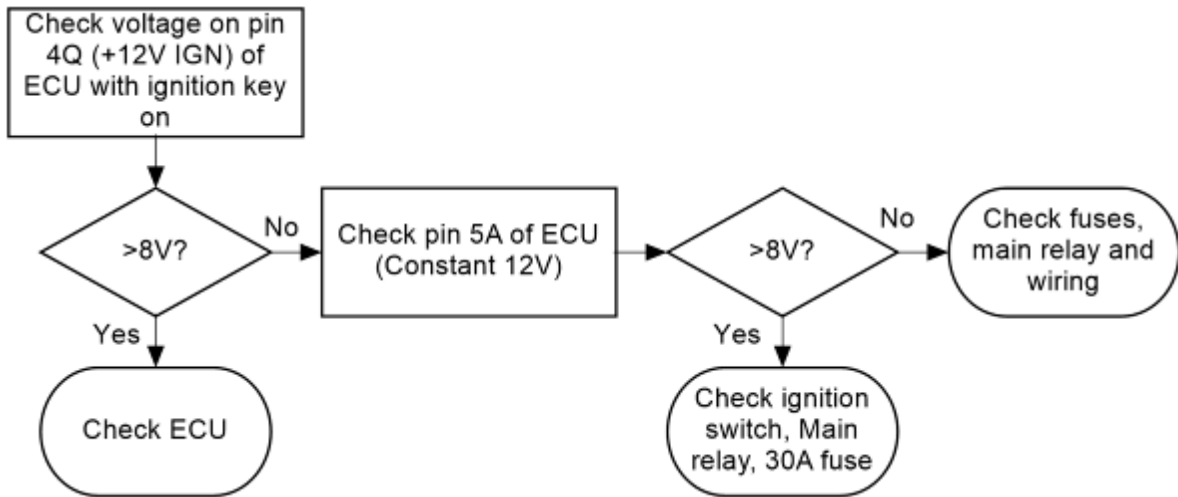


2. TPS calibration – throttle position no more than 5%

The factory ECU will hold the throttle slightly open during cranking, so you can't do the 0% calibration until it's warmed up and idling. The 100% normally is OK to do with the engine not running though. You can check that the throttle is opening all the way by pulling off the pipe and watching the throttle when someone else pushes the pedal to the floor.



3. No battery voltage on live gauges window

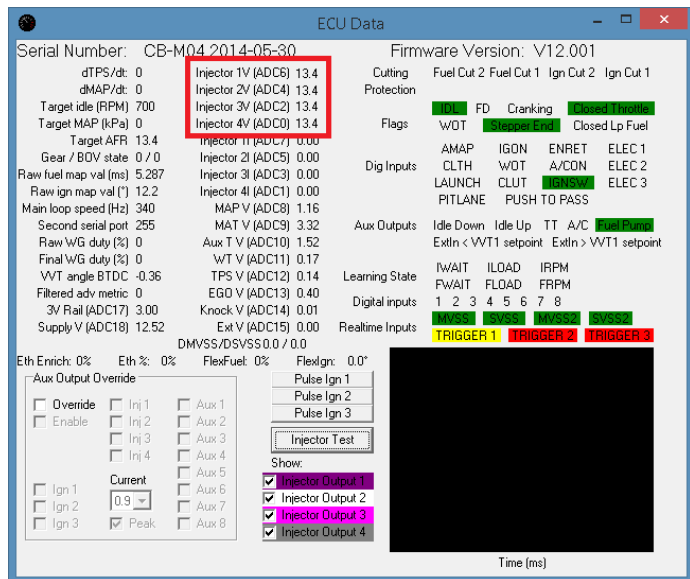


C. Injector Outputs

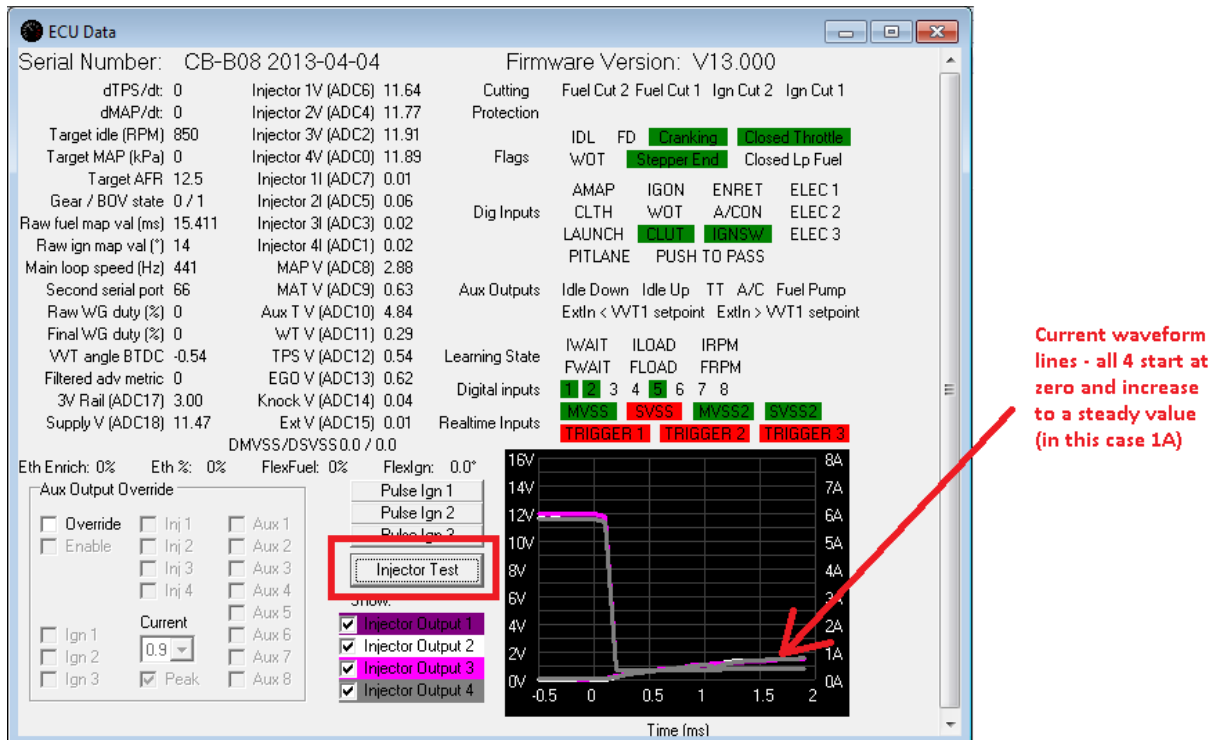
Firstly, perform an injector test. Hit F11. Check the 4 voltages for Injector outputs 1, 2, 3, 4. Each should show almost 12V except on the 4-port (automatic) – Injector 2V will show 0V then.

If one does not show battery voltage, then check the wiring and the injectors to make sure that they are connected. The injectors on each channel are given in the pinout reference section in this document.

If all show 0V, then there is no power to the injectors



If all 4 outputs show battery voltage, click “injector test” to perform a test of the injectors:



The table below shows the injector outputs and their corresponding injector wirings, but these can also be found on the pinout section later in the document.

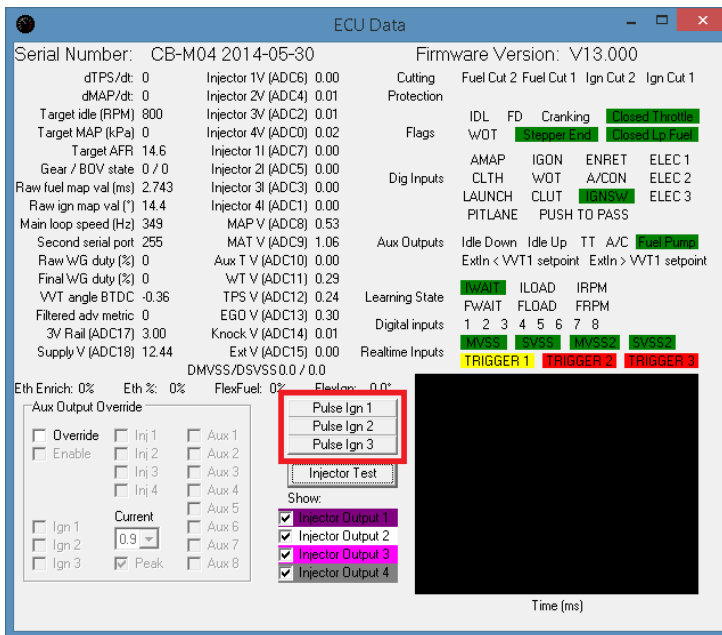
Injector Output	Injector Wiring (6-port / MSP only)
1	Primary 1, rotor 1
2	Primary 2, rotors 1 & 2
3	Primary 2, rotor 2
4	Secondary, rotors 1 & 2

The purple and pink lines will only go to about 1A, whereas the white and grey should go to 2A because they have 2 injectors on the output. If one line only has half the current as described, then the injector on that output is open circuit or disconnected.

D. Ignition Outputs

Ignition outputs can be checked by “pulsing” the ignition output on the ECU and check if the coils generate enough spark that go through the leads. On F11 window, the Pulse ignition function generates pulse signal to the ignition output so it won’t burn the coils. **USING THE OVERRIDE FUNCTION CAN DAMAGE YOUR IGNITION COILS AND /OR IGNITORS.**

1. On the engine bay, pull off the high-tension (HT) leads off the spark plug and rest it next to the rotor housing. This creates an arc about 10mm long the can jump from the lead to the rotor housing.
2. Turn the ignition key on (engine not running).
3. Connect the ECU to the laptop and then open WARI.
4. Hit F11 to show the ECU data window, and then click on ‘Pulse Ign’ as follows and check on the HT leads for the spark:

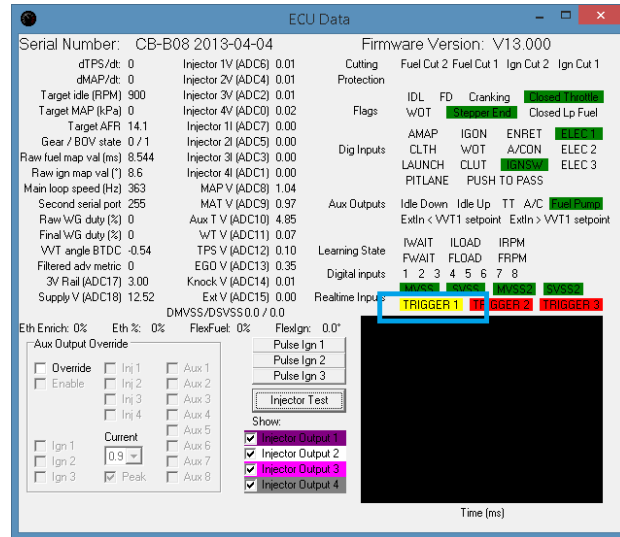


On a factory direct fire system

Pulse Ign 1	Fires the leading HT lead for the front rotor (rotor 1)
Pulse Ign 2	Fires the trailing HT lead for the front rotor (rotor 1)
Pulse Ign 3	Fires the trailing HT lead for the rear rotor (rotor 2)
There is currently no way to test the leading plug for rotor 2	

E. Crank Trigger Inputs – No RPM indication during cranking

1. Hit F11 to open the ECU data window.
2. Locate the TRIGGER1 indicator, as shown in the image on the right.
3. Record what the indicators do with ignition on, and during cranking.



The following table tells you what to check depending on each condition. X = don't care

TRIGGER1, ignition on	TRIGGER1, cranking	Action to take
Green	X	Check that your map has "Reluctor" selected for trigger 1, or reload your base map.
Yellow	X	Check wiring for trigger 1; it looks as though it's shorted to an oscillating signal
Red	Green	Check the connection between the CAS signal wires and the ECU if shorted to a voltage source
Red	Green	Check connection between CAS 1 signal and ECU if shorted to a voltage source
Red	Red (Constant)	Check that CAS 1 is plugged in. If that's still no good, then check the connection between the CAS 1 signal wires and the ECU
Red	Yellow	Correct operation. If this doesn't give you an RPM reading on the F2 gauges window, then reload your base map.

F. APV Motor not functioning

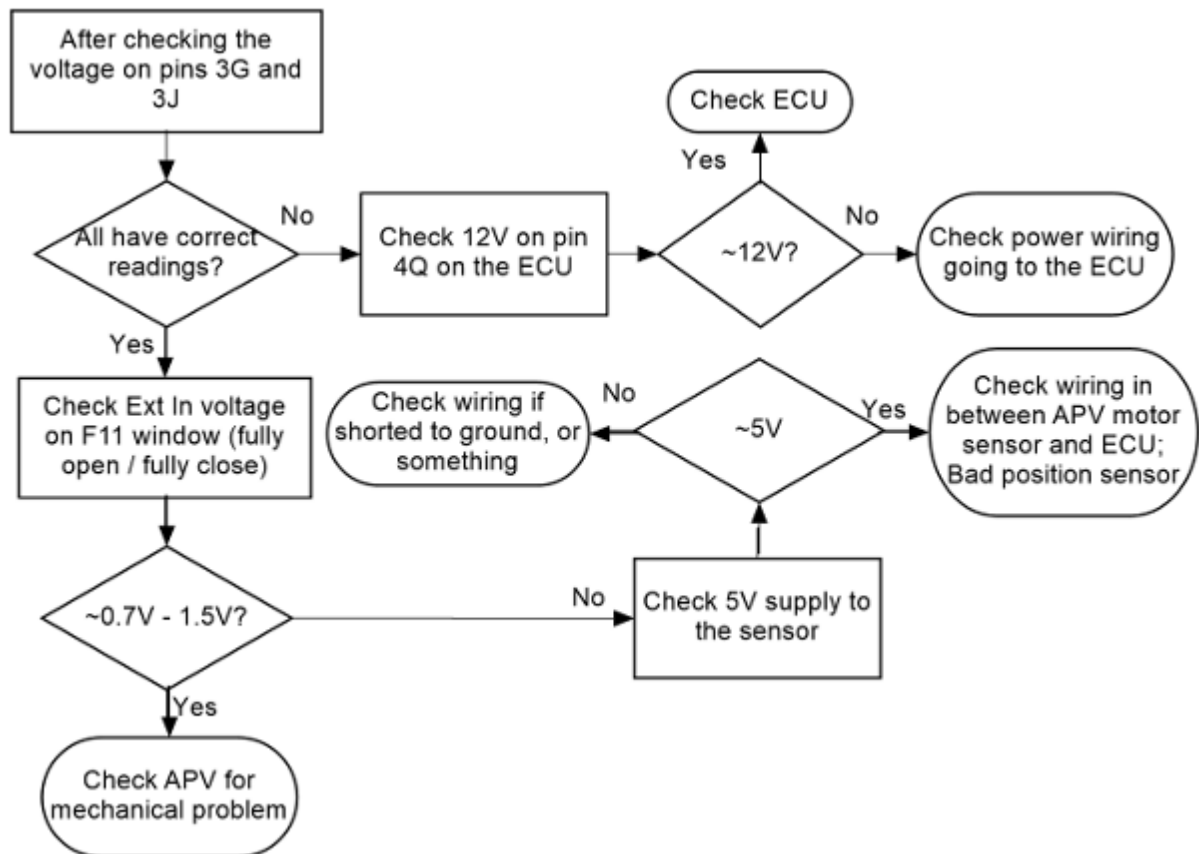
When the motor doesn't really seem to move, test the APV outputs of the ECU. **Please note that you shouldn't leave the motor on for more than few seconds, because that will burn out the APV motor. Or unplug the motor before doing the test.**

1. Set Aux output 7 (Idle Down) and 8 (Idle Up) to 'None' – make sure 'Invert' is not selected
2. Measure the voltage at pins 3G and 3J on the ECU

The following table shows the approximate voltages that we expect in the different conditions:

Condition	Pin 3G	Pin 3J
Aux 7 and 8 set to 'None'	12V	12V
Click 'Invert' on Aux 7, but Aux 8 still 'none'	0V	12V
Both Aux 7 and 8 inverted	0V	0V

3. Set the Aux outputs 7 & 8 (APV Motor) back to their original functions (Idle Down and Idle up, respectively)



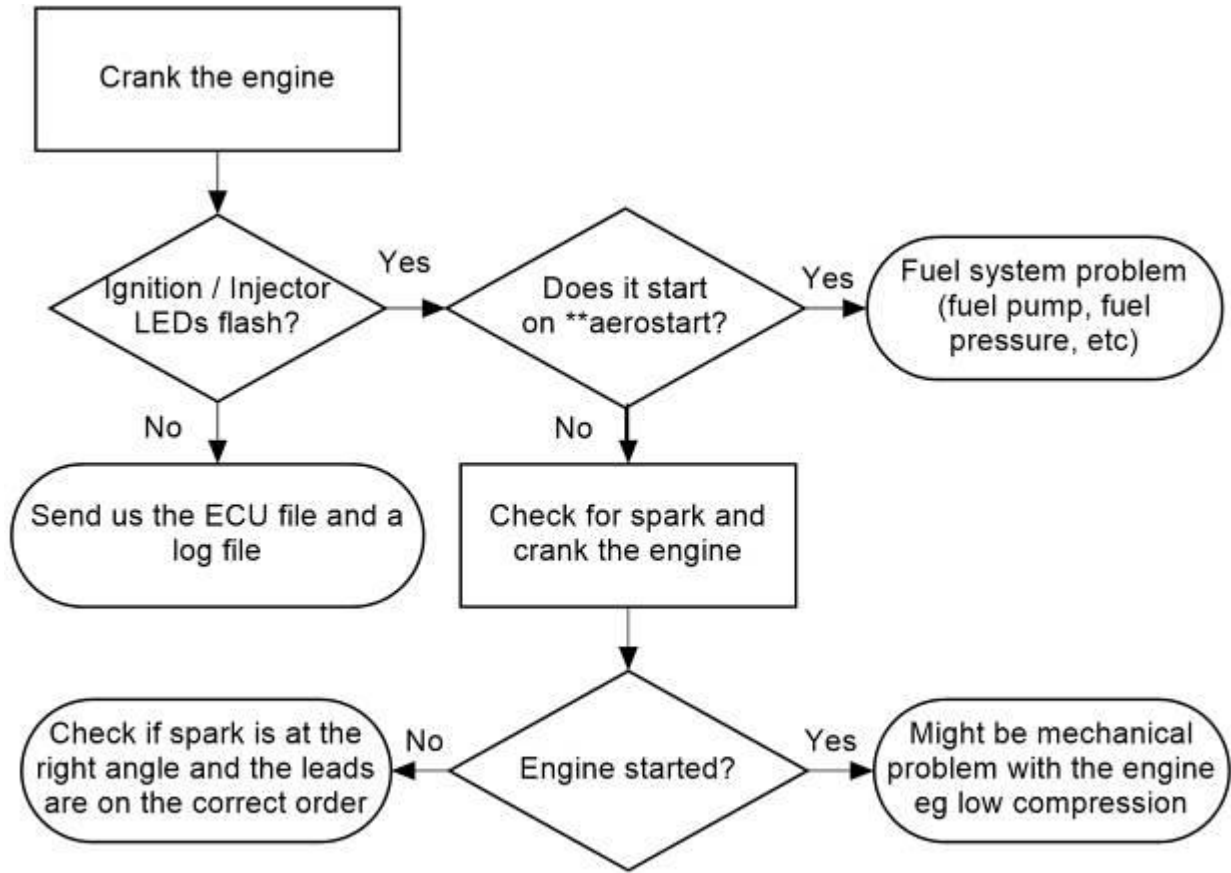
G. Constant flashing of LED from inside the ECU

If there's a constant flashing that appears to come from inside the ECU as soon as it has 12V power or USB connection, this means that a map for a different ECU has been loaded into this ECU. If you are sure that you have the correct map for this ECU, then go to the hidden menu beside "Help", and select the item "ECU ID". Choose the correct ID ("2 RX8") for the ECU displayed in the "ECU connected" display on the main window.

H. Does not start

Check all the above troubleshooting guides, especially the injector and ignition output tests and the RPM test. If you've done that then you've established that we have:

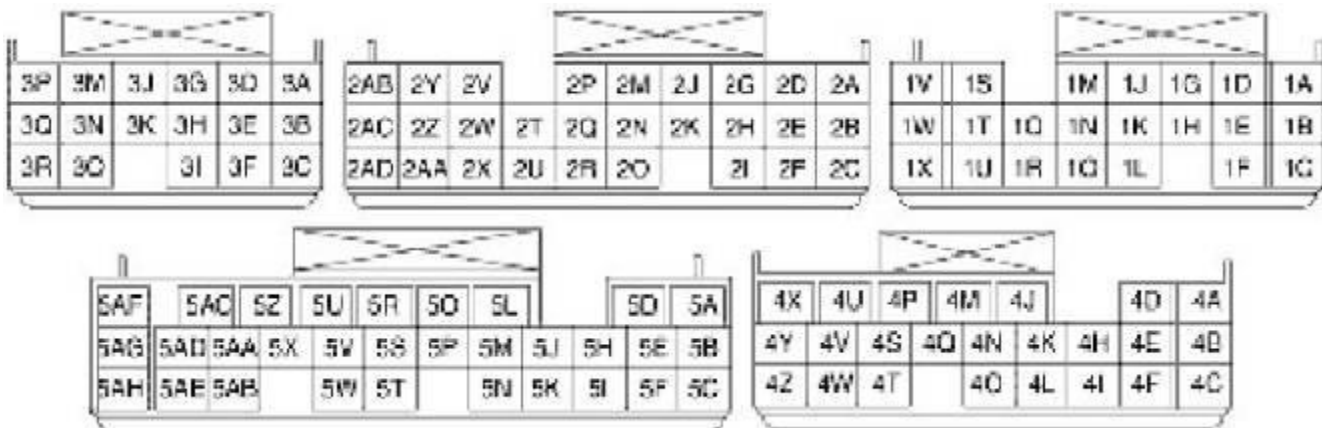
1. All sensors reading correctly (battery voltage, TPS, MAP, RPM during cranking)
2. Injectors go "click" when we perform an injector test
3. Coils and spark plugs fire when we perform an ignition test



** "Aerostart" / brake cleaner / carby cleaner / starter fluid

Pinout references

Pin numbering from loom side of plug (looking into ECU)



Factory Pin	Factory Function (NC means No Connection in factory loom)	Adaptronic Pin (blank means no connection to Adaptronic)	Still connected to factory ECU?	Comments
1A	NC			
1B	Drive-By-Wire throttle control		Yes	
1C	Drive-By-Wire throttle control		Yes	
1D	SSV switch		Yes	
1E	NC			
1F	Knock sensor -		Yes	
1G	Knock sensor shield		Yes	
1H	NC			
1J	Throttle position sensor 1		Yes	
1K	NC			
1L	SSV solenoid valve	Aux Output 4	No	Secondary Side Valve
1M	Throttle position sensor 2		Yes	
1N	NC			
1O	Air solenoid valve		Yes	
1Q	Throttle Position Sensor power		Yes	
1R	NC			
Factory Pin	Factory Function (NC means No Connection in factory loom)	Adaptronic Pin (blank means no connection to Adaptronic)	Still connected to factory ECU?	Comments
1S	APV position sensor power		Yes	
1T	Knock sensor +	Knock signal input	Yes, shared with both ECUs	
1U	Sensor ground	Sensor Ground	Yes, shared with both ECUs	
1V	Front O2 sensor heater		Yes	
1W	VDI solenoid valve	Aux Output 3	No	Variable Dynamic Intake
1X	NC			
2A	Rear O2 sensor heater		Yes	
2B	O2 sensor ground		Yes	

2C	Front O2 sensor signal		Yes	
2D	Rear (Rotor 2) secondary injector	Injector Output 4	No	Secondary injectors for rotors 1 and 2 fire together
2E	Oil Pressure switch		Yes	
2F	Throttle Position Sensor ground		Yes	
2G	Front (Rotor 1) secondary injector	Injector Output 4	No	Secondary injectors for rotors 1 and 2 fire together
2H	Sensor shields		Yes	
2I	Generator control		Yes	
2J	Rear (Rotor 2) primary injector 1	Injector Output 3	No	
2K	Engine Coolant Temperature sensor	ECT signal input	Yes, shared with both ECUs	
2M	Front (Rotor 1) primary injector 1	Injector Output 1	No	
2N	Oil Metering Pump switch		Yes	
2O	Neutral switch	Digital Input 2	Yes, shared with both ECUs	
2P	Purge solenoid valve		Yes	
2Q	Rear O2 sensor signal	O2/EGO signal input	Yes, shared with both ECUs	
2R	Oil Level switch		Yes	
2T	Generator control		Yes	
Factory Pin	Factory Function (NC means No Connection in factory loom)	Adaptronic Pin (blank means no connection to Adaptronic)	Still connected to factory ECU?	Comments
2U	Eccentric shaft position sensor +	CAS 1 input	Yes, shared with both ECUs	Reluctor trigger for ignition timing
2V	Oil Metering Pump		Yes	
2W	Oil Metering Pump		Yes	
2X	Eccentric shaft position sensor -		Yes	
2Y	Oil Metering Pump		Yes	
2Z	Rear (Rotor 2) leading ignition	Ignition output 4	No	Aux Output 1 cannot be used due to the fourth ignition output
2AA	Front (Rotor 1) leading ignition	Ignition output 1	No	
2AB	Oil Metering Pump		Yes	

2AC	Rear (Rotor 2) trailing ignition	Ignition output 3	No	
2AD	Front (Rotor 1) trailing ignition	Ignition output 2	No	
3A	Front (Rotor 1) primary 2 injector	Injector Output 2	No	The Adaptronic ECU fires both primary 2 injectors together
3B	APV position sensor	0-5V Ext/Spare input	Yes	
3C	NC			
3D	Rear (Rotor 2) primary 2 injector	Injector Output 2	No	The Adaptronic ECU fires both primary 2 injectors together
3E	NC			
3F	NC			
3G	APV motor control	Controlled by Aux Output 7 via additional high current circuitry inside the Adaptronic ECU	No	Auxiliary Port Valve
3H				
3I				
3J	APV motor control	Controlled by Aux Output 8 via additional high current circuitry inside the Adaptronic ECU	No	Auxiliary Port Valve
Factory Pin	Factory Function (NC means No Connection in factory loom)	Adaptronic Pin (blank means no connection to Adaptronic)	Still connected to factory ECU?	Comments
3K	NC			
3M	NC			
3N	NC			
3O	NC			
3P	NC			
3Q	NC			
3R	NC			
4A	Ground	Power Ground	Yes, shared with both ECUs	
4B	NC			
4C	Power from Drive-By-Wire relay		Yes	
4D	NC			

4E	Main Relay enable		Yes	
4F	Clutch switch	Digital Input 1	Yes, shared with both ECUs	
4H	NC			
4I	NC			
4J	Ground	Power Ground	Yes, shared with both ECUs	
4K	Barometric sensor power		Yes	
4L	NC			
4M	Fuel pump speed control		Yes	
4N	NC			
4O	Air pump relay		Yes	
4P	Brake switch		Yes	
4Q	Ignition switch	+12V Ignition	Yes, shared with both ECUs	
4S	CAN low		Yes	
4T	Coolant Level switch		Yes	
4U	Sensor ground		Yes	
4V	CAN high		Yes	
4W	High/Low A/C control		Yes	
4X	APP sensor power 2		Yes	
4Y	APP sensor power 1		Yes	
4Z	Medium A/C control		Yes	
5A	Starter		Yes	
5B	NC			
5C	APP sensor 2		Yes	
Factory Pin	Factory Function (NC means No Connection in factory loom)	Adaptronic Pin (blank means no connection to Adaptronic)	Still connected to factory ECU?	Comments
5D	Ground	Power Ground	Yes, shared with both ECUs	
5E	NC			
5F	APP sensor 1	Aux temp input	Yes	
5H	Drive-By-Wire relay		Yes	
5I	NC			
5J	Constant power		Yes	
5K	Intake air temperature sensor	Air Temp signal input	Yes, shared with both ECUs	
5L	Fuel pump relay		Yes	
5M	NC			

5N	Air flow meter signal	MAP signal input	Yes, shared with both ECUs	AFM signal pin can be used for MAP signal when fitting an external MAP sensor
5O	Ground	Power Ground	Yes, shared with both ECUs	
5P	Fuel pump relay		Yes	
5R	Ground	Power Ground	Yes, shared with both ECUs	
5S	Barometric pressure sensor		Yes	
5T	Ground	Power Ground	Yes, shared with both ECUs	
5U	Intake air temperature sensor ground		Yes	
5V	Cruise control switch		Yes	
5W	A/C amplifier		Yes	
5X	Cooling fan relay 1		Yes	
5Z	VFAD solenoid valve	Aux Output 2	No	Variable Fresh Air Duct
5AA	Aircon relay		Yes	
5AB	APP sensor ground 2		Yes	
5AC	Power from Main Relay		Yes	
5AD	Cooling fan relays 2 and 3		Yes	
5AE	APP sensor ground 1		Yes	
5AF	Power from Main Relay		Yes	
Factory Pin	Factory Function (NC means No Connection in factory loom)	Adaptronic Pin (blank means no connection to Adaptronic)	Still connected to factory ECU?	Comments
5AG	NC			
5AH	NC			

The following spare Adaptronic pins can be accessed by removing the ECU lid and fitting a plug on the 6-pin or 8-pin headers:

8-pin header

Pin	Description	Comments
1	Sensor 5V supply	
2	Sensor Ground	
3	MAP signal	Connected to the Air Flow Meter signal pin (pin 5N)

4	Air Temperature signal	Connected to pin 5K
5	MVSS1 (master vehicle speed sensor 1)	
6	MVSS2 (master vehicle speed sensor 2)	
7	SVSS1 (slave vehicle speed sensor 1)	
8	SVSS2 (slave vehicle speed sensor 2)	

6-pin header

Pin	Description	Comments
1	CAS3	Can be used for flex fuel sensor input
2	Aux Temperature signal	Temperature sensors must be wired with one wire to sensor ground and the other wire to the ECU signal input
3	Aux Output 5	Low current, only suitable for low current loads such as relay coils
4	Aux Output 6	Low current, only suitable for low current loads such as relay coils
5	Digital Input 7	
6	Digital Input 8	