# ecutek

# ProECU EVO X



# Tuning Guide

# 2008-onward Model Year

v1.8

# Contents

# ECU Map Descriptions

## 3D Maps

### Fuel Maps – Shown in Live Data as Injector % and Injector ms

The fuel maps contain AFR data, based on RPM and calculated engine load. When altering fuel maps, bear in mind that the AFRs are only theoretical, they are calculated AFR, and that the ECU will operate in open loop fuelling mode when on full power.

For this reason, add and remove fuel in small increments, and watch for changes in actual AFR, based on wideband lambda readings. ALL tuning should be checked with a wideband Lambda sensor.

The A/F Ratio is only under closed loop control on part throttle.

Generally once the vehicle makes positive boost pressure the AFR is in open loop and reading from the Calculated Fuel Table. Changing something simple like Fuel pressure from say 3.0Bar to 4.0Bar would make this table inaccurate, bear this in mind.

### High Octane

This fuel map is used when there is no detonation detected. If the ECU has been tuned properly, this is the only fuel map that will be accessed.

### Low Octane

If continuous detonation occurs or a serious CEL occurs the ECU will default to this map. Make sure that the values in this map are 'richer' in positive pressure than the 'high octane' map.

### Ignition Maps

**NOTE: Shown in Live Data as Ignition Timing degrees**

These maps contain the ignition timing values, based on RPM and calculated engine load. Detonation should always be listened for, as the ECU will remove Ignition timing if detonation occurs. This is shown under Live Data in Ignition Degrees as the Knock Retard value.

The ECU uses the High Octane ignition map after ECU programming.

The ECU uses the LIVE DATA value called LEARNT RETARD to bias between the High and Low Octane Ignition maps.

If the LEARNT RETARD value shows 100 then 100% of the High Octane Fuel Map will be used in the Ignition timing calculation. If the LEARNT RETARD values shows 80% then 80% of the High Octane map lookup will be used and 20% of the Low Octane Fuel map will be used

**Example:**

Assume the High Octane Ignition map is filled completely with 20 degrees and Low Octane filled with 10 Degrees (FOR EXAMPLE ONLY, NEVER TRY THIS!!)

If the LEARNT RETARD value is 100% then the Ignition timing would be 20 degrees.

If the LEARNT RETARD value is 80% then the Ignition timing would be 18 degrees.

(80% of 20deg = 16 degrees) PLUS  (20% of 10deg = 2 degrees),  therefore 16+2 = 18 degrees.

If the LEARNT RETARD value is 50% then the Ignition timing would be 15 degrees.

   (50% of 20deg=10deg PLUS (50% of 10deg=5deg) = 15 degrees.

If the LEARNT RETARD value is at 30% then you have far too much detonations and further investigation is needed!

If the ECU is detecting knocking and the KNOCK RETARD VALUE is showing continuous correction then the LEARNT RETARD will start to decrease.

## Inlet VVT (MIVEC)

**NOTE: Shown in Live Data as Intake VVT Angle**

This map controls the angle of the intake cam (note that 1 degree at the camshaft is 2 degrees at the crankshaft). This number is in camshaft degrees <u>before</u> Top Dead Centre. Modifying the cam timing map can increase power and turbo response, but too much advance can significantly increase in cylinder pressures. This is dependent on Camshafts, Turbocharger and naturally any item which will change.

In our experience only Inlet VVT#1 is used. Log files should always be checked to ensure that Inlet VVT#2 map is not being used.

## Exhaust VVT (MIVEC)

**NOTE: Shown in Live Data as Exhaust VVT**

This map controls the angle of the Exhaust cam (note that 1 degree at the camshaft is 2 degrees at the crankshaft). This number is in camshaft degrees <u>before</u> Top Dead Centre. Modifying the cam timing map can increase power and turbo response, but too much advance can significantly increase in cylinder pressures. This is dependent on Camshafts, Turbocharger and naturally any item which will change.

In our experience only Exhaust VVT#1 is used. Log files should always be checked to ensure that Exhaust VVT#2 map is not being used.

## Primary Wastegate Duty#1-#3

**NOTE: Shown in Live Data as Wastegate 1**

The maximum allowed wastegate solenoid duty at each RPM point against Throttle position. This map is used to reduce the Primary Wastegate Duty Solenoid open time.

#1 is very low speed (1st gear), maps #2 and #3 are higher speed modes (set the same values in map #2 and #3)

## Desired Engine Load #1-#3

**NOTE: Shown in Live Data as Engine Load**

Boost control (Airflow/Boost Pressure) is managed by the 'Desired Engine Load' maps. Values in the table **MUST** be added to the 'Boost Control - Desired Engine Load Offset' (found under 'Data values') to see the true Desired Engine Load target. Remember this is Engine Load not Boost Pressure.

#1 is very low speed (1st gear), maps #2 and #3 are higher speed modes (set the same values in map #2 and #3)

# 2D Maps

## Boost Limit

This determines the boost limit against Engine Load. The Engine load is slightly less than ABSOLUTE Boost Pressure, so 80% Engine Load equals roughly 0 psi (or atmospheric pressure). An engine load of 200% is approximately 2.2 Bar Boost (2 Bar Absolute). Keep Boost Limit at least 20% Engine Load above your Desired Engine Load values (remember to add the Offset value to your Desired Engine Load values) but you do NOT need to add the Offset value to the 2d Boost Limit map.

## Open Loop Load

This map is still being investigated and is not yet available.

## Open Loop Load Throttle

This map is still being investigated and is not yet available.

## Injector Battery Voltage Compensation

This map is still being investigated and is not yet available.

## Turbo Dynamics

The Turbo Dynamics tables are used for 'boost' error compensation. These maps control the rate at which the wastegate duty cycle is altered (according to amount of error) in order to produce the desired level of boost. This map represents the actual change in duty cycle according to the amount of error.

Standard dynamics are set to take a large percentage of wastegate duty with only a small amount of boost error causing boost to drop very quickly. If you struggle with overboost and boost oscillations then we suggest you reduce the larger correction values in the map. This will stop the boost pressure from 'surging' either side of the target value.

## Secondary Wastegate Duty A – C

### NOTE: Shown in Live Data as Wastegate Duty 2

The maximum allowed duty for the Secondary Wastegate Solenoid at each RPM. This map is used to increase boost pressure in the midrange.

Secondary Wastegate Duty – C is used for very low speed (1$^{st}$ gear), maps A and B are higher speed modes (set the same values in map A and B).

# 1D Maps - Data Values

## Boost Control - Desired Engine Load OFFSET

The Desired Engine Load OFFSET value MUST be added to all the **3D Map** "Desired Engine Load" maps to see the correct Desired Engine Load for reference against the Fuel or Ignition tables. Increasing this value will raise all of the Boost curves together by the same amount.

### Boost Limit Timer Delay

If the Engine Load exceeds the **2D Map** 'Boost Limit' this timer must expire before the Boost cut will occur. The standard time is normally 1000milliseconds (1 second) and the maximum setting is 6375 milliseconds (just over 6 seconds). So in the standard ROM you can exceed the standard 'Boost Limit' **2D Map** for 1 second before Boost/Fuel cut will occur. This explains quite often after a full performance exhaust system has been fitted that the vehicle will Boost/Fuel cut in 5th and 6th gear around 3000 rpm as this is when maximum boost is created. If the boost does not reduce below the Boost Limit within 1 second then Fuel Cut will cut the Injectors for a split second causing complete power loss on peak torque.

### Injector Scaling

Under Development

### Rev Limit

Under Development

### Speed Limiters 1, 2, 3 (on-off)

Japanese Domestic models are normally limited to 180 KPH / 118 MPH. Speed Limiter #1 will start to close the throttle when this speed is reached. Speed Limits 2 and 3 are fuel cut and move violent in operation.

### Stationary Rev Limit – Launch Control

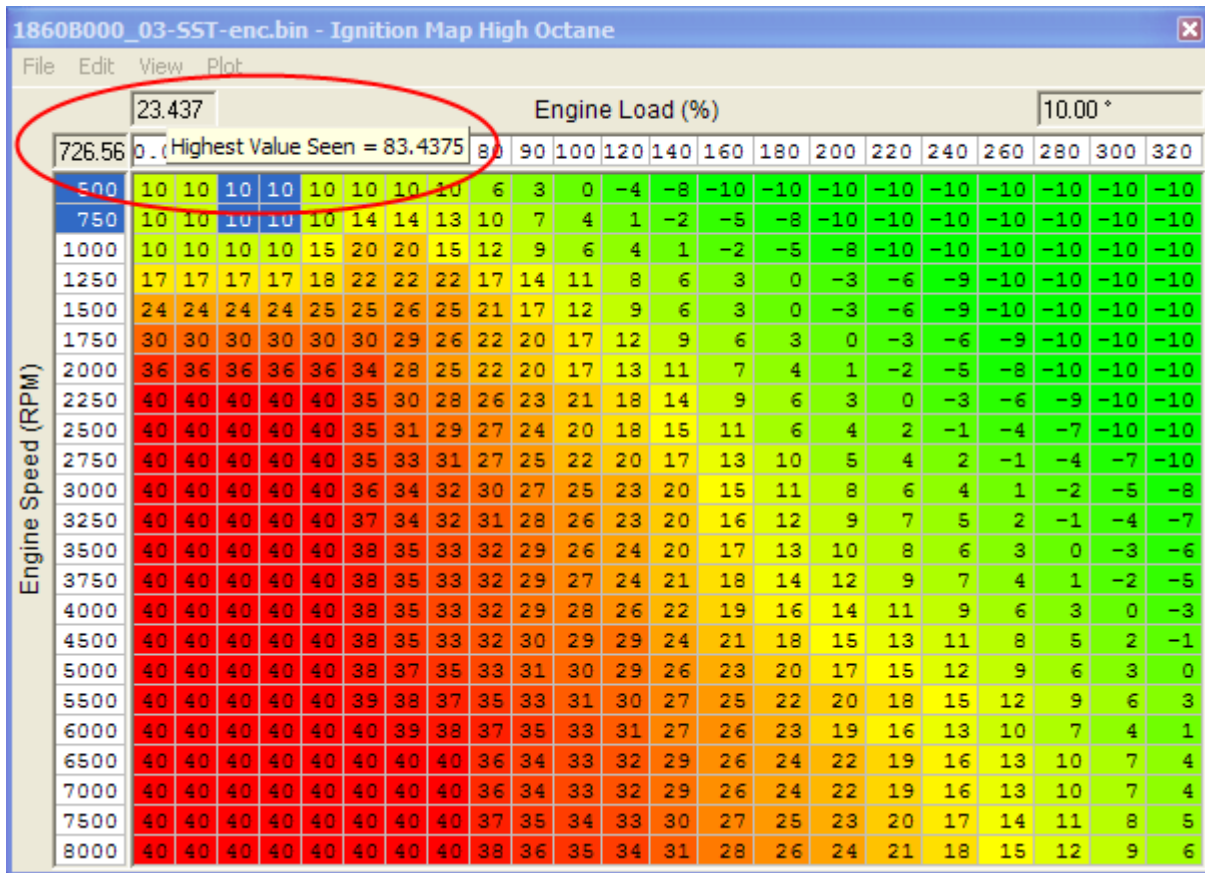Under Development

## Additional Maps

Additional maps will be added as further testing and development is carried out.

These maps will be added, with relevant help files, to new versions as we release them.

Please use the EcuTek Update regularly to receive new software versions with the updates help files.

# Map Access

After enabling Map Access, all open maps will show the value currently used in the table. *Please note that it is not possible to edit map values while Map Access is enabled*.

**1860B000_03-SST-enc.bin - Ignition Map High Octane**  ☒

File   Edit   View   Plot

23.437          Engine Load (%)          10.00 °

726.56   0.(Highest Value Seen = 83.4375)

Engine Speed (RPM)

| RPM \ Load | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 320 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 500 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 6 | 3 | 0 | -4 | -8 | -10 | -10 | -10 | -10 | -10 | -10 | -10 | -10 |
| 750 | 10 | 10 | 10 | 10 | 10 | 14 | 14 | 13 | 10 | 7 | 4 | 1 | -2 | -5 | -8 | -10 | -10 | -10 | -10 | -10 | -10 | -10 |
| 1000 | 10 | 10 | 10 | 10 | 15 | 20 | 20 | 15 | 12 | 9 | 6 | 4 | 1 | -2 | -5 | -8 | -10 | -10 | -10 | -10 | -10 | -10 |
| 1250 | 17 | 17 | 17 | 17 | 18 | 22 | 22 | 22 | 17 | 14 | 11 | 8 | 6 | 3 | 0 | -3 | -6 | -9 | -10 | -10 | -10 | -10 |
| 1500 | 24 | 24 | 24 | 24 | 25 | 25 | 26 | 25 | 21 | 17 | 12 | 9 | 6 | 3 | 0 | -3 | -6 | -9 | -10 | -10 | -10 | -10 |
| 1750 | 30 | 30 | 30 | 30 | 30 | 30 | 29 | 26 | 22 | 20 | 17 | 12 | 9 | 6 | 3 | 0 | -3 | -6 | -9 | -10 | -10 | -10 |
| 2000 | 36 | 36 | 36 | 36 | 36 | 34 | 28 | 25 | 22 | 20 | 17 | 13 | 11 | 7 | 4 | 1 | -2 | -5 | -8 | -10 | -10 | -10 |
| 2250 | 40 | 40 | 40 | 40 | 40 | 35 | 30 | 28 | 26 | 23 | 21 | 18 | 14 | 9 | 6 | 3 | 0 | -3 | -6 | -9 | -10 | -10 |
| 2500 | 40 | 40 | 40 | 40 | 40 | 35 | 31 | 29 | 27 | 24 | 20 | 18 | 15 | 11 | 6 | 4 | 2 | -1 | -4 | -7 | -10 | -10 |
| 2750 | 40 | 40 | 40 | 40 | 40 | 35 | 33 | 31 | 27 | 25 | 22 | 20 | 17 | 13 | 10 | 5 | 4 | 2 | -1 | -4 | -7 | -10 |
| 3000 | 40 | 40 | 40 | 40 | 40 | 36 | 34 | 32 | 30 | 27 | 25 | 23 | 20 | 15 | 11 | 8 | 6 | 4 | 1 | -2 | -5 | -8 |
| 3250 | 40 | 40 | 40 | 40 | 40 | 37 | 34 | 32 | 31 | 28 | 26 | 23 | 20 | 16 | 12 | 9 | 7 | 5 | 2 | -1 | -4 | -7 |
| 3500 | 40 | 40 | 40 | 40 | 40 | 38 | 35 | 33 | 32 | 29 | 26 | 24 | 20 | 17 | 13 | 10 | 8 | 6 | 3 | 0 | -3 | -6 |
| 3750 | 40 | 40 | 40 | 40 | 40 | 38 | 35 | 33 | 32 | 29 | 27 | 24 | 21 | 18 | 14 | 12 | 9 | 7 | 4 | 1 | -2 | -5 |
| 4000 | 40 | 40 | 40 | 40 | 40 | 38 | 35 | 33 | 32 | 29 | 28 | 26 | 22 | 19 | 16 | 14 | 11 | 9 | 6 | 3 | 0 | -3 |
| 4500 | 40 | 40 | 40 | 40 | 40 | 38 | 35 | 33 | 32 | 30 | 29 | 29 | 24 | 21 | 18 | 15 | 13 | 11 | 8 | 5 | 2 | -1 |
| 5000 | 40 | 40 | 40 | 40 | 40 | 38 | 37 | 35 | 33 | 31 | 30 | 29 | 26 | 23 | 20 | 17 | 15 | 12 | 9 | 6 | 3 | 0 |
| 5500 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 37 | 35 | 33 | 31 | 30 | 27 | 25 | 22 | 20 | 18 | 15 | 12 | 9 | 6 | 3 |
| 6000 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 37 | 35 | 33 | 31 | 27 | 26 | 23 | 19 | 16 | 13 | 10 | 7 | 4 | 1 |
| 6500 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 36 | 34 | 33 | 32 | 29 | 26 | 24 | 22 | 19 | 16 | 13 | 10 | 7 | 4 |
| 7000 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 36 | 34 | 33 | 32 | 29 | 26 | 24 | 22 | 19 | 16 | 13 | 10 | 7 | 4 |
| 7500 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 37 | 35 | 34 | 33 | 30 | 27 | 25 | 23 | 20 | 17 | 14 | 11 | 8 | 5 |
| 8000 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 38 | 36 | 35 | 34 | 31 | 28 | 26 | 24 | 21 | 18 | 15 | 12 | 9 | 6 |

It is possible to view the highest value reached for either the X- or Y-axis by holding the mouse pointer over the grey box above each axis, as shown above.

## Colour on Knock or Lambda

It is possible to clear the colouring based on map values and colour based on Knock/Det correction or Lambda instead.

This is only possible if Map Access is enabled from 'View' menu.
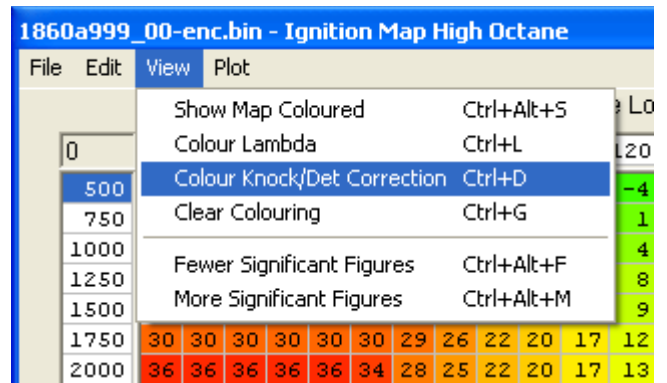


Select 'Colour Keys' from the 'View' menu of the ROM file that is open to view the colour coding that is used on the map when 'Colour Lambda' or 'Colour Knock/Det Correction' is enabled.
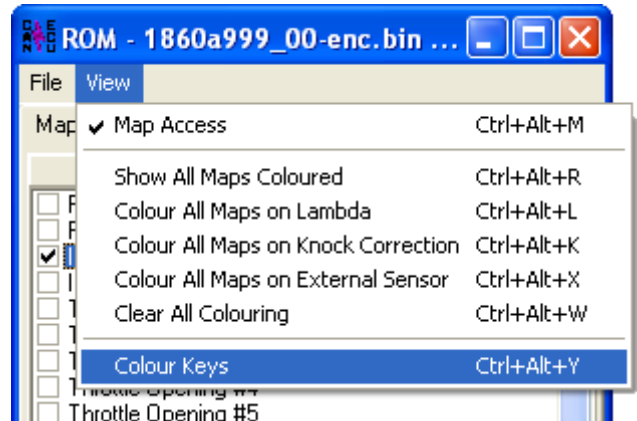


The example below shows the Knock correction on the Ignition Map. Hold the mouse over a specific value to get more detailed information.
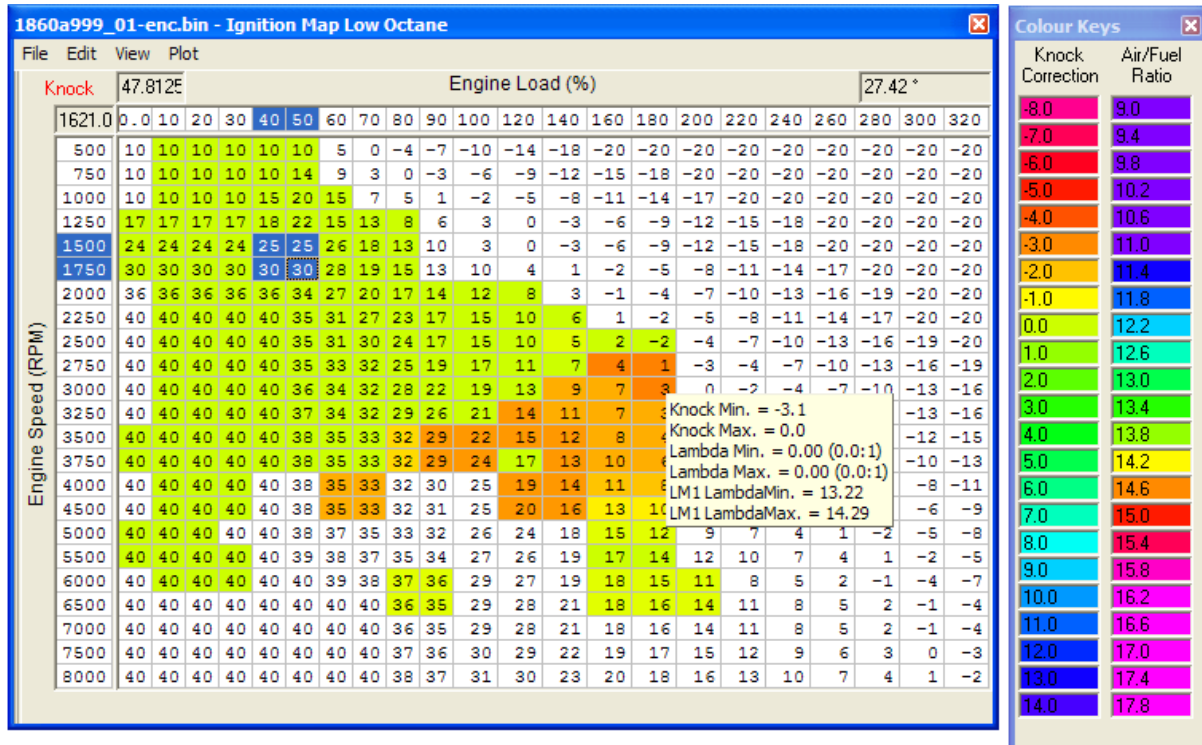
# HINTS and TIPS

- Make sure you have plenty of battery power before commencing ECU programming. ECU programming currently takes FULL laptop power for a few minutes.

- Use the LOG TO FILE check box under the LIVE DATA tab to create LOG FILES you can view in DeltaDash. This makes tuning much easier as you can see exactly where you are on the map by referencing RPM and True Engine Load values.

- Check the maximum Engine Load achieved whilst using Map Access by hovering the mouse over the Engine Load value in the top left hand corner of the map

- The standard EVO ROM files have been kindly calibrated to 2.0 Bar of boost pressure. So by just increasing the desired boost pressure (Boost Desired Engine Load) and Boost Limit/Boost limit timer then the tuning as actually pretty good from the factory!

- AFR should always be checked with a wideband Lambda sensor and we would suggest a target AFR of around 11.5:1 at peak torque (3500-4000rpm) dropping to around 11:1 by 6000rpm

- Detonation should be checked for using an Engine Knock listening device or a stethoscope, the standard Knock Sensor may not actually 'hear' all different knock frequencies on an engine with modified parts.

- The standard Injectors are generally OK for around 380 BHP using a high flow fuel pump; don't forget fuel pressure can also be raised to achieve a richer AFR.

- If a map is too big for the screen then use the CTRL-ALT-F (Fewer Significant points) to reduce the size of the values in the map and make the map smaller.

- Check and support the EcuTek ProECU Forum, we can all share information that will increase our understanding of the factory ECU, this feedback will allow EcuTek to further develop and improve this new generation ProECU-EVO product

# IGNITION CONTROL

The ECU uses the LIVE DATA value called LEARNT RETARD to bias between the High and Low Octane Ignition maps.

If the LEARNT RETARD value shows 100 then 100% of the High Octane Fuel Map will be used in the Ignition timing calculation. If the LEARNT RETARD value shows 80% then 80% of the High Octane map lookup will be used and 20% of the Low Octane Fuel map will be used

**Example:**

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If the LEARNT RETARD value is at 30% then you have far too much detonations and further investigation is needed!

# Glossary

**AFM**

Air Flow Meter

**AFR**

Air Fuel Ratio

**FMIC**

Front Mounted Intercooler

**ISS**

Intercooler Spray System

**MAF**

Mass Air Flow (sensor)

**MAP**

Manifold Absolute Pressure (sensor)

**MRP**

Manifold Relative Pressure or boost pressure.

**O2 Sensor**

Lambda Sensor (oxygen sensor)

**Calculated Air Flow**

The air flow sensor voltage is not linearly related to the amount of air flow. The ECU uses a scaling map to translate the air flow sensor voltage into an air flow rate value i.e. calculated air flow.

**Calculated Engine Load**

The ECU calculates engine load based on calculated air flow divided by engine RPM. It is effectively how much air enters the engine on each revolution.