EDC-16C9/C39

Written by: ***
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Thanks to: Taurius, Dieselpower, Xinpl
For more info: **www.ecuconnections.com**
Revision: 1.0

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Introduction:

The EDC16C9 and EDC16C39 are used in Opel Vectra, Fiat Chroma, Alfa 156, SAAB 9000 and some other cars that use 1.9cdti engine. The system looks a lot like the EDC15 system, but the EDC16 system is based on Torque (Nm) instead of Injected Quantity. There are a few more differences that are explained in this document. For the examples in this document I used the pro tuned Opel Astra 1.9 cdti 16v 150bhp file. The pictures show tuned file and difference from original by Delta or %.

I chose to use different values in my remap, hope my explanation will not be confusing for you.

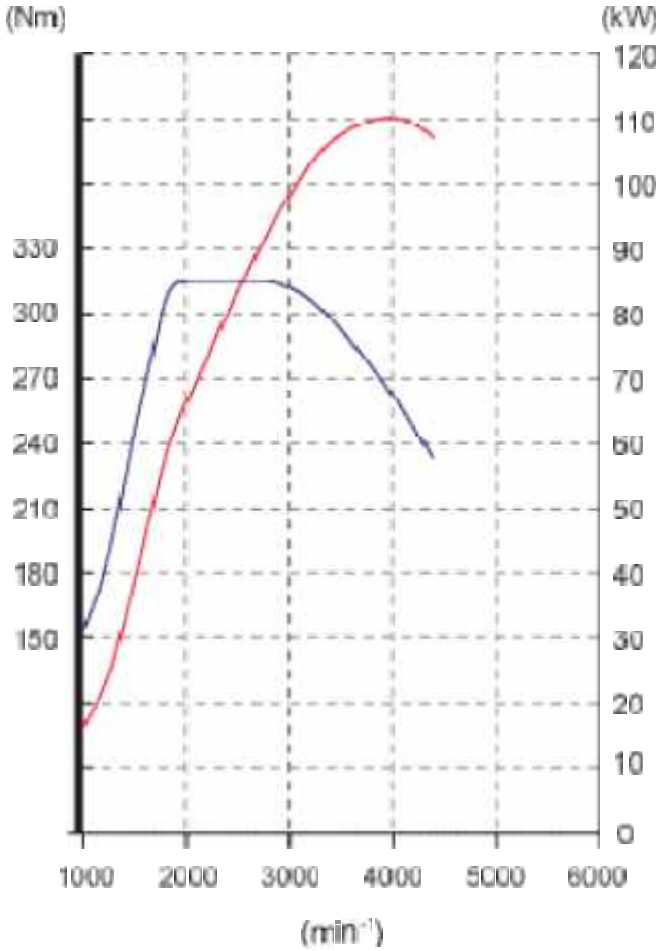
This Guide has no intention to show how to save money by DIY remap as it is a Mission Impossible. This Guide intends to brief you about control of the 1.9 DTH engines so you can enjoy playing with it. Be aware that this could be an expensive hobby. Wish you a lot of fun.

Car data

Z19DTH - 1.9CDTI 150BHP

Engine Specification
Engine, location: Front, transverse in front of axle 17º 24' forward inclined
Cooling system: Liquid, sealed circuit
Cylinders, number: 4
Bore (mm) 82
Stroke (mm): 90.4
Displacement (cc): 1910
Compression ratio: 17.5: 1
Engine, type: In line; 5 main bearings
Cylinder block/ head, material: Cast iron/ aluminium
Camshaft (s), location: 2 overhead (DOHC), driven by toothed belt
Valve train: Indirect, roller cam followers
Valve, arrangement: In line; 4 per cylinder Valve,
Adjustment: Automatic - hydraulic
Fuel system: Diesel direct injection, common rail
Ignition system: n/a
Fuel pump: High pressure mechanic
Emission control system: 2- way cat. conv. (oxidizing catalytic converter) exhaust gas recirculation DPF
Output (kW/hp CEE at 1/min): 110/ 150 at 4000
Specific power (kW/l; hp/l): 57.6; 78.5
Max. torque (Nm at 1/ min): 315 at 2000
Specific torque (Nm/litre): 164.9
Mean effective pressure at max. power/ max. torque (kPa):1727.7/ 2073.4
Average piston speed (m/ s): 12.1
Engine oil, capacity (l): 4.3
Cooling capacity (l): 7.5
Battery 12 V,
capacity (Ah): 70
Alternator 14.2 V,

Capacity (W): 1420
Max. service interval: 20,000 miles or 1 year
Emission compliance: Euro 4
Engine mass (kg): tba
Charger system: Turbo with intercooler
Max. boost pressure (bar): tba

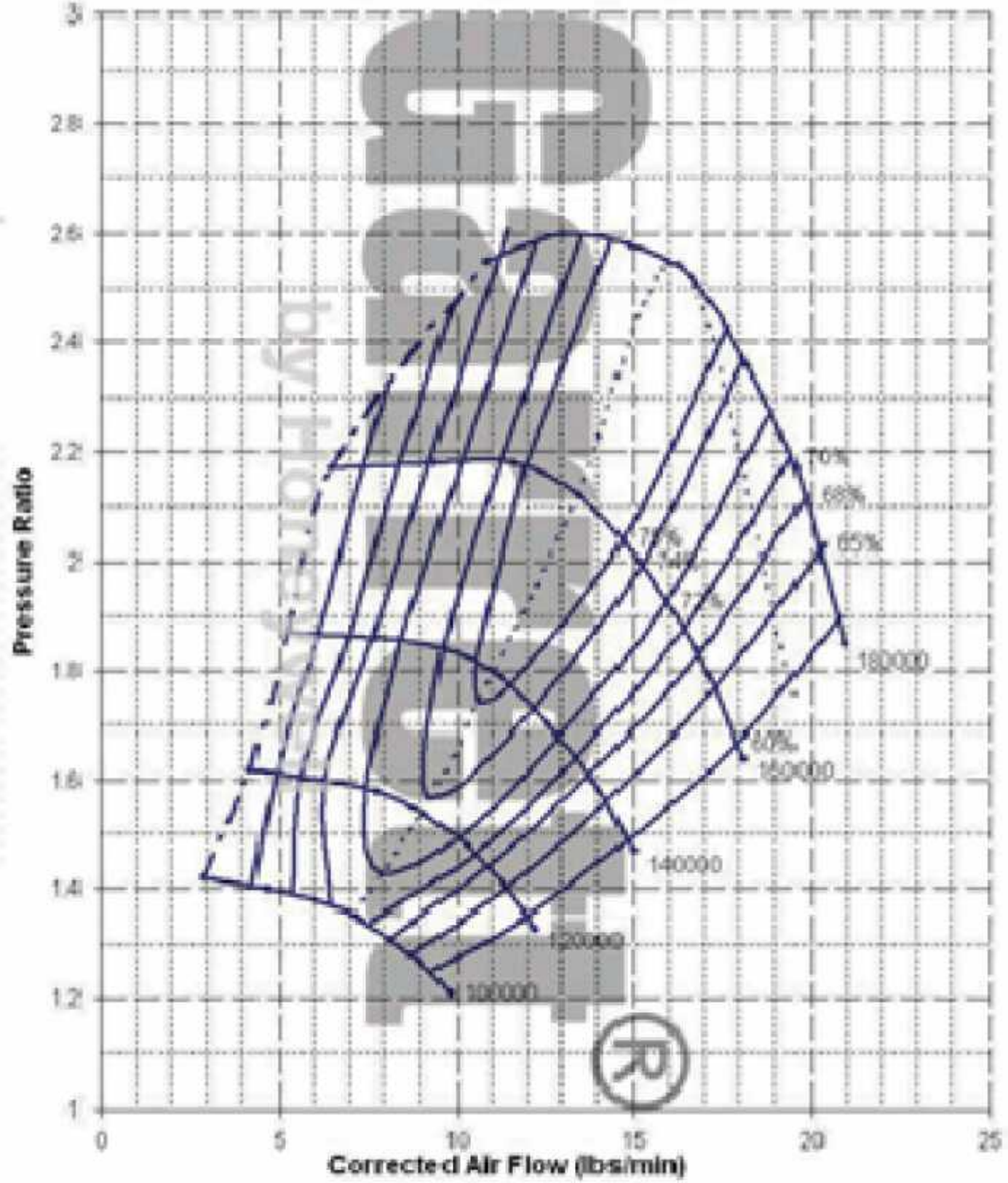


Power Output (kW) Torque (Nm)

2009 Aisin Warner AF40-6 (M36) FWD & (MXE) AWD Transmission	
Type:	six speed front wheel drive, electonically controlled automatic tansmission with torque converter clutch
Maximum engine torque:	400 Nm (Gasoline), 450 Nm (Diesel)
Gear Ratios:	**M36 & MXE**
1st	4.15
2nd	2.37
3rd	1.56
4th	1.16
5th	0.86
6th	0.69
REV	3.39
F/D	2,561 / 2,666 / 2,774 / 2,839 / 2,955 / 3,075 / 3,200 / 3,329 / 3,464 / 3,640 / 3,750
Ratio spread	6,05:1
Maximum shift speed:	7000 rpm
Min input speed:	650 rpm

Maximum validated gross vehicle weight:	2355 kg (MY09 Opel Insignia HB AF40 AWD A28NET)
Shifting mechanism:	Integrated position sensor with TCM
Shifting positions:	P,R,N,D (by cable) & Tiptronic (by CAN)
Case material:	Die cast aluminum
Center distance:	197 mm
Overall length:	358 mm
Shift pattern:	Pulse width modulated solenoid control
Shift quality:	Variable bleed solenoid
Torque converter clutch:	Pulse width modulated solenoid control
Available control features:	Eco Mode Selective Sport Mode Drivers Adaptive (Fuzzy) Manual Mode (Tiptronic) Up Hill Control Down Hill Control Torque Limitation (axle shaft protection) Fast Acceleration OFF Fast Acceleration ON Shift by Temperature Brake Assist Cornering Control Pass-by Noise Test Function Differential Protection Warm-up Shift Pattern (WUSP) Neutral Control L-up Slip Control (drive & coast) Tip Auto Down Tip Auto Up Improved Downshift Protection Up Shift Prevention Low m Conrol Highest Gear in Limp Home Gear Stabilization
EOBD II, OBD	
Converter size:	241 & 260
k-Factor:	142k - 225k
Torque ratio:	2,0 - 2,32
Fluid type	AW-1 (low friction), lifetime fill
Transmission weight (dry):	87 kg
Fluid capacity	6,96 kg (incl. cooler)
Pressure taps available:	Access to all clutches & brakes possible
Assmbly site:	Anjo City, Japan
Applications:	Opel Astra, Zafira, Vectra Saab 9-3, Cadillac BLS

GT1749V, 49mm, 55 Trim, 0.46 A/R



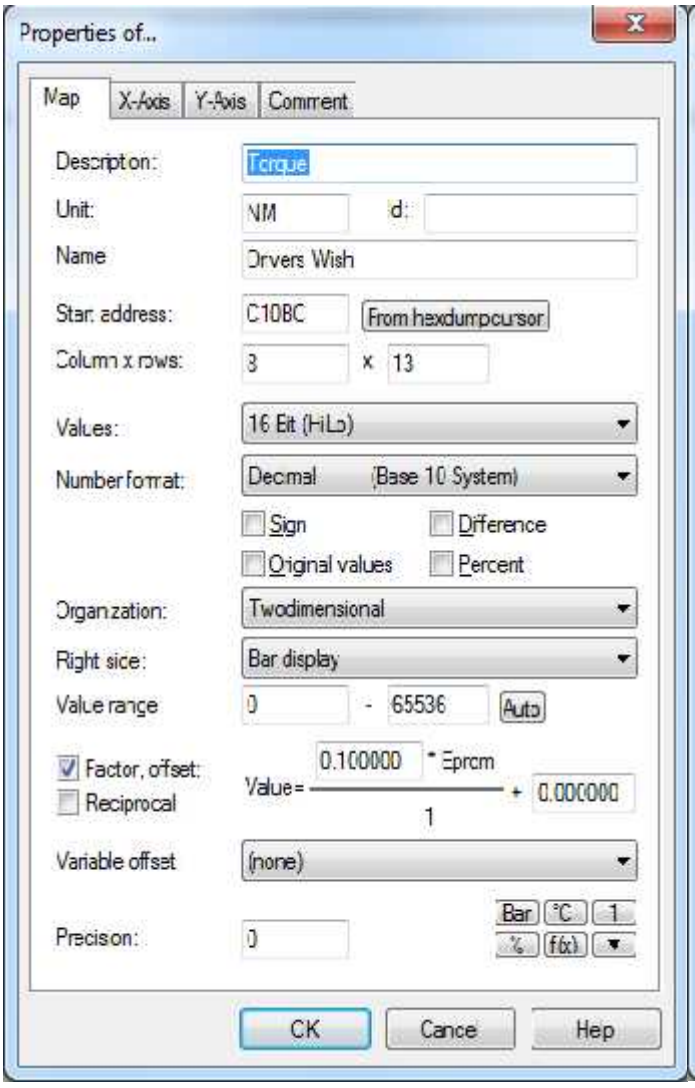
Map address, dimensions and factors

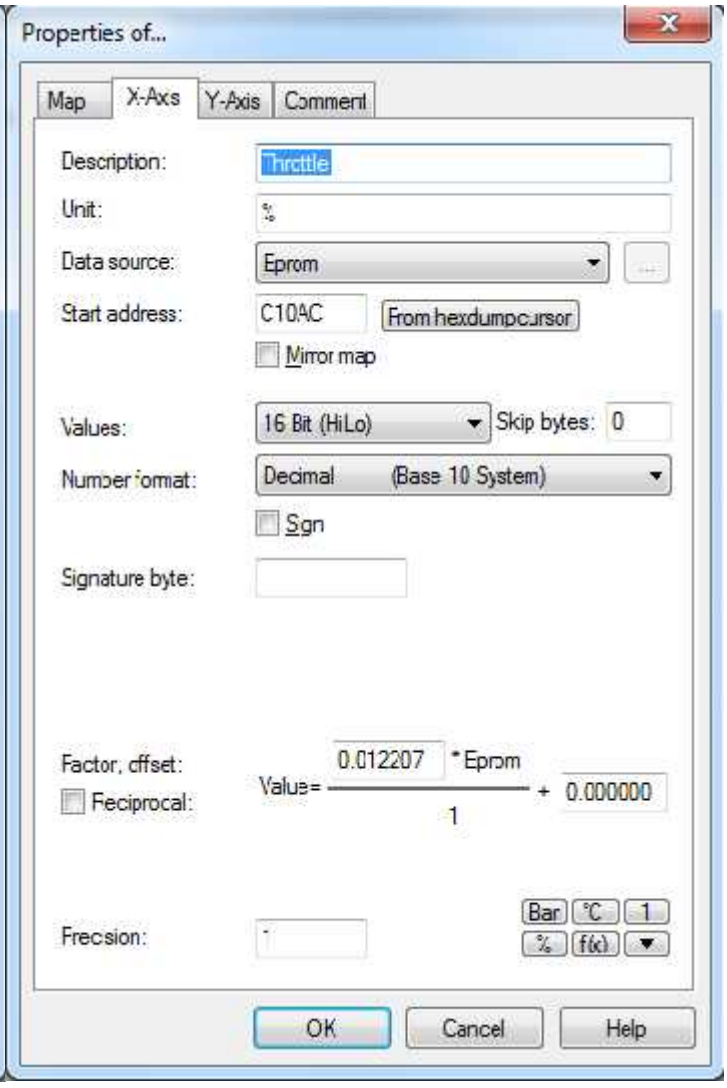
Fuel related maps

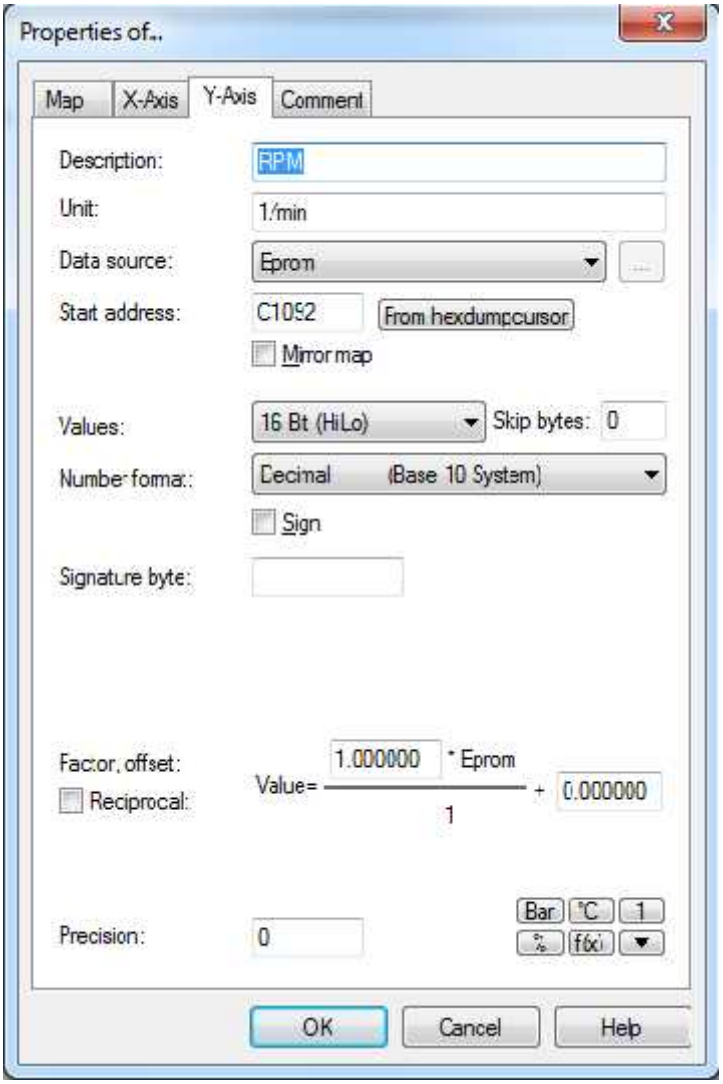
1. **Drivers wish Maps:**

General:

This map shows the required torque based on the RPM and the Throttle position. The output of this map is Torque in Nm. There may be more drivers wish maps, in the file I used for this guide there were 3 drivers wish maps.



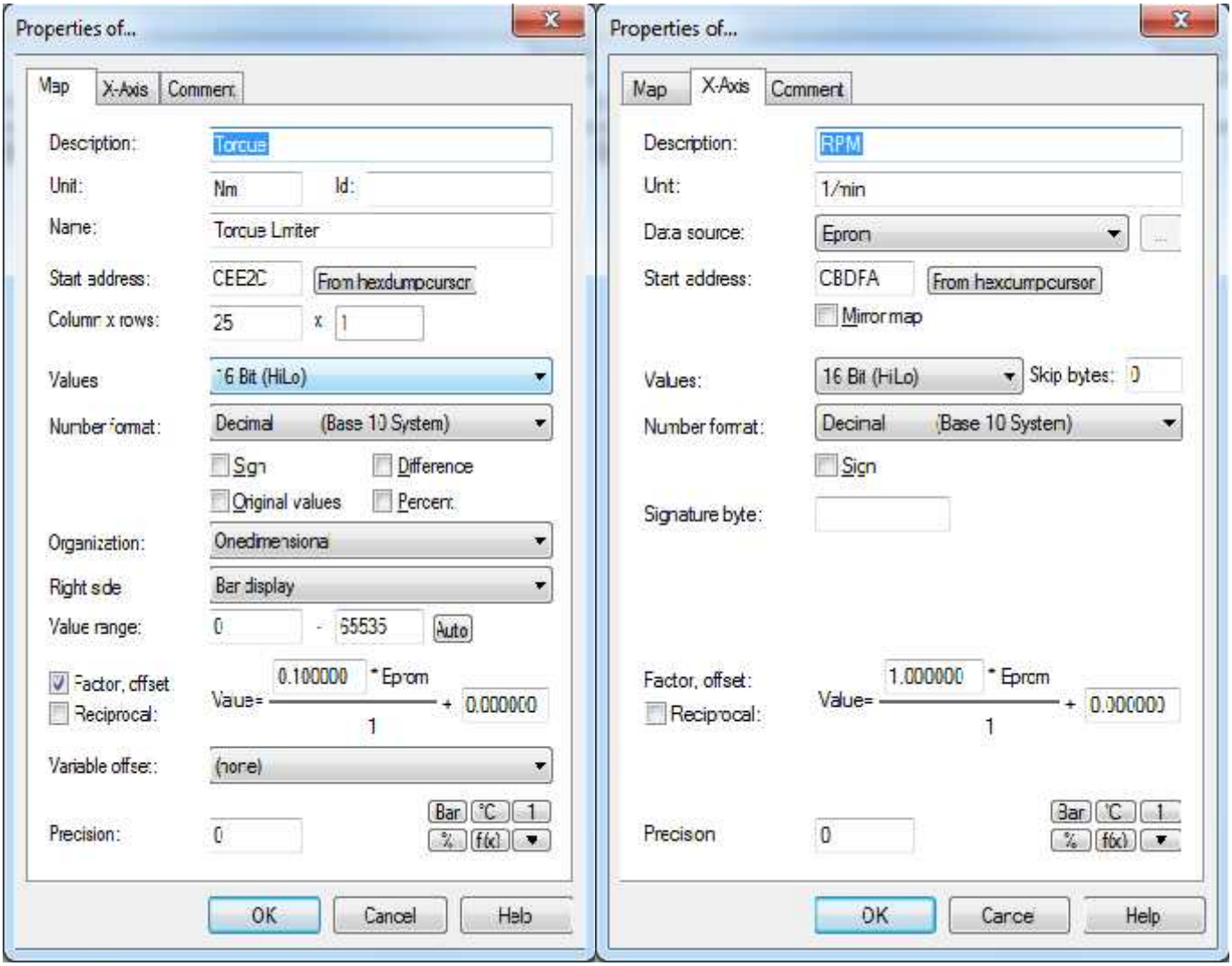



Properties of..
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
C1052
From hexdumpcursor
Mirror map
Values:
16 Bt (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
Value=
1.000000
* Eprom
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

2. **Torque limiter:**

General:

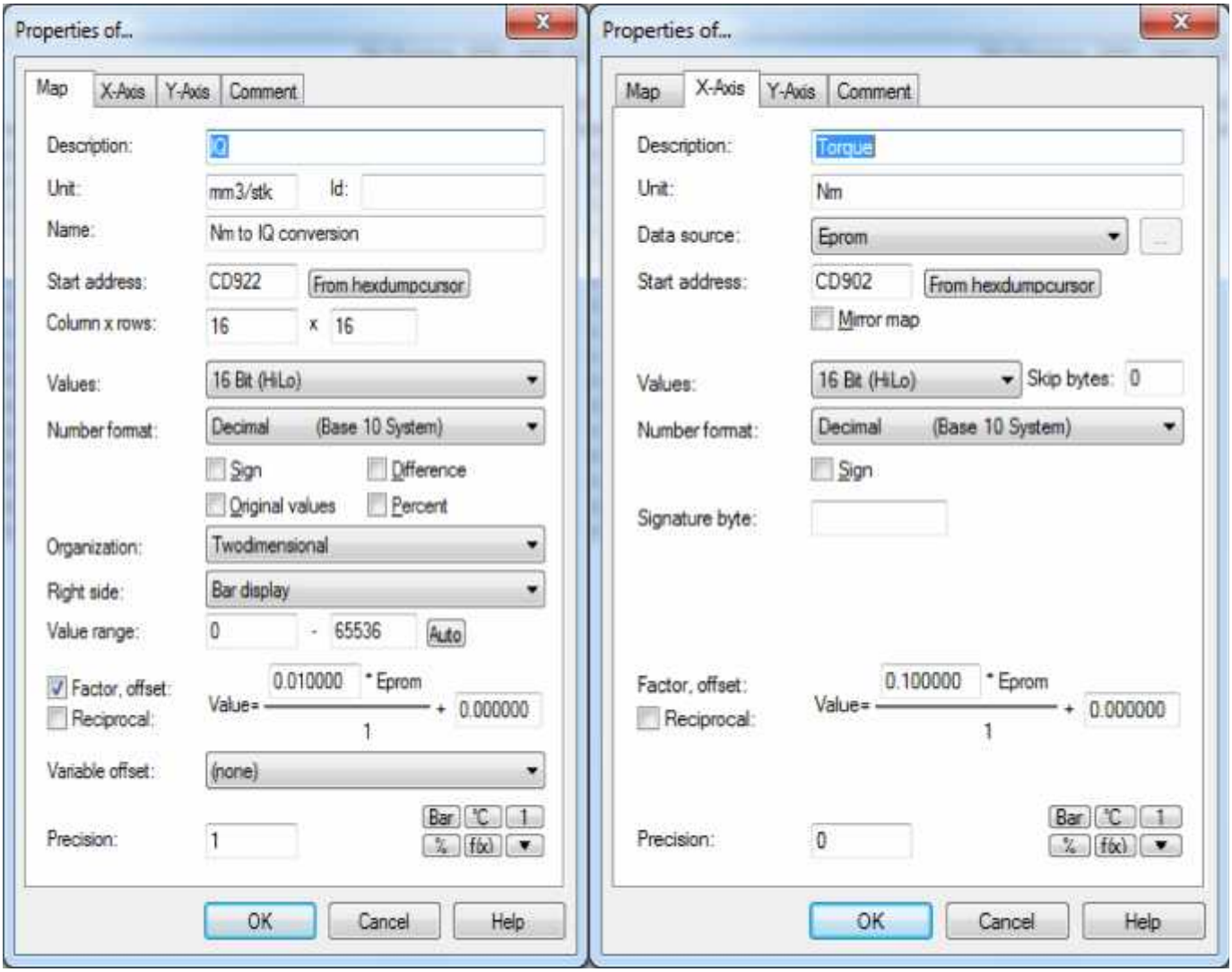
This map limits the torque of the engine based on RPM and atmospheric pressure. The output of this map is also Torque in Nm. This is 2D map.

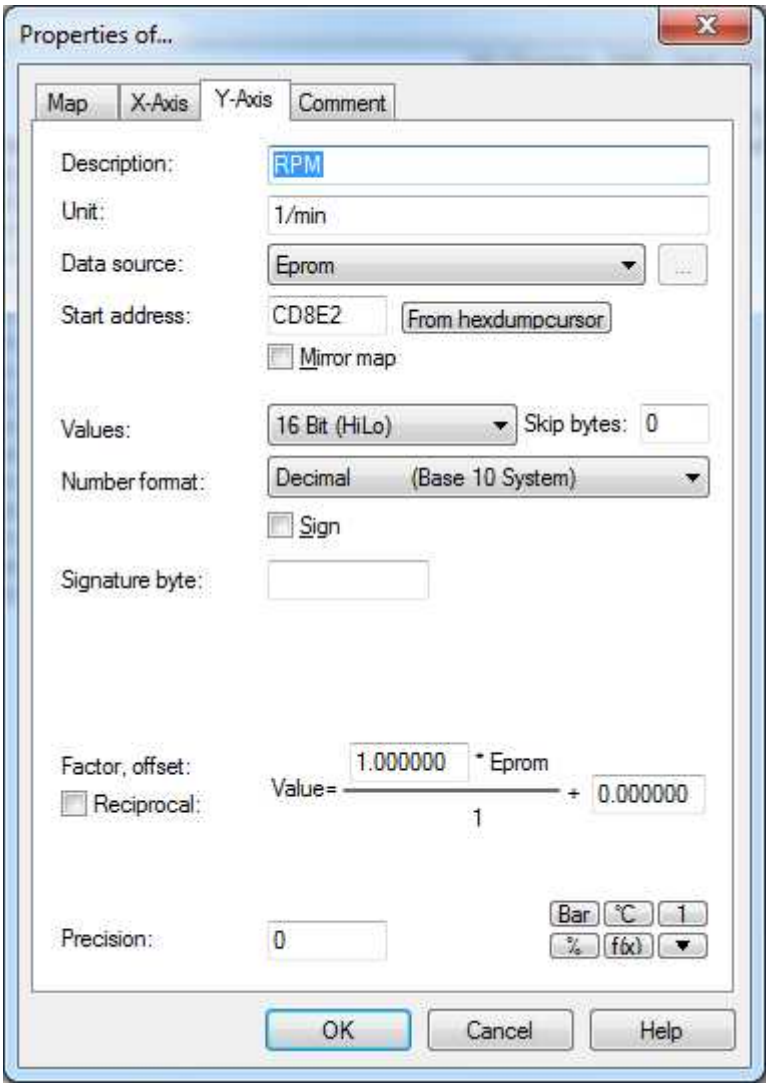


3. Nm to IQ conversion map:

General:

This map is a calibration map. This map converts the requested Torque in Nm into IQ (injected quantity).

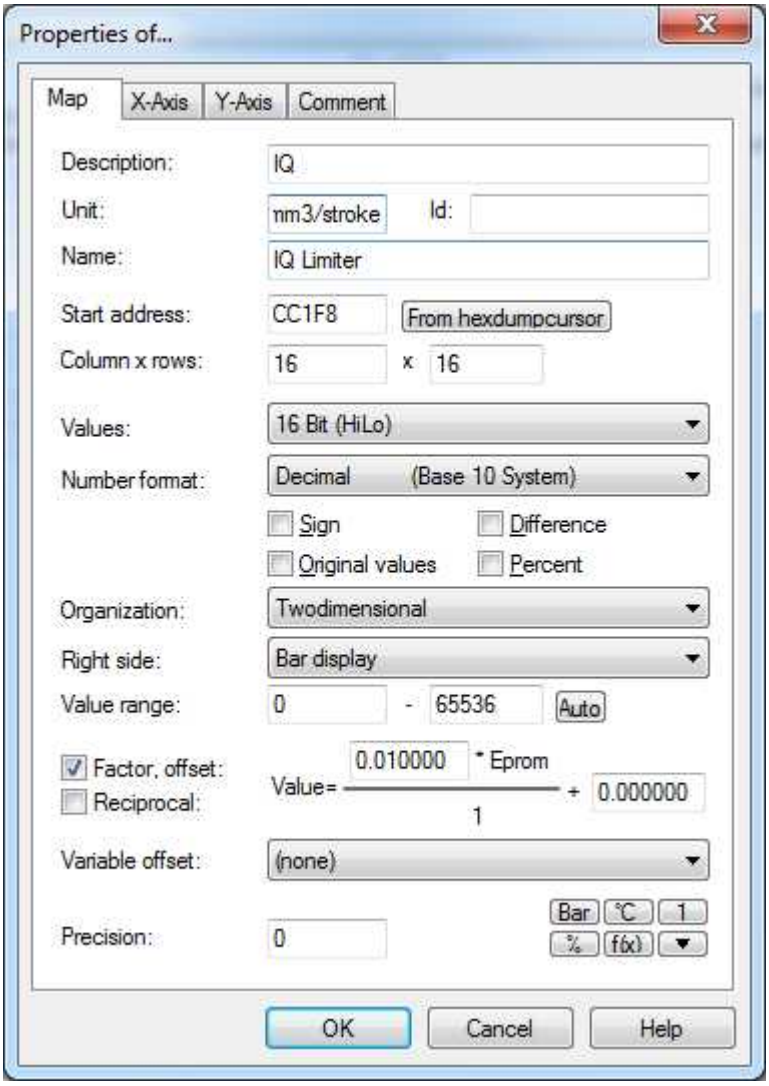


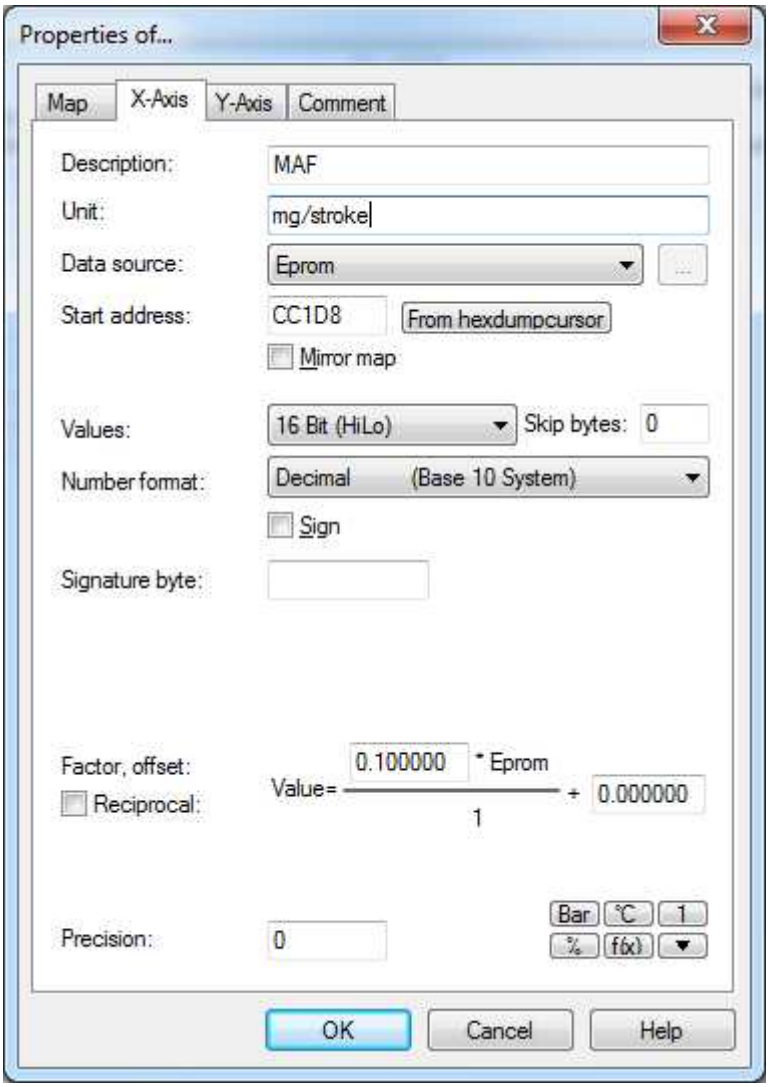

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
CD8E2
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

4. **Smoke limiter map:**

General:

This map limits the IQ depending on air mass and the current rpm.

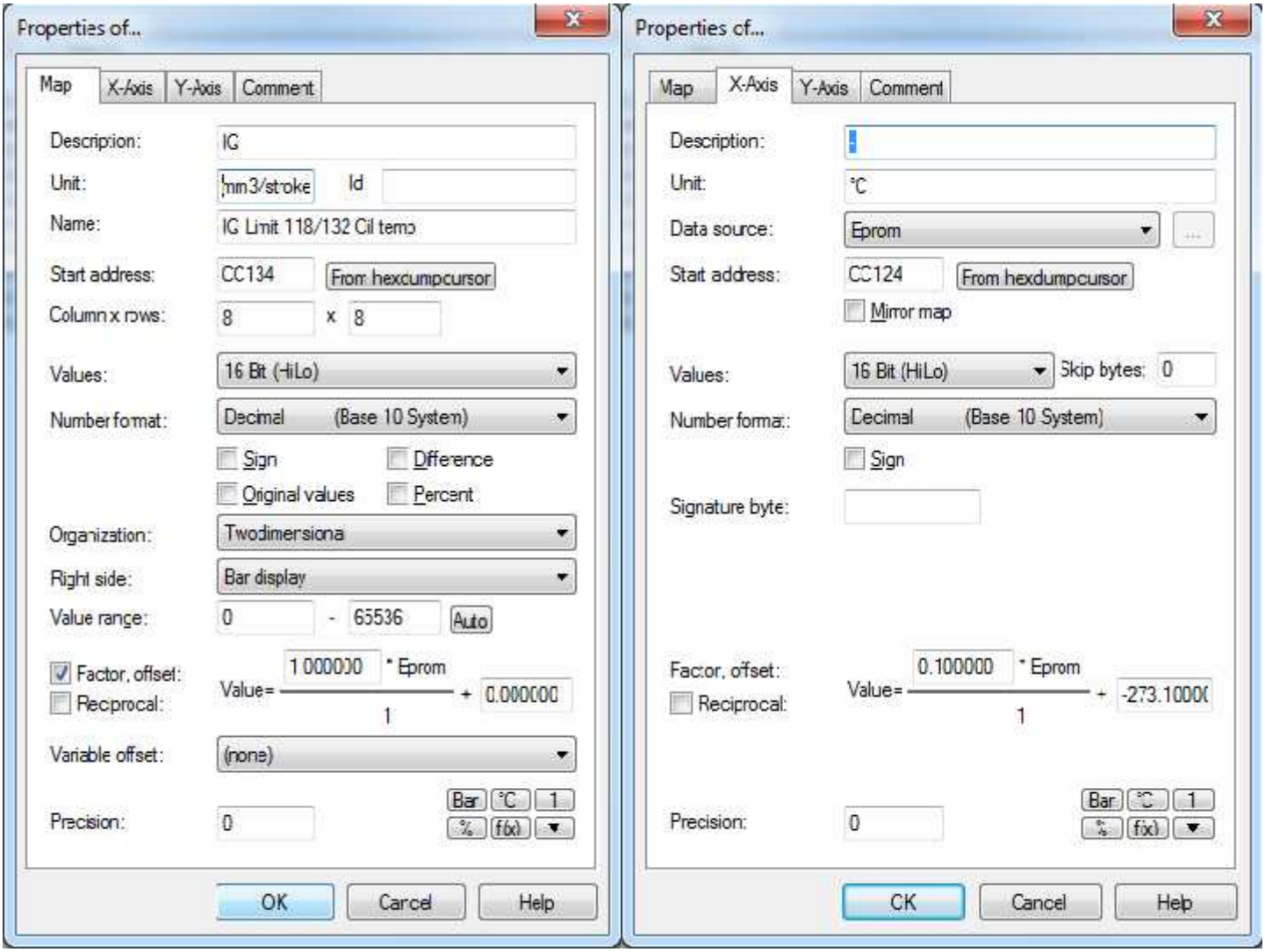


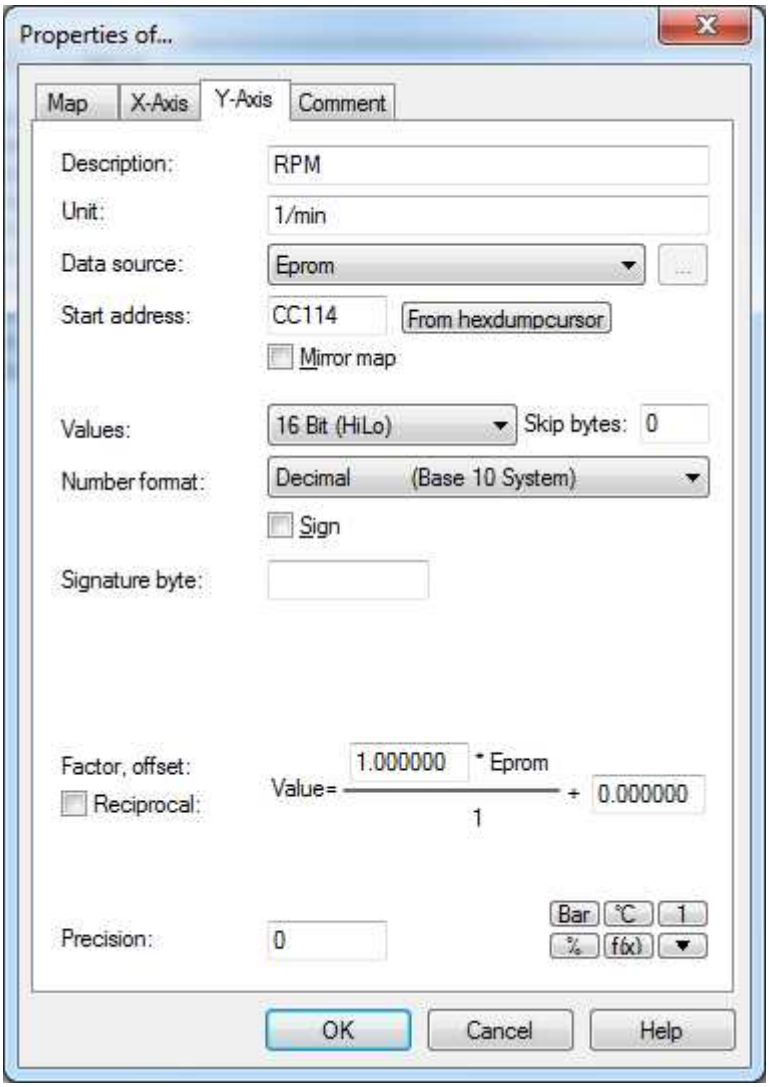

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
MAF
Unit:
mg/stroke
Data source:
Eprom
Start address:
CC1D8
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
Value=
0.100000
* Eprom
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

5. IQ limit by Oil Temperature

General:

This map limits IQ depending of Intake Air Temperature.

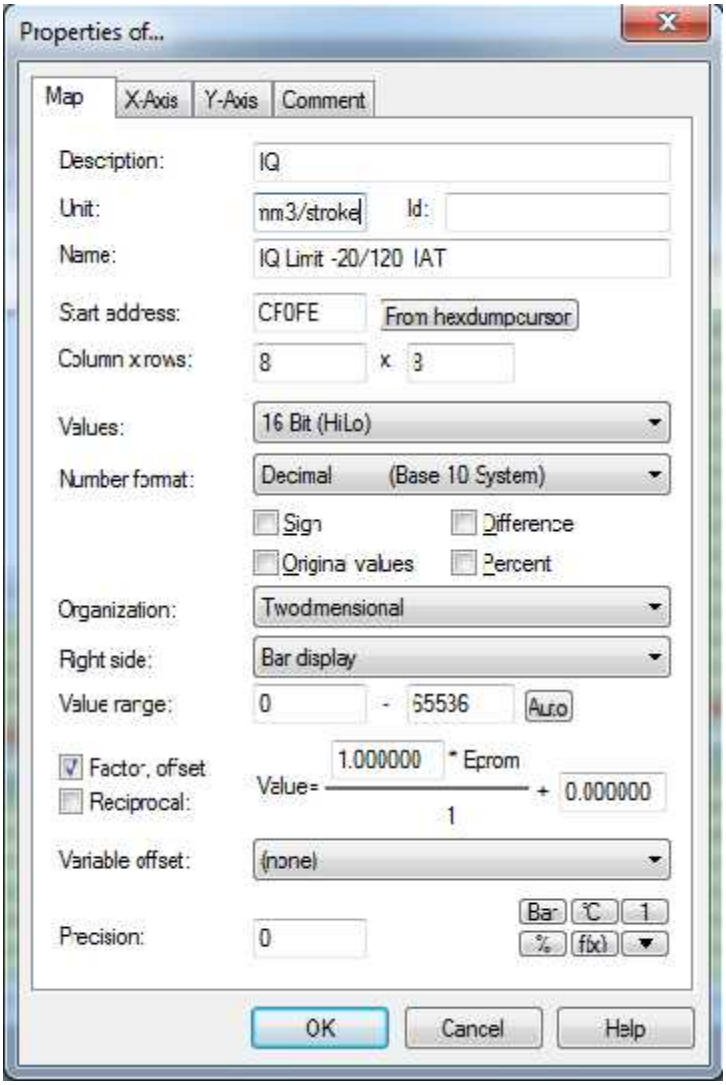


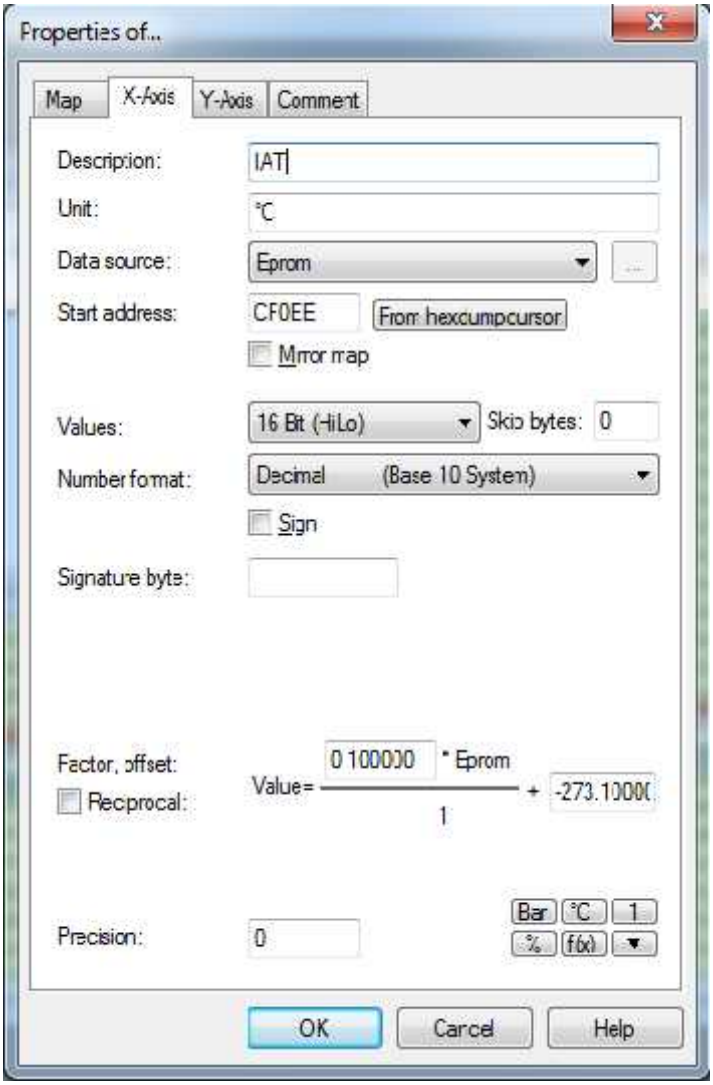

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
CC114
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

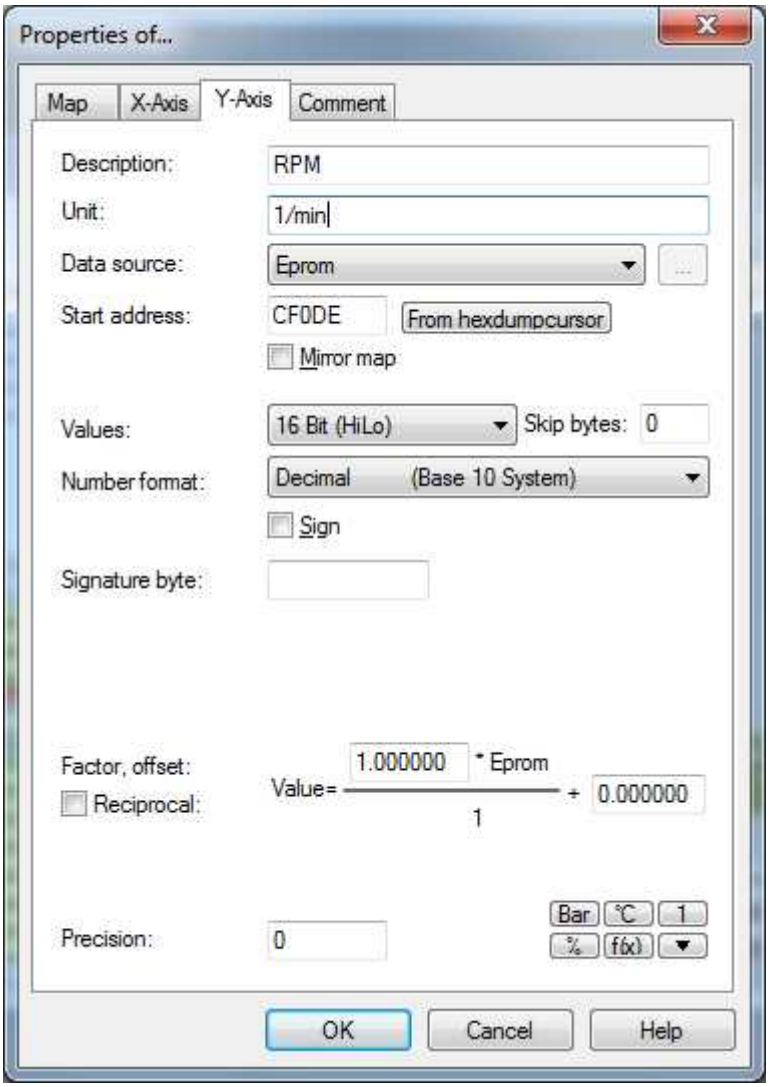
6. IQ limit by Intake Air Temperature

General:

This map limits IQ depending of Intake Air Temperature.



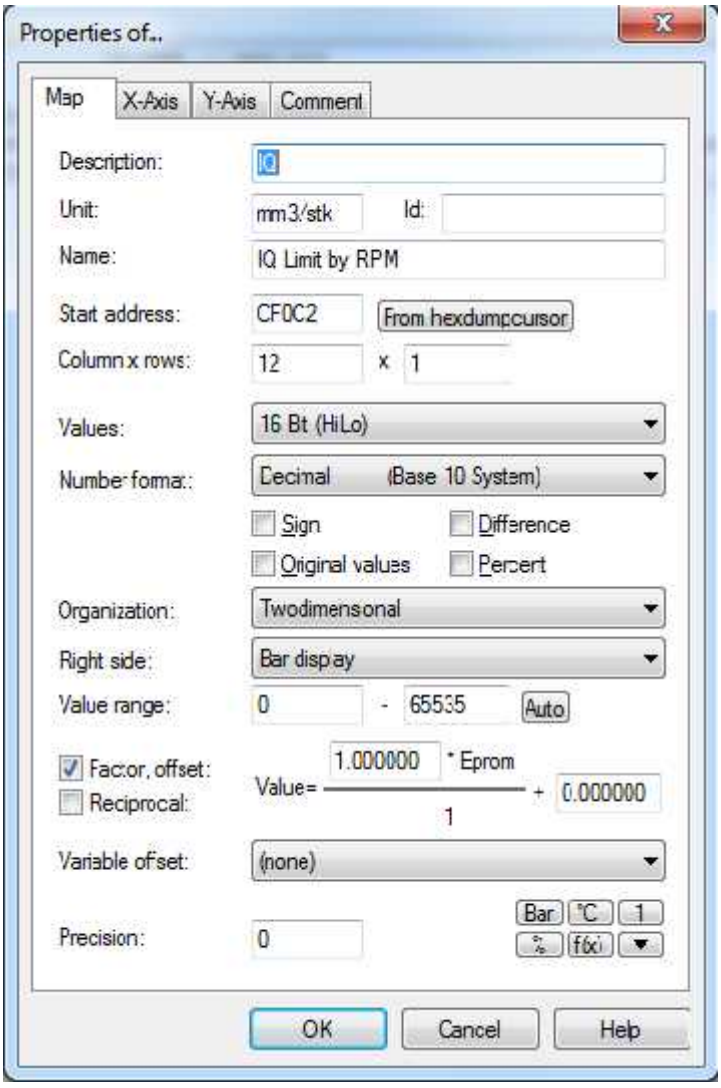


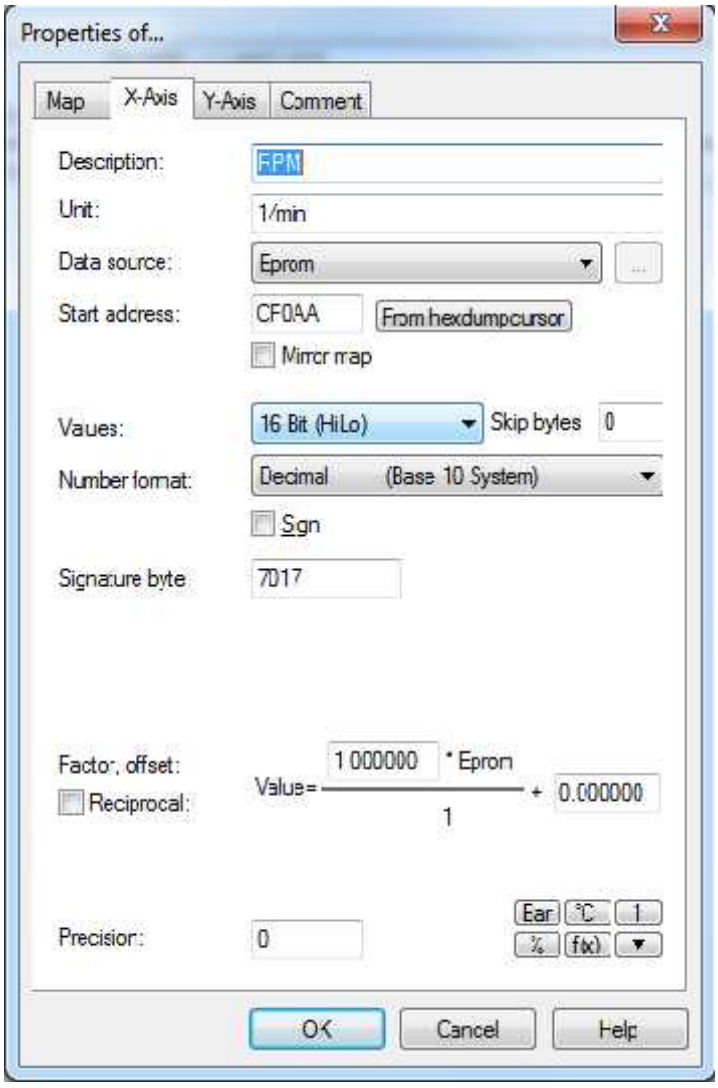

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
CF0DE
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

7. IQ limit by RPM

General:

This map limits IQ depending of Intake Air Temperature.

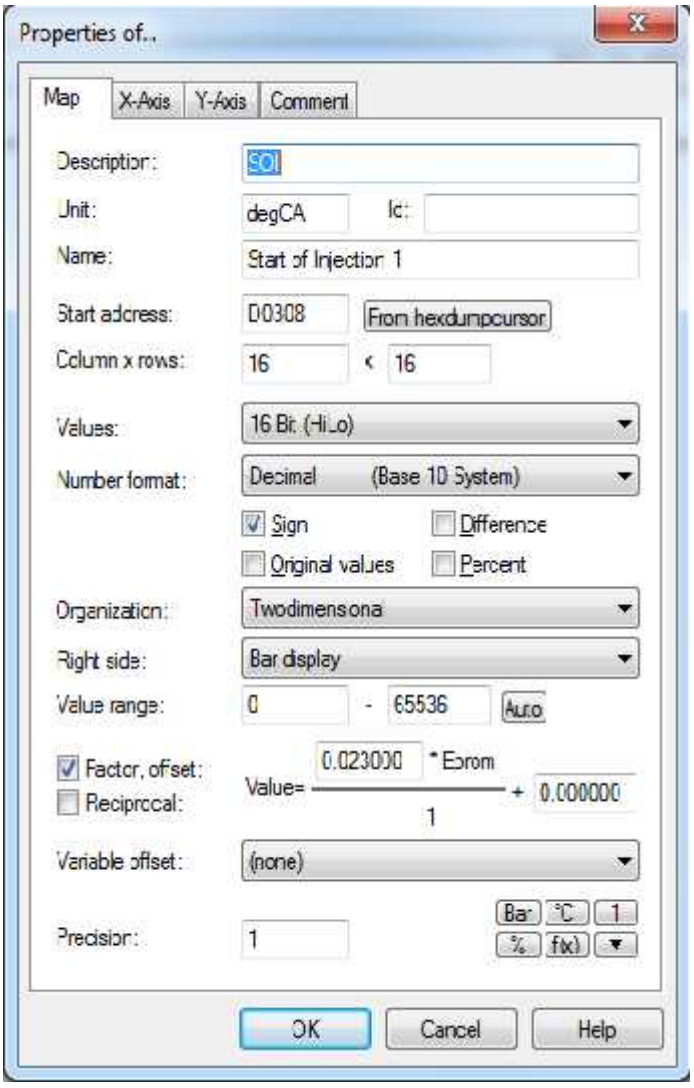


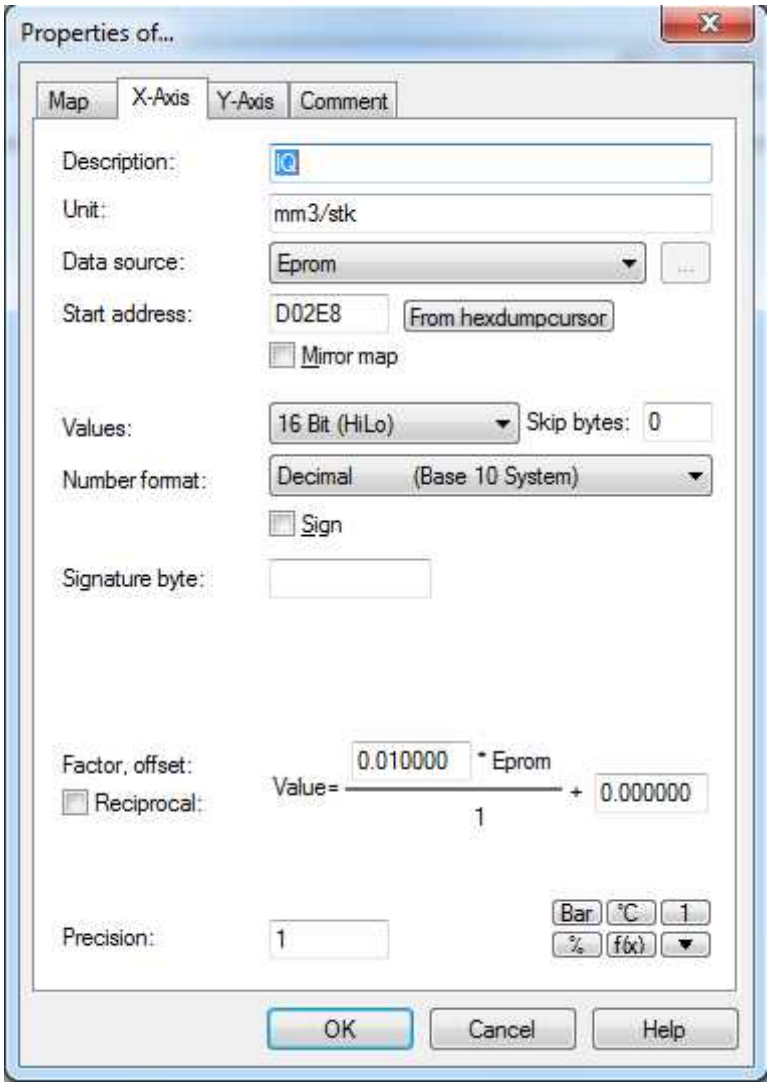


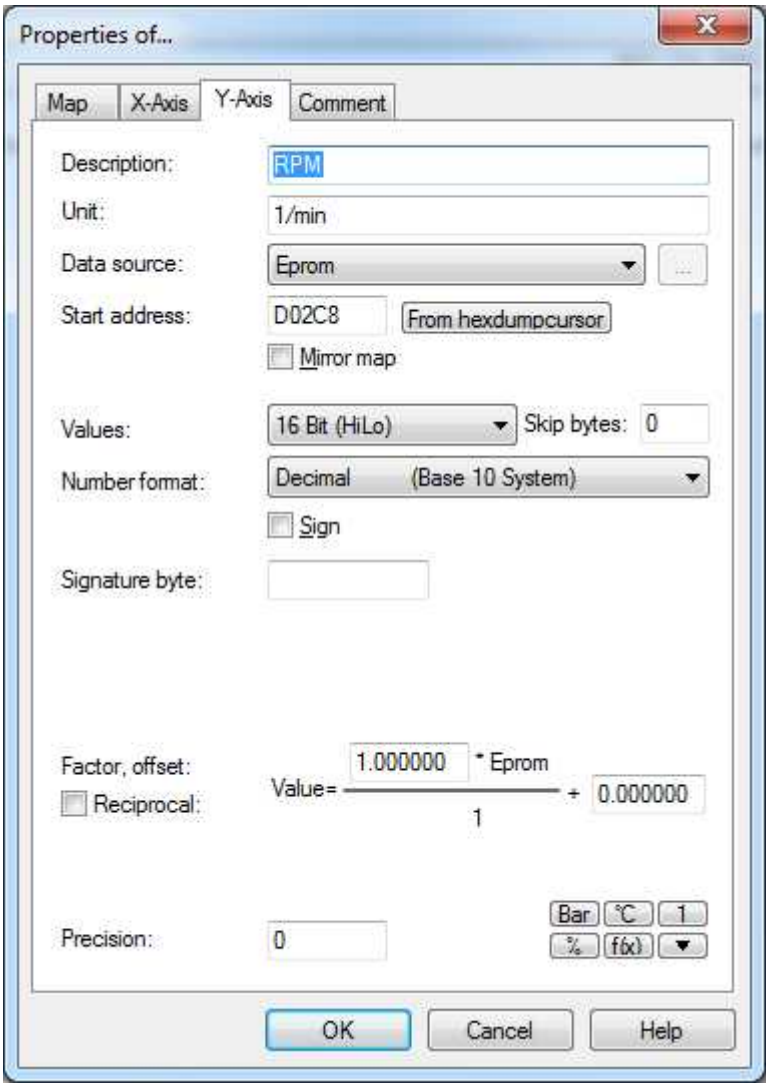
8. **Start Of Injection map:**

General:

This map shows angle at which start injection against TDC. There is 10 maps, 5 of them are exactly the same and are used during DPF regeneration.



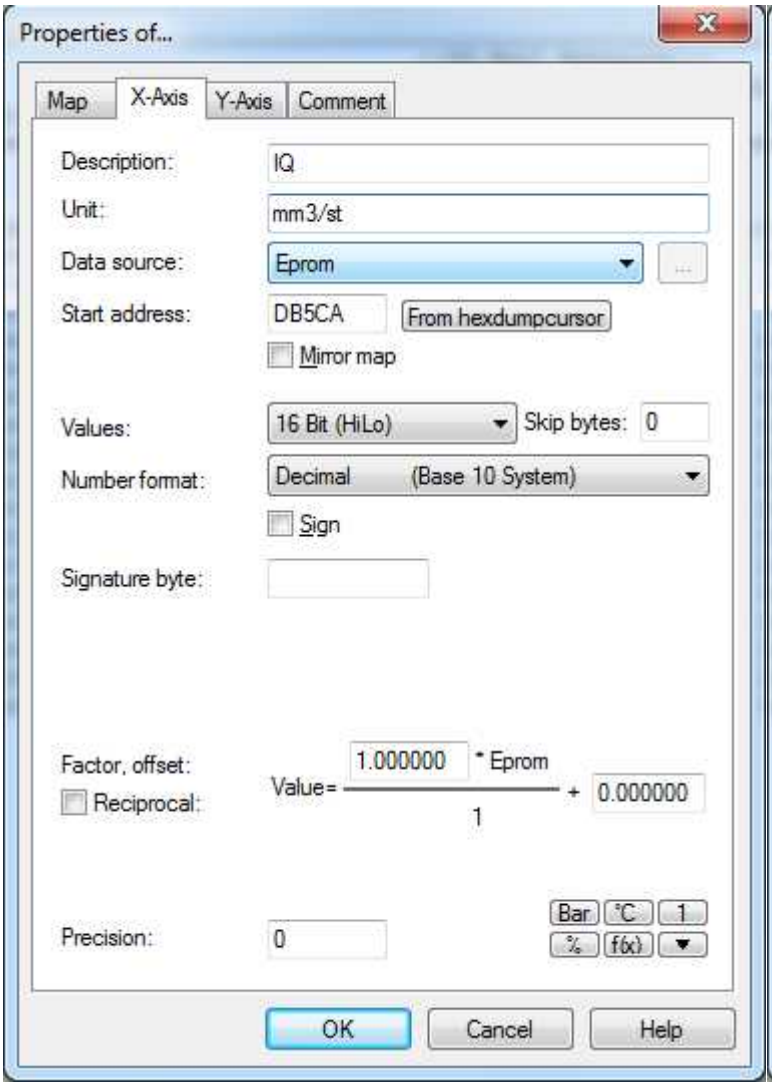


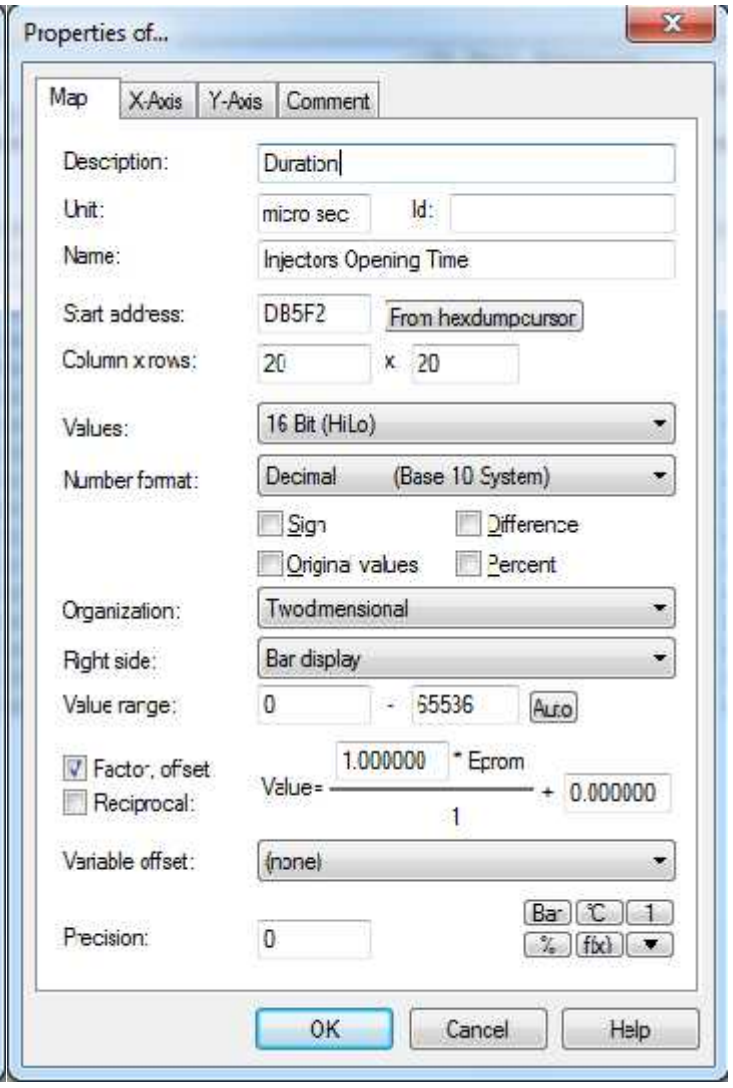

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
D02C8
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

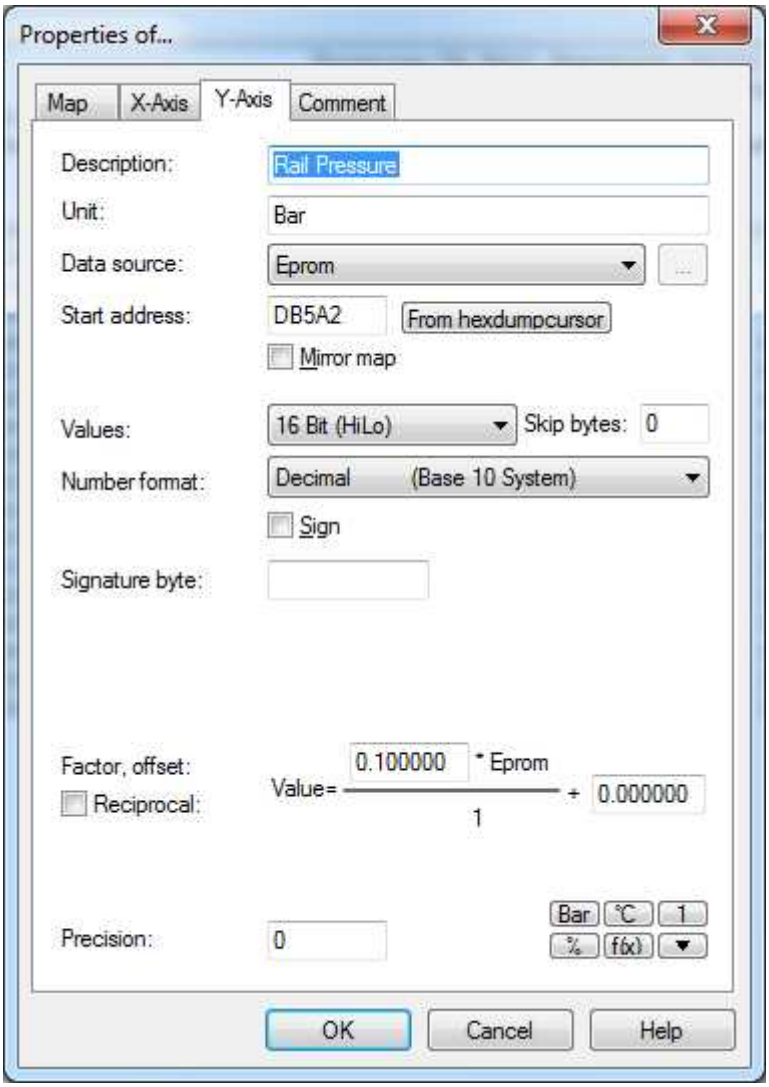
9. **Injector opening time (Duration map):**

General:

This map is a calibration map. This map shows how much rotation it takes to achieve the required amount of fuel injected. The output of this map is in engine degrees.



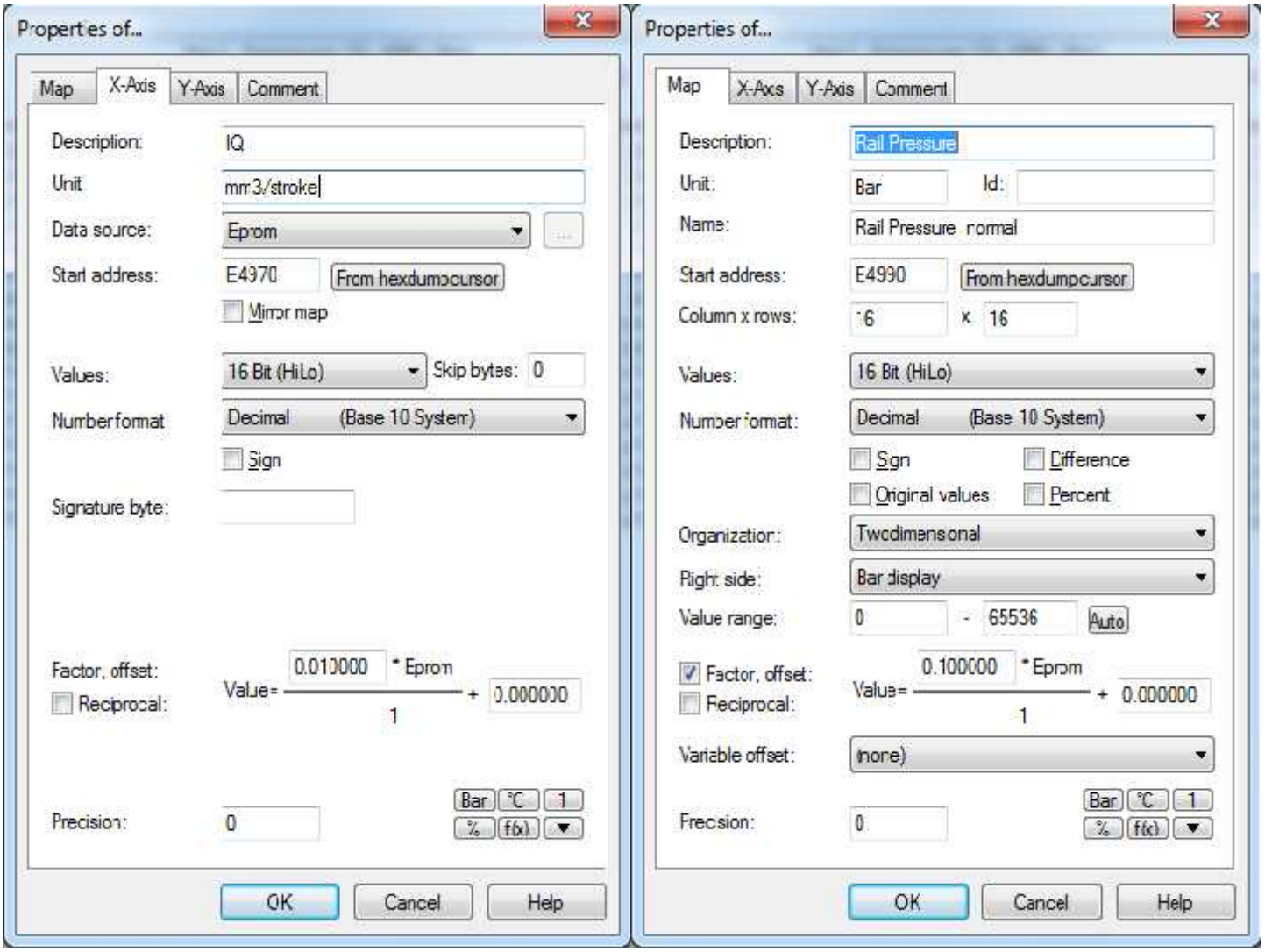


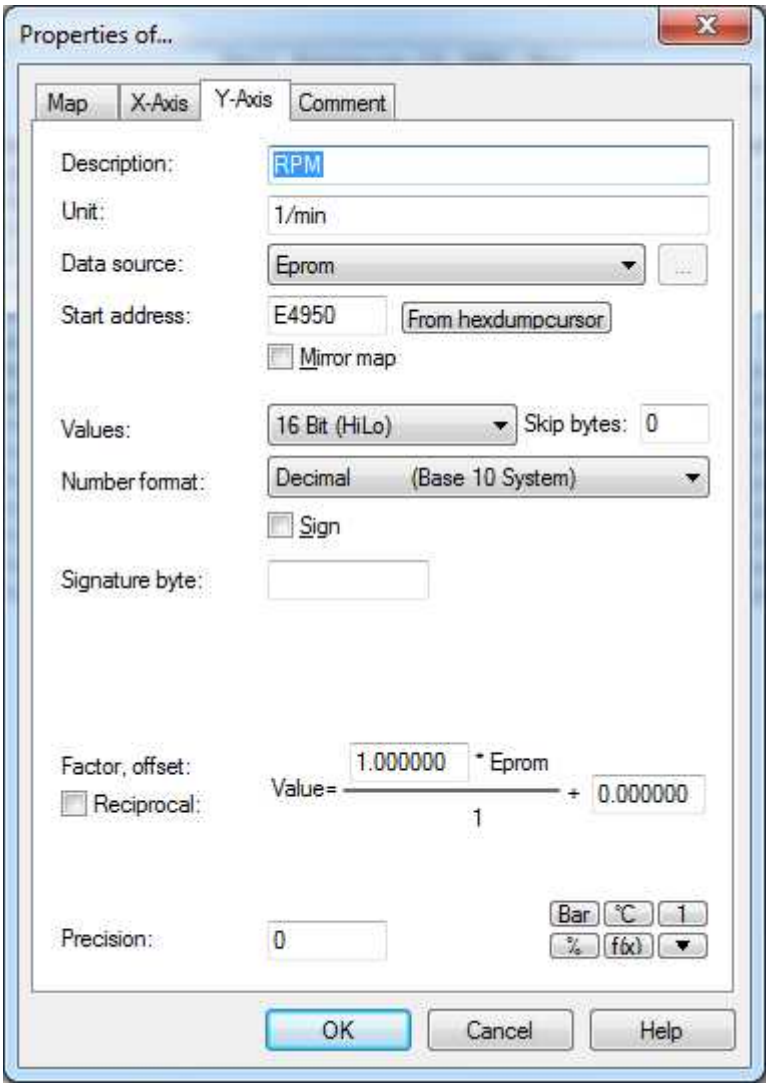

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
Rail Pressure
Unit:
Bar
Data source:
Eprom
Start address:
DB5A2
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
0.100000
* Eprom
Value=
+
0.000000
1
Reciprocal:
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

10. CRS Rail Pressure:

General:

This map shows how should be the rail pressure at certain RPM and IQ. There is 2 maps, 1st is used during DPF regeneration, 2nd during normal operation.

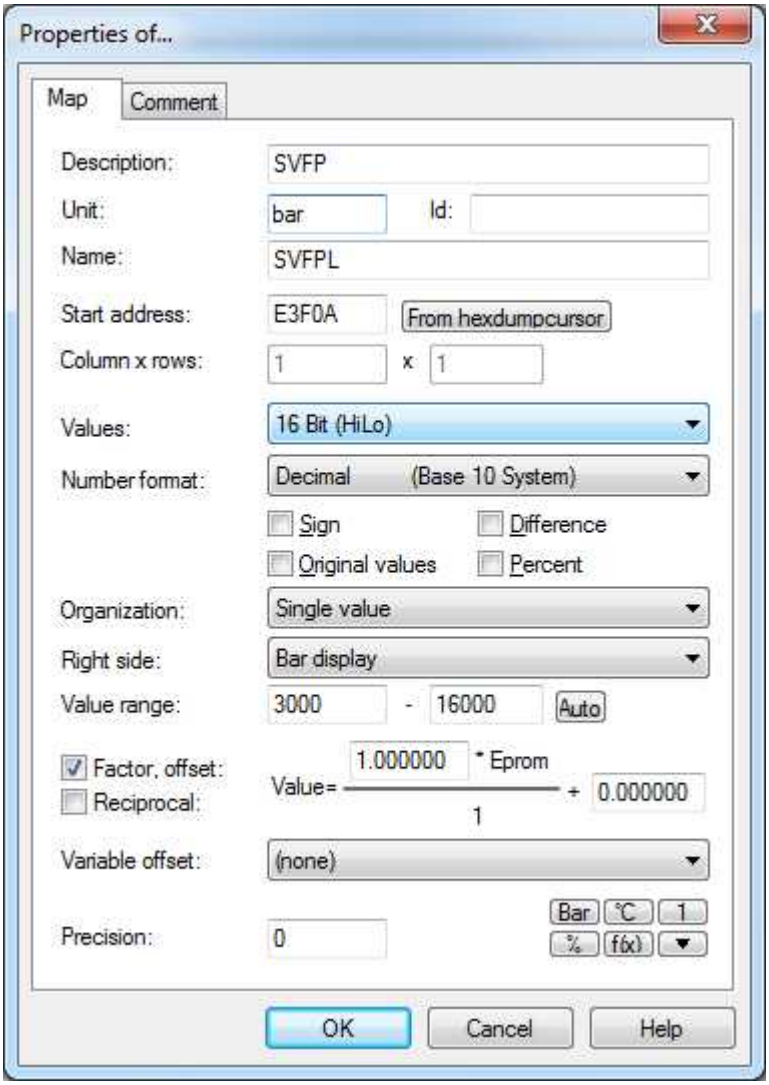



Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
E4950
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

11. SV Rail Pressure:

General:

This value limits the absolute common rail pressure. This value can be found behind the rail pressure map. There is 4 maps.

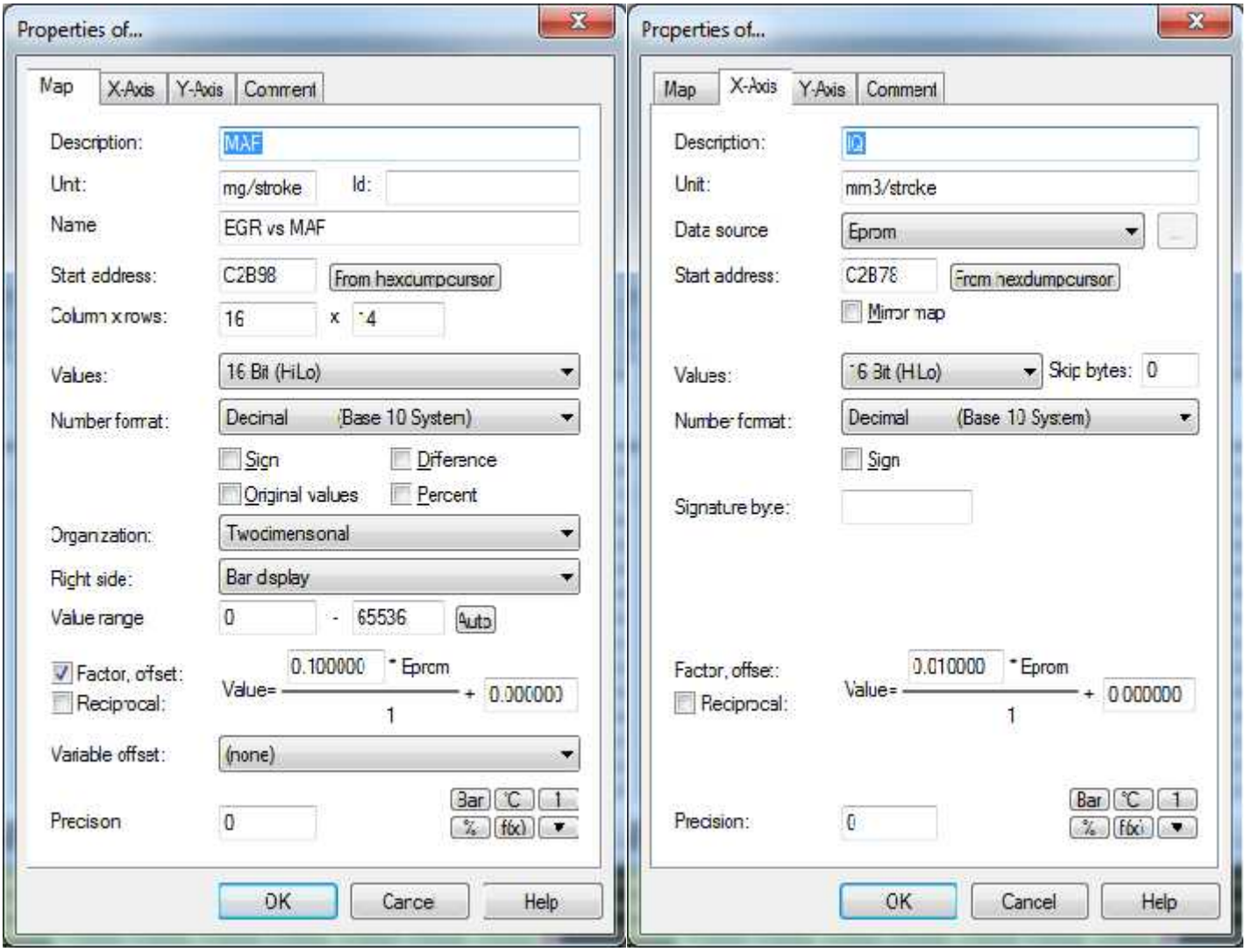


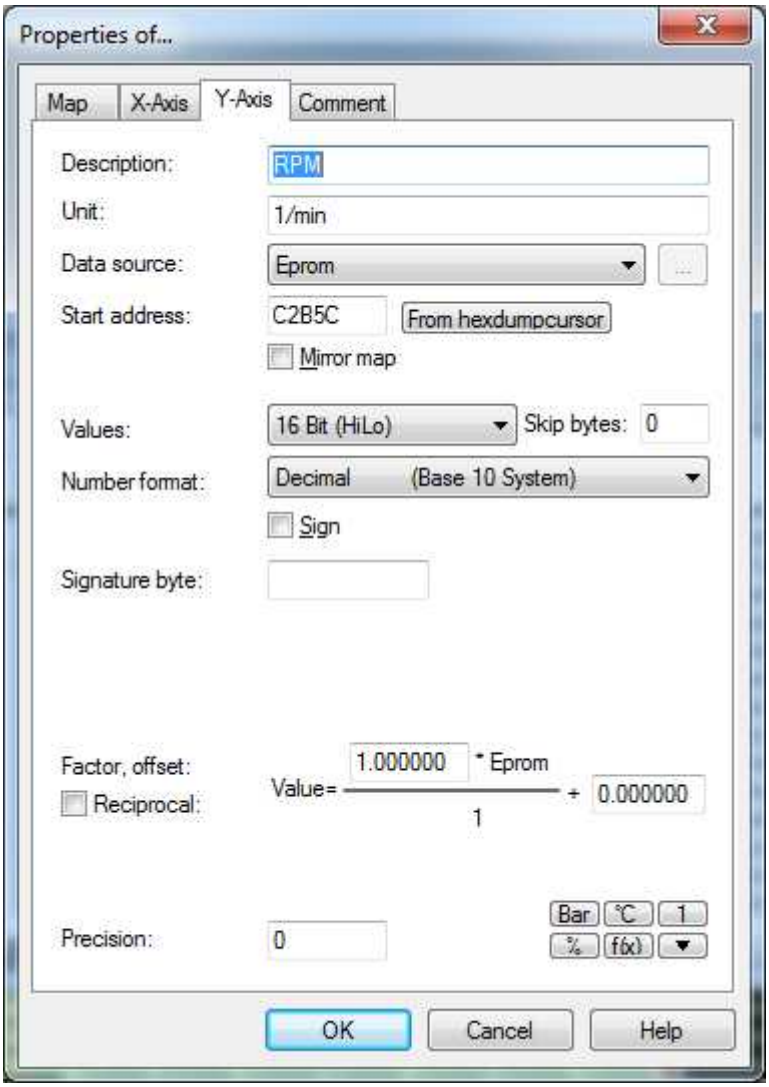
Air related maps

12. EGR vs MAF map:

General:

This map regulates the Exhaust gas recirculation valve.

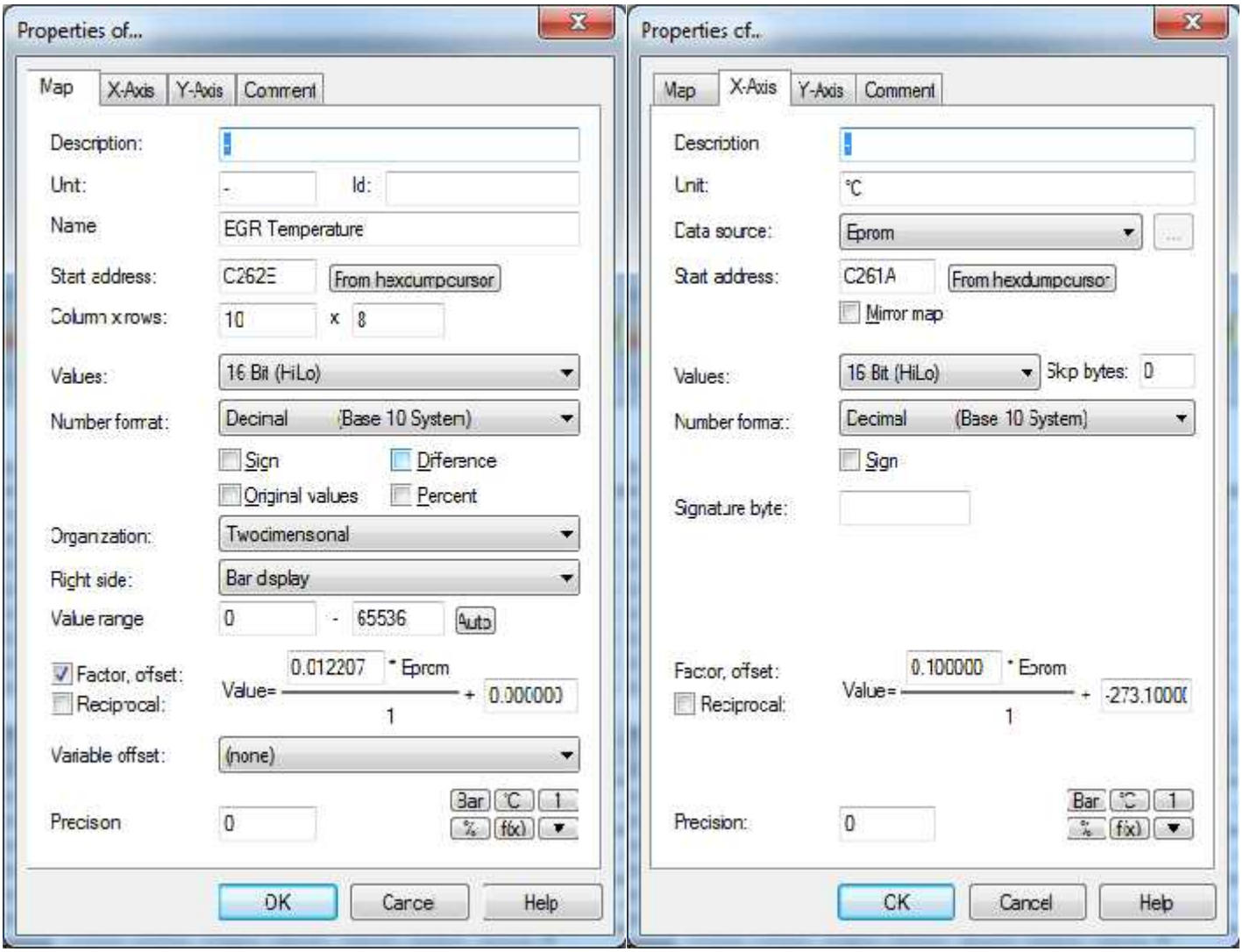


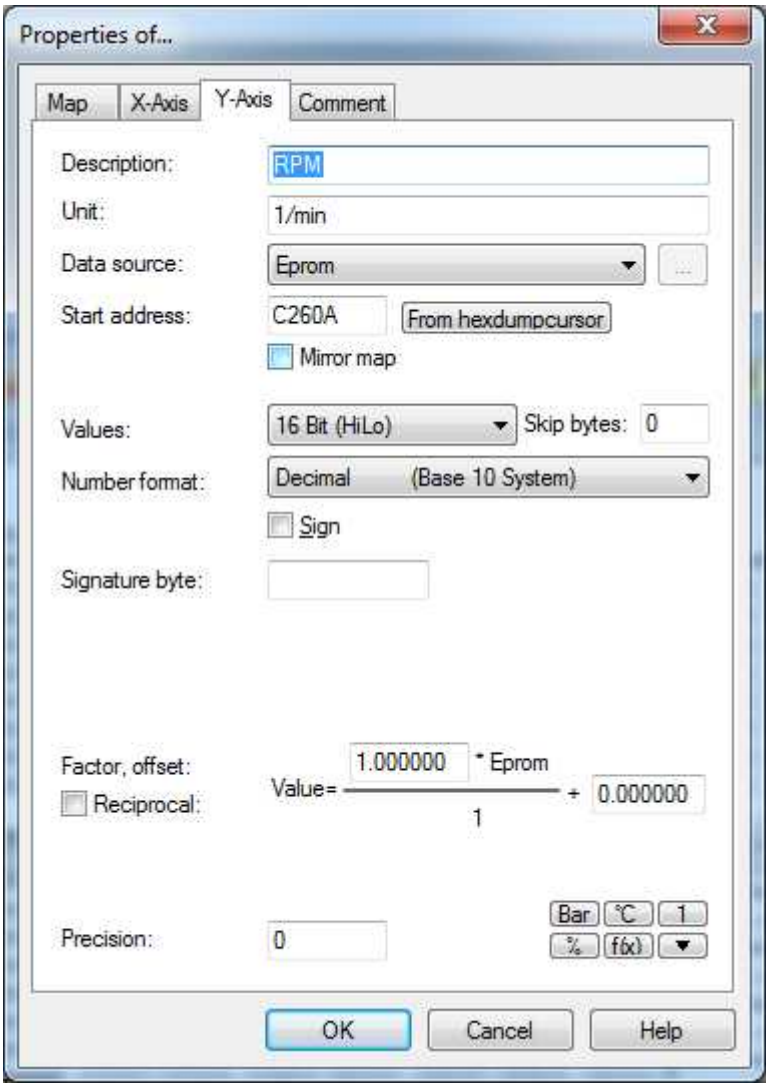

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
C2B5C
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

13. EGR vs Temp map:

General:

This map regulates the Exhaust gas recirculation valve.

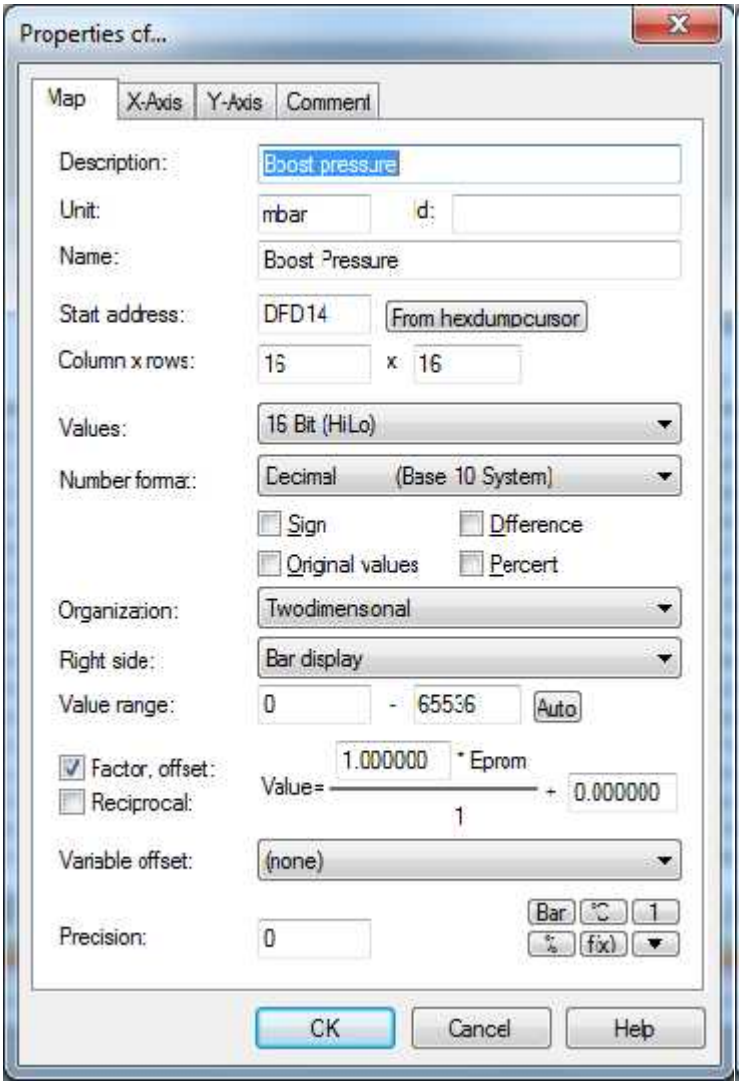


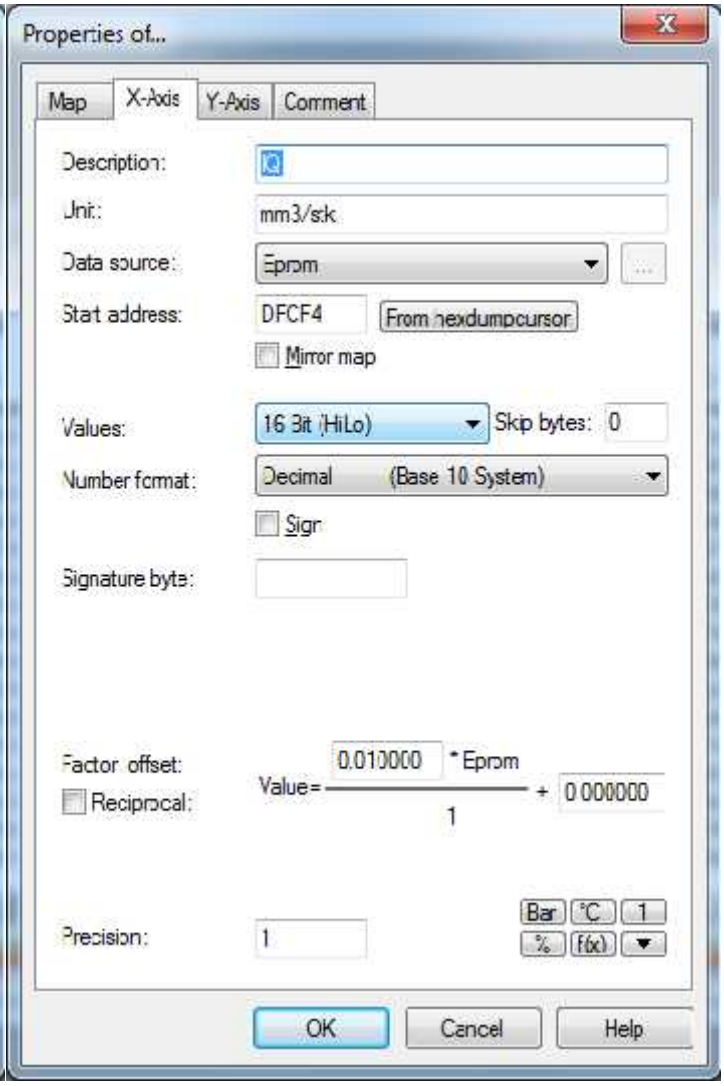

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
C260A
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

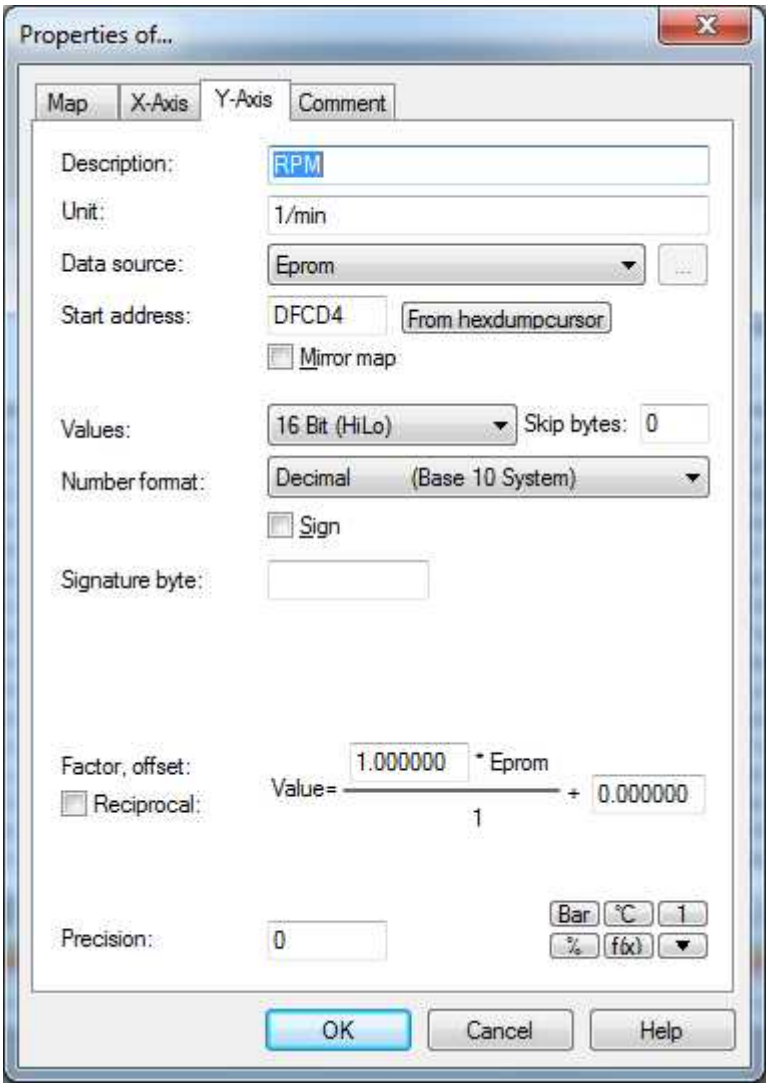
14. Turbo (Boost request) map:

General:

This map set the required boost depending on the requested torque and current rpm. There might be more than one boost map. In this file there is 2 maps, 1st is used during DPF regeneration, 2nd during normal operation.



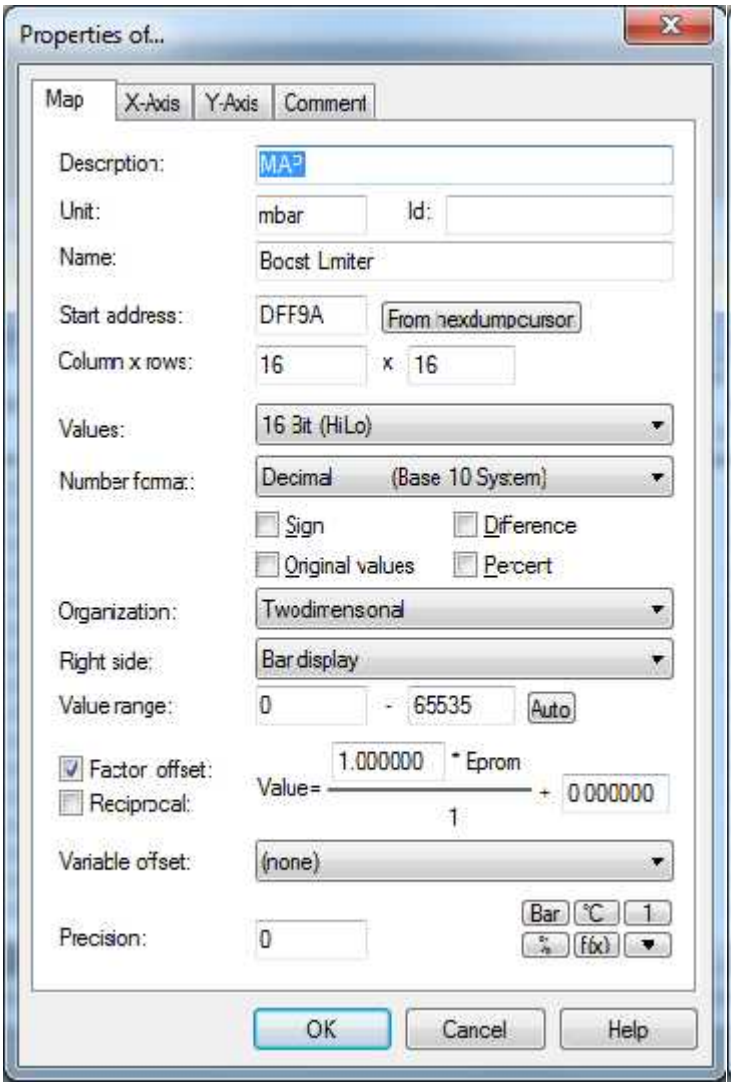


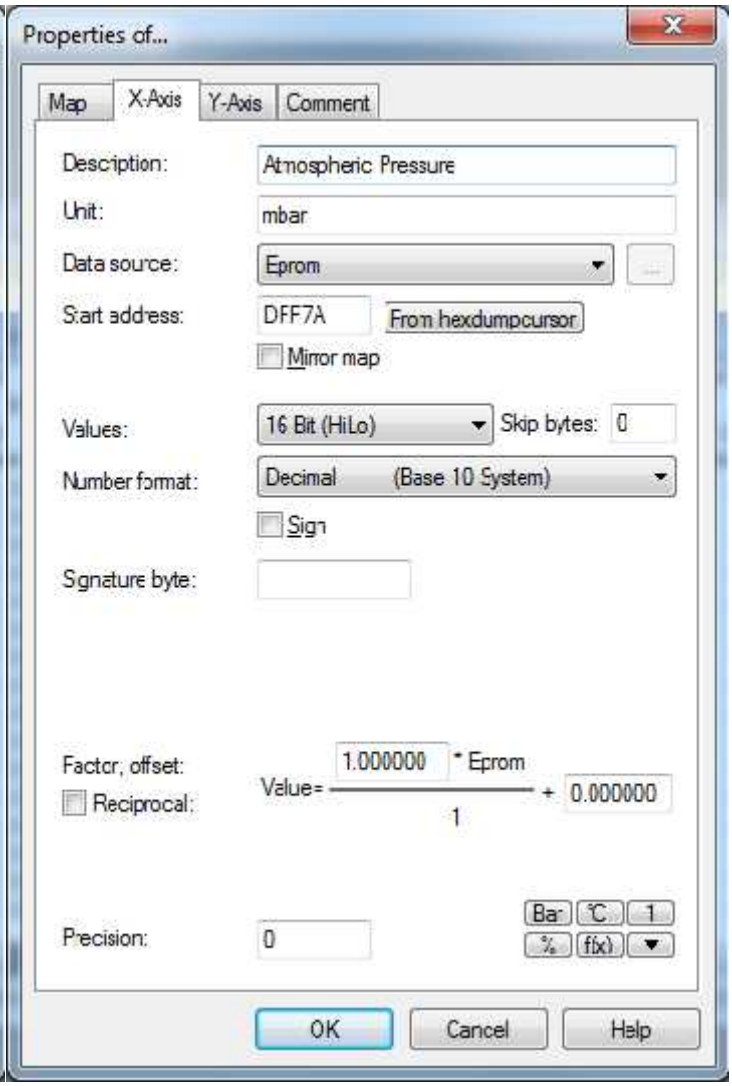

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
DFCD4
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
1.000000
* Eprom
Value=
+
0.000000
1
Reciprocal:
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

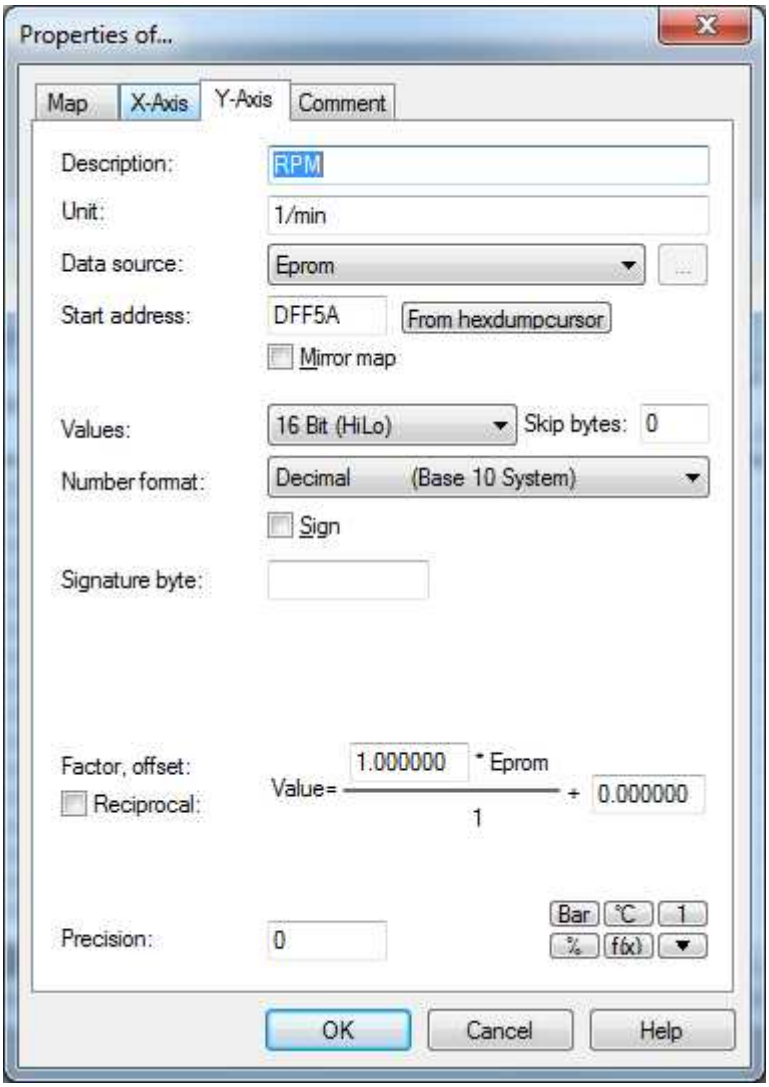
15. Turbo (Boost) limiter map:

General:

This map limits the required boost depending on the atmospheric pressure and the current rpm.





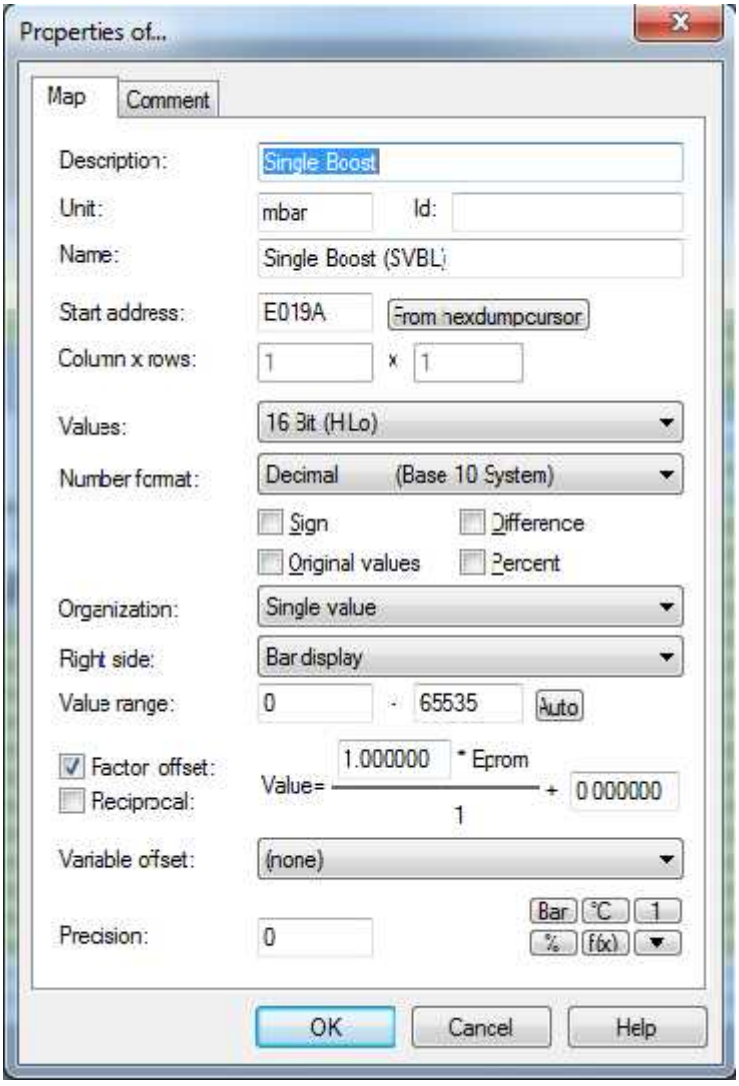

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
DFF5A
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

16. Single value boost limiter:

General:

This value limits the absolute pressure of the turbo. This value can be found by looking directly behind the turbo limiter map. If you look in 2D you see a series of bumps like this:

The SVBL is located at the end of the series of bumps, just before the line "falls" back to "0". In this case it is the highest value between the turbo limitation map and the next map. The value of the SVBL in this file is 2500mBar.



17. **Turbo vanes (N75) map:**

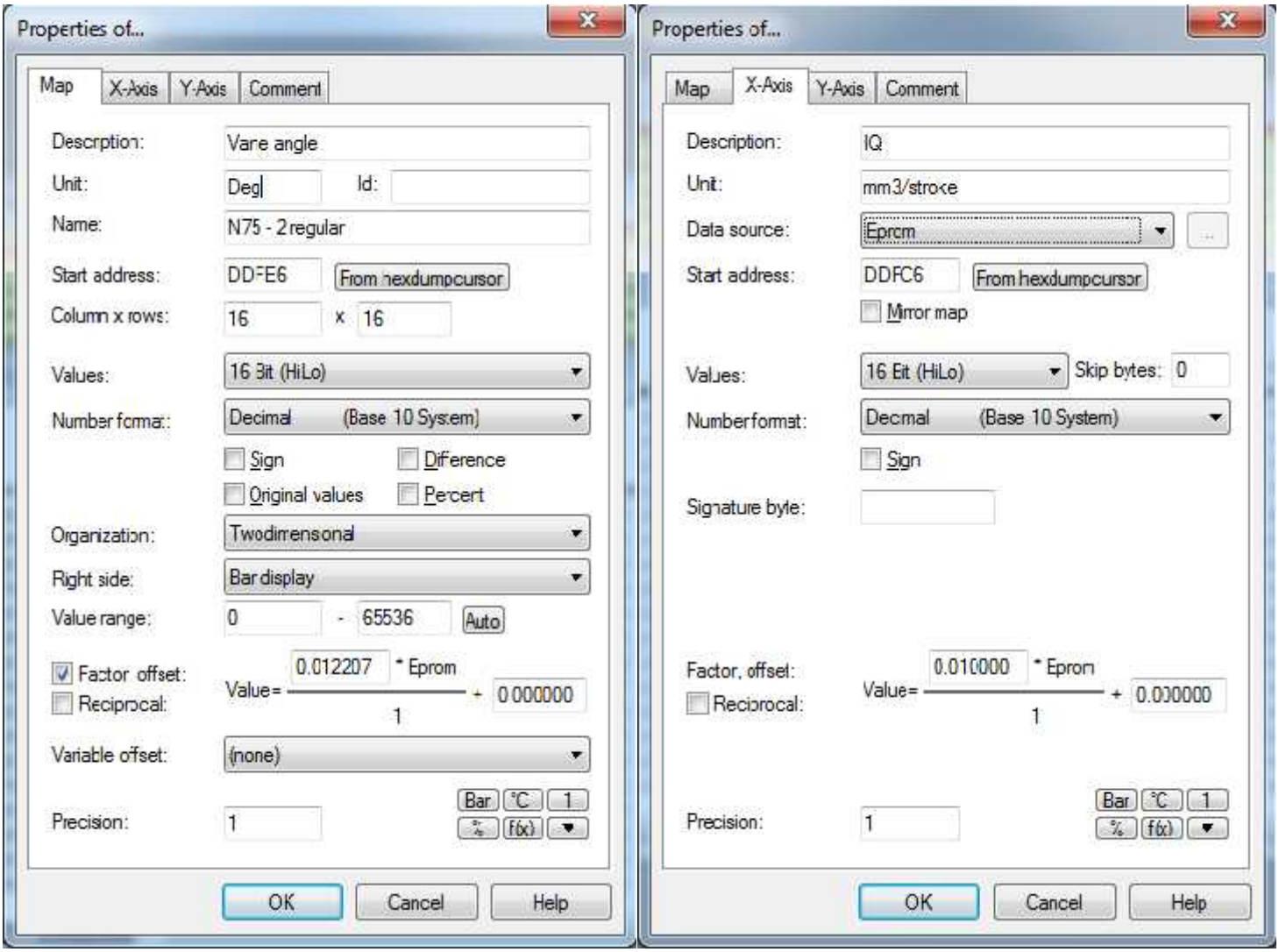
General:

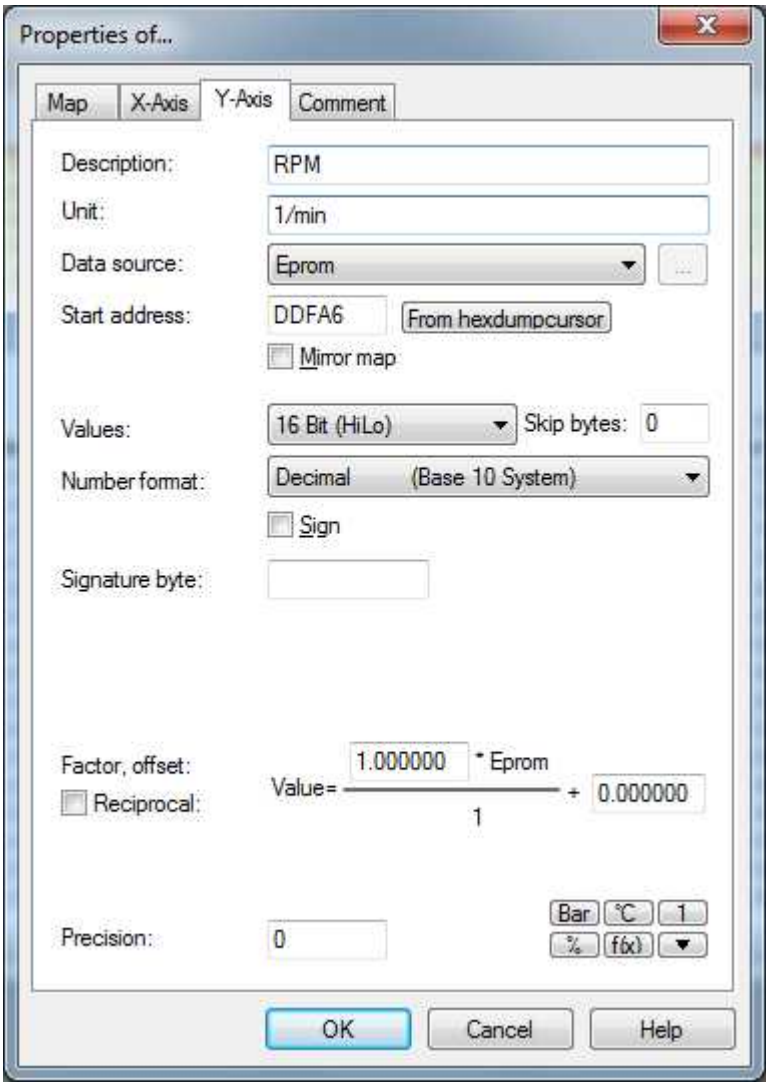
This map controls the vanes inside the turbo at a certain rpm and injected quantity. There is 4 maps, 1st is used during DPF regeneration, 2nd during normal operation.

Requested boost is how much boost the turbo should be making according to the map like in the ECU

Actual boost is how much boost the turbo is making, measured by the MAP (Manifold Absolute Pressure) sensor. this should obviously be similar to the requested value, however it's normal for it to have a little bit of lag, and then spike as the turbo spools up before returning to "about the same as the requested value"

N75 Duty Cycle this is given as a %, the highest it reads to is 75% and the lowest is around 30%. A low duty cycle equates to the ECU asking for more boost from the turbo, and a high duty cycle means the ECU has too much boost already and is requesting the boost be lower. so looking at the graph as accelerator is pressed, more fuel is injected and more boost is requested, as the boost is requested you will see the duty cycle go down, the boost will then rise to the required value as the turbo spools up and then the duty cycle will increase as you go up the revs. It does this because the amount of air flowing through the turbo is increasing, and with that increasing the need for the the vanes to close and build more boost is decreasing, hence the duty cycle rising.

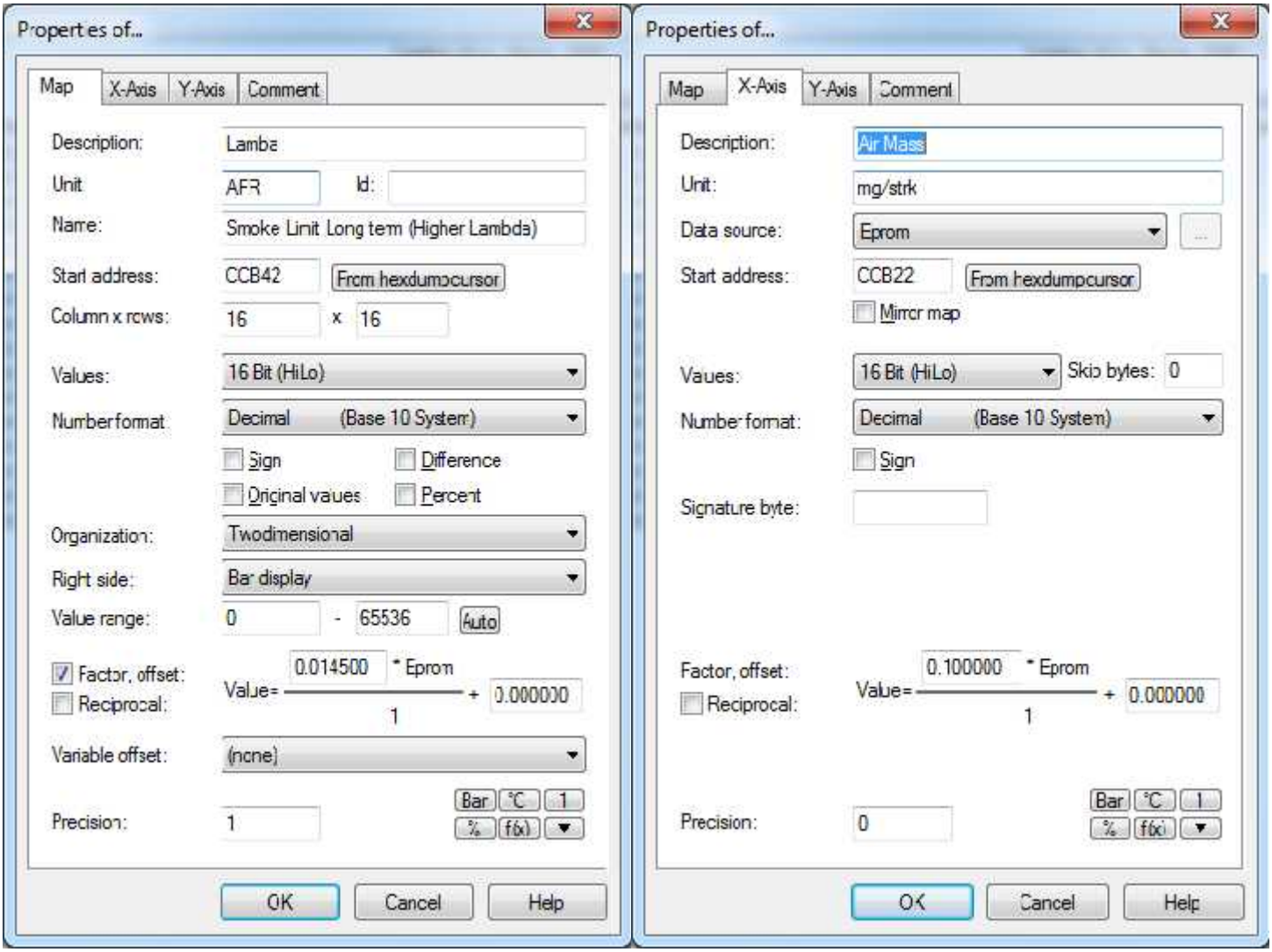


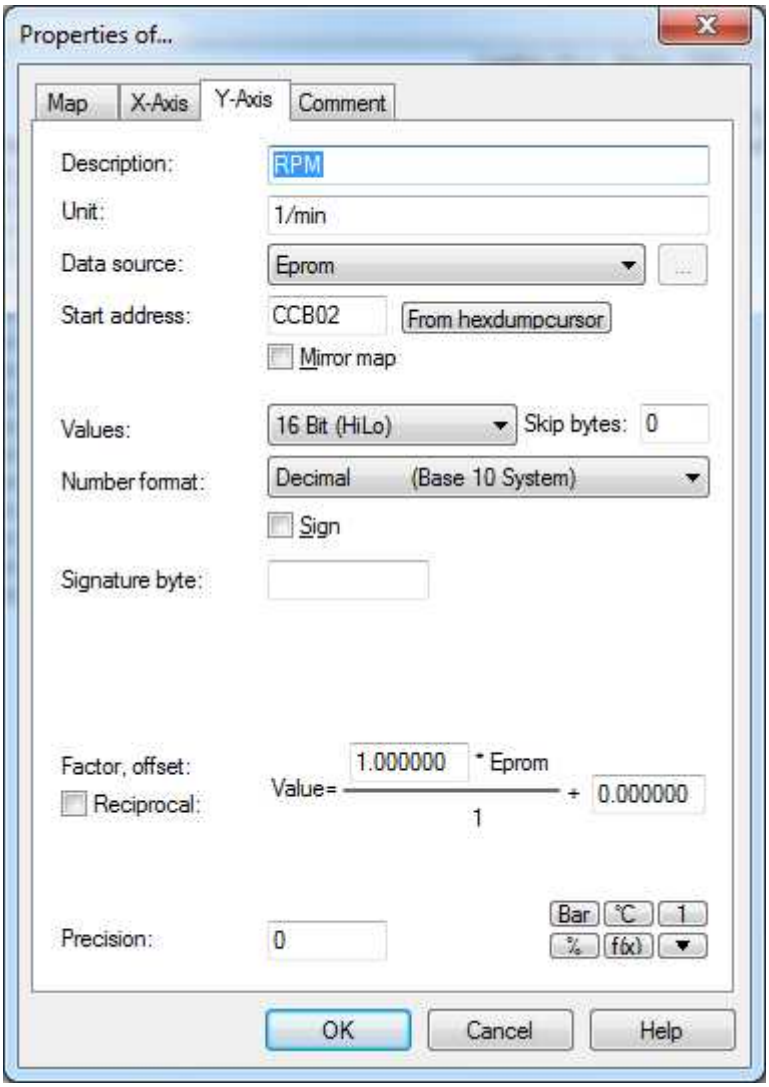

Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
DDFA6
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
Value=
1.000000
* Eprom
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

18. Lambda:

General:

The purpose of these important functions is to protect key components such as the exhaust manifold, turbocharger and catalytic converter. The principle of operation is the reduction of high exhaust temperature by enriching the air-fuel mixture. Excess (unburned) fuel evaporates cooling the cylinder walls, thus the exhaust temperature decreases. The ignition angle efficiency decreases as EGT increases but mixture enrichment can counteract this.




Properties of...
Map
X-Axis
Y-Axis
Comment
Description:
RPM
Unit:
1/min
Data source:
Eprom
Start address:
CCB02
From hexdumpcursor
Mirror map
Values:
16 Bit (HiLo)
Skip bytes:
0
Number format:
Decimal (Base 10 System)
Sign
Signature byte:
Factor, offset:
Reciprocal:
1.000000
* Eprom
Value=
1
+
0.000000
Precision:
0
Bar
°C
1
%
f(x)
OK
Cancel
Help

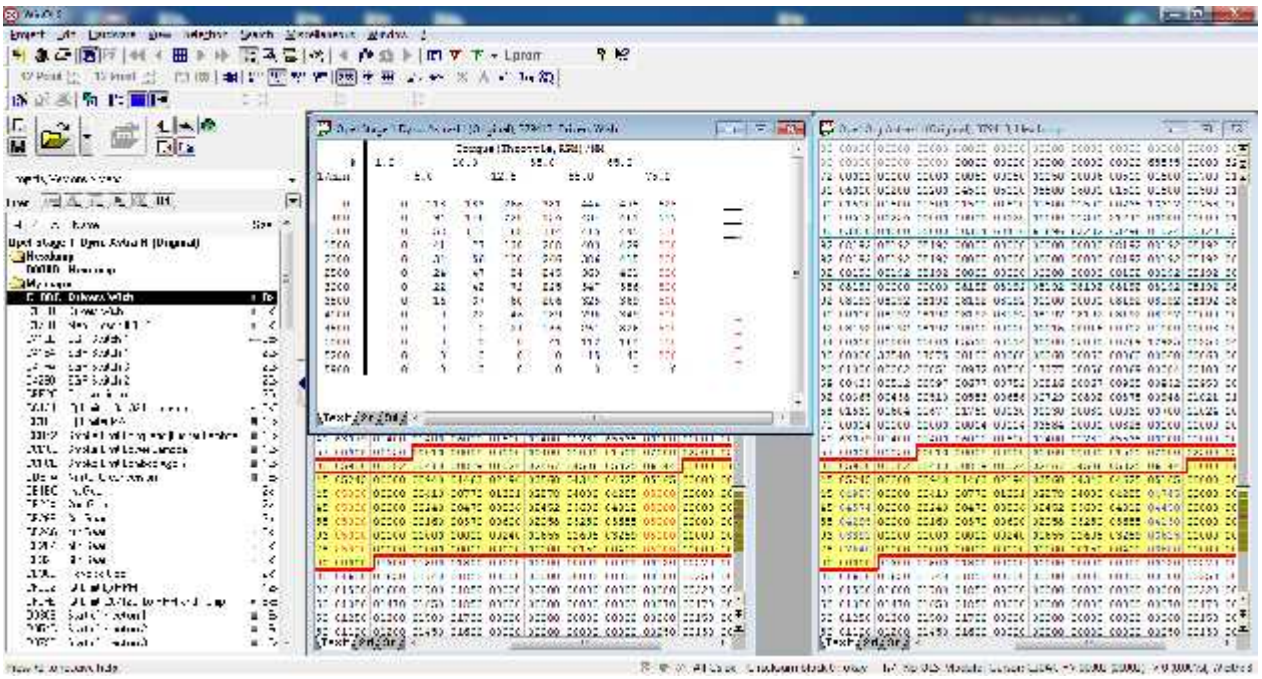
Tuning

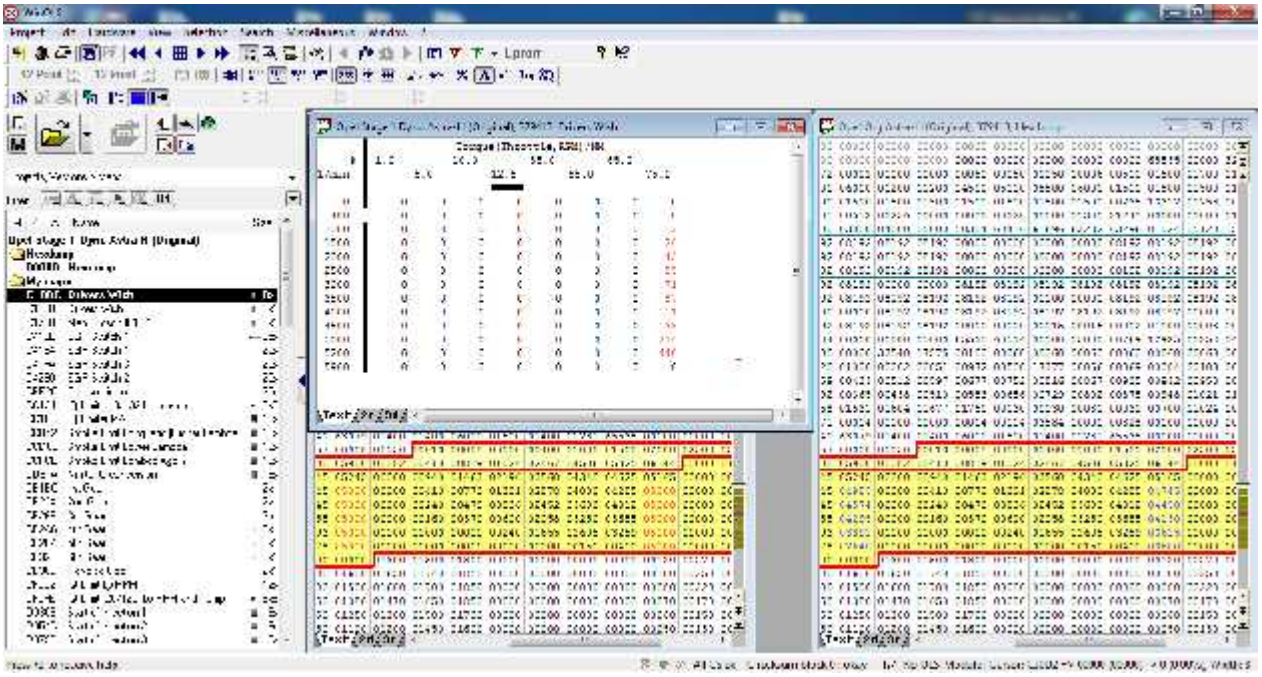
Fuel related maps

This example is from car tuned by popular tuner. While he works all over with increase of 20%, for safety I did my car with only 15% increases (and so in this example).

1. **Drivers wish Maps:**

If we want to tune a stock cdti/jtd engine it is enough to change the driver wish, torque limiter, smoke limiter, IQ limiter by IAT, IQ limiter by RPM, IQ limiter by Oil Temp, duration map (sometimes). EGR map and the turbo maps come later on.
The drivers wish can stay the same for pedal request up to 50%. And only increase the last two columns by 15% but not more than 500NM, as the NM to IQ map is calibrated to this value.

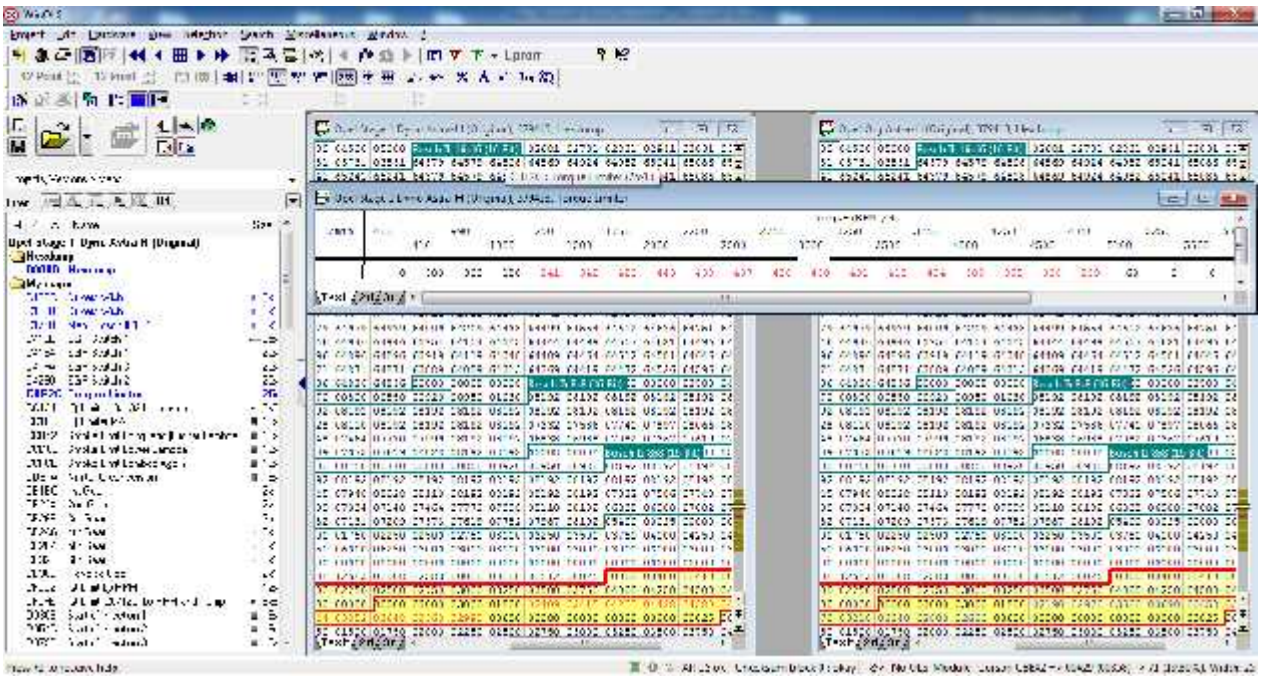




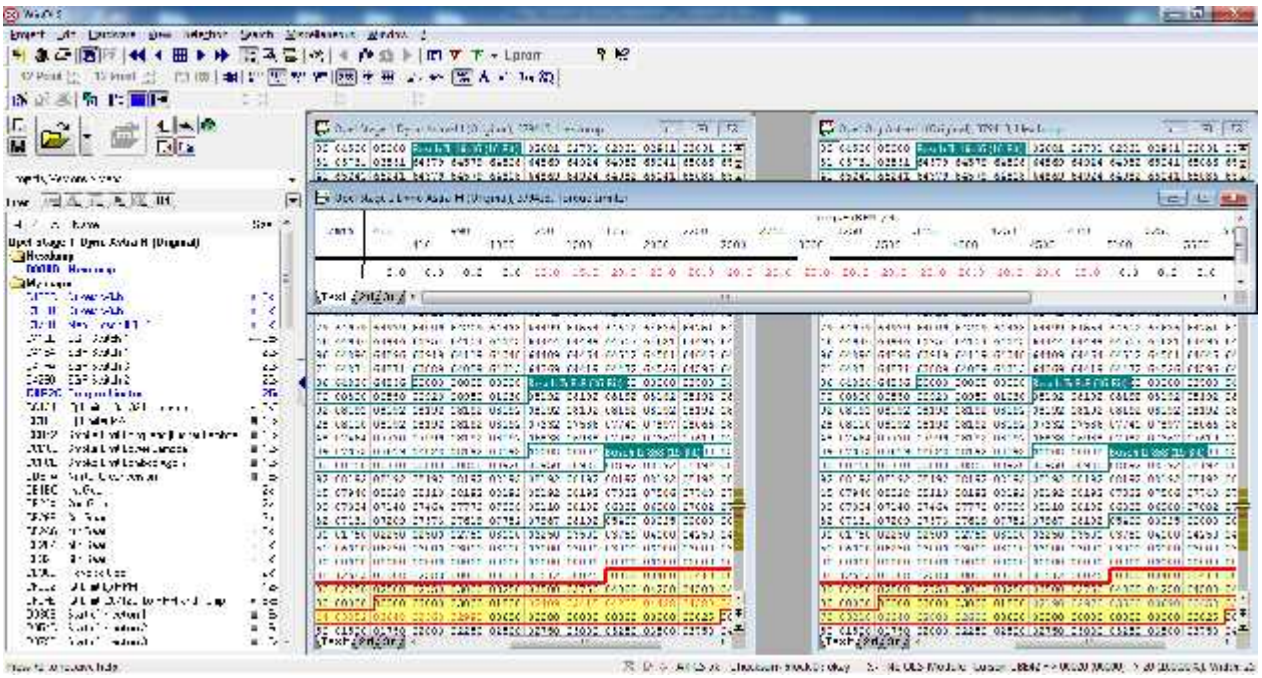
2. **Torque limiter:**

The torque limiter can be increased up to 4500rpm by ± 15%, leave car stock over those rpm (hard cut). Do not reduce the requested % in before 4500rpm as it will make your car powerful at low and powerless at high rpm (very inconvenient for overtaking, especially on auto-gearbox kick-down).
To avoid clutch problem start from 1250 with less %, and has the max % at 2000rpm on. So you will keep similar torque curve shape.

To give an example looks at the picture below. It is an original text view of the torque limiter.

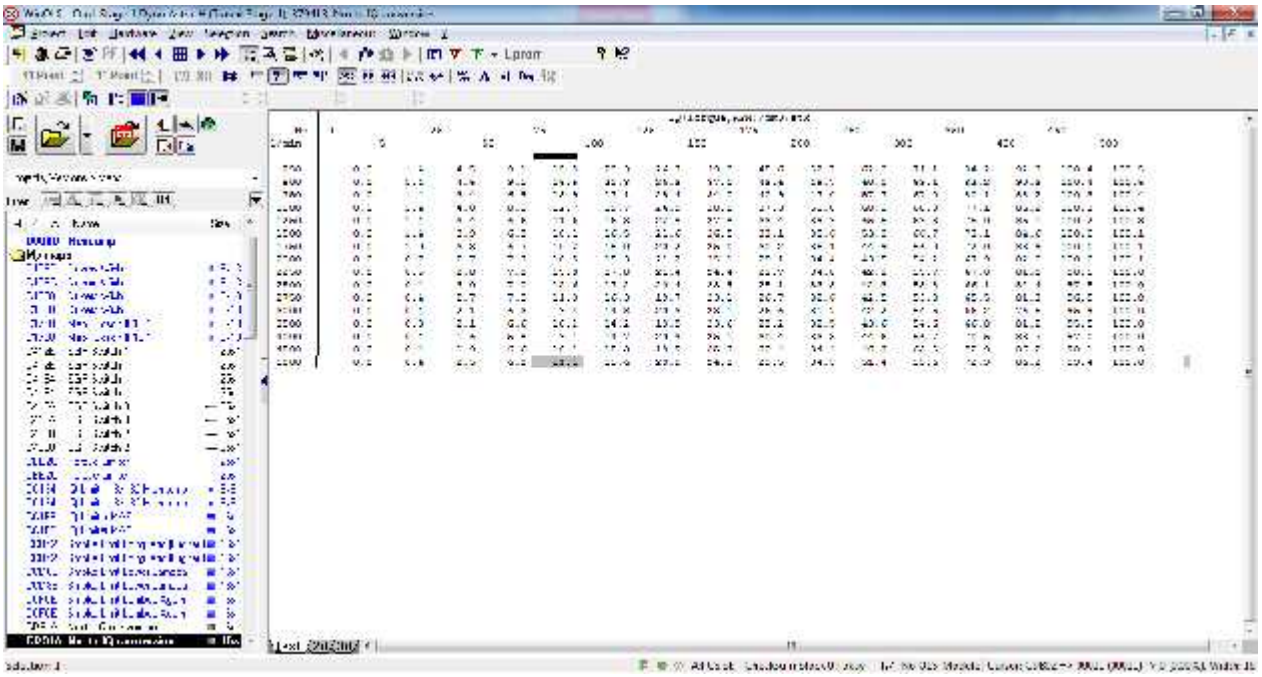


The modified torque limiter in % can look something like the picture below.



3. **Nm to IQ conversion map:**

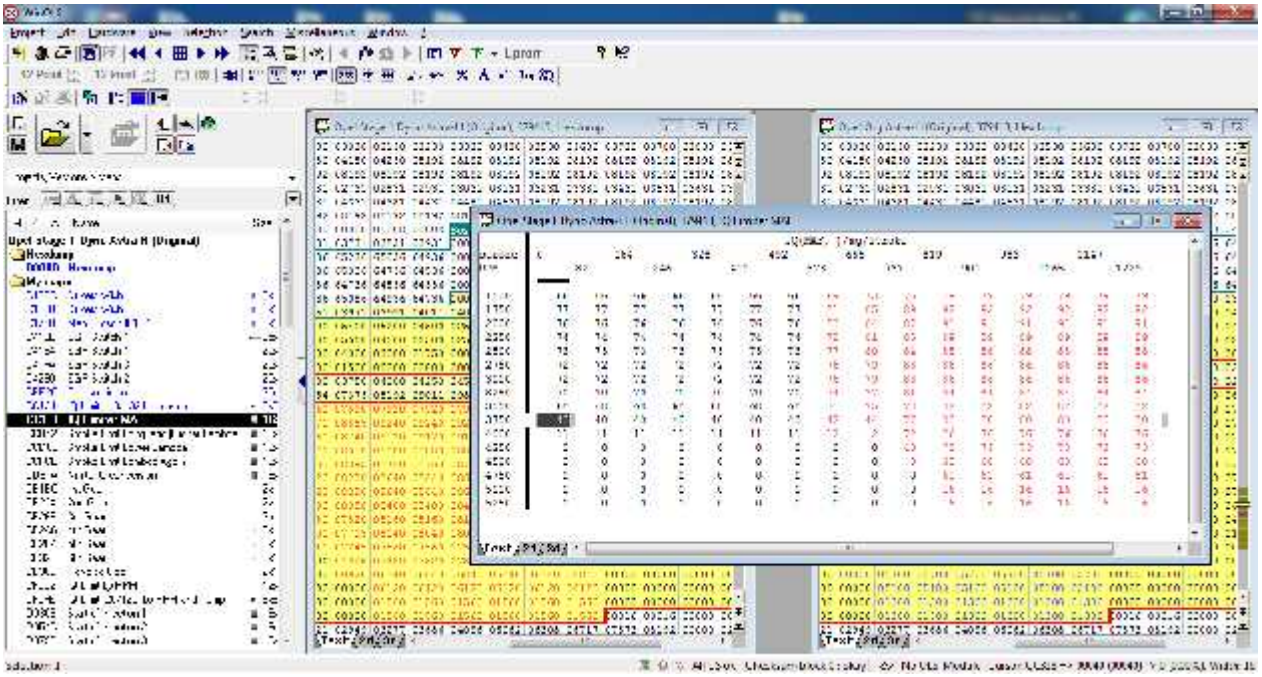
This map usually stays stock for CRS. However when some of the SV limiters are missed to avoid being embarrassed paid tuners yield to temptation of de-calibrating the engine. Should be used with caution when tuning auto-gearbox cars. Many VAG owners got bad experience. As mention above Vectra got calibration to up to 500NM, so should be enough for stock tuning.



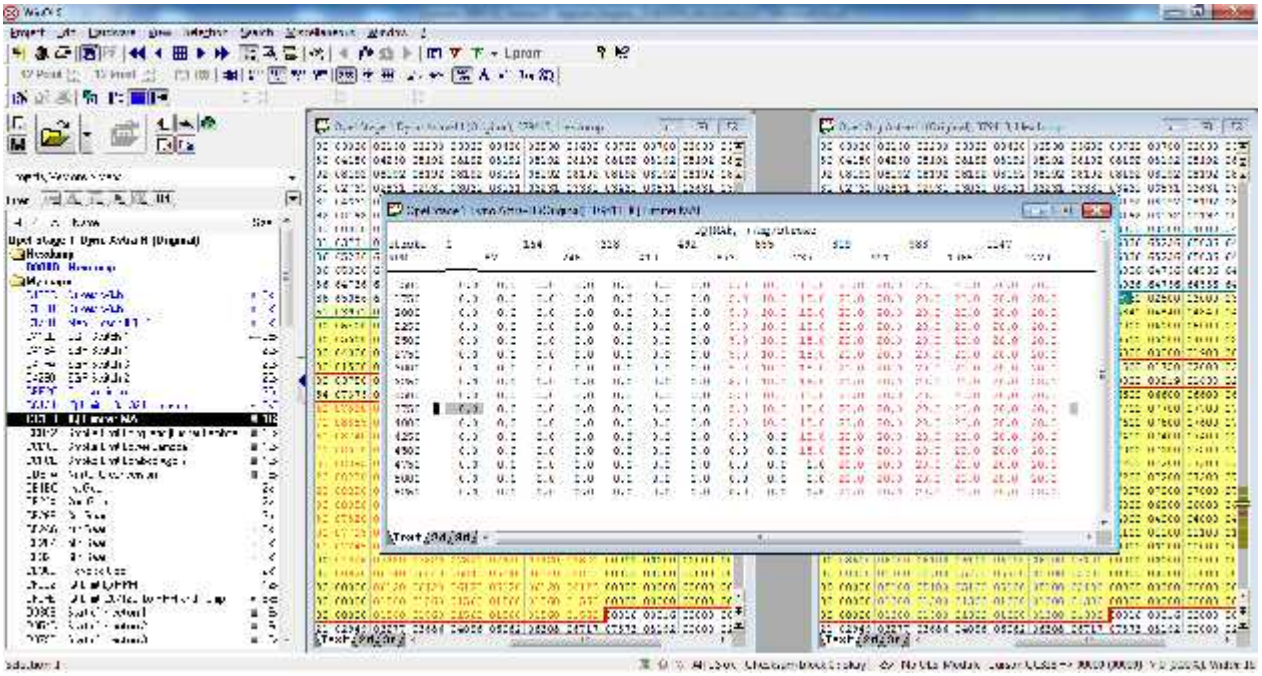
4. **Smoke limiter:**

As you can see manufacturer use the same values (mg/stroke) for low rpm despite of the IQ. However in the high rpm and less air mass, IQ is restricted more. We only want to change the smoke limiter at high IQ's and air mass. Let says you can start from half of the map area increasing by 5%, then 7.5%, 10%, 12.5% and make the whole last quarter +15%.

You can increase the highest value of MAF axis in order to achieve higher IQ at higher air mass, however the pro tune did NOT. I believe it is not be necessary as you will not be able to exceed the stock MAF axis quantity (1228,8 mg/stroke).

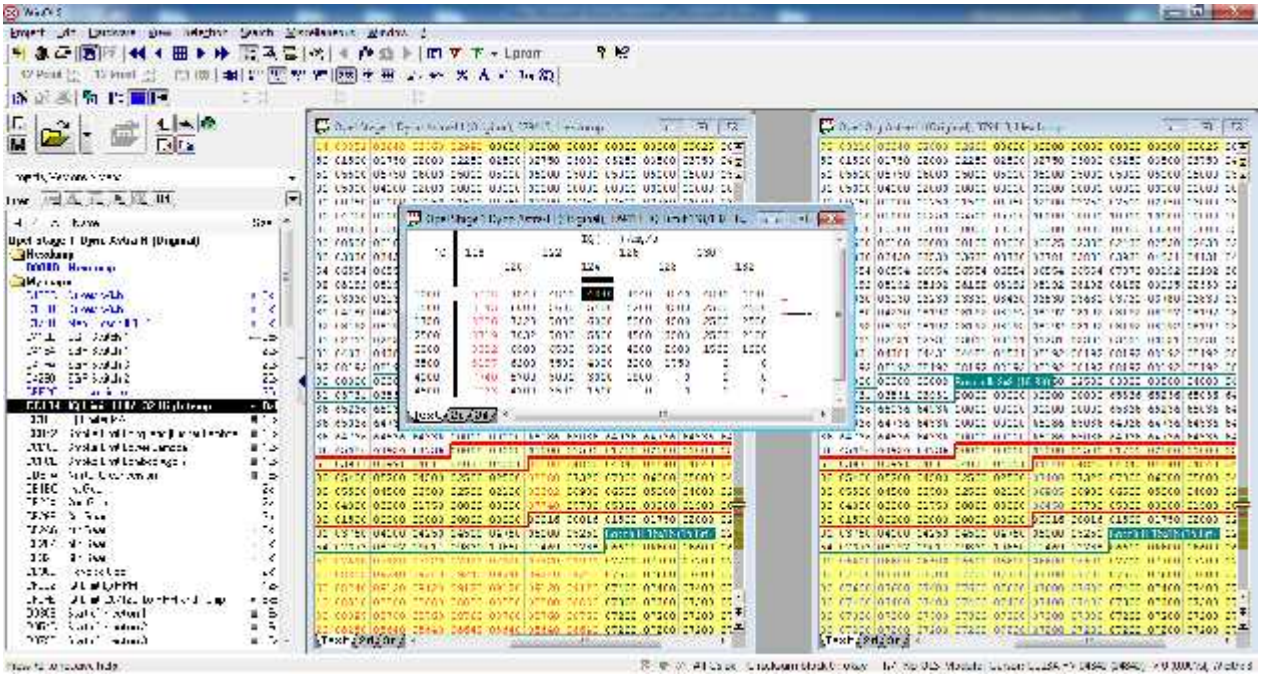


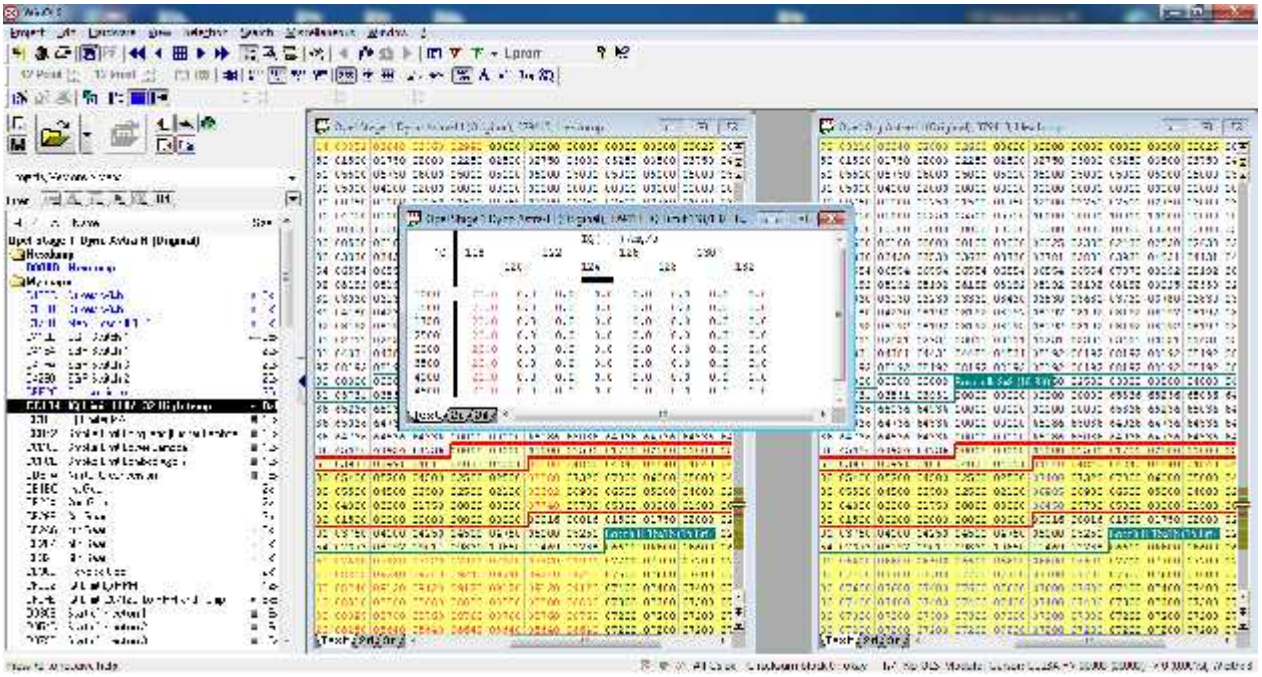
Original the text view of the smoke map looked like the picture



5. IQ limit by Oil Temperature

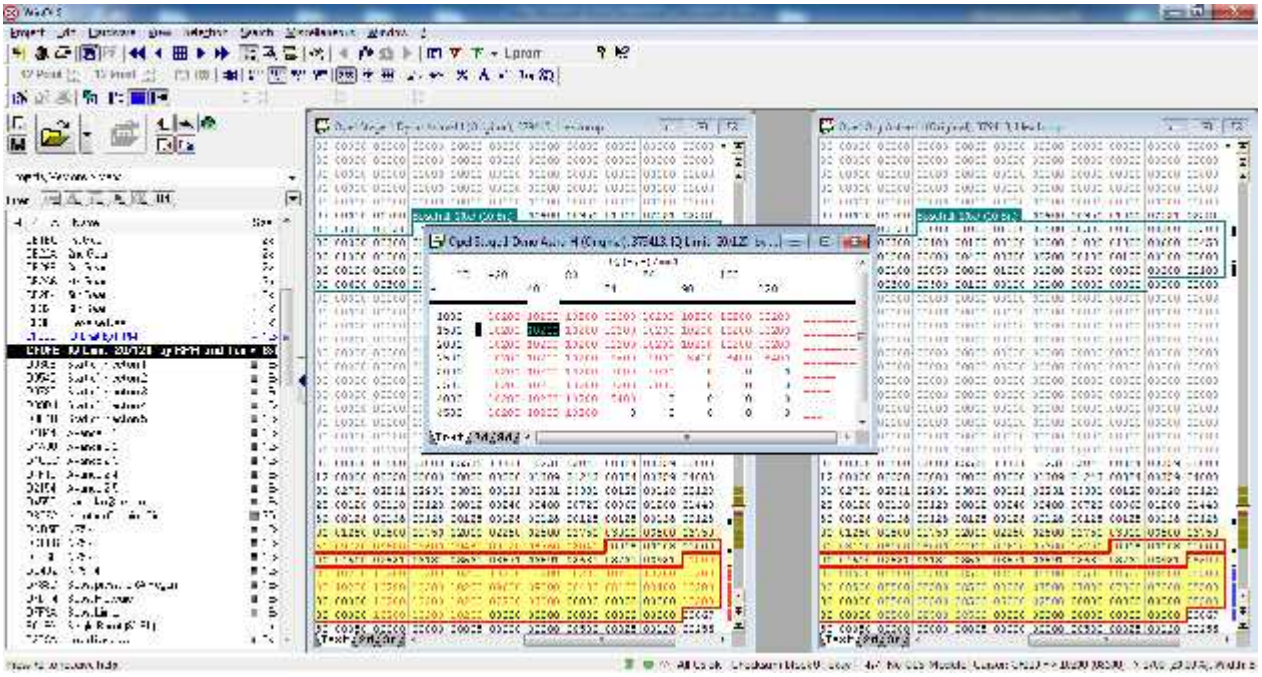
I this map limit IQ based on the Engine Oil Temp, however I could not find this temp in my car logs. I just follow pro tuners work and increasing the values by 15%, leaving last columns stock for safety margin.

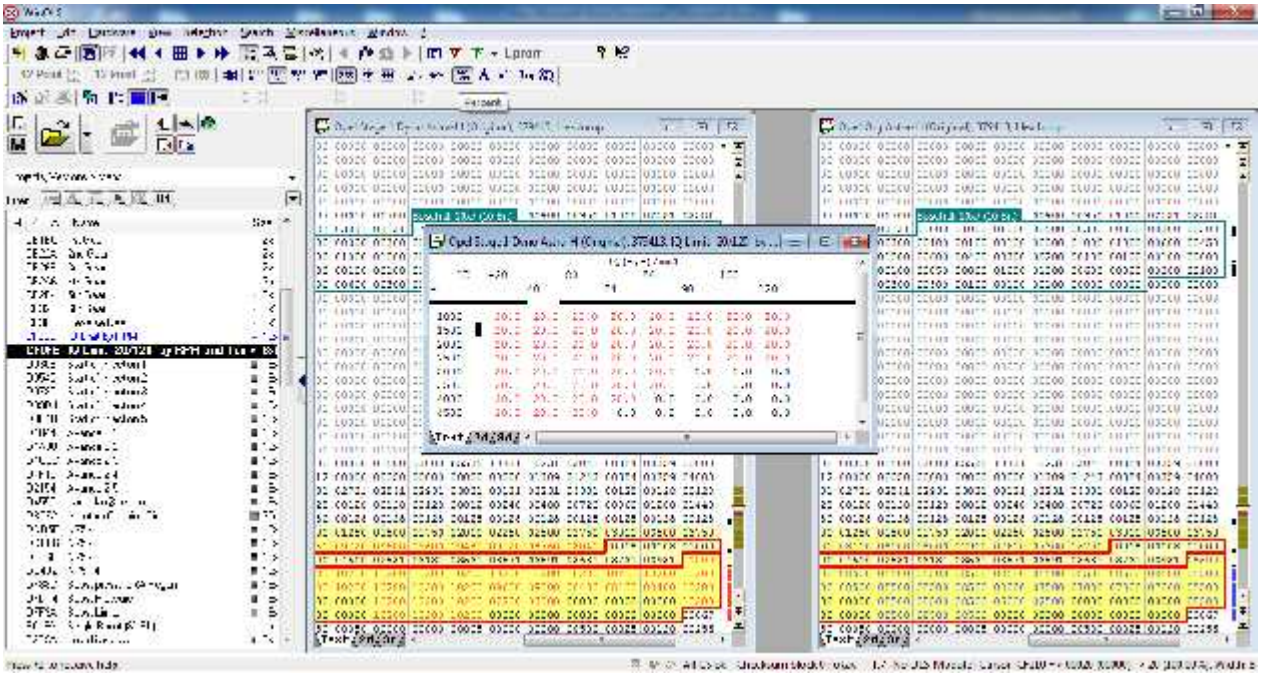




6. IQ limit by Intake Air Temperature

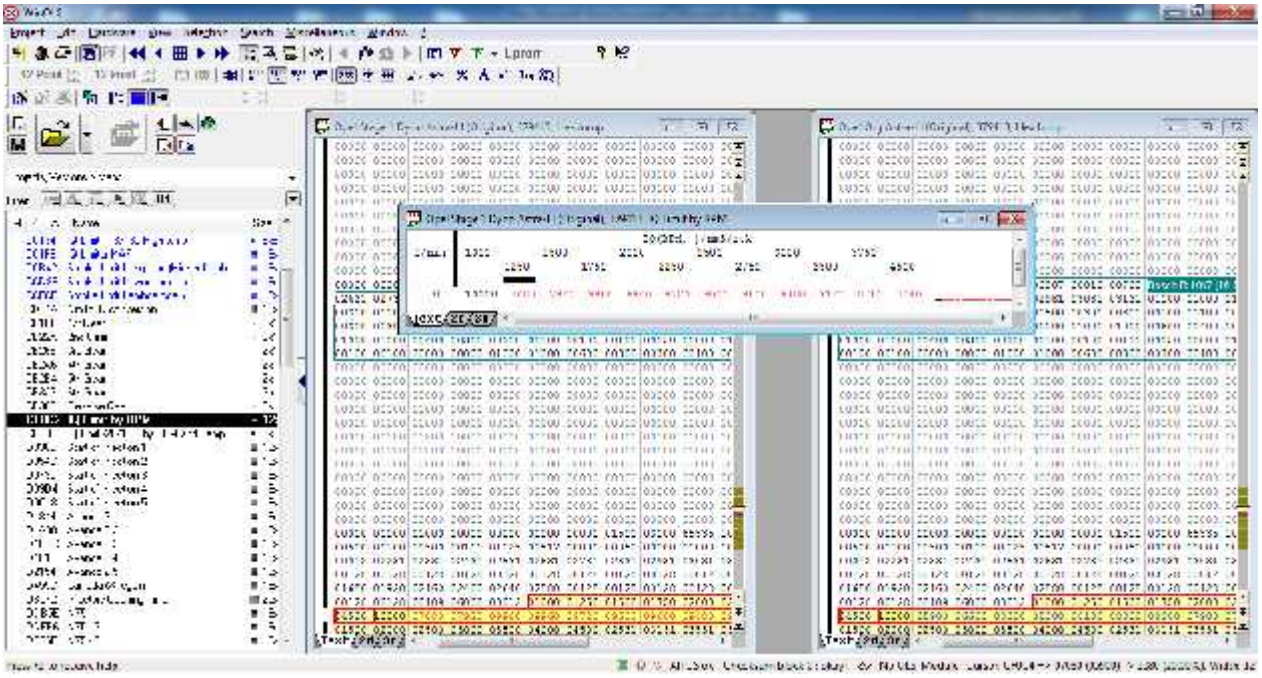
I this map limit IQ based on the Intake Air Temperature. I follow pro tuners work and increasing the values by 15%, leaving last columns stock for safety margin.

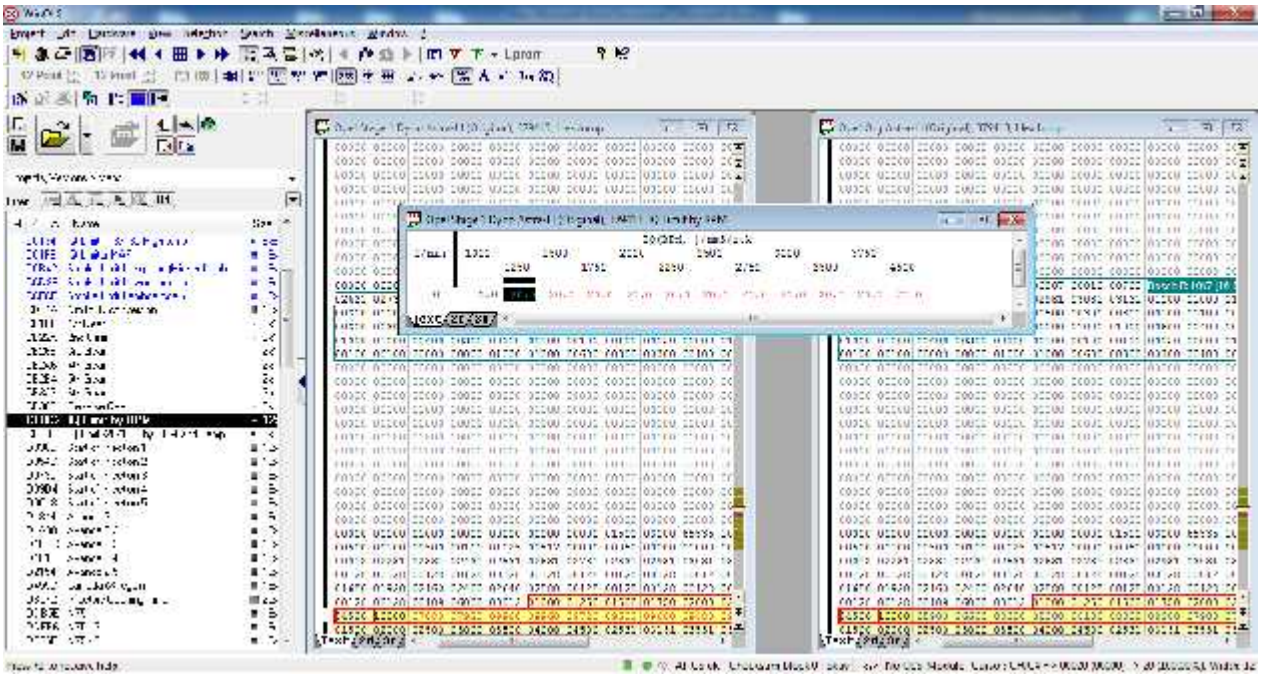




7. IQ limit by RPM

I this map limit IQ based on the Intake Air Temperature. I follow pro tuners work and increasing the values by 15%, leaving last columns stock for safety margin.

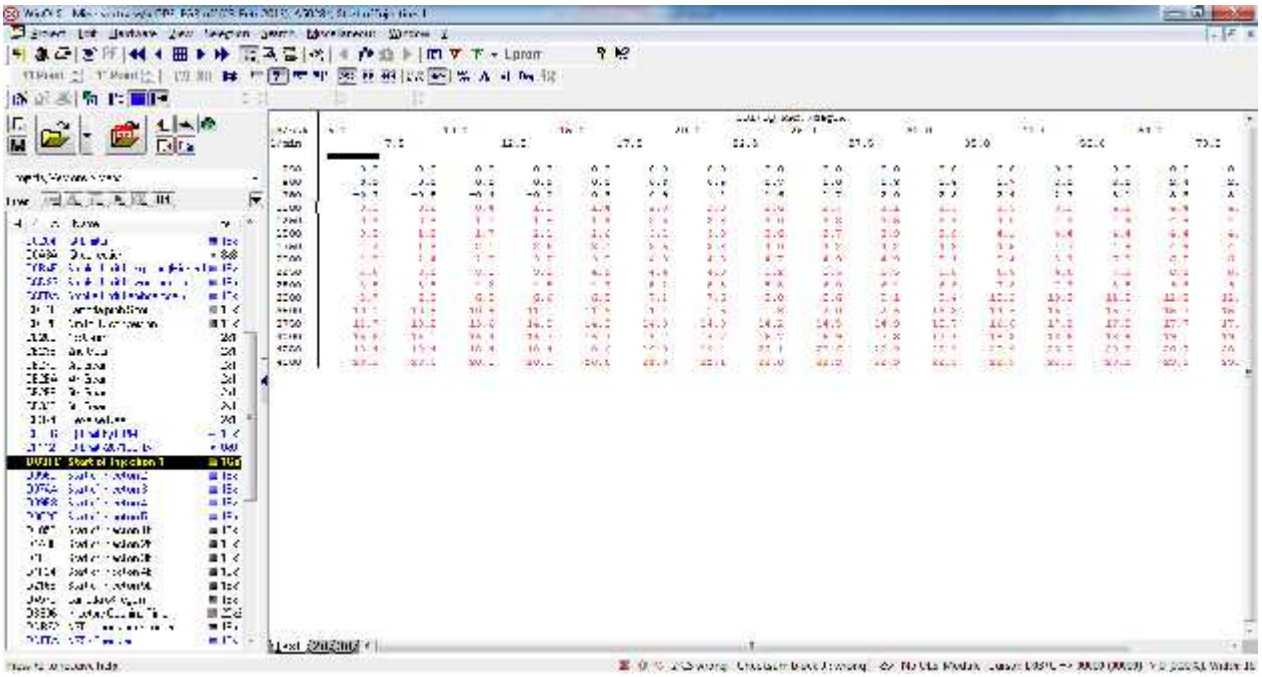


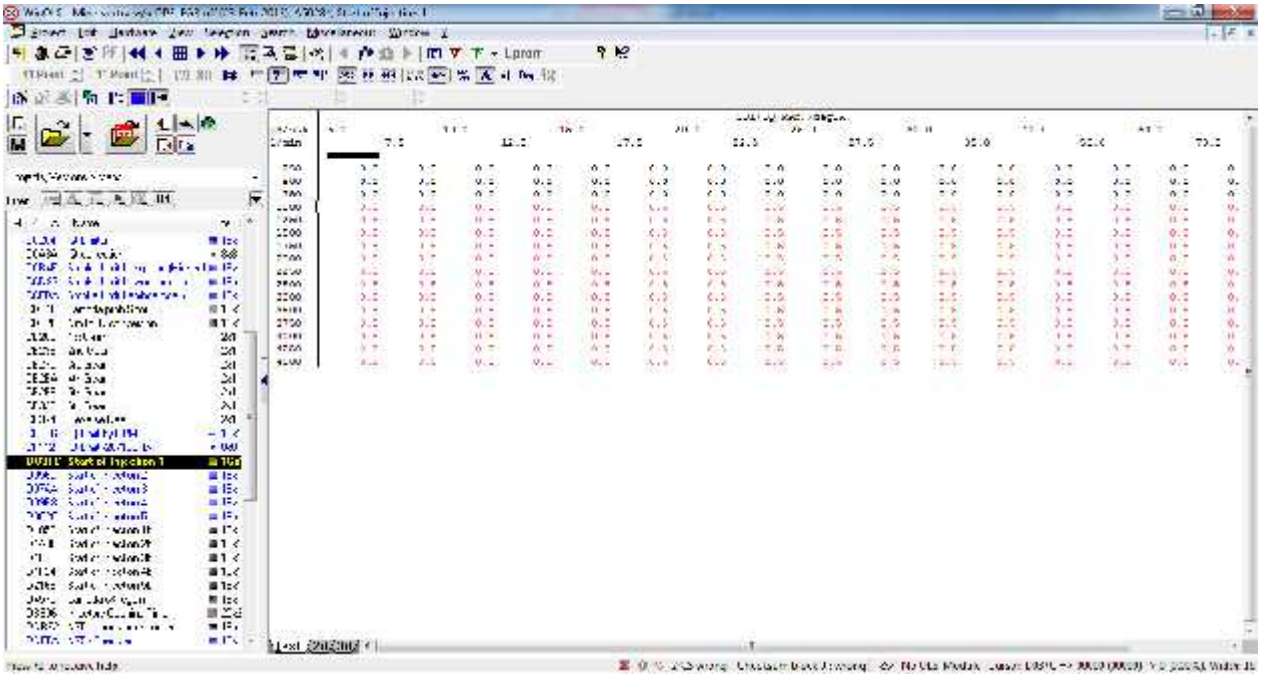


8. Start Of Injection map:

Pro tuner **left this map stock**. I advanced mine all over the IQ and revolution range by 2.0deg on steps by 0.5 deg at a time. “Luckily” I did blow out the O-ring of one of my injectors. And I go back to +0.5deg all over assuming that it will not be too mach.

You should bear in mind that switching off EGR increase speed of combustion, increasing boost advance start of combustion, and increasing rail pressure will make injecting higher more quantity BTDC. So finally better stay on safe side and do not play to much with SOI.

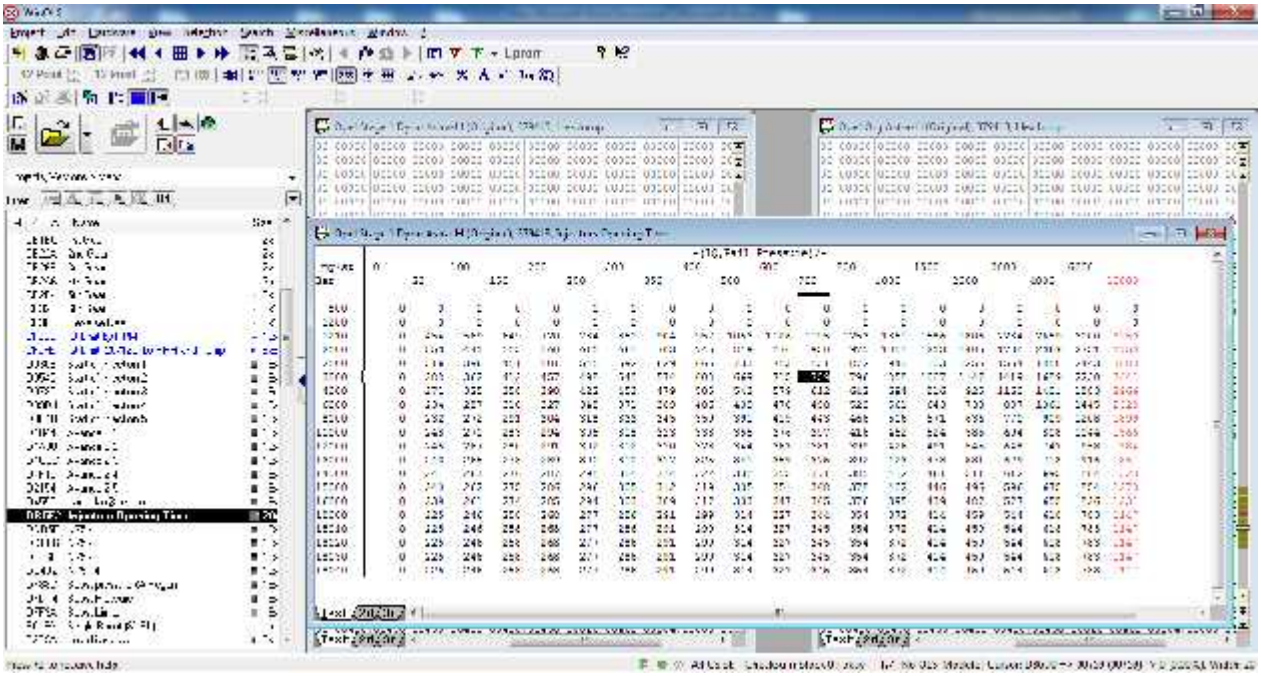


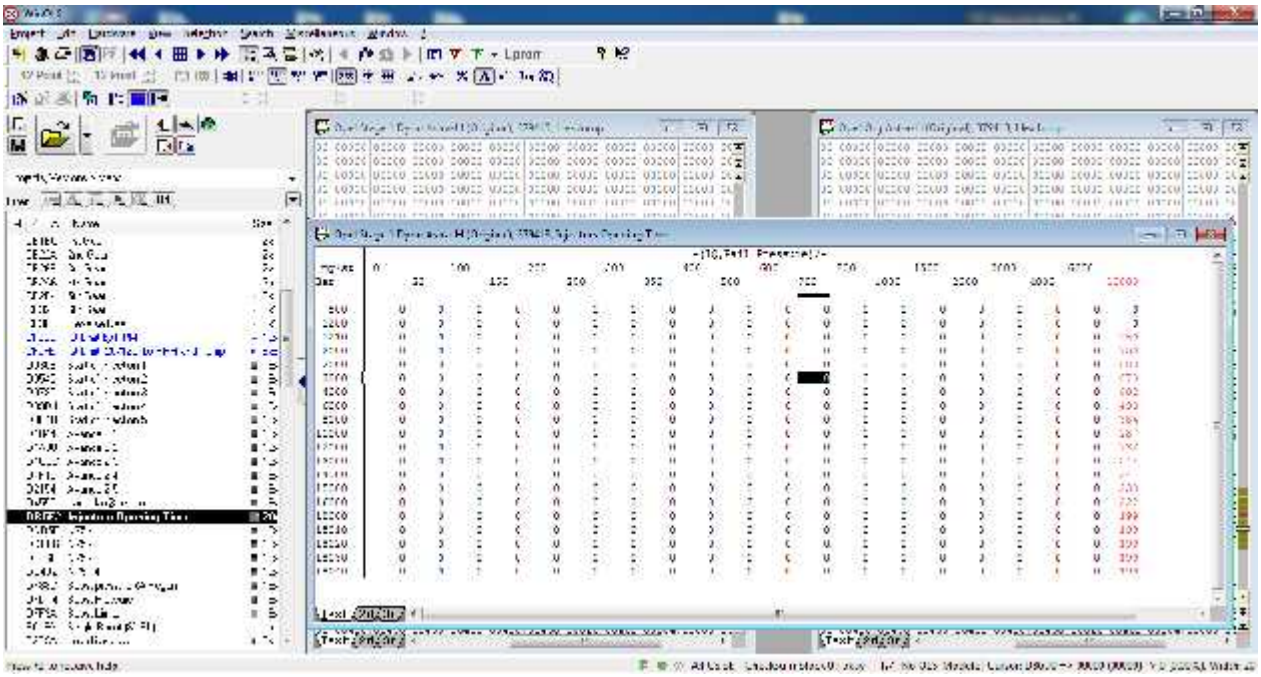


9. **Injector opening time (Duration map):**

The duration maps may need to be changed also. Otherwise the duration map will limit the injected quantity at the highest possible axis. So we need to change the axis value from 80mg/stroke to 100mg/stroke in this case. And extrapolate injector opening time for the new IQ axis. You can see in the example how pro tuner did it. However you can choose different values as it the opening time not rising in progression.

It is visible that when stock injector opening time is never more than 3000 micro sec, and got same values for lowest rail pressure and IQ 60 - 80mg/stroke(for all 1.9DTH engines including Opel, Fiat and SAAB). So maybe it is not advisable to go over those timing, even so I don't think the car will ever operate at that CRS pressure/IQ/RPM range.

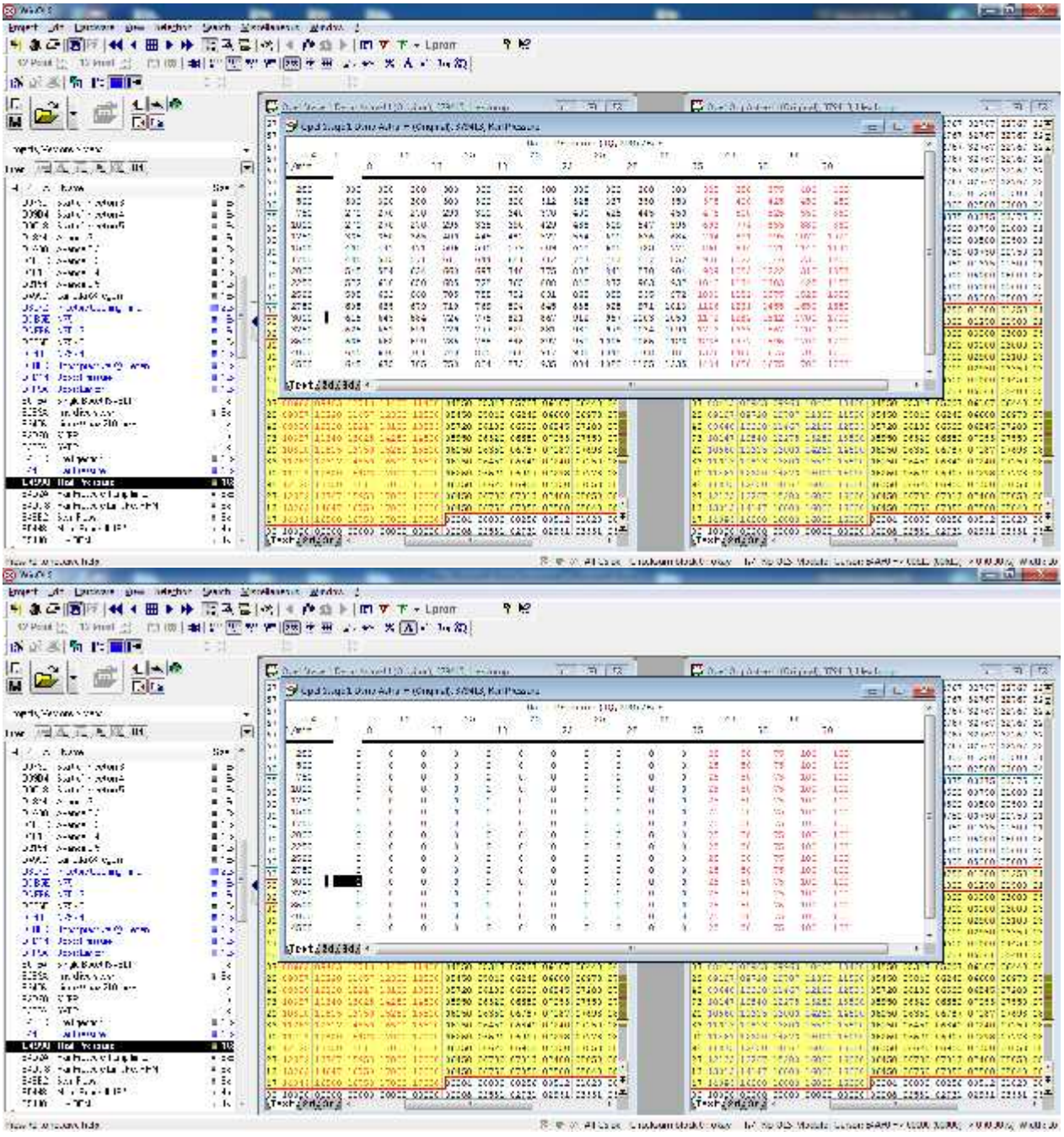




10. CRS Rail Pressure:

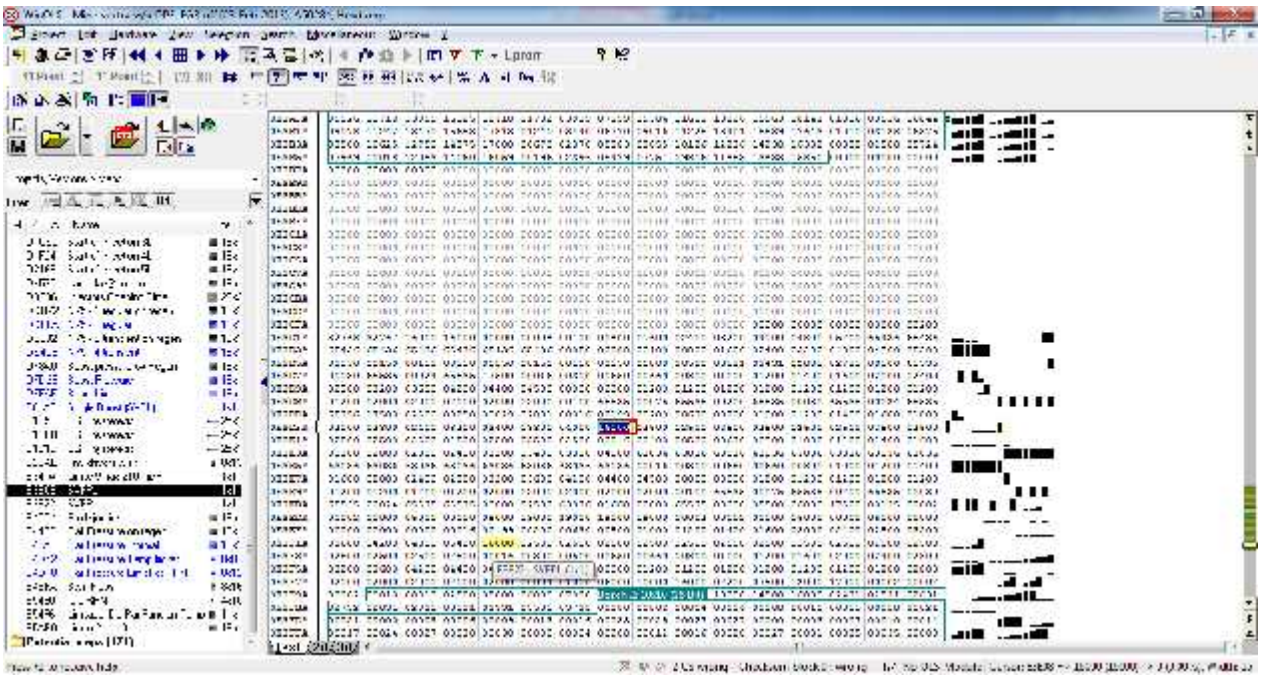
A positive effect of increased fuel pressure... is that forcing the fuel through the same injector at a higher pressure tends to improve fuel atomization. This will tend to improve fuel distribution and combustion efficiency, and may contribute to improved fuel economy. The benefits of higher pressure are accompanied by some additional concerns, the main one being safety. With fuel lines and connections being subjected to higher pressure, there naturally is an increased risk of leaks or outright failure. To ensure reliability, the standard Bosch parts are rated for pressures well above the normal operating range...

The pro tuner increased all pressure related maps using flat Delta (100bar) over the whole revolution range, same story here. I used +6% (max 1696bar) and extend this all over (1000rpm) the map even for low IQ values.



11. SV Rail Pressure:

This value limits the absolute common rail pressure. This value can be found behind the rail pressure map. There is 4 maps like this. No need to touch them.



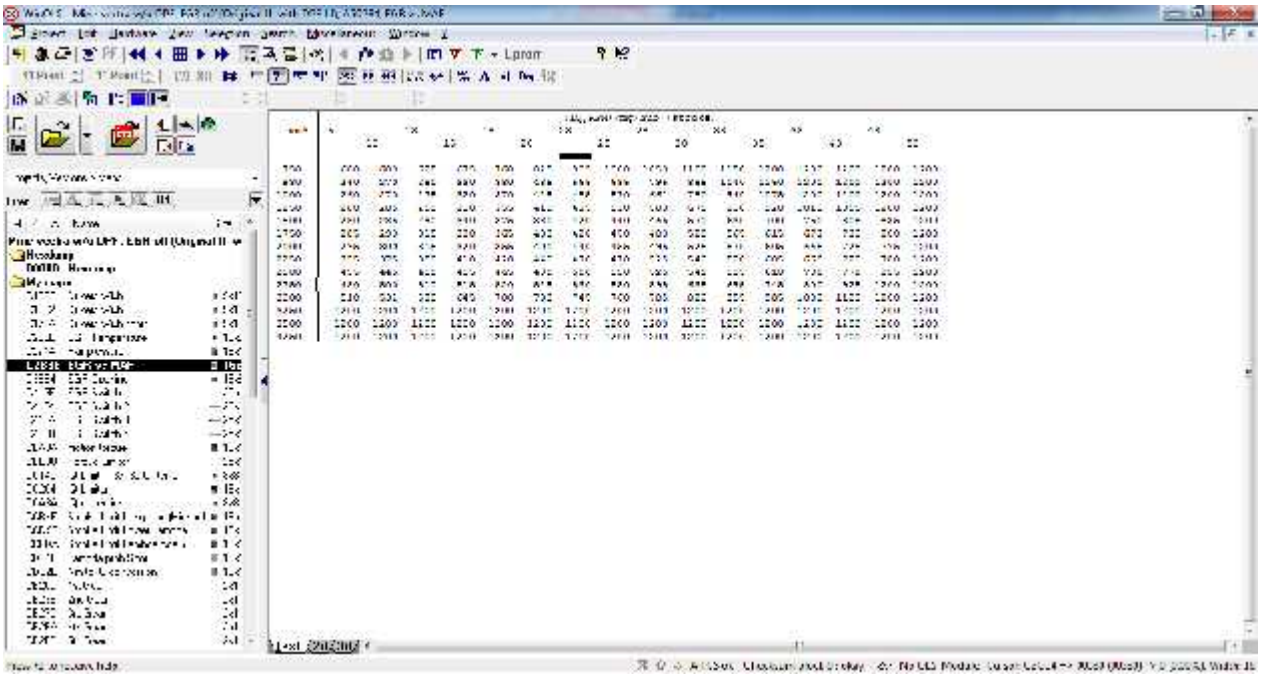
Air related maps

12. EGR vs MAF map:

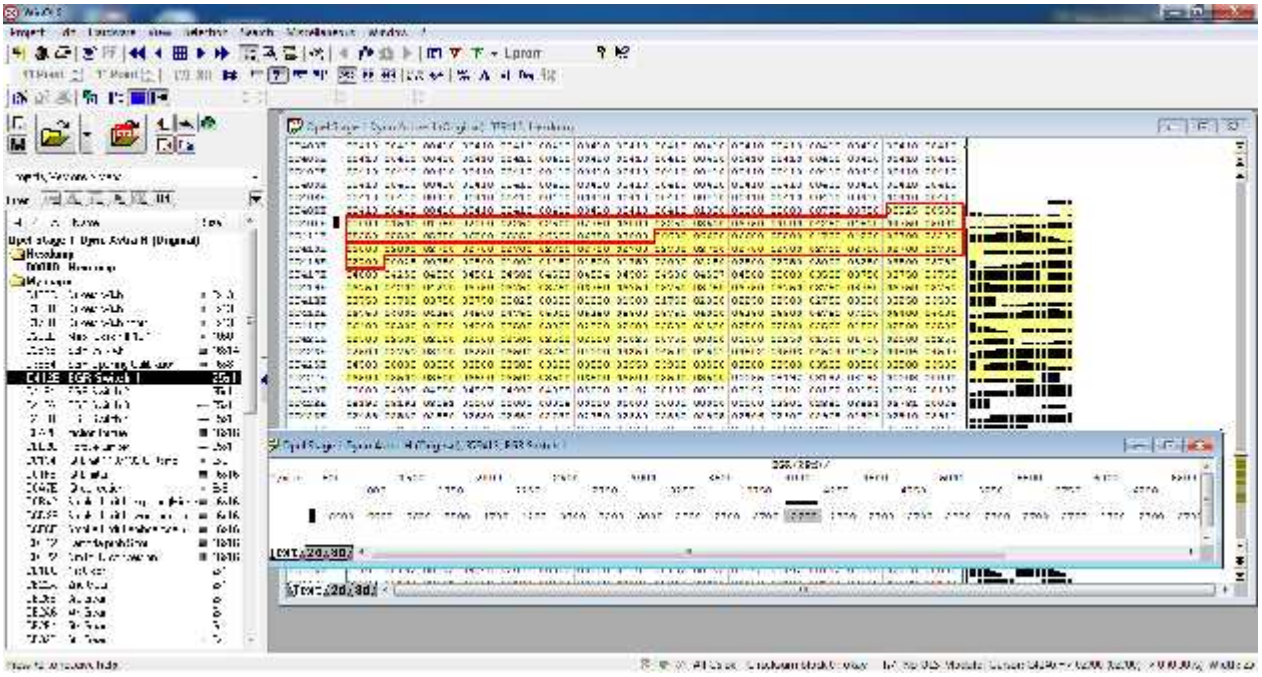
To prevent clogged intake and avoid future (Swirl flaps, MAP, EGR) problems the EGR map can be simply disabled using switch. However some tuners report less fuel consumption while leaving EGR working but reduced i.e increase allowed MAF. To reduce EGR and allow more air intake we need to increase the allowed MAF in mg/stroke. Do not go over the highest value, in this case it is 1200. The pro tuner did not switch of the EGR neither touch this map.

When reading data from the ECU log, the mass air flow is reported in kg per hour but in hexdump we work in mg per stroke. Converting one value to the other is quite simple:

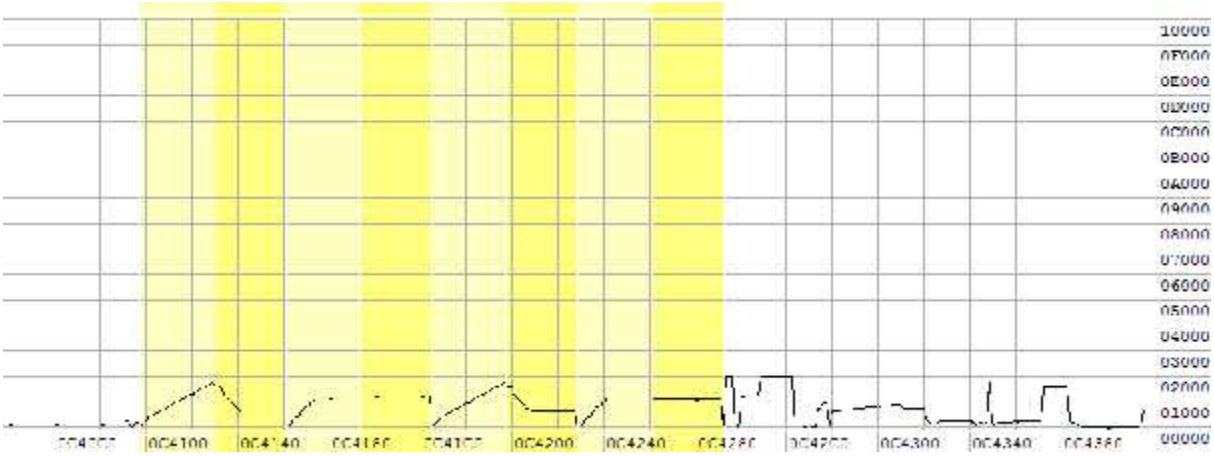
At 900 RPM a 4 cylinder 4 stroke engine makes 900 RPM * 2 strokes/revolution * 60 minutes in one hour = 108,000 strokes.
So if the ECU reads 480 mg/stroke at idle, it equals to 108,000 * 480e-6 = 52 kg/hour air flow.
480 mg/stroke is the value you should read with a 1.9L engine during idle when the EGR is closed.
One full cylinder filling is 0.48 liter. Air is about 1290mg per liter.
So we can calculate 0.48 * 1290 = 619 mg/stroke.
However, the cylinder is not fully filled as it has to suck in the air in a limited amount of time. Therefore the value is a little lower. (If the turbo would be really working at idle, the air flow could be higher than 619 mg/stroke.)



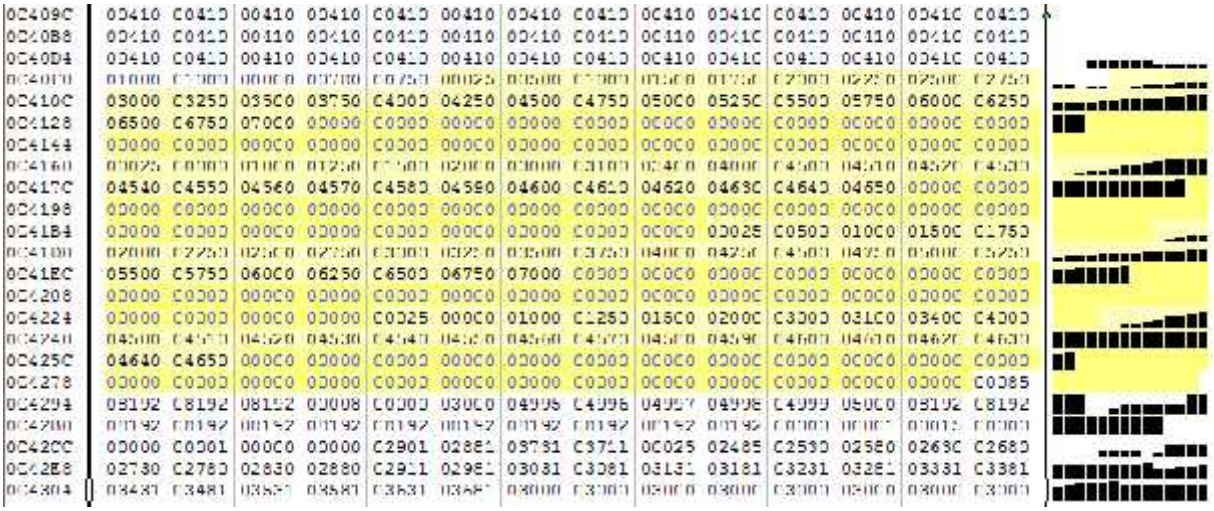
If you like to switch off EGR completely, there is no need to touch the above map:
Find the 4 switches shown on the screenshot below.



Or find EGR map (Desired air quantity MAF) - *in this file C2B98* Turn on 16bit, HiLo, decimal and 2D mode. Search after EGR map 4 hysteresis (25x1) like on the pictures below



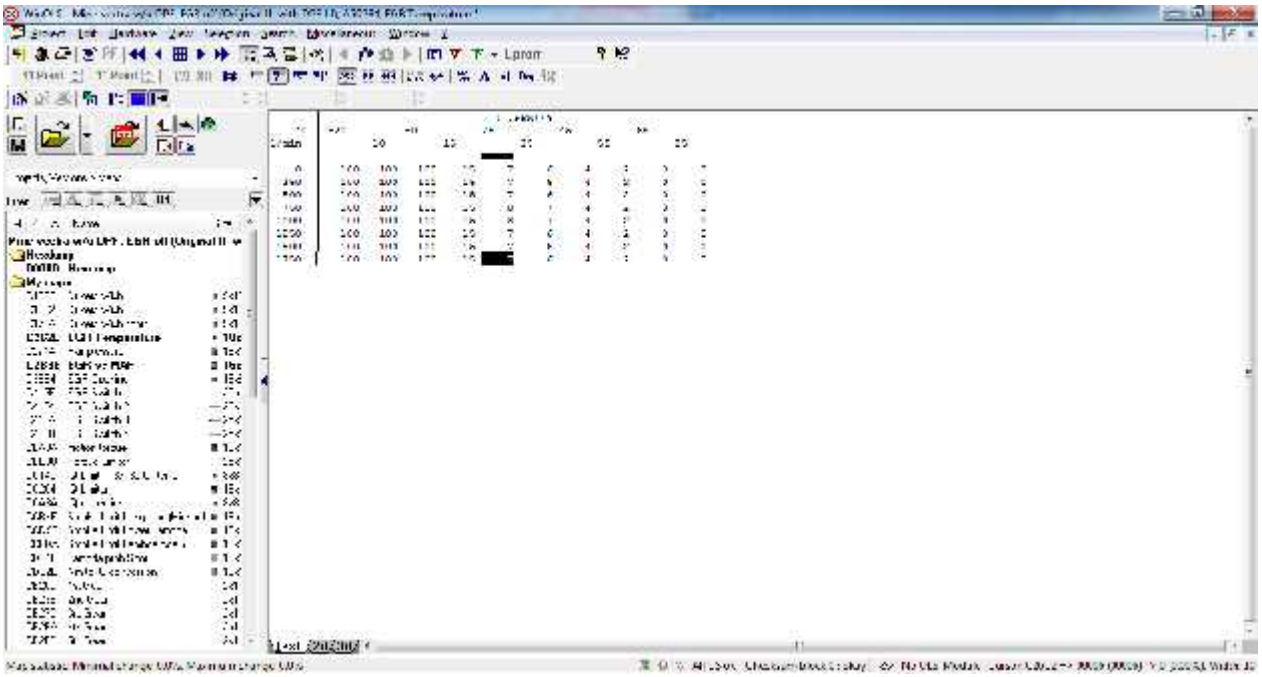
Fill these maps with 0 like on the pictures below

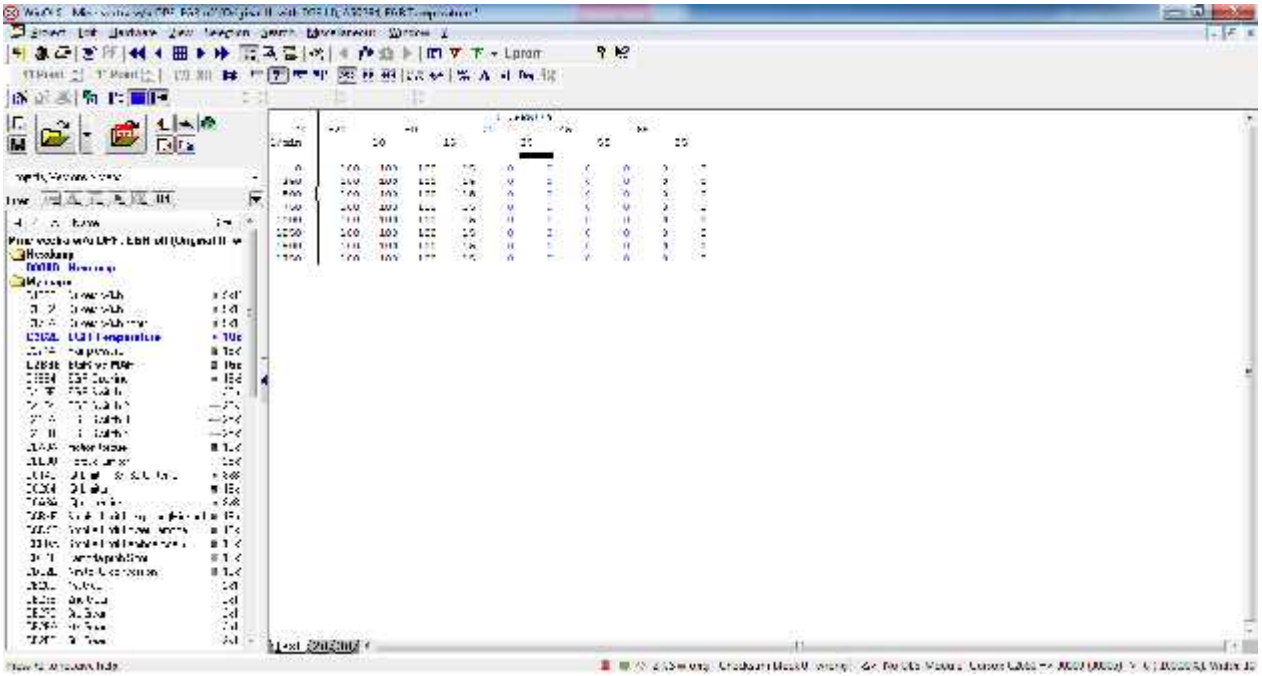


13. EGR vs Temp map:

I`m not sure what this map do!!! And planning some experiments!

Hope it will act as I wish and will make EGR working only at low Ambient Temperatures.





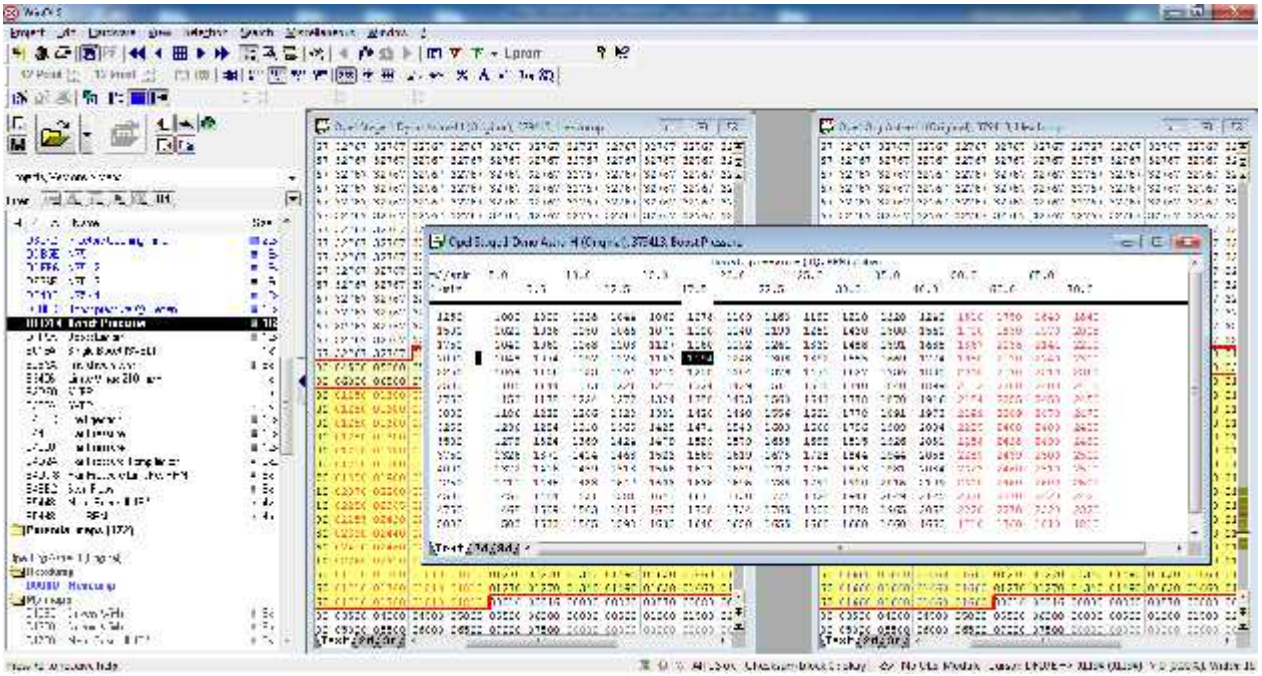
14. Turbo (Boost request) map:

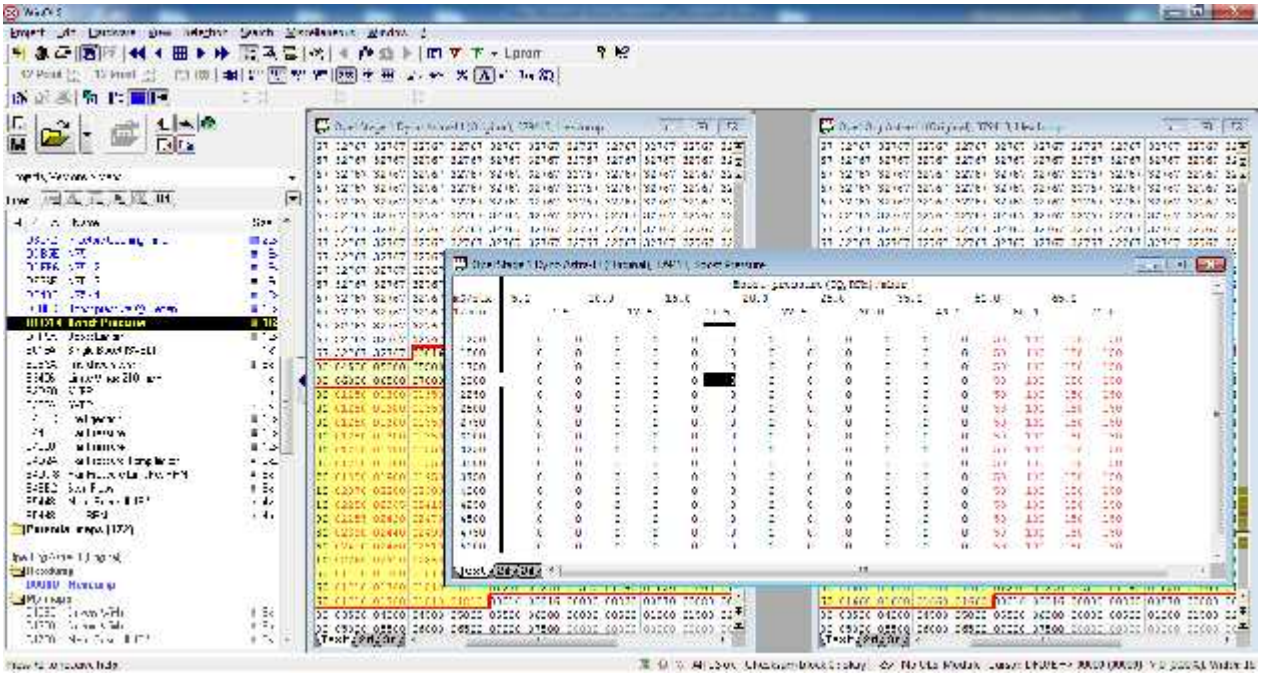
As you can see the boost goes up to max 2510mbar. The turbo on this car, a GT1749V, can handle a max boost of around 2650mbar. So the max value in this map may be 2600mbar.
Since we are only tuning for max power only the 3-4 most right columns has to be changed. This turbo pressure is only for the 150hp version. The lower hp versions have also lower turbo pressure! You can assume that the turbo pressure may be increased by around 7% max. Pro tuner work with fixed Delta and increase boost request for 70mm3 IQ by 150mbar. As I read that using flat value from the lowest to the highest rpms is not the best approach, I choose to increase mine with 2.5%, 5%, 6% and 6.5%

As you can see the axis value goes up to 70mm3/stroke. As we will inject about 80mm3/stroke (by my logging, with 15% increase) you can rescale axis and boost request. Pro tuner did not although he did 20% increase of IQ...

Economy tuning is much more complicated… At low RPM and IQ, EGR restrict MAF to 200 – 500 mg/stroke.
Naturally aspired 1.9l engine will get 0.48ltr/stroke * 1290mg/ltr = 619 mg/stroke.
So why should restrict natural aspiration by EGR and request boost for IQ less than 25mm3/stroke (and 1mm3 is only 0,86mg)

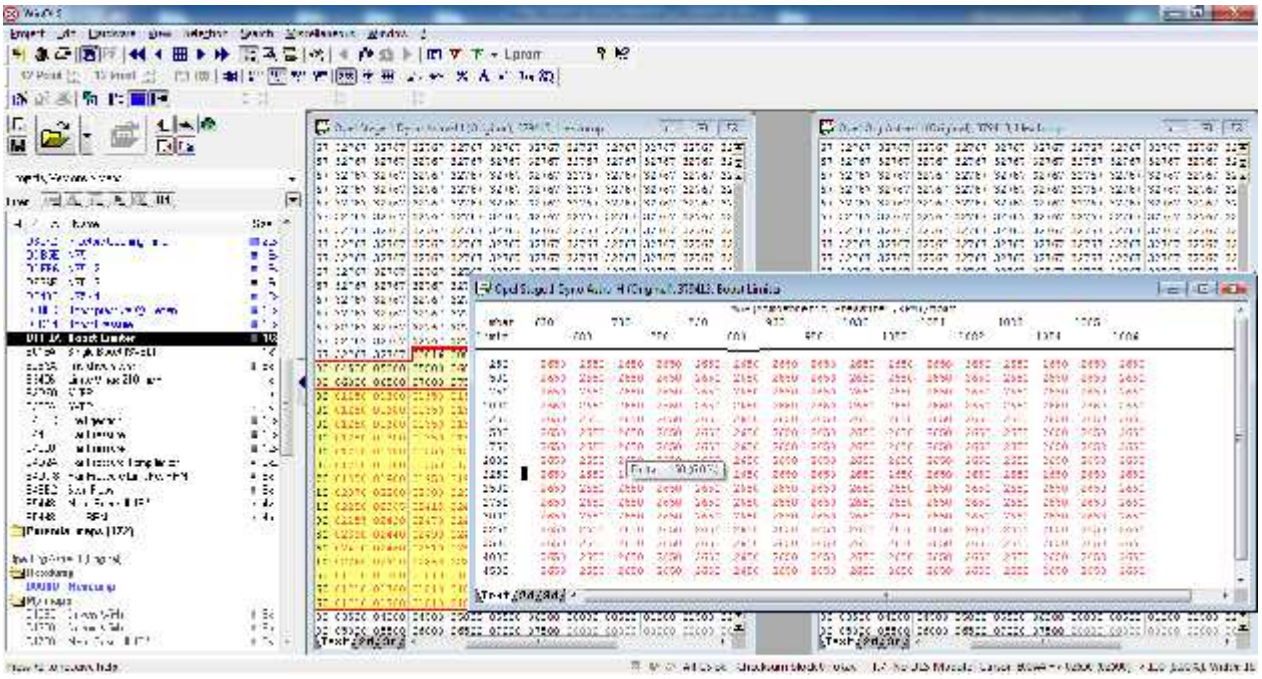
Many tuners report increased fuel economy with decreased boost request, however N75 should also be reduced to lower back pressure on the exhaust system.

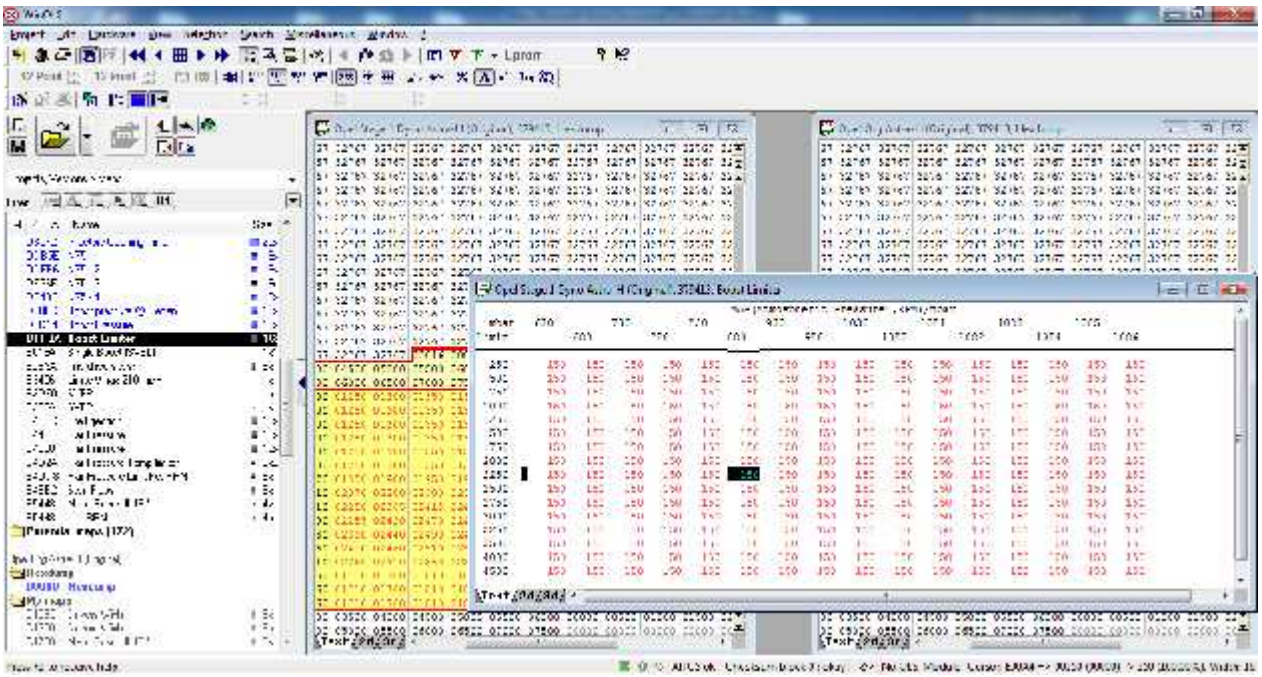




15. Turbo (Boost) limiter map:

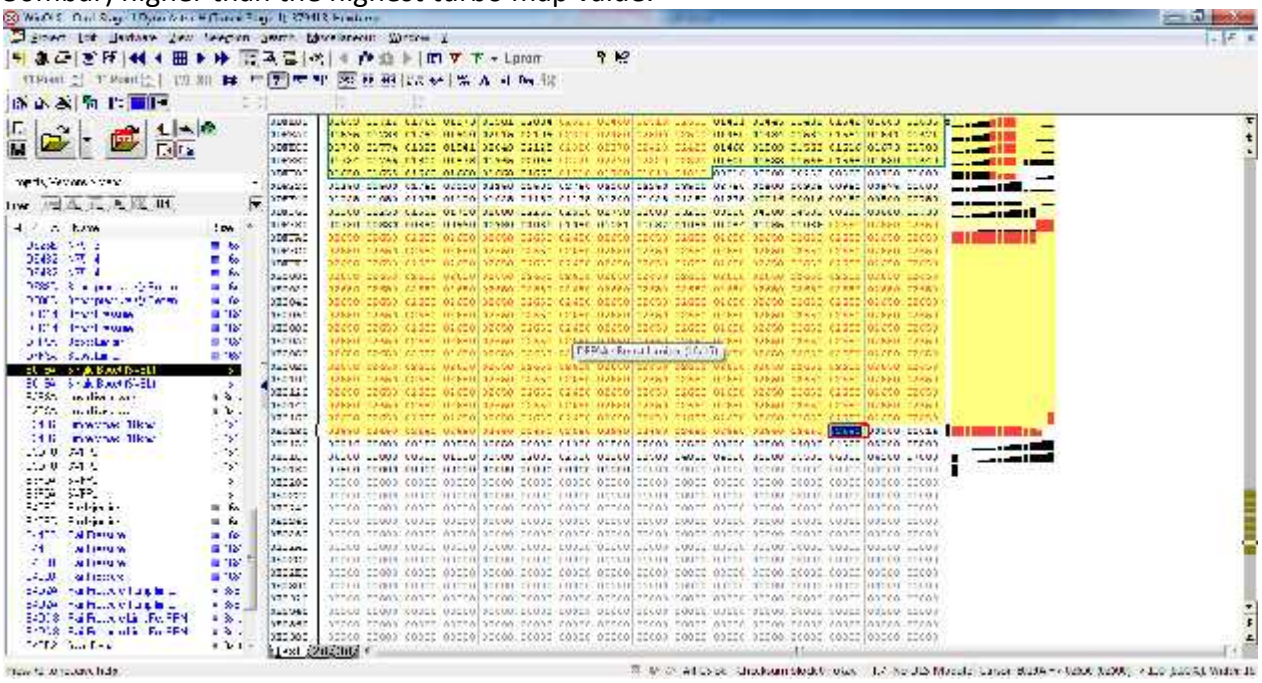
At this point we have set the boost up to 2513 mbar in the turbo map, and prevent boost spikes by lowering the N75 map. But the boost limiter map will limit the 2513mbar back to 2500mbar as you can see in picture. Pro tuner increase boost request by 150mbar and so he did for the boost limiter. This way margin between boost request and limiter stay untouched. As I used 6.5% for my boost I used same value for the boost limiter.
We need to change that values the same way as the turbo map, even a bit higher because this is the limiter. Since we only drive at sea level (1013,25hpa), there is no need to adjust the car at 900hpa and lower (or you live at more than 1000metres above sea level). Stock Opel have same value all over the range despite of atmospheric pressure.





16. Single values boost limiter*:*

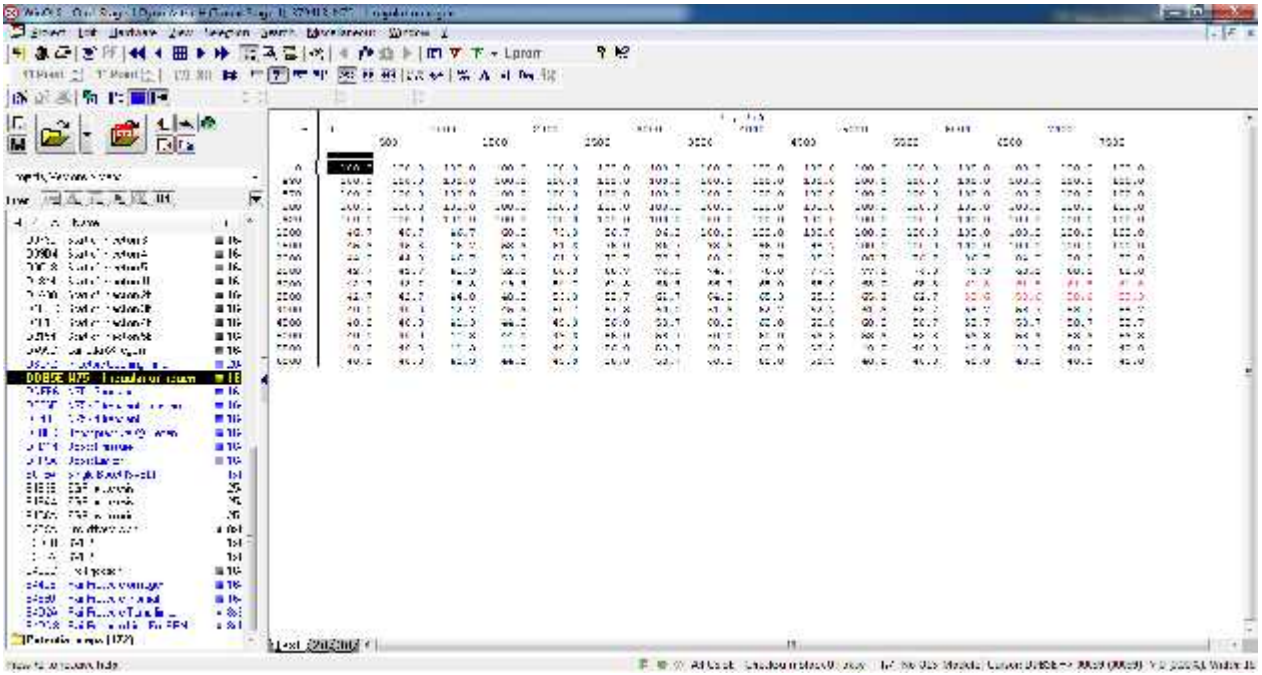
At this point we have set almost everything to get a higher boost except the absolute limiter.
That's the last one we need to change. Opel engineers use same value for SVBL and boost limiter despite the atmospheric pressure. So just use the same stock +6.5%. As per some tuners this value has to be a bit (read 50mbar) higher than the highest turbo map value.

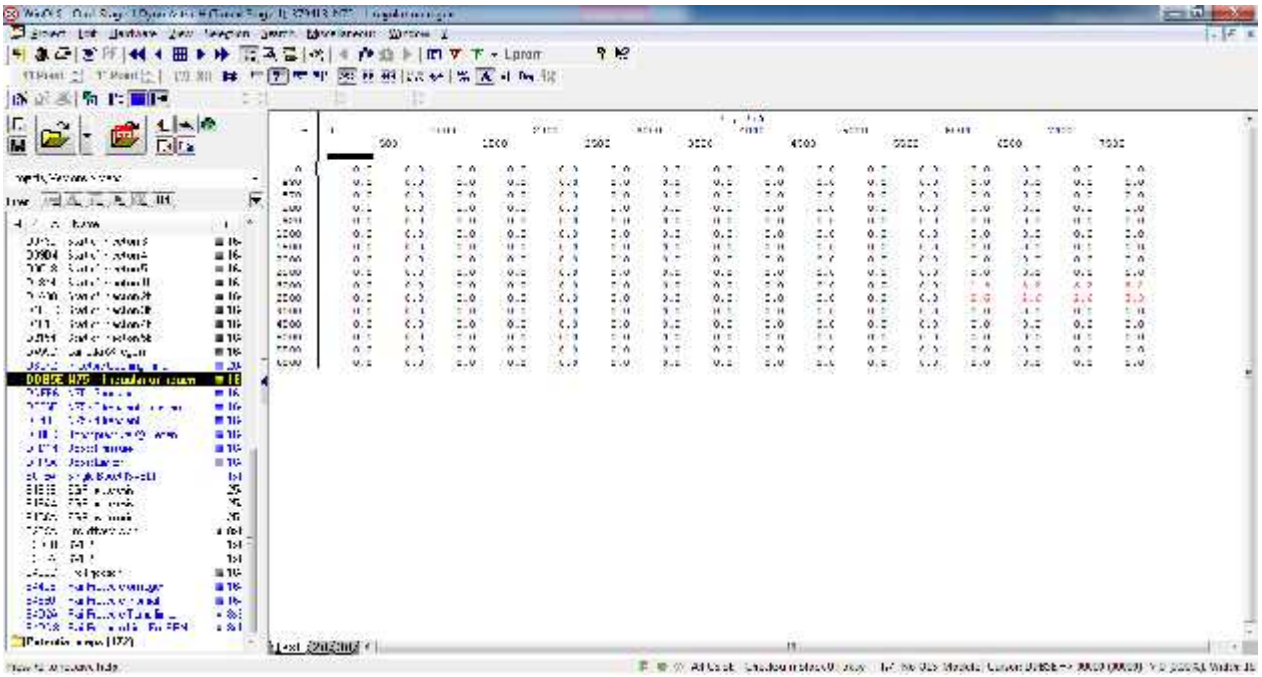


17. Turbo vanes (N75) map:

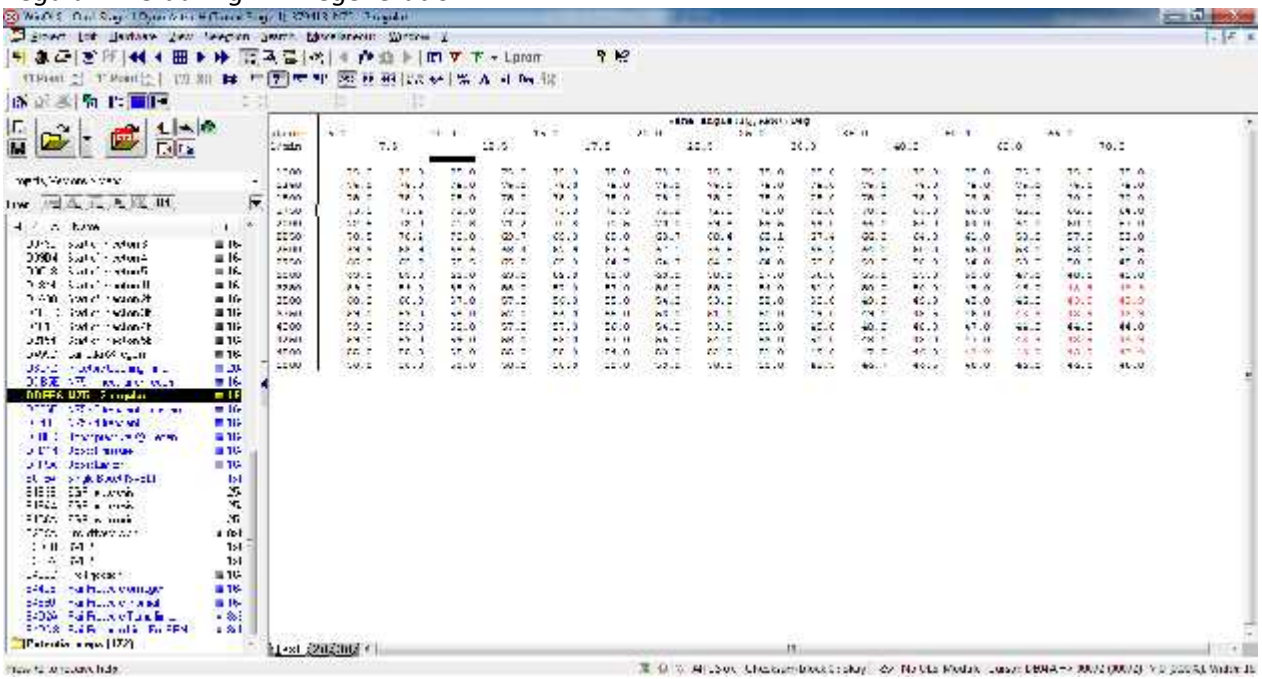
The N75 map controls the vanes inside the turbo, and when increasing IQ (or removing DPF) needs to be reduced to prevent turbo spiking. As we did not rescale boost map IQ axis will not rescale N75 axis neither. If you did so, better match N75 IQ axis to boost map IQ axis.
As a rule you can decrease the values from 1500-5000rpm at high IQ's by 8%. This is depending on the car, and how much boost spikes you have… still got boost spikes… reduce the map. You can see that the tuner choose to change all the maps same why, even those that are not in use (Astra didn`t have DPF). He did the same for the rail pressure (but not for lambda) designated for DPF regeneration.

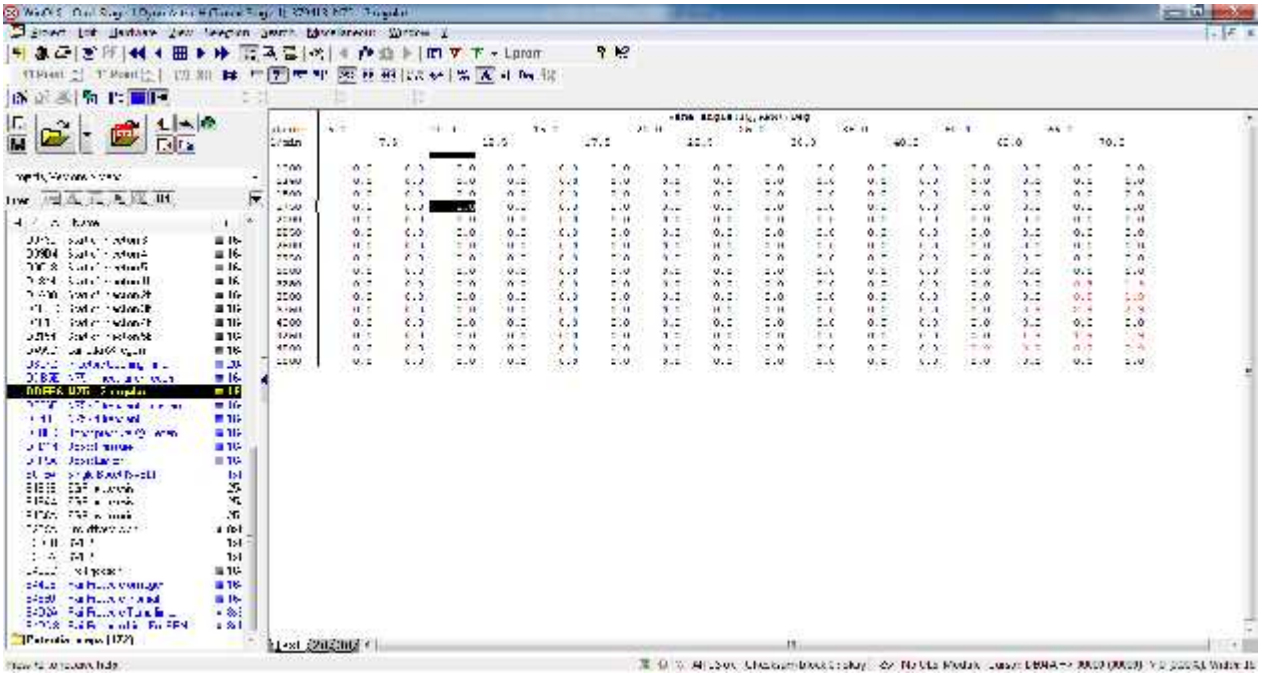
Regular N75



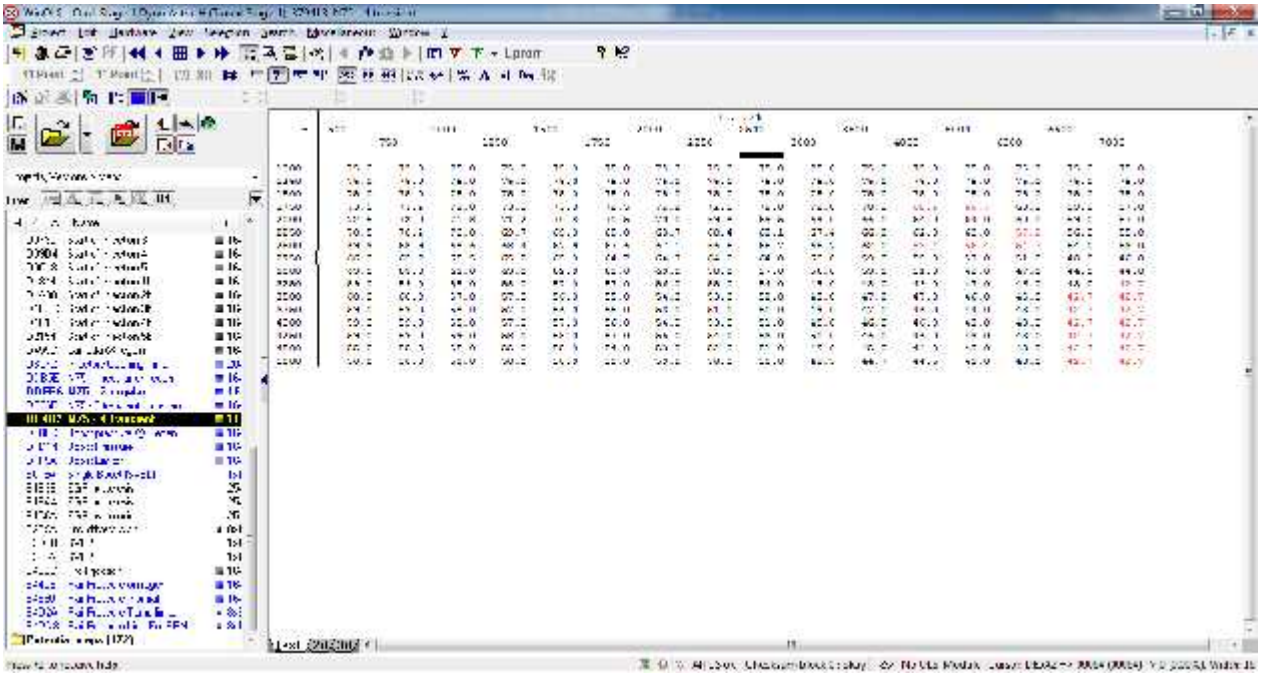


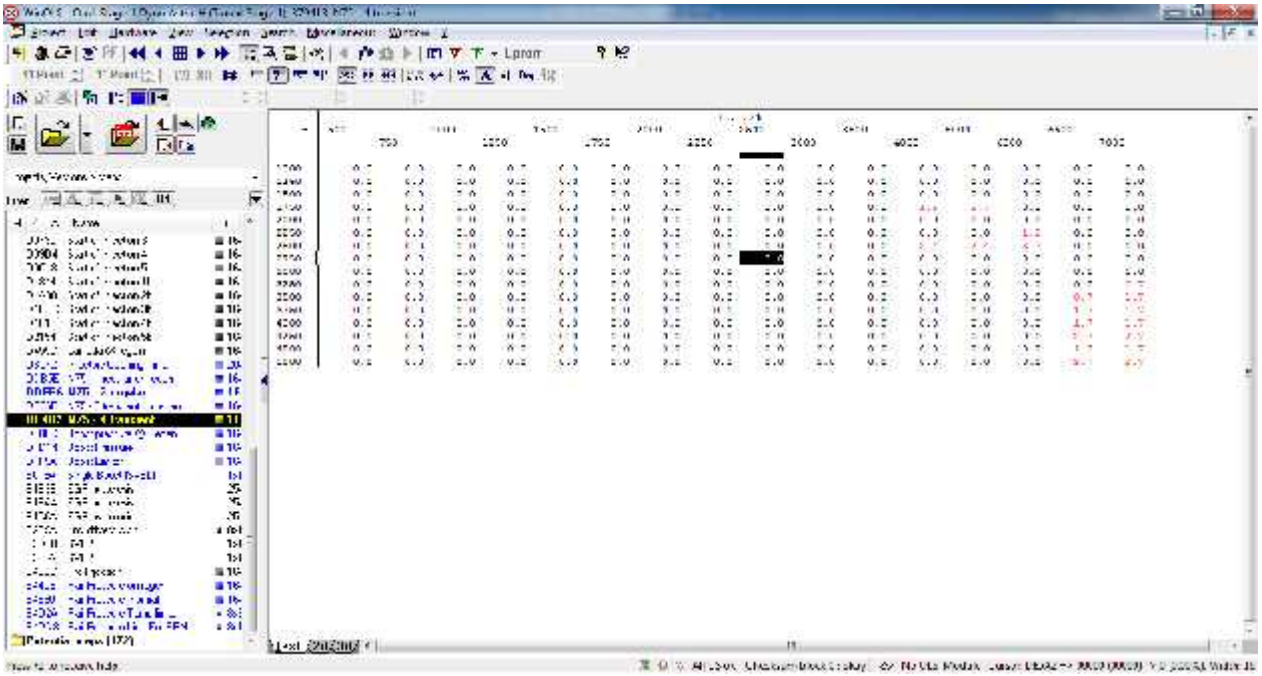
Regular N75 during DPF regeneration





Transition N75 during

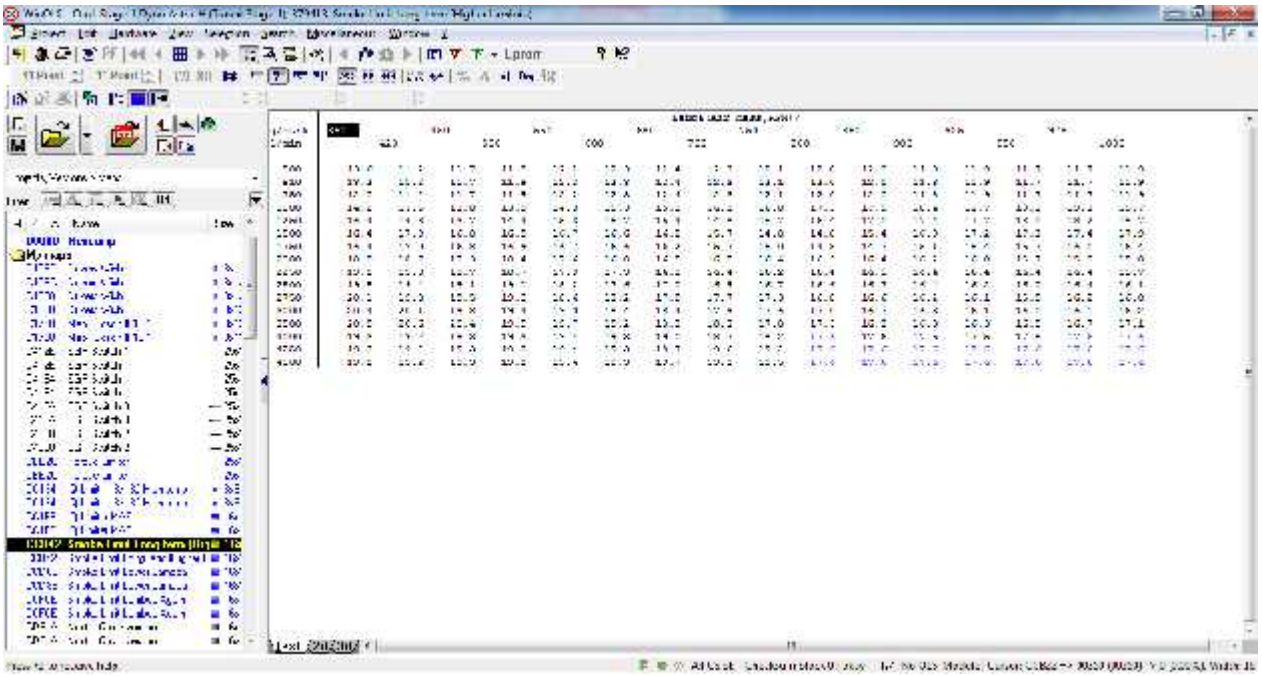


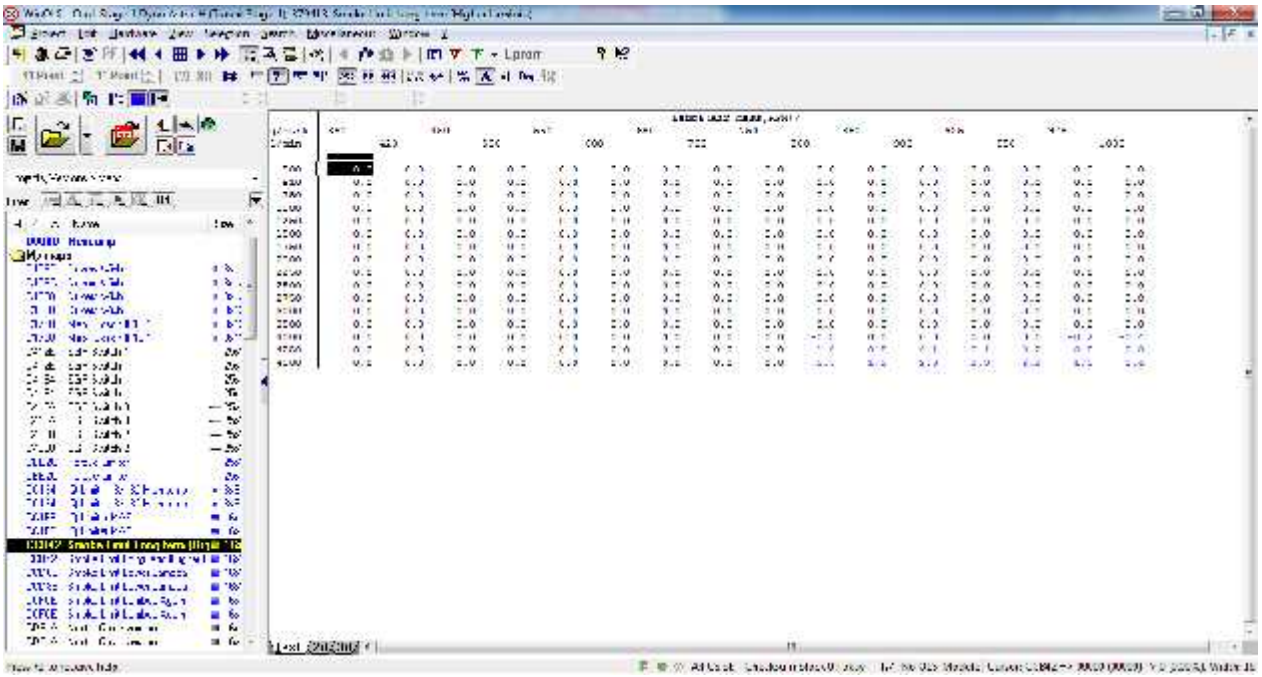


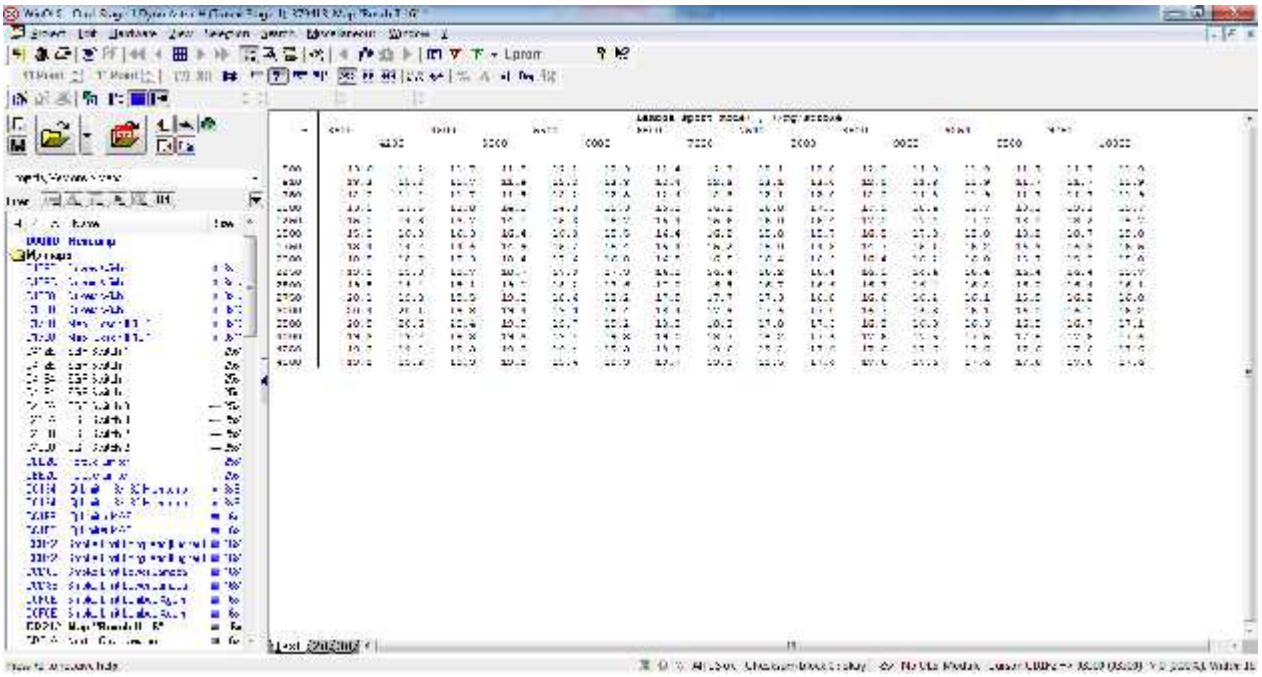
19. Lambda:

Pro tuner change very few values at high rpm and MAF, In fact he just copy the Sport Button lambda for high RPM and MAF. He left the sport button lambda unchanged.

My car don't have sport button so I choose to copy whole Sport button lambda map, over the regular lambda map. To avoid being too smoky I set the minimum AFR value to 14,5







Tips

1. All 0 maps are ignored
2. For everything higher than max, last known value is used.
3. Transient VNT maps are used when pedal change is more than 20% in one second.
4. VNT maps are only used in open loop mode, when closed loop kicks in PID controller takes over. If actual boost is too far from requested when PID takes over, you get boost oscillation, because PID control is slow.
5. Lambda maps limit IQ in relation to air mass mg/hub (hub means stroke), to keep the intended AFR.
6. 1ltr diesel is about 0.85 kg i.e 100mm3 are 86mg
7. Lambda factor for EDC16 is 0.0145 as per Bosch EDC16 manual
8. You could increase rail pressure up to 1750 bar, 1,9DTH/CDTI engine has 1800-bar rail sensor.
9. GT1749V, can handle a max boost of around 2650-2700mbar. Garrett turbo chart says a bit different story.
10. Make torque limiter linear. The horse power comes in high RPM. If you increase suddenly the torque the clutch and the flywheel will die.
11. Most work in good tuning goes to proper VNT tuning so your boost does not oscillate. There are 4 VNT maps in this ecu, 2 normal and 2 on regen. Normally you need to LOWER them on tuned car by 2 or 3%. You need logs for exact match as every car is little different.
12. Both of the boost readings they are in mBar and Absolute
13. 1.18 *wheel power=flywheel power; Usually RWD-lose 10%; FWD-lose 15%; AWD-lose 20%; Auto-lose 5%
14. Torque limiter: Start at 1750 to protect your clutch and don't work with % please! Just give it max fuel all the way up to the rev limit you have in mind, and create a "hard cut" there. (I still use 15%however up to 4500rpm leaving stock at 4750rpm, mine gear box shift automatically at about 4600rpm)
15. Keep duration maps as "true" as possible (and or nm/iq maps if edc16), so that the gearbox ecu understands that there is more torque coming its way
16. Lower lambda/smoke limiter in high rpm, as VE (volumetric efficiency) will be lower here, even with the same boost pressure
17. You should add more advances of SOI in high rpm than low. Especially if duration maps have been altered.
18. Increase SOI maps and naturally increase them a bit more for the expanded axis for new IQ.
19. Frankly I doubt that there are many tuners out there, who know 100% what they are doing
20. The same factor 100:8196=0.012207 is used for pedal % in the DW, N75 duty %, Swirl Duty% and EGR duty %....

Thanks to everybody!