Bootmod3 Tuning guide

This Tuning Guide will mention the necessary tables in order to tune an MG1 PPC / Aurix equipped car.

The main difference between the MG1 PPC and Aurix equipped cars are related to more limiters which in this case can be datalogged, this will be discussed in the load and torque table section. This Tuning Guide will be a general way of showing how it can be done. Values of the tables will vary depending on what car you are trying to tune, but the tables will be the same. Please note, Aurix will have more tables and these will also be shown and pointed out as Aurix tables.

Engine Type	ECU Type	Displacement
B48 Gen 1	MG1 PPC	2.0L
B58 Gen 1	MG1 PPC	3.0L
N63T2	MG1 PPC	4.4L
B48 Gen 2	MG1 Aurix	2.0L
B58 Gen 2	MG1 Aurix	3.0L
S58	MG1 Aurix	3.0L
N63T3	MG1 Aurix	4.4L
S63T4	MG1 Aurix	4.4L

The calibration in this Tuning Guide will be from a BMW Z4 M40i with the B58D engine to show the additional limiters there may be over the B58 Gen 1 engine.

Torque based ECU:

The MG1 ECUs are torque based, meaning this ECU operates by a torque limiter/target that the ECU will try to reach. This is done by converting the torque target based on pedal input into a load target. The load target sets the boost pressure, fuel mass and ignition timing to produce the requested torque.

MG1 Tables:

We will look at the following:

- **Load and Torque structure**
- **Boost Control**
- **Fuel**
- **Ignition Timing**

Load and Torque tables:

- **Maximum Torque Limit**
- **Optimal Reference Torque**
- **Full Load Torque Limitation**
- **Maximum Filling**
- **Torque Monitors**
- **Torque Reduction Factors**

Load and Torque

These cars do not run a fixed boost target, they go by a torque target. This means, even if the ambient temperature drops or increases, the car will try to achieve this torque target making the same power in any scenario, this will be done by increasing boost or ignition timing.

- **Maximum Torque Limit**

There can be up to 5 of these tables depending on ROM version. These are the global torque limiters and must be lifted over stock to make a higher power output.

For starters, increase slowly, remember this is the maximum output possible in NM.

B58D Maximum Torque Limit

The torque from these tables are converted to load using the **Optimal Reference Torque** tables.

- **Optimal Reference Torque**

The higher the torque output, the higher will the load request. This results in a different ignition timing and fuel mixture since the values of those tables changes based on load %.

In order to make above the highest load value of the X-Axis, this table must be scaled. The correct way of doing this is by increasing the 200% load value of the X-Axis and the respective column by the same percentage.

Depending on the car, B58 TCU has a limit of **550NM**, S58 / N63T2 / N63T3 and S63T4 has it set to **760NM**.

CustomROM has this torque limiter skipped meaning there will be no limit from the TCU. Although, transmission flashes are available for almost all vehicles today.

Engine speed [1/min]	0.000	12.000	14.000	18.000	22.000	27.000	35.000	45.000	55.000	70.000	90.000	110.000	130.000	140.000	150.000	160.000	180.000	200.000
500.000	0.000	31.700	34.500	47.400	66.300	76.200	102.500	132.100	169.400	210.000	254.400	288.600	340.100	376.800	406.300	456.600	522.600	630.900
600.000	0.000	31.200	41.000	59.400	71.300	86.300	112.600	145.700	174.600	219.300	264.500	300.900	353.100	390.800	420.200	469.900	535.100	643.700
800.000	0.000	33.200	41.000	53.900	71.700	92.000	116.500	152.700	185.600	237.500	282.600	318.800	375.100	412.000	441.300	490.900	555.600	664.100
1000.000	0.000	34.700	43.000	59.500	75.700	92.000	121.300	156.200	193.300	243.800	303.300	350.200	389.800	426.200	455.400	505.100	570.000	678.300
1250.000	0.000	36.800	46.800	62.900	76.300	92.600	123.200	159.000	196.000	250.700	314.100	369.000	417.500	448.200	474.500	521.300	583.500	691.800
1500.000	0.000	37.200	46.600	63.100	76.100	97.100	126.100	162.900	200.700	253.100	317.800	383.600	436.500	472.600	501.200	544.100	600.800	702.900
1750.000	0.000	38.900	49.900	63.400	76.500	97.600	126.900	163.000	201.700	256.300	327.700	393.300	448.900	481.200	526.100	569.300	630.300	720.500
2000.000	0.000	42.100	49.900	63.800	76.600	95.000	125.000	165.100	201.800	260.000	331.200	397.400	460.900	498.800	539.100	574.900	651.300	724.400
2250.000	0.000	42.800	49.900	65.800	79.100	97.800	125.000	166.300	201.800	260.100	331.800	400.000	468.000	508.200	547.700	587.000	654.200	730.100
2500.000	0.000	42.500	51.800	65.300	79.700	97.300	126.000	168.300	201.700	261.800	334.000	399.900	473.000	517.600	554.300	590.000	664.500	739.400
2750.000	0.000	41.300	50.600	65.700	78.500	97.600	128.500	168.600	202.800	259.400	335.400	407.200	472.800	511.400	550.300	589.300	664.200	747.300
3000.000	0.000	42.000	51.000	65.900	79.300	97.000	128.000	169.900	204.600	259.900	338.600	406.100	472.000	511.300	549.800	589.500	660.100	734.600
3500.000	0.000	42.400	52.200	68.700	81.200	100.500	130.500	168.800	206.700	262.900	339.300	417.800	487.100	521.300	561.800	603.100	671.200	729.500
4000.000	0.000	41.500	52.100	68.800	83.000	102.300	131.200	168.200	208.100	264.200	343.600	421.500	496.700	530.000	563.500	607.500	690.700	757.300
4500.000	0.000	39.800	52.700	69.400	82.400	102.700	133.000	170.700	208.700	266.300	343.800	422.400	498.100	533.000	569.500	612.000	687.800	757.600
5000.000	0.000	40.400	53.000	70.600	83.200	103.000	134.200	172.000	209.900	267.900	343.700	421.000	494.200	529.400	566.300	605.000	677.900	737.300
5500.000	0.000	40.100	54.000	71.600	84.400	105.300	130.900	173.300	209.800	268.300	344.700	421.100	493.700	528.700	565.700	607.200	672.200	746.800
6000.000	0.000	41.800	48.600	70.400	85.500	104.700	138.000	175.700	215.500	272.700	346.200	417.500	492.800	529.100	564.500	601.100	666.900	744.700
6500.000	0.000	42.100	49.500	70.000	85.300	106.800	138.000	179.500	218.200	273.000	348.600	419.400	491.500	528.200	569.300	593.500	663.800	738.200
7000.000	0.000	41.200	48.400	69.200	85.800	105.200	138.000	179.300	218.300	272.500	349.800	418.200	488.100	521.700	562.300	593.000	657.200	731.700

B58D Optimal Reference Torque

- **Full Load Torque Limitation**

  There are several of these tables for different scenarios, these should be set high enough not to limit anything. These can be set to 800 or even 1000NM across, it will not hurt drivability or performance of the car when going for such high value.

- **Maximum Relative Filling Characteristic**

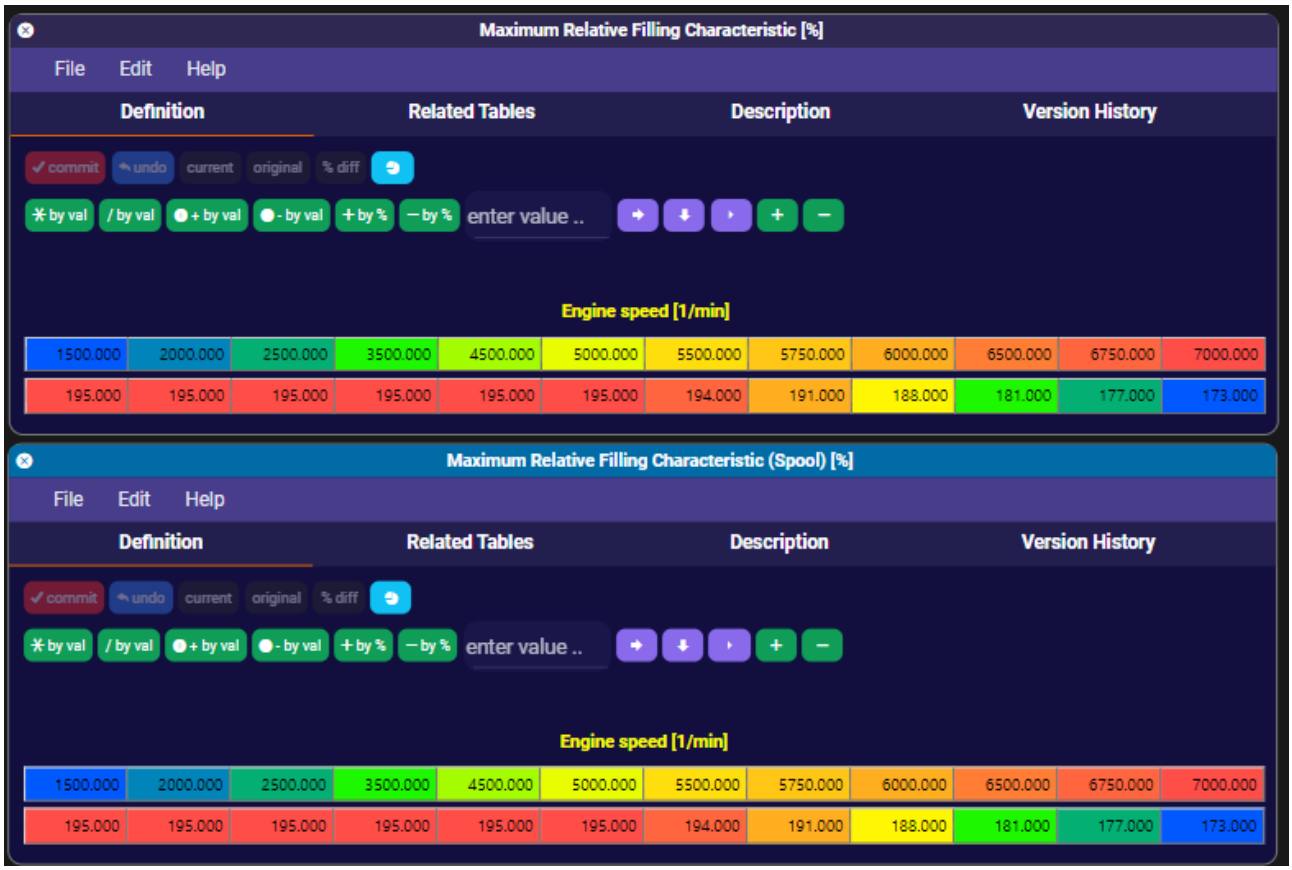
There are several load limiters and setpoints that has to be changed, depending on ROM version, some can have more others less, but they are all available under Load (Relative Filling) -> Setpoint.

- *Maximum Relative Filling Characteristic*
- *Relative Filling (Timing Retard)*
- *Relative Filling (Timing Retard – Sport Mode)*
- *Relative Filling Target (Component Protection)*
- *Relative Filling Target (Launch Control)*
- *Relative Fililng (Fuel Quality)*
- *Relative Fililng (Fuel Quality – Sport)*

On some ROM versions you may find several of the above table set to 327%.

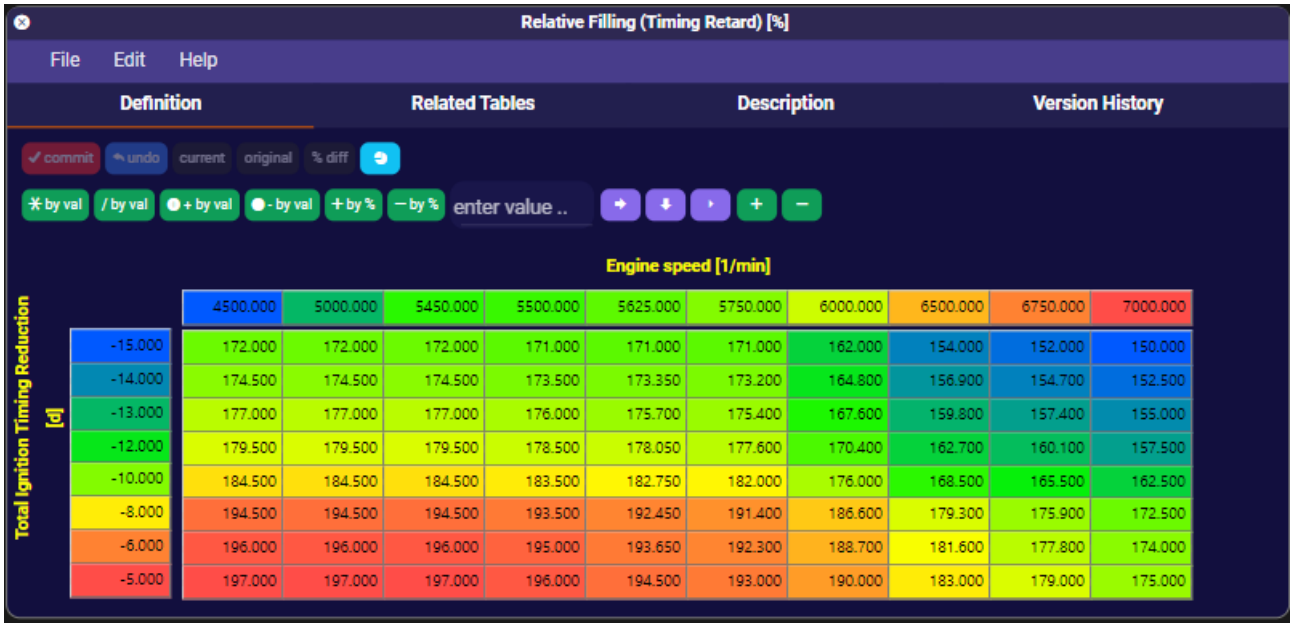
- **Maximum Filling Relative Filling Characteristic**

The maximum load setpoints must be increased in order to achieve higher power levels. These are the main load limiters. These can be handy to limit boost pressure if keeping torque limiters high. Stock turbochargers cannot flow as upgraded turbos to redline, so tapering the load limiters to redline will lower boost target resulting in a lower boost deviation.



- **Relative Filling (Ignition Retard) + Relative Filling (Ignition Retard – Sport Mode)**

This table is based on RPM and on the ignition timing target pulled. You can increase this table at low ignition correction, while leaving the rest stock. Make sure to increase or be limited by the stock values.

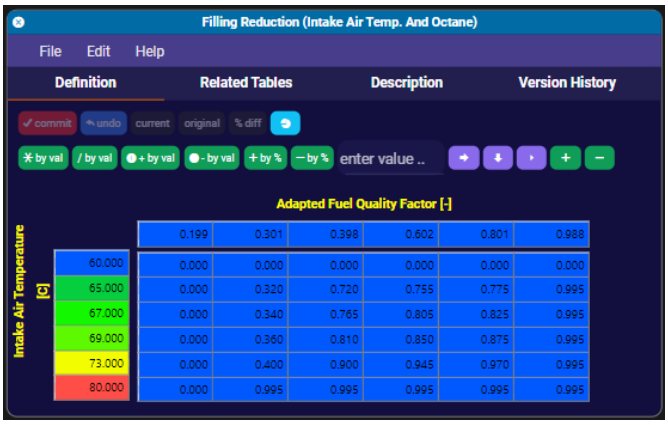


Total Ignition Timing Reduction [d] \ Engine speed [1/min]	4500.000	5000.000	5450.000	5500.000	5625.000	5750.000	6000.000	6500.000	6750.000	7000.000
-15.000	172.000	172.000	172.000	171.000	171.000	171.000	162.000	154.000	152.000	150.000
-14.000	174.500	174.500	174.500	173.500	173.350	173.200	164.800	156.900	154.700	152.500
-13.000	177.000	177.000	177.000	176.000	175.700	175.400	167.600	159.800	157.400	155.000
-12.000	179.500	179.500	179.500	178.500	178.050	177.600	170.400	162.700	160.100	157.500
-10.000	184.500	184.500	184.500	183.500	182.750	182.000	176.000	168.500	165.500	162.500
-8.000	194.500	194.500	194.500	193.500	192.450	191.400	186.600	179.300	175.900	172.500
-6.000	196.000	196.000	196.000	195.000	193.650	192.300	188.700	181.600	177.800	174.000
-5.000	197.000	197.000	197.000	196.000	194.500	193.000	190.000	183.000	179.000	175.000

Total Ignition Timing Reduction [d] \ Engine speed [1/min]	4500.000	5000.000	5450.000	5500.000	5625.000	5750.000	6000.000	6500.000	6750.000	7000.000
-15.000	172.000	172.000	172.000	171.000	171.000	171.000	162.000	154.000	152.000	150.000
-14.000	174.500	174.500	174.500	173.500	173.350	173.200	164.800	156.900	154.700	152.500
-13.000	177.000	177.000	177.000	176.000	175.700	175.400	167.600	159.800	157.400	155.000
-12.000	179.500	179.500	179.500	178.500	178.050	177.600	170.400	162.700	160.100	157.500
-10.000	184.500	184.500	184.500	183.500	182.750	182.000	176.000	168.500	165.500	162.500
-8.000	194.500	194.500	194.500	193.500	192.450	191.400	186.600	179.300	175.900	172.500
-6.000	196.000	196.000	196.000	195.000	193.650	192.300	188.700	181.600	177.800	174.000
-5.000	197.000	197.000	197.000	196.000	194.500	193.000	190.000	183.000	179.000	175.000

- **Relative Filling (Fuel Quality) + Relative Filling (Fuel Quality – Sport Mode)**

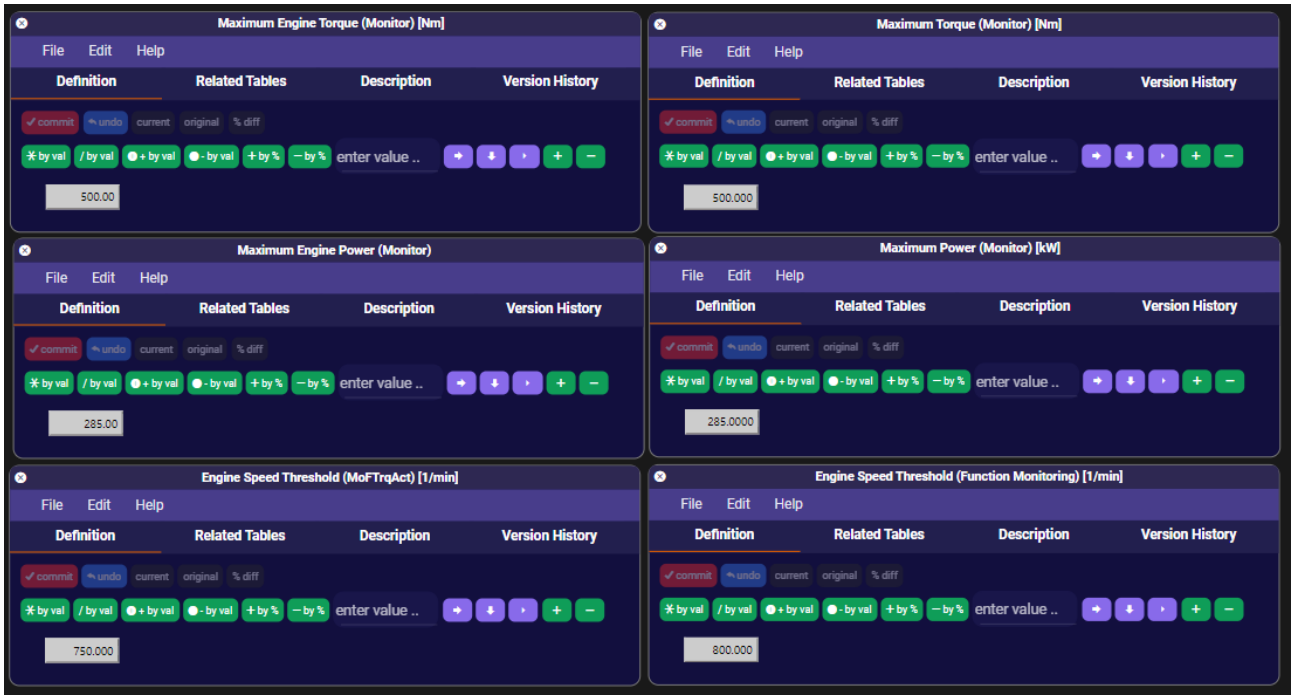
These next two load limiters are based dependent on the table Filling Reduction (Intake Air Temp. And Octane):



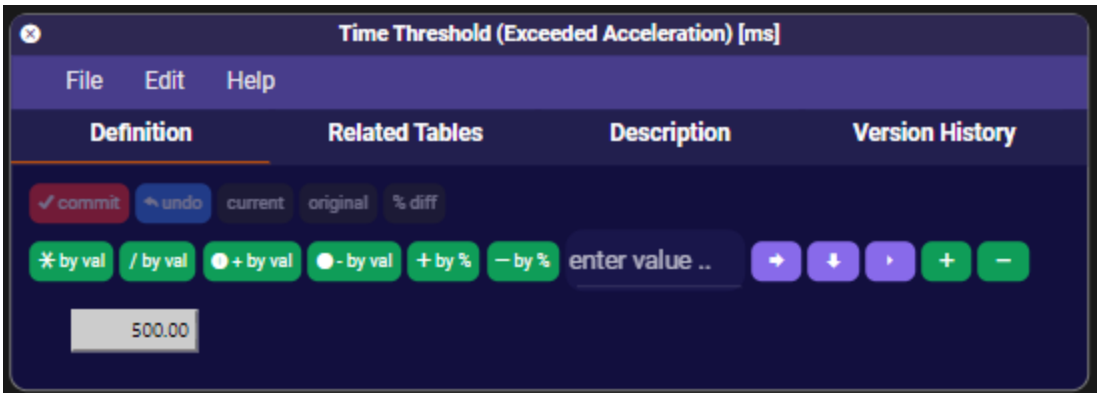
The value from the above table is on the axis of the following two tables. If the intake temperature is high and the adaptation values set the fuel quality factor high, that will reduce load significantly, increasing where load already is high to what the main load is the way to go.

- **Torque Monitoring**

These cars have several monitors to prevent tuning from happening. If these are not changed and the car makes more power than stock, it may go into limp mode. On some cars the table '*Full Load Torque Characteristic (Monitoring)* also must be increased. On this ROM, it's set to 3276NM from factory.



Another interesting table is the following one, this is basically an anti-tuning table as well, this should be maxed out to prevent any codes that might appear due to quicker acceleration.



- **Relative Filling Flags (Aurix ECU only)**

On the new DME type, MG1 Aurix, the reason for a load limitation can be datalogged. If you are struggling with a load limitation eventhough all limits are higher than datalogged RAM channel 'Load Limit'.

Flag	Description	Cause / How to resolve
0	No Limits	-
1	Condensate	Condensation build-up at cold intake temperatures, this is a very rare scenario
2	ATL component protection	Set by turbine ratio limitation. Increase resolution for the 3 turbine tables in the subcategory 'Turbine': **Derivative Of The Turbine Flow Characteristic** **Derivative Of The Turbine Flow Characteristic (Reduced Mass Flow)** **Calculation Of The Pressure Ratio Across The Turbine** This can also be set if boost ceiling is set too low.
3	HPFP control limit	HPFP flow limitation. If Maximum HPFP Angle is reached. Usually this is set to 126 degrees. Lower HPFP targets and load targets in the lower RPM to compensate.
4	EKP delivery rate	Caused by a LPFP load limitation, the load limitation gradient can be lowered by the table '**Pressure Control Specification (Negative Gradient)**'
5	Intake temp, Ignition correction and driving behavior	Set by high intake temps / ignition correction,
6	Turbocharger component protection (EGT)	High Exhaust Gas Temperatures (EGT) sets this, make sure to lift the EGT limiters to prevent a load limitation. Please note, the EGT is calculated.
7	Particulate Filter	This only appears on cars equipped with the particulate filter. To prevent this, increase '**Load Limitation (OPF Protection)**'
8	Injection Duration	Appears when injection window becomes limited, i.e., running ethanol content. To overcome this, decrease the End Of Injection (Warm) table at high load.

- **Torque Limit (Flag)**

This RAM channel can be logged as hex/decimal, please check the comments below:

Bit	Decimal	Comment
0	1	Superknock
1	2	Cold pistons (internal load limitation)
2	4	Component protection (intake temp)
3	8	Traction management
4	16	Flexfuel
5	32	Internal torque application
6	64	Emission limitation
7	128	Component protection (rich running)
8	256	Factor cooling/rich limit
9	512	Emergency cylinder suppression
10	1024	Clutch torque application
11	2048	Slave ECU
12	4096	Limitation fuel temperature
13	8192	UL Variant
14	16384	Fuel temperature
15	32768	Limp mode
16	65535	Standard
17	131072	Condensate
18	262144	Turbocharger component protection
19	524288	HPFP control limit
20	1048576	LPFP delivery rate
21	2097152	Intake temp, ignition timing correction, driving behaviour
22	4194304	Turbocharger component protection controller
23	8388608	Particle filter
24	16777216	Injection duration

Boost Control

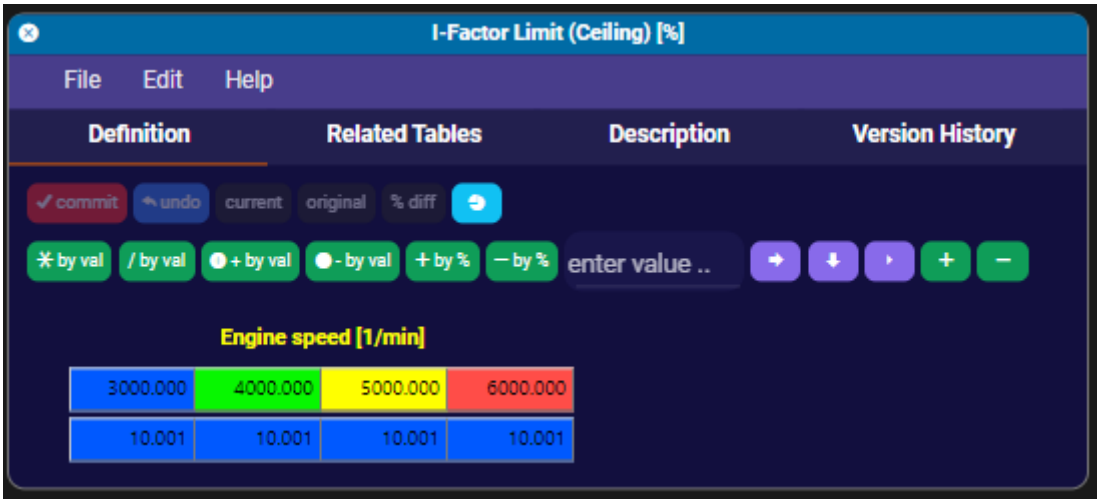
Boost Control tables:

- **I-Factor Limit (Ceiling)**
- **Boost Control Variable (PID) Floor**
- **Boost Control Variable (PID) Ceiling**
- **Boost Ceiling**
- **Maximum Pressure Ratio**

- **WGDC P-Gain (hPa)**
- **WGDC D-Gain (kW)**
- **WGDC I-Gain**
- **Compressor Map With Required Compressor / Turbine Output [kW]**
- **PID Adder Ceiling**
- **Boost Setpoint Limitation**
- **Target Boost Pressure Offset In Sport Mode**

- **I-Factor Limit (Ceiling)**

This table will limit maximum I gain added. If the base wastegate duty cycle (wgdc) is not enough to meet the boost target at high engine speed, this table can help.



- **PID Integral Limit Floor / Ceiling**

These two tables adjust the amount of PID that should be added based on boost deviation. Going too high on this can cause a boost to over/undershoot based on your PID settings. Leaving these two tables stock at high deviation for instance at high engine speed, may result in a pressure too low plausibility code – 120308.

- **Boost Ceiling**

On the N55 engine this is set to 2500hPa ~ (22 psi relative pressure). The B58 comes with a 4 bar pre-throttle mapsensor, meaning you can run up to 4 bar absolute pressure before running out of resolution. Please note, the stock turbocharger of the B58 gen 1 cannot on the flow much at higher engine speed, but midrange it can easily produce excess of 22 psi which can produce high amounts of torque. The turbocharger of the B58 gen 2 flows better to redline thus holding pressure.

- **Pressure Ratio Limitation**

This is another boost limitation based on airflow and intake temperature. This should be increased in order to achieve higher boost pressure targets. Without this, you may taper boost pressure at high engine speed.

- **WGDC P-Gain (hPa)**

This is one of the more advanced tables that takes time to perfect.

By logging boost deviation and (RAM) Target Mass Flow will get you the exact z value for a given engine speed in this table. Should the car under or overboost in a given area, this table can be adjusted in the respective area. Adjusting this table will add or subtract wgdc to the base wgdc.

MAF pre-turbine [kg/h] \ Boost Deviation [hPa]	-500.000	-50.000	-20.000	-10.000	-5.000	0.000	5.000	10.000	30.000	50.000	100.000	500.000
75.000	-380.000	-25.000	-7.000	-3.500	-2.000	0.000	2.500	5.000	14.875	33.000	134.000	578.375
200.000	-400.000	-31.250	-17.750	-7.375	-2.500	0.000	3.000	10.625	17.000	44.750	144.000	619.000
500.000	-420.000	-36.500	-21.750	-13.625	-3.750	0.000	4.250	15.625	22.875	52.000	152.000	655.750
650.000	-440.000	-46.750	-27.000	-15.625	-4.625	0.000	5.250	20.750	28.625	54.125	172.000	700.875
820.000	-460.000	-57.250	-29.125	-18.750	-5.750	0.000	6.250	26.000	34.375	61.375	186.000	749.750
1000.000	-480.000	-60.000	-33.000	-15.000	-6.500	0.000	7.000	30.000	38.500	83.000	200.000	803.875

- **Boost Control D-Gain (kW)**

The D-Share table is a table that needs some work in general. Usually going half across helps.

This table is based on the rate of change of boost deviation. Higher values prevent fast spool, it basically slows down the P-Gain, and of course, lower values may result in overboost as a result of faster spool. Make sure to log and see the effect your change.

Boost Deviation [hPa] \ Boost Target Deviation [hPa]	-500.000	-400.000	-300.000	-200.000	-100.000	-50.000	0.000	47.000	65.000	75.000	120.000	200.000	300.000	400.000
-45.000	-23.869	-15.248	-9.225	-5.348	-2.670	-1.473	-2.316	-2.709	-3.150	-3.600	0.000	0.000	0.000	0.000
-35.000	-16.254	-9.379	-5.621	-3.393	-2.574	-1.686	-2.150	-2.635	-3.131	-3.250	0.000	0.000	0.000	0.000
-20.000	-11.580	-7.225	-4.199	-2.260	-1.840	-1.473	-2.041	-2.281	-2.730	-2.787	0.000	0.000	0.000	0.000
-15.000	-9.242	-5.758	-3.283	-1.713	-1.588	-1.270	-1.309	-1.621	-2.551	-2.787	0.000	0.000	0.000	0.000
-8.500	-6.949	-4.338	-2.643	-1.287	-1.287	-1.029	-1.131	-1.492	-2.551	-2.787	0.000	0.000	0.000	0.000
-2.000	-4.199	-2.961	-1.863	-1.000	-0.768	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
-0.750	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.750	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.000	0.000	0.000	0.000	0.000	0.000	0.063	0.301	0.668	0.879	1.080	1.621	2.250	2.719	2.719
4.500	0.000	0.000	0.000	0.000	0.000	0.221	0.520	0.748	1.346	1.848	3.180	3.906	4.623	5.398
6.000	0.000	0.000	0.000	0.000	0.240	0.330	0.715	1.199	1.785	2.504	3.902	5.045	5.885	6.678
10.000	0.000	0.000	0.000	0.000	0.660	0.635	1.287	1.699	2.406	3.180	5.004	6.381	7.471	8.188
15.000	0.000	0.000	0.000	0.961	1.514	1.189	2.211	2.301	3.121	3.707	6.006	8.000	8.732	9.598
27.000	0.000	0.000	0.000	2.268	3.564	2.158	3.564	3.699	4.104	4.748	7.072	9.000	9.900	10.801

- **WGDC I-Gain**

This table is a tricky one. Usually stock values work very well, but in case you are not hitting boost target, this table can add wastegate duty cycle, going too high in values can lead to a wavy boost pressure curve. On the other hand, this table can also be reduced in case you have too high boost pressure in some areas of the RPM range.

Boost Target Deviation [hPa]	1250.000	1500.000	1750.000	2000.000	2500.000	3000.000	3500.000	4000.000	4500.000	5000.000	5500.000	6500.000
-320.000	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.007
-160.000	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011
-70.000	0.012	0.012	0.012	0.012	0.025	0.025	0.025	0.025	0.025	0.027	0.029	0.029
-40.000	0.016	0.016	0.016	0.016	0.032	0.032	0.032	0.032	0.032	0.036	0.037	0.037
-10.000	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.037	0.039	0.039
0.000	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.037	0.039	0.039
10.000	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.040	0.042	0.042
40.000	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.036	0.037	0.037
70.000	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.027	0.029	0.029
160.000	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011
320.000	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.007
640.000	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004

- **Compressor Map With Required Compressor / Turbine Output [kW]**

These cars do not go by a direct wastegate dutycycle base table, they have instead a Compressor map. This table has Turbine Mass Flow and Boost Setpoint as axis and turbine (kW) as z-values. Increasing the z-value will increase the wgdc base. The base wgdc is adjusted mainly by this table as this table changes turbine power should be added. Logging the RAM channels: WGDC (Base), Turbine Power (Base) and the Distribution Factor will help a lot for adjusting the base wgdc. Having a high wgdc base will result in overboost, especially if the car is equipped with an aftermarket high flow downpipe.

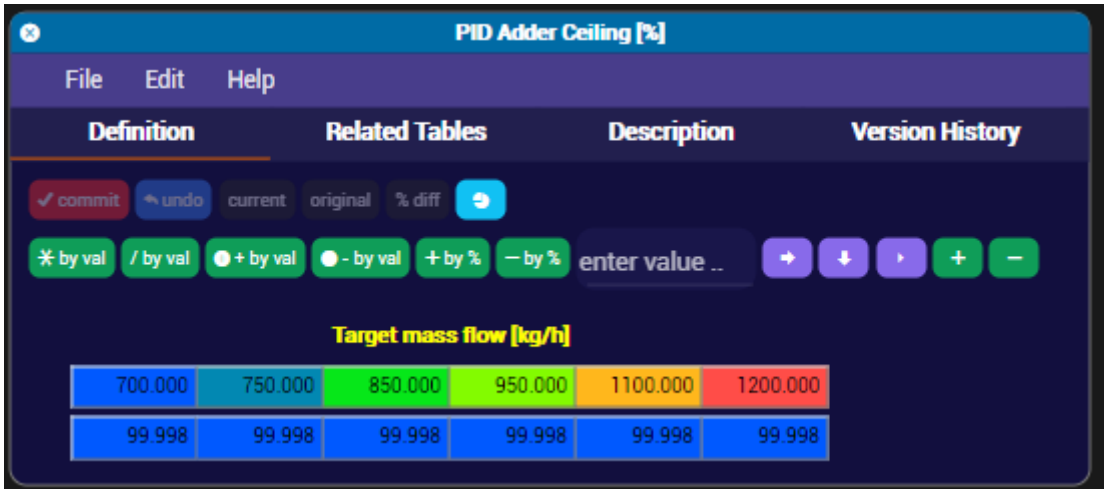
The Wastegate Feed-Forward table uses the Distribution Factor and the Exhaust Gas Mass Flow to determine what the wastegate base value should be (z-value). By increasing the turbine (kW) in the compressor map table there will be a change in the distribution factor. The distribution factor is the split between how much of the exhaust gas goes through the turbine and out through the wastegate valve. The lower the value of the distribution factor, higher amounts of exhaust gas goes through the wastegate valve. The higher the value of the distribution factor, the higher the amount of exhaust gas goes through the turbine resulting in higher boost pressure.

MAF pre-turbine [kg/h]	0.380	0.400	0.440	0.500	0.550	0.600	0.650	0.700	0.750	0.850	0.900	1.000
100.000	45.525	48.764	56.061	67.850	75.664	80.771	85.744	88.449	90.796	95.494	97.496	99.998
200.000	42.120	45.883	53.481	66.554	74.501	79.741	84.798	87.750	90.051	95.100	97.002	99.998
300.000	36.551	40.746	49.881	64.703	73.459	78.496	83.508	86.955	89.252	94.083	96.251	99.998
400.000	34.174	38.235	47.984	63.699	72.498	77.496	82.558	86.252	89.102	93.796	95.895	99.998
500.000	31.815	36.205	46.143	61.502	70.998	76.993	81.754	85.751	88.452	93.425	95.290	99.998
600.000	30.750	35.249	44.044	59.000	69.206	76.300	81.056	85.306	87.975	92.780	94.684	99.998
700.000	29.750	34.413	43.507	57.254	67.757	75.352	80.254	84.778	87.498	92.383	94.579	99.998
800.000	29.501	33.575	42.783	56.258	67.058	74.249	79.755	84.251	86.771	92.238	94.223	99.998
900.000	29.002	32.979	41.812	55.298	65.961	73.500	79.254	83.974	86.293	91.841	93.867	99.998
1000.000	28.502	32.382	40.840	54.410	65.083	72.766	79.004	83.446	85.817	91.362	93.512	99.998
1100.000	28.001	32.001	40.369	54.022	65.085	72.501	78.755	82.919	85.339	90.881	92.906	99.998
1250.000	27.502	31.500	39.786	53.397	64.761	72.249	78.255	82.503	84.999	90.331	92.499	99.998

Turbine MAF Target (After Corr.) [kg/h]	1.011	1.150	1.200	1.250	1.300	1.400	1.500	1.600	1.700	1.800	1.900	2.000	2.100	2.200	2.300	2.400	2.500	2.650	2.800	3.100
100.000	0.314	0.348	0.432	0.541	0.703	1.049	1.318	1.639	1.859	2.078	2.422	2.693	2.961	3.154	3.449	3.742	4.012	4.465	4.793	5.549
160.000	0.326	0.576	0.799	1.004	1.291	1.586	2.023	2.689	3.055	3.420	3.760	4.047	4.486	4.850	5.189	5.502	5.838	6.322	6.781	7.771
240.000	0.430	0.719	1.096	1.326	1.561	2.176	2.803	3.479	3.988	4.514	5.090	5.695	6.102	6.658	7.215	7.621	8.127	8.836	9.496	10.965
320.000	0.576	0.996	1.412	1.648	2.145	2.918	3.565	4.350	5.041	5.791	6.477	7.096	7.717	8.338	8.959	9.531	10.250	11.154	12.113	13.924
400.000	0.748	1.244	1.559	2.125	2.604	3.398	4.295	5.266	6.146	6.855	7.490	8.104	8.953	9.752	10.553	11.400	12.150	13.301	14.352	16.646
480.000	1.000	1.660	2.020	2.434	3.096	4.090	4.982	6.004	7.059	8.023	8.883	9.762	10.617	11.512	12.611	13.510	14.408	15.529	16.703	19.199
560.000	1.551	2.045	2.459	2.898	3.826	4.777	5.801	6.764	7.965	9.162	10.191	11.174	12.172	13.322	14.354	15.484	16.367	17.502	18.688	21.479
640.000	2.340	2.904	3.209	3.688	4.785	5.662	6.738	7.711	8.982	10.160	11.477	12.627	13.707	15.008	16.145	17.453	18.512	19.951	21.240	24.219
720.000	3.098	4.063	4.670	5.301	6.277	7.248	7.973	8.803	9.791	11.172	12.512	14.012	15.463	16.926	18.248	19.510	20.621	22.311	23.959	27.049
800.000	3.990	5.512	6.053	6.750	8.094	9.104	9.934	10.699	11.572	12.852	14.186	15.598	17.191	18.563	20.131	21.549	23.080	25.074	27.160	30.922
900.000	5.014	7.176	7.990	9.012	10.021	11.531	12.490	13.795	14.695	15.809	16.904	18.018	19.305	20.670	22.363	23.932	25.133	27.234	29.242	33.508
1000.000	7.158	9.564	10.506	11.436	12.410	13.914	15.350	16.600	18.148	19.293	20.432	21.539	22.527	23.814	25.180	26.492	28.061	30.469	32.992	38.215
1100.000	8.615	11.574	12.590	13.570	14.426	15.828	17.371	19.104	20.691	22.127	23.758	25.256	26.633	27.908	29.361	31.006	32.932	36.809	40.779	47.021
1250.000	10.396	13.348	14.441	15.543	16.586	18.498	20.162	21.945	23.859	25.740	27.799	29.869	31.639	33.490	35.258	37.096	39.111	43.939	48.504	55.586
1400.000	13.051	15.992	17.035	18.137	19.170	20.982	22.859	24.842	27.025	29.045	31.109	33.371	36.193	39.172	41.828	44.334	47.100	51.896	56.207	64.594
1600.000	15.314	18.482	19.576	20.668	21.871	24.203	26.225	28.557	30.826	33.209	35.922	38.094	40.543	42.973	45.455	48.242	50.926	54.904	58.377	66.385

- **PID Adder Ceiling**

This table is a limitation of how much more wastegate duty cycle the PID gain can add over the wastegate duty cycle base. This is a global limiter for the PID gain. Going too high may result in overboost, while going too low can result in underboost. Stock is fine for most applications, upgrade turbo may have to increase much further to make up for the higher boost requested. This calibration has the values maxed out, but limited by the PID Integral limits.



- **Boost Setpoint Limitation**

This table may have a drop in boost setpoint. This is mostly due to lowering the boost setpoint at higher airflow, see this as another limiter for boost setpoint. This should be raised to prevent any boost target limitation.

This table is a very big limiter in terms of boost pressure. This will limit your boost setpoint (x-axis on the Compressor map table) causing your turbine (kW) to drop at higher target mass flow. This should be increased in order to achieve higher boost pressure for the respective ‘Target mass flow’.

- **Target Boost Pressure Offset In Sport Mode**

Pay attention to this table, it will increase your boost target in sport modes above what it's calculated to. This table is already increased from factory, and it's done so your target is high while at low pedal input (only in sport mode). This is done to have boost build up in front of the throttle plate, making it a feature that gives less turbolag i.e., when on a track or during spirited driving. As soon as you step on the pedal, boost is there giving the driver an NA feeling without the turbolag. This is a great OEM feature when on stock map but tuned it may hurt performance. The higher the value, the higher the boost target, but this does not increase the torque target which may result in throttle closures as requested boost is higher than the requested boost by torque target. Zeroing out may fix throttle closures caused by this table.

Fuel

Fuel tables:

- **Lambda Target (Bank 1/2)**
- **Lambda Limit (Floor)**
- **Lambda Target (at Superknock)**
- **Minimum Lambda**
- **Fuel Scalar**
- **Correction Factor**

- **Lambda Target (Bank 1/2)**

There are 2 lambda (AFR) targets for this car, one for each bank. If you take a look at the stock values, you'll see the axis is set very high in load, up to 180%. Stock, this car will never reach such load.

If you log the N55 stock tune on pumpgas, you will notice how the AFR is. It never goes super rich, so this table should be understood properly (when stock). This tables is setup so, whenever or if the load should somehow go very high, AFR goes very rich to cool down the engine and prevent knock.

Tuned, these cars like it a little lean if the pumpgas is good, if you're on a lower octane fuel, it's suggested to go a little richer to prevent knock. A lambda of 0.82 or lower for low quality pumpgas works. For better quality pumpgas 0.84 is acceptable. Tuning on ethanol blends it is possible to go even leaner due to the cooling effects of the ethanol but also to keep the high-pressure fuel pump (HPFP) on these cars, especially if the given car has a stock HPFP.

Load (Relative Filling) [%]	500.000	750.000	1000.000	1250.000	1500.000	2000.000	2250.000	2500.000	3000.000	3500.000	4000.000	4500.000	5000.000	5500.000	5750.000	6000.000	6500.000	6950.000
20.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.980
40.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.980
50.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.970	0.970
60.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.983	0.960
70.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.000	1.000
80.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.995	1.000	0.980
90.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.000	0.990	0.956	0.960
100.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.979	0.970	0.953	0.920	0.920
110.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.985	0.952	0.935	0.917	0.905	0.910
120.000	0.950	0.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.968	0.932	0.910	0.895	0.875	0.875
130.000	0.940	0.940	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.962	0.935	0.908	0.893	0.875	0.860	0.860
140.000	0.920	0.930	0.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.962	0.940	0.910	0.880	0.856	0.844	0.830	0.830
150.000	0.900	0.900	0.920	1.000	1.000	1.000	1.000	1.000	1.000	0.970	0.935	0.911	0.885	0.854	0.830	0.814	0.810	0.810
160.000	0.880	0.880	0.880	0.950	0.950	0.950	0.950	0.950	0.950	0.920	0.900	0.870	0.850	0.824	0.800	0.794	0.790	0.790
170.000	0.880	0.880	0.880	0.900	0.900	0.950	0.950	0.930	0.950	0.880	0.890	0.840	0.822	0.814	0.800	0.784	0.780	0.780
180.000	0.880	0.880	0.880	0.880	0.900	0.950	0.950	0.920	0.920	0.860	0.880	0.845	0.815	0.804	0.790	0.774	0.770	0.770

- **Lambda Limit (Floor)**

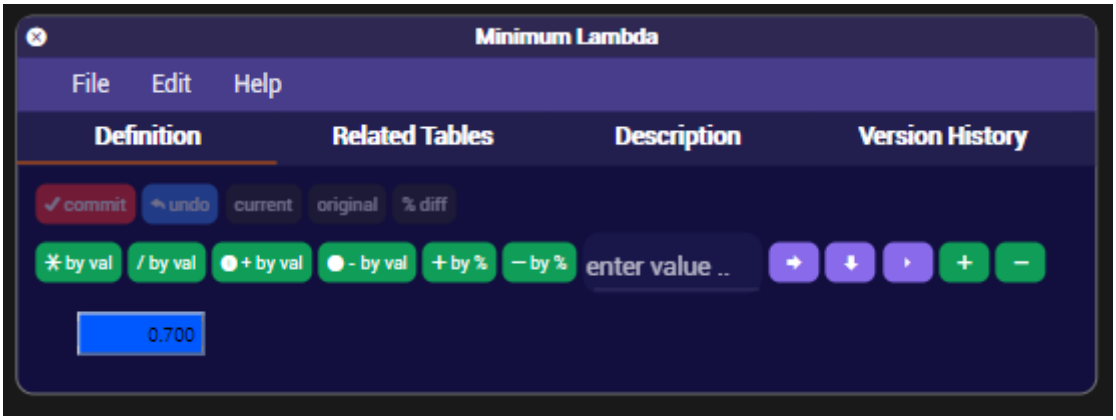
This is the absolute minimum lambda; you'd want to set this to match your richest point of your lambda target tables.

- **Lambda Target (at Superknock)**

On this table BMW set the lambda target very rich at load target this car may reach stock. Should it experience misfire or even worse, superknock. It will make sure to inject way more fuel in to keep everything cool and to prevent further knock. This table can be modified, but personally I'd keep this map stock. If you keep having a rich AFR even though you set the previous tables leaner than these values AND you have fresh spark plugs and ignition coils, you can match the values of this table with the ones from your lambda target.

- **Minimum Lambda**

This table is a global limiter for the richest point of lambda, this does the same as the Lambda Floor, but the Lambda Floor is based on load and engine speed, while this is just a 1 value table. Set this to the richest point of your Lambda Target tables.



- **Fuel Scalar**

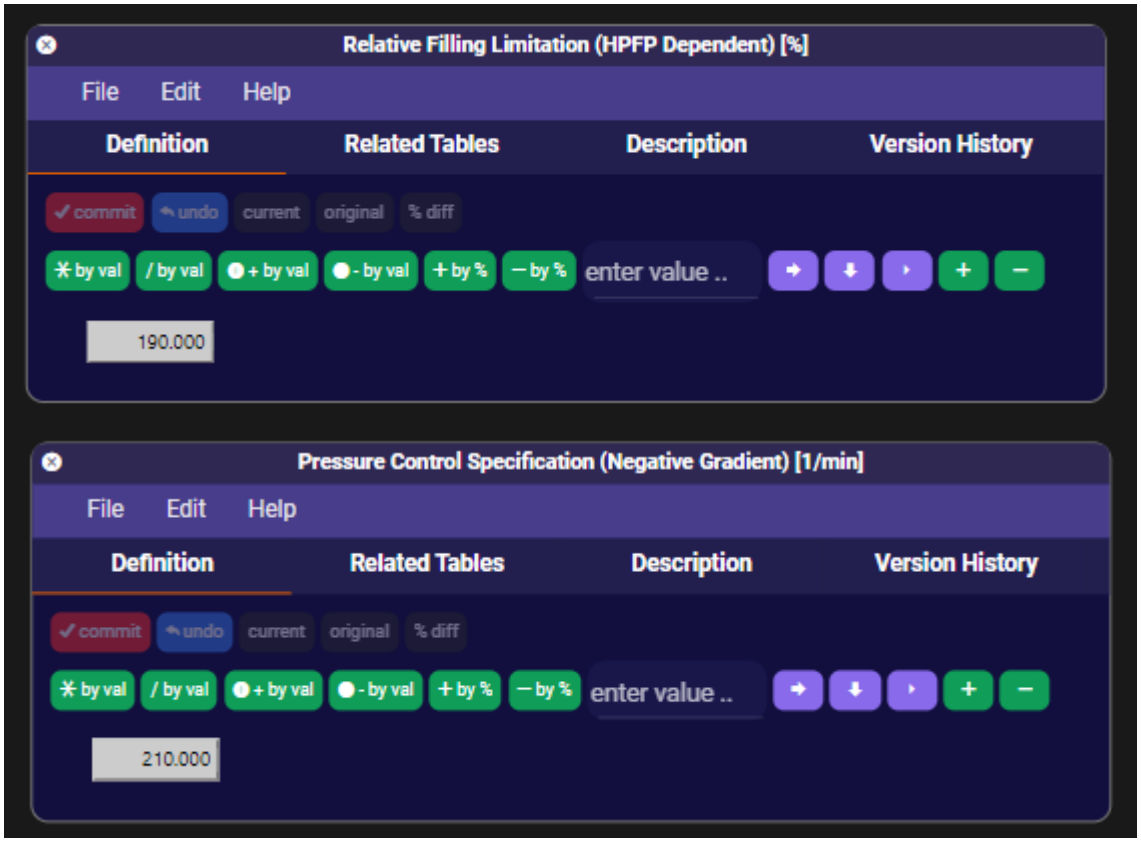
Keeping this table stock on pumpgas is the way to go, in case your fuel has more ethanol than expected you can modify it. The only way to figure out how to modify is, logs! You'd want to keep an eye on the STFT (Short Term Fuel Trims). That will tell you how much fuel is added or subtracted, you want to be around 1 in STFT. If your fuel has ethanol and this map is unmodified, you will notice STFT go above 1, meaning you need to inject more fuel. Simply increase this table across in percentage.

For E30 fuels, you want around 5% increase on the whole table, again, logs! Make sure to log and check the STFT at idle (low load and low engine speed) and do a pull from low engine speed to redline. Look at STFT, load and engine speed and increase where needed.

- **Load limitations due to fuelling**

There are several tables that can trigger the relative filling (flag). In this case it would be set to 4. This is most likely due to a limitation caused by the low pressure fuel pump (LPFP) tables.

If you see a drop in load limit/target while the flag is at 4, these tables should be looked at:



The first one would set a flat load limitation; this can be set to the same value as any other load limit table or just set max (327) to not limit anything.

The second table on the other hand can help with flag 4. Lowering this table by 50% or even setting it to zero will disable any load drop cause by it. Please note, on some software versions e.g., in the G8X S58 this table can be a very high value, please adjust with caution as this may trigger limp mode on those.

Another set of tables that may help on flag 4 are the following:

All values of 9200 can be set to 10000, that includes the single value table for max mode, so it matches the boost mode max value of 10000. Please note, this is example is from an B58 Gen 2 Z4 M40i. These values may be slightly different depending on car and country code. But following this example will help.

- **Correction Factor**

This table is more or less like the fuel scalar, you'd want to increase this the same amount if running ethanol blends. Rule of thumb is to increase it across by 5% if on E30 blends. Again, make sure to log and adjust properly.

Ignition Timing

Ignition tables:

- **Base Ignition Timing (Full Load – Warm)**
- **Ignition Timing (Full Load – Spool)**
- **Ignition Timing Correction (Factor – Full Load)**
- **Ignition Correction (Full Load)**

- **Base Ignition Timing (Full Load – Warm):**

This table sets the ignition timing targets over load and engine speed. The values shown are before any correction. Depending on what octane the car runs, ignition timing should be adjusted. Best is to reduce ignition at higher loads by 2 degrees over stock, to prevent ignition timing corrections and or knock while tuning. Once all that is set, this can be increased. The values in the stock table (M135 in this case) are higher than the regular 35i models such as 335i or 435i. For a regular 93 octane (98RON) fuel these targets fit very well, but datalogging is necessary to make sure it follows the path of the values set in this table.

Load (Relative Filling) [%]	500.000	750.000	1000.000	1250.000	1500.000	1750.000	2000.000	2250.000	2500.000	2750.000	3000.000	3250.000	3500.000	4000.000	4500.000	5000.000	5500.000	6000.000	6500.000	6950.000
10.000	25.000	27.000	27.500	32.500	35.000	38.500	41.000	42.000	43.500	43.500	43.500	43.500	44.500	45.500	43.500	43.500	43.500	43.500	43.500	43.500
20.000	15.000	24.000	27.500	34.500	37.500	40.000	44.500	46.000	47.000	47.000	48.000	49.000	44.500	45.500	43.500	47.000	49.000	49.000	49.000	49.000
30.000	10.000	17.000	27.000	30.500	31.500	33.000	33.500	35.500	36.500	37.000	34.500	34.500	34.500	36.500	37.500	40.000	41.000	42.000	44.000	45.000
40.000	6.000	13.000	18.000	22.000	25.000	28.500	28.500	29.000	30.000	33.000	33.000	32.500	32.500	34.500	35.500	35.500	37.000	40.000	40.000	41.000
50.000	-1.000	9.000	11.500	15.000	17.000	19.000	23.000	25.500	27.000	28.500	29.500	30.000	31.000	31.500	33.000	33.500	34.000	36.000	34.000	35.000
60.000	-6.500	-4.500	6.000	11.000	13.000	14.500	17.500	21.000	23.000	23.000	24.000	24.000	24.000	24.500	26.500	27.000	26.500	25.500	23.500	24.500
70.000	-6.000	-4.000	3.500	5.500	10.500	12.000	15.000	17.500	18.500	19.000	20.000	19.500	20.000	21.000	22.000	22.000	21.000	20.500	20.000	20.000
80.000	-6.500	-4.000	1.500	4.500	8.500	10.000	13.500	14.000	15.500	16.500	17.000	17.000	17.500	17.500	17.500	17.500	17.500	17.500	19.500	19.500
90.000	-8.500	-5.500	-0.500	3.500	7.500	8.500	12.000	12.500	13.000	14.000	15.000	15.500	16.000	16.000	16.500	16.500	16.500	18.000	18.500	19.000
100.000	-10.000	-7.000	-1.500	1.000	5.000	6.000	9.500	11.000	11.500	13.000	13.500	13.500	14.000	14.500	15.000	15.500	16.000	17.000	18.000	19.000
110.000	-12.500	-11.000	-6.000	-0.500	3.000	4.000	7.500	9.500	10.000	11.000	12.000	11.500	12.000	13.000	13.000	13.500	14.500	15.500	16.000	17.000
120.000	-13.500	-12.000	-9.000	-3.000	0.500	2.500	5.500	7.000	8.500	9.000	10.500	10.500	11.000	12.000	12.000	12.500	13.000	13.500	14.000	14.000
130.000	-13.500	-12.000	-9.000	-5.000	-1.000	-1.000	3.500	5.500	7.000	7.500	8.500	9.000	9.500	10.500	11.000	11.500	12.000	12.500	13.000	13.000
140.000	-13.500	-12.000	-9.500	-6.500	-3.500	-1.000	2.000	4.000	5.500	6.000	6.500	7.000	8.000	8.500	10.000	10.500	11.000	11.500	12.000	11.500
160.000	-13.500	-12.000	-9.500	-7.000	-5.000	-2.500	0.000	2.500	4.000	5.000	5.000	6.000	6.500	7.500	8.000	8.500	9.500	10.000	11.000	11.000
180.000	-13.500	-12.000	-9.500	-8.000	-5.500	-3.500	-1.500	0.500	1.500	2.000	2.500	3.500	4.500	5.000	6.500	7.500	8.000	8.500	9.500	9.500

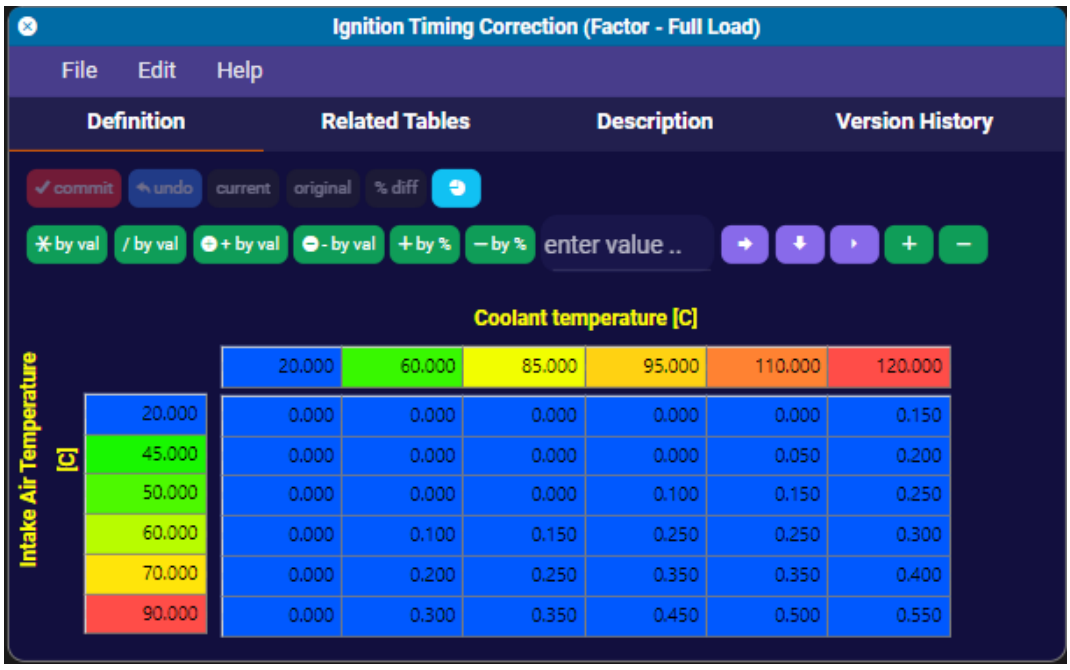
- **Ignition Timing (Full Load – Spool)**

When tuned, more boost is into play, this may cause ignition timing corrections or even knock during spool. The following table should be adjusted to prevent that. Looking at the OEM values, ignition timing drops quite a lot at high load, to be on the safe side, this can be reduced further by a couple of degrees. This may cause a drop in performance, so this should be logged and reviewed.

Load (Relative Filling) [%]	500.000	750.000	1000.000	1250.000	1500.000	1750.000	2000.000	2250.000	2500.000	3000.000
30.000	8.000	10.000	11.500	13.500	14.500	16.500	18.000	19.500	26.000	31.000
40.000	5.500	6.500	7.500	10.000	12.000	14.500	17.000	18.000	25.000	27.000
50.000	1.000	3.000	4.500	7.500	12.000	13.000	17.000	17.500	24.000	26.000
60.000	-7.000	-3.500	1.000	4.500	10.000	12.000	15.500	17.500	23.500	26.000
70.000	-8.000	-1.500	4.500	7.500	13.000	13.000	15.000	15.500	16.500	25.000
80.000	-9.000	-0.500	1.000	5.000	9.500	12.000	14.000	15.500	15.500	17.500
90.000	-10.000	-0.500	2.000	5.000	7.000	9.500	11.000	12.000	15.500	16.500
100.000	-10.500	-0.500	1.000	3.000	4.500	7.000	8.500	10.000	13.000	14.500
110.000	-11.000	-5.000	-1.000	1.000	4.000	5.500	7.000	7.500	11.500	13.000
120.000	-11.500	-7.000	-4.500	-0.500	2.500	4.000	5.000	6.500	10.500	11.000
130.000	-12.000	-10.500	-6.500	-3.000	0.500	2.500	3.500	5.000	8.500	10.500
140.000	-13.500	-12.000	-7.500	-4.500	-1.500	1.000	2.500	3.000	7.000	10.000
160.000	-14.000	-12.500	-9.000	-6.000	-3.000	-2.000	1.500	2.000	5.000	8.000
180.000	-14.500	-13.000	-10.000	-7.500	-4.000	-2.500	0.500	1.000	4.000	5.000

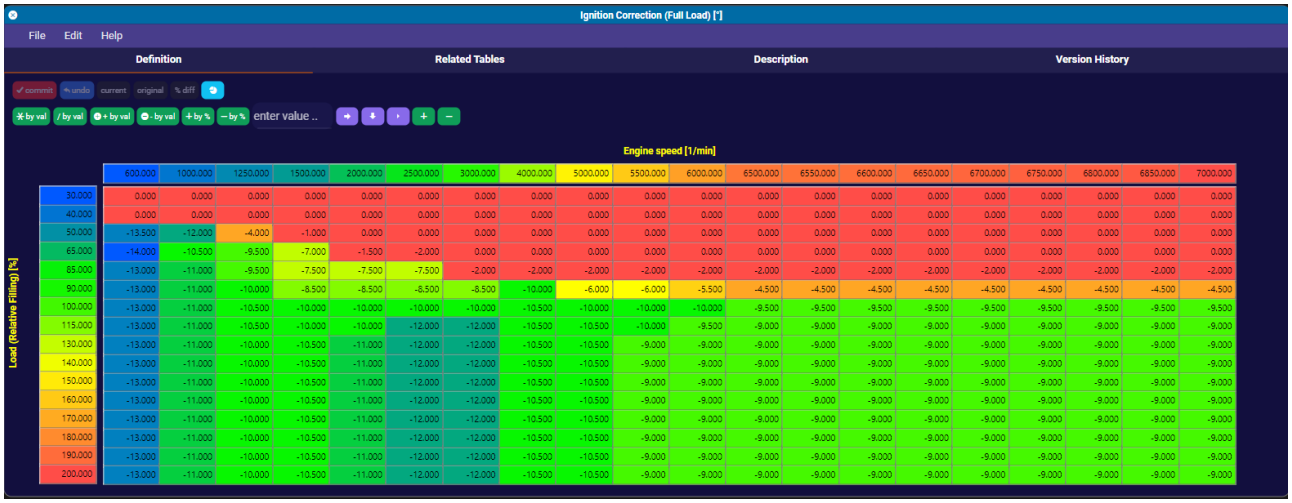
- **Ignition Timing Correction (Factor – Full Load)**
- **Ignition Correction (Full Load)**

These two tables work together, the factor table is a factor of the big ignition correction table. For pumpgas applications the stock values are fine, but when on ethanol blends the ignition correction at higher intake temperatures can be lowered due to the cooling effect of ethanol.



Intake Air Temperature [C]	20.000	60.000	85.000	95.000	110.000	120.000
20.000	0.000	0.000	0.000	0.000	0.000	0.150
45.000	0.000	0.000	0.000	0.000	0.050	0.200
50.000	0.000	0.000	0.000	0.100	0.150	0.250
60.000	0.000	0.100	0.150	0.250	0.250	0.300
70.000	0.000	0.200	0.250	0.350	0.350	0.400
90.000	0.000	0.300	0.350	0.450	0.500	0.550

This will reduce the **Base Ignition Timing (Full Load – Warm)** by the **Ignition Timing Correction (Factor – Full Load)** multiplied with the respective value of the following table **Ignition Correction (Full Load)**:



	600.000	1000.000	1250.000	1500.000	2000.000	2500.000	3000.000	4000.000	5000.000	5500.000	6000.000	6500.000	6550.000	6600.000	6650.000	6700.000	6750.000	6800.000	6850.000	7000.000
30.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50.000	-13.500	-12.000	-4.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65.000	-14.000	-10.500	-9.500	-7.000	-1.500	-2.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
85.000	-13.000	-11.000	-9.500	-7.500	-7.500	-7.500	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000	-2.000
90.000	-13.000	-11.000	-10.000	-8.500	-8.500	-8.500	-8.500	-10.000	-6.000	-6.000	-5.500	-4.500	-4.500	-4.500	-4.500	-4.500	-4.500	-4.500	-4.500	-4.500
100.000	-13.000	-11.000	-10.500	-10.000	-10.000	-10.000	-10.000	-10.500	-10.000	-10.000	-10.000	-9.500	-9.500	-9.500	-9.500	-9.500	-9.500	-9.500	-9.500	-9.500
115.000	-13.000	-11.000	-10.500	-10.000	-10.000	-12.000	-12.000	-10.500	-10.500	-10.000	-9.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
130.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
140.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
150.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
160.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
170.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
180.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
190.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000
200.000	-13.000	-11.000	-10.000	-10.500	-11.000	-12.000	-12.000	-10.500	-10.500	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000	-9.000

Tuning example of an N55 M135 (please note that the MG1 equipped cars have more limiters as mentioned above):

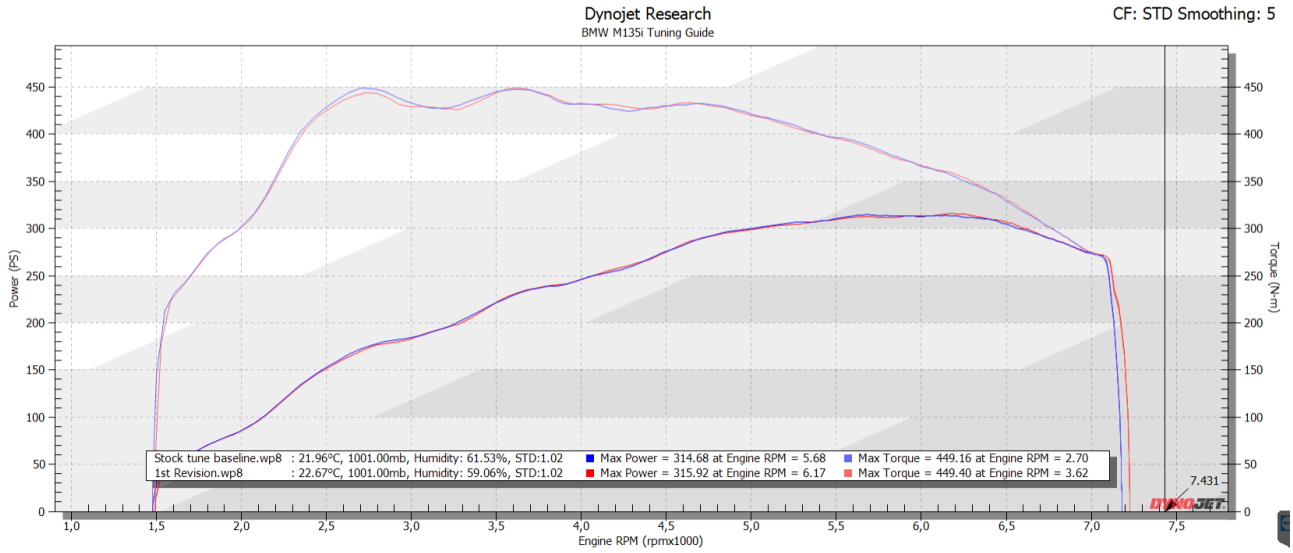
The test car is RWD and has a ZF8 automatic transmission, so we will be in 5th gear on our DynoJet.

Octane used is 98RON (93 octane).

To make any additional power on this car we want to increase the Maximum Torque Limitation. For starters, start with a small increase, datalog the car. 3rd gear pull from low engine speed to redline. If you are on a dyno just go ahead and do a pass in the appropriate gear.

Baseline datalog: www.bootmod3.net/log?id=614b3b54d10b4355c2311cce

We start by increasing our 'Maximum Torque Limit' by 50NM across:

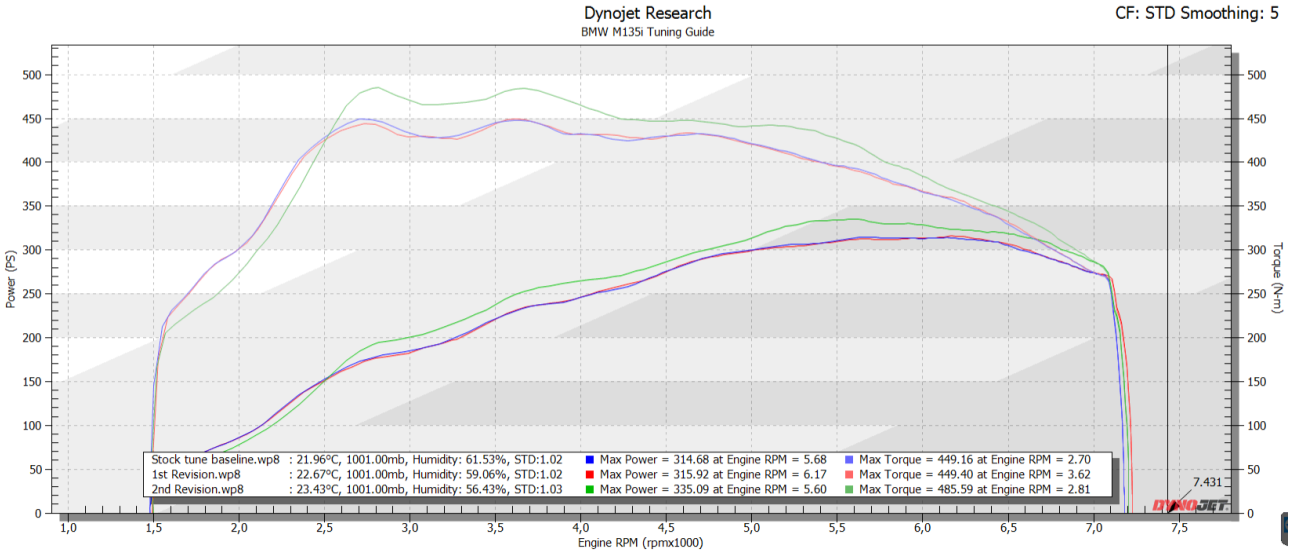


Datalog (1st Revision): www.bootmod3.net/log?id=614c6615d10b4355c23121cf

This made no difference in power as we are limited by the two 'Maximum Permissible Clutch Torque', we will also increase those two tables by 50NM across by marking all the z-values and increment on the pop-up window by 50:

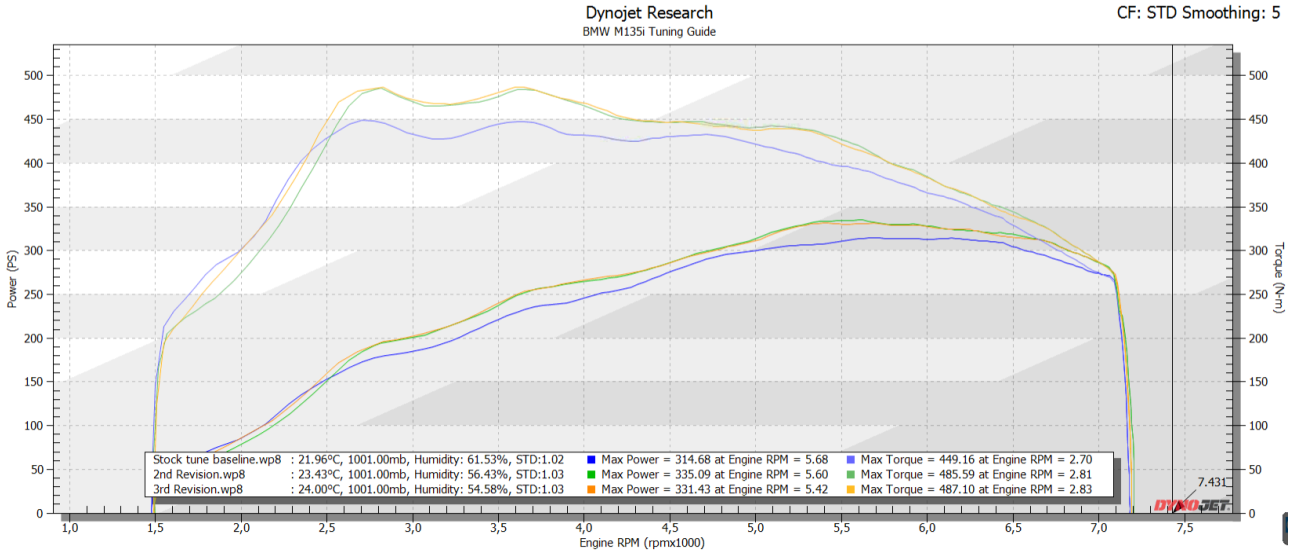

Maximum Permissible Clutch Torque 1 [Nm]
File
Edit
Help
Definition
Related Tables
Description
Version History
commit
undo
current
original
% diff
by val
/ by val
+ by val
- by val
+ by %
− by %
enter value ..
Engine speed [1/min]
Actual gear [-]
400.000 460.000 2000.000 4500.000 4800.000 5000.000 5500.000 5800.000 6000.000 6500.000 6750.000 7000.000
0.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
1.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
2.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
3.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
4.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
5.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
6.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
7.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
8.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
9.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000

Maximum Permissible Clutch Torque 2 [Nm]
File
Edit
Help
Definition
Related Tables
Description
Version History
commit
undo
current
original
% diff
by val
/ by val
+ by val
- by val
+ by %
− by %
enter value ..
50
Engine speed [1/min]
Actual gear [-]
400.000 460.000 2000.000 4500.000 4800.000 5000.000 5500.000 5800.000 6000.000 6500.000 6750.000 7000.000
0.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
1.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
2.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
3.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
4.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
5.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
6.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
7.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
8.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000
9.000 510.000 510.000 510.000 515.000 502.000 495.000 470.000 455.000 442.000 398.000 375.000 355.000



Datalog (2nd Revision): www.bootmod3.net/log?id=614c6787d10b4355c23121d1

We went on and incremented the torque values by another 50NM to see the outcome:



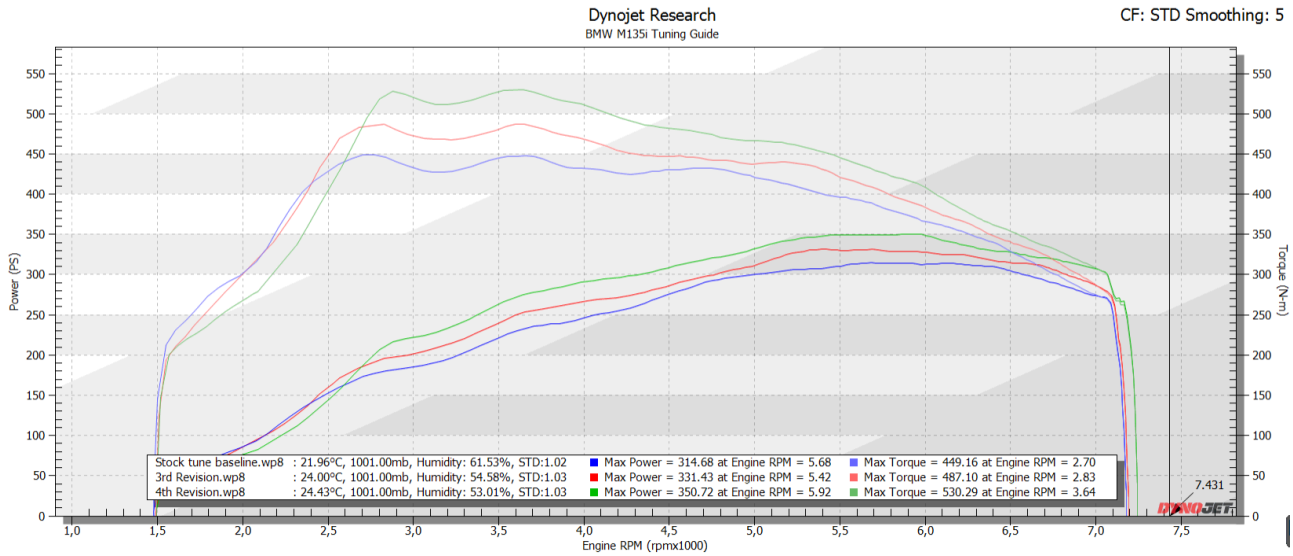
Datalog (3rd Revision): www.bootmod3.net/log?id=614c6925c090c67cf1149b18

Comparing this datalog to the second revision there is no difference at all in power. We are now limited by load.

Next will be to increase the ‘Maximum Filling (Ignition Retard)’ table.

Again using the increment function, we marked the last 2 rows and increased the load limitation by 15.

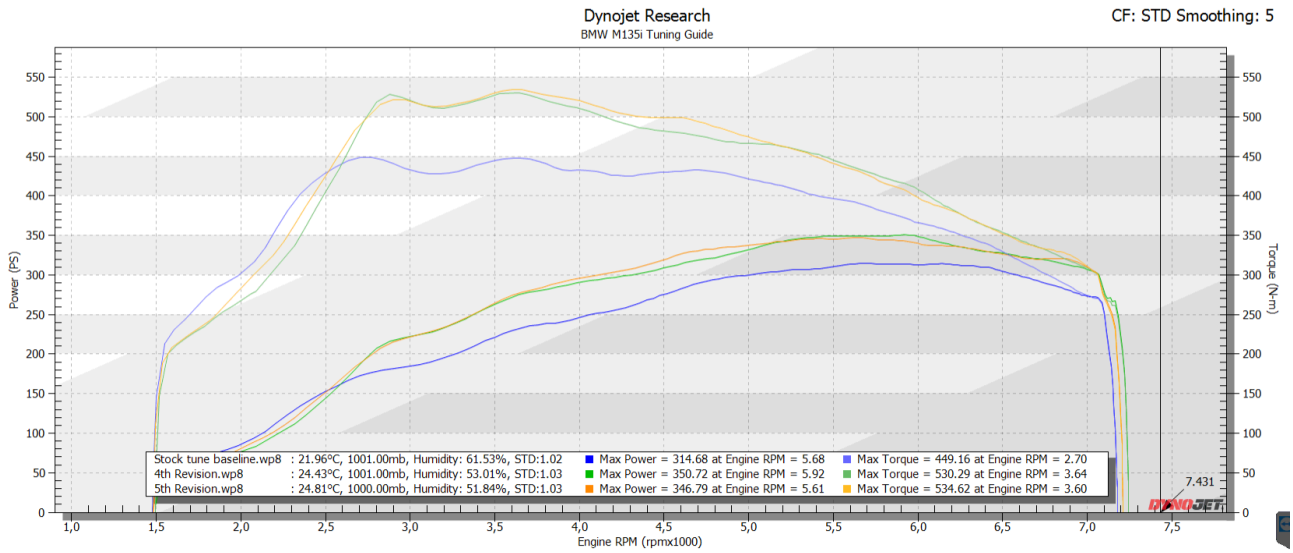
Dyno:



Datalog (4th Revision): www.bootmod3.net/log?id=614c6ac2ae729b7f195afefb

Great increase over the whole powerband, but still limited. To prevent the car from being limited by load we will in the next revision set the table to 180 across in the last 2 rows:

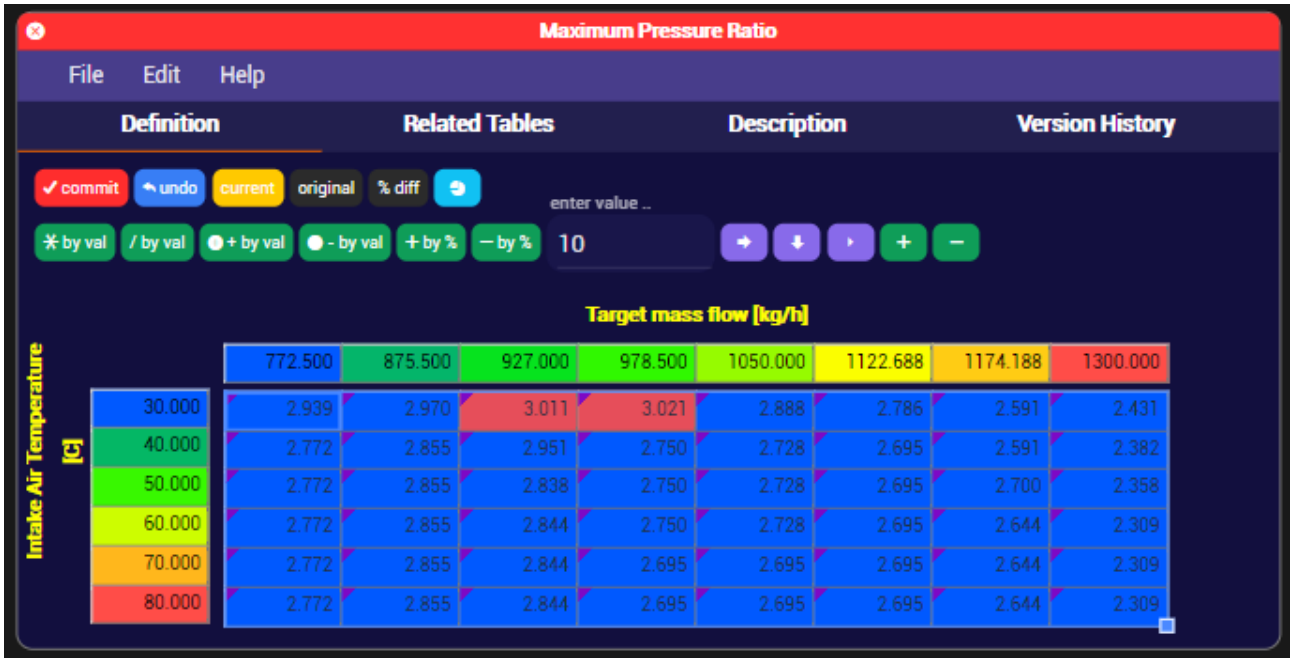
Dyno:



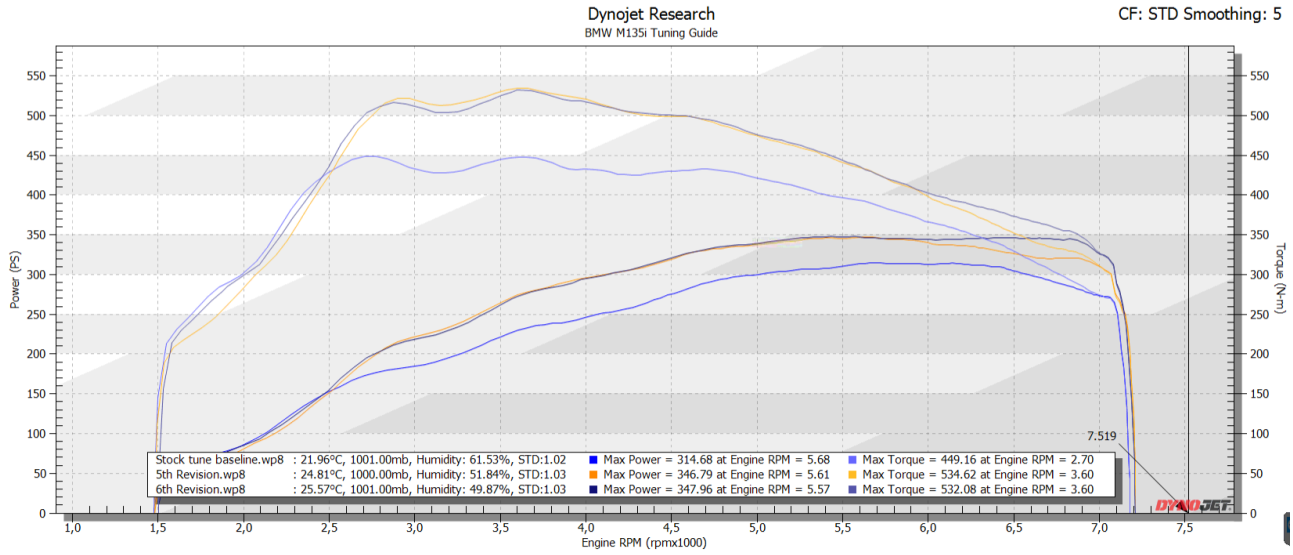
Datalog (5th Revision): www.bootmod3.net/log?id=614c6c4ec090c67c64a99e0f

Looking at the 5th revision datalog I notice we are still limited and there was no power gain compared to previous revision. A quick glance of the datalog shows that we are limited by pressure ratio.

Next will be to look at the 'Maximum Pressure Ratio' table to overcome this boost limitation. We increase the whole table using the 'multiply by value' function. We increase the whole table by 15%:



Dyno:



Datalog (6th Revision): www.bootmod3.net/log?id=614c6e28c090c67cf1149b2d

Looking at the 6th revision it is noticeable that the boost setpoint is increased in the higher RPM range. Boost target and actual boost is higher than previous revision which results in more power torwards redline.

Increasing the ‘Maximum Pressure Ratio’ table another 15% to see if we still are limited by boost setlimit:

Dyno graph is more or less the same without a change, but when looking at the datalog it appears that our boost target seems higher than actual with a deviation of 2-2.5 psi in the high RPM range.

Moreover, going forward we will have Maximum Pressure Ratio set to 2.4 across, to prevent any high boost pressure while testing.

Datalog (7th Revision): www.bootmod3.net/log?id=614c9500ae729b7f195affc0

To bring the actual boost pressure closer to target we have to play around with boost control.

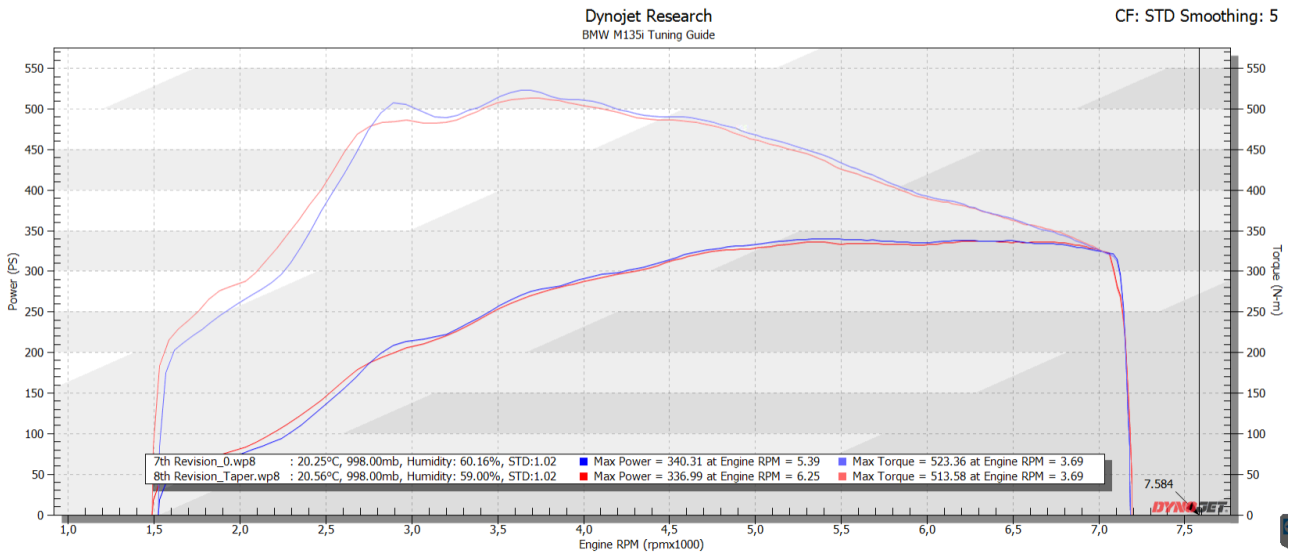
This may be limited by ‘Boost Setpoint Limitation’ which is based on airflow.

This basically allows for big taper in boost setpoint to happen when airflow is high. We will set this to 3 across to prevent any limitation in boost pressure caused by this table.

To allow more PID to be added, the following tables were also changed:


PID Integral Limit (Ceiling) [%]
File
Edit
Help
Definition
Related Tables
Description
Version History
commit
undo
current
original
% diff
* by val
/ by val
+ by val
- by val
+ by %
− by %
enter value ..
Boost Target Deviation [hPa]
Target Pressure Ratio
0.000
100.000
200.000
300.000
1.000
1.400
1.600
1.800
19.998
PID Integral Limit (Floor) [%]
File
Edit
Help
Definition
Related Tables
Description
Version History
commit
undo
current
original
% diff
* by val
/ by val
+ by val
- by val
+ by %
− by %
enter value ..
Boost Target Deviation [hPa]
Target Pressure Ratio
0.000
-100.000
-200.000
-300.000
1.000
0.700
0.600
0.400
-19.998
I-Factor Limit (Ceiling) [%]
File
Edit
Help
Definition
Related Tables
Description
Version History
commit
undo
current
original
% diff
* by val
/ by val
+ by val
- by val
+ by %
− by %
enter value ..
Engine speed [1/min]
3000.000
4000.000
5000.000
6000.000
12.000

Dyno:

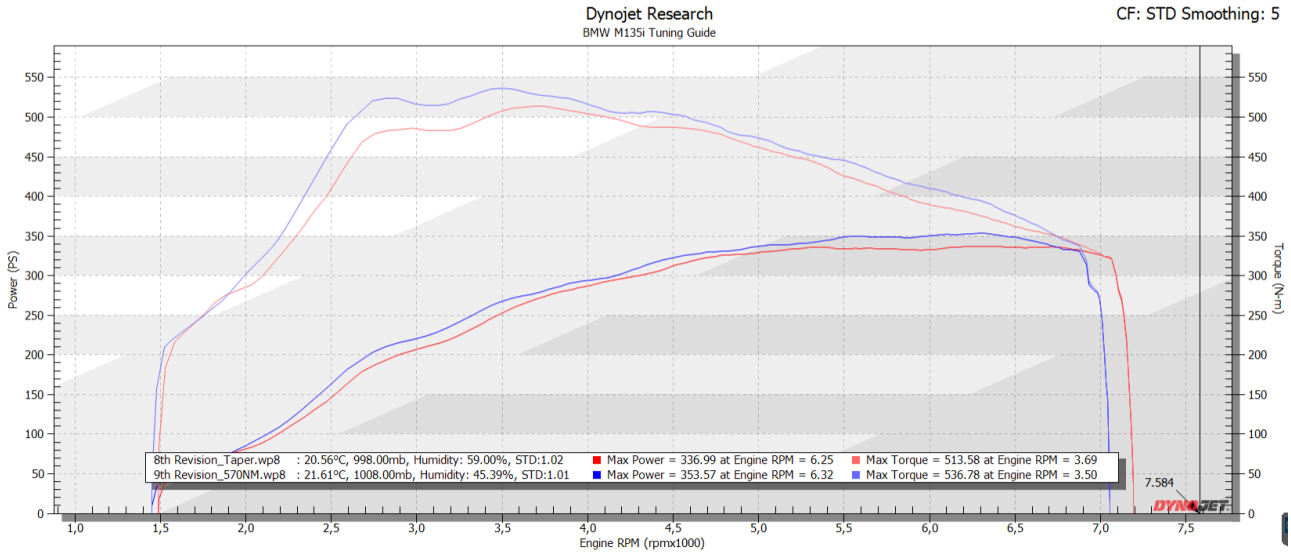


Datalog (8th Revision): www.bootmod3.net/log?id=614d9973c090c67cf1149fe2

No difference between the two revisions. Looking at the 8th revision datalog, it appears that our torque target tapers too much.

For the next revision 'Maximum Torque Limit' and 'Maximum Permissible Clutch Torque' are set to 570NM across to prevent any torque limitation.

Dyno:



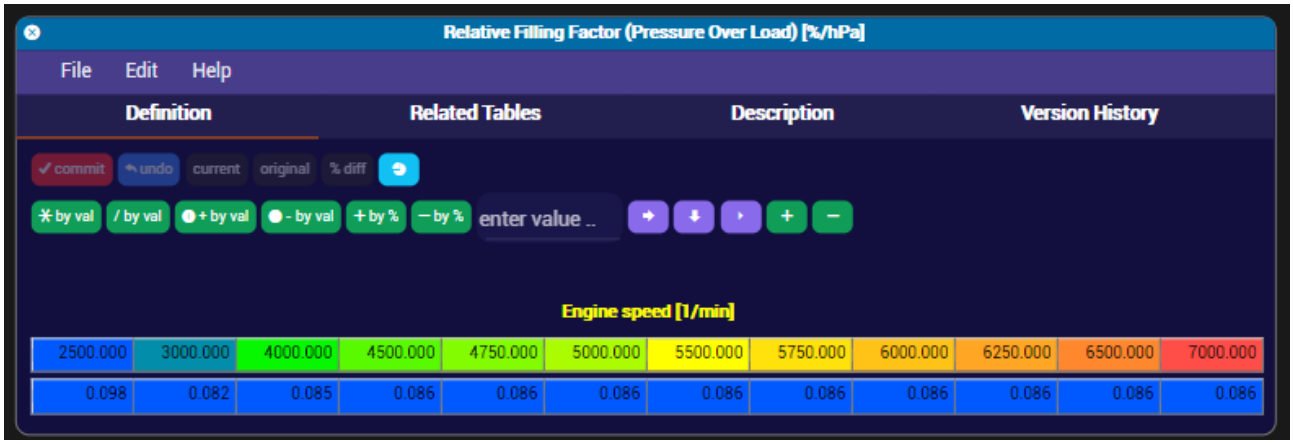
Datalog (9th Revision): www.bootmod3.net/log?id=614d9a58c090c67c64a9a312

Great power increase on the topend after the torque limitation is set high.

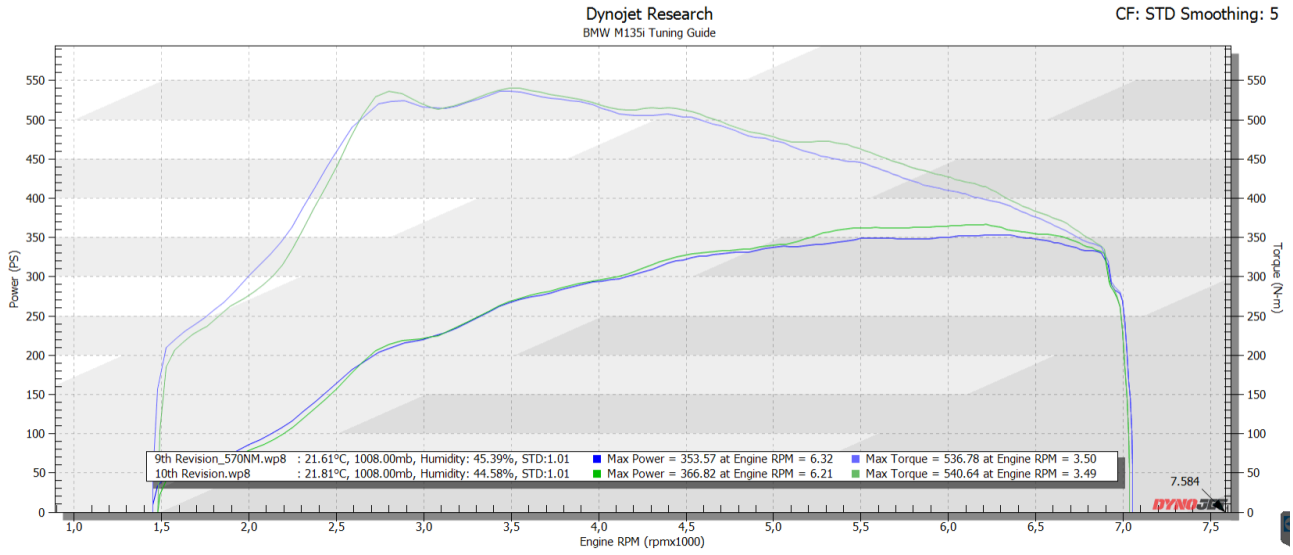
There still seem to be a limitation in the topend which points at the following table:

The OEM values clearly show a drop causing our load target to drop.

For the next revision we try to set the values from 4750RPM to redline to 0.086:



Dyno:



Datalog (10th Revision): www.bootmod3.net/log?id=614d9ea1c090c67cf1149ffa

The 10th revision clearly makes more power up top by the change to the ‘Relative Filling Factor’. It seems to have removed the torque target limitation near as well on the top end.

Taking another glance at the datalog shows rich AFR near redline. This is because we are now hitting higher load targets since the last revision. Looking at the Lambda Targets (Bank 1/2) it is noticeable that lambda target is set rich, stock this car never gets to those values and runs an AFR of around 12.4 near redline.

Lambda Target Bank 1

File Edit Help

Definition | Related Tables | Description | Version History

commit undo current original % diff

by val / by val + by val - by val + by % – by % enter value ..

Engine speed [1/min]

Load (Relative Filling) [%]	500.000	750.000	1000.000	1250.000	1500.000	2000.000	2250.000	2500.000	3000.000	3500.000	4000.000	4500.000	5000.000	5500.000	5750.000	6000.000	6500.000	6950.000
20.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.980
40.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.980
50.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.970	0.970
60.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.983	0.960
70.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.000	1.000
80.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.995	1.000	0.980
90.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.000	0.990	0.956	0.960
100.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.979	0.970	0.953	0.920	0.920
110.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.985	0.952	0.935	0.917	0.905	0.910
120.000	0.950	0.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.968	0.932	0.910	0.895	0.875	0.875
130.000	0.940	0.940	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.962	0.935	0.908	0.893	0.875	0.860	0.860
140.000	0.920	0.930	0.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.962	0.940	0.910	0.880	0.856	0.844	0.830	0.830
150.000	0.900	0.900	0.920	1.000	1.000	1.000	1.000	1.000	1.000	0.970	0.935	0.911	0.885	0.854	0.830	0.814	0.810	0.810
160.000	0.880	0.880	0.880	0.950	0.950	0.950	0.950	0.950	0.950	0.920	0.900	0.870	0.850	0.824	0.800	0.794	0.790	0.790
170.000	0.880	0.880	0.880	0.900	0.900	0.950	0.950	0.930	0.950	0.880	0.890	0.840	0.822	0.814	0.800	0.784	0.780	0.780
180.000	0.880	0.880	0.880	0.880	0.900	0.950	0.950	0.920	0.920	0.860	0.880	0.845	0.815	0.804	0.790	0.774	0.770	0.770

Lambda Target Bank 2

File Edit Help

Definition | Related Tables | Description | Version History

commit undo current original % diff

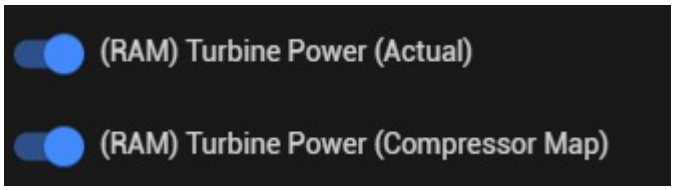
by val / by val + by val - by val + by % – by % enter value ..

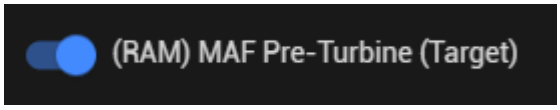
Engine speed [1/min]

Load (Relative Filling) [%]	500.000	750.000	1000.000	1250.000	1500.000	2000.000	2250.000	2500.000	3000.000	3500.000	4000.000	4500.000	5000.000	5500.000	5750.000	6000.000	6500.000	6950.000
20.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
30.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.980
40.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.980
50.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.970	0.970
60.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.983	0.960
70.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.000	1.000
80.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.995	1.000	0.980
90.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.004	1.000	0.990	0.956	0.960
100.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.979	0.970	0.953	0.920	0.920
110.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.985	0.952	0.935	0.917	0.905	0.910
120.000	0.950	0.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.968	0.932	0.910	0.895	0.875	0.875
130.000	0.940	0.940	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.003	0.962	0.935	0.908	0.893	0.875	0.860	0.860
140.000	0.920	0.930	0.950	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.962	0.940	0.910	0.880	0.856	0.844	0.830	0.830
150.000	0.900	0.900	0.920	1.000	1.000	1.000	1.000	1.000	1.000	0.970	0.935	0.911	0.885	0.854	0.830	0.814	0.810	0.810
160.000	0.880	0.880	0.880	0.950	0.950	0.950	0.950	0.950	0.950	0.920	0.900	0.870	0.850	0.824	0.800	0.794	0.790	0.790
170.000	0.880	0.880	0.880	0.900	0.900	0.950	0.950	0.930	0.950	0.880	0.890	0.840	0.822	0.814	0.800	0.784	0.780	0.780
180.000	0.880	0.880	0.880	0.880	0.900	0.950	0.950	0.920	0.920	0.860	0.880	0.845	0.815	0.804	0.790	0.774	0.770	0.770

For this car we set the lambda to 0.83 ~ 12.2 AFR:

Moreover, boost was tapering from target causing a boost deviation. To prevent this, we datalogged the current map again and adding the following RAM channels:

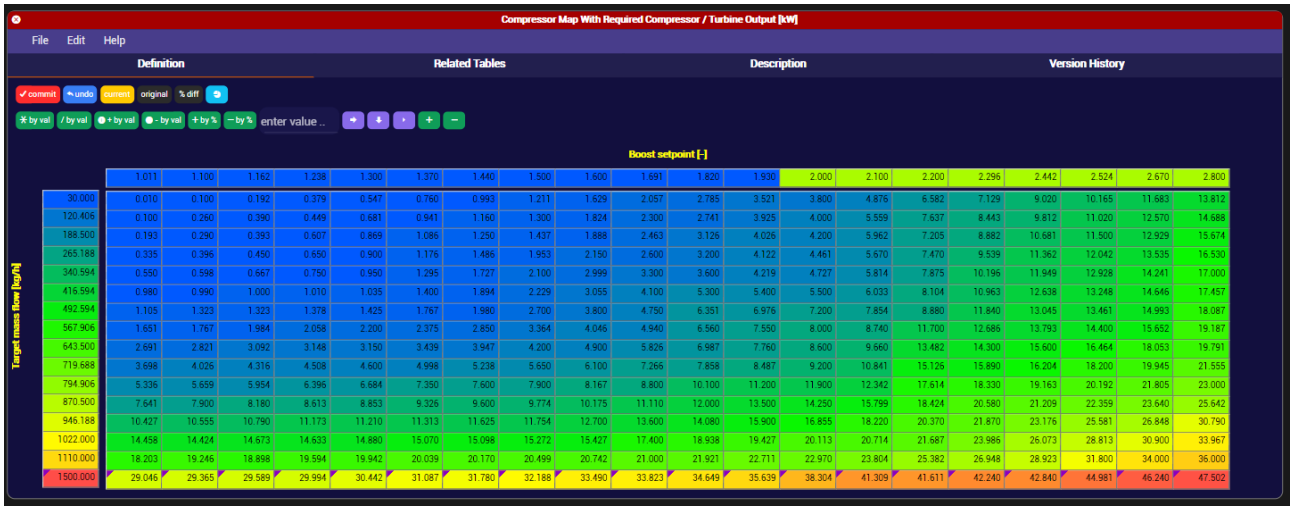




New datalog: www.bootmod3.net/log?id=614da3c1c090c67cf114a007

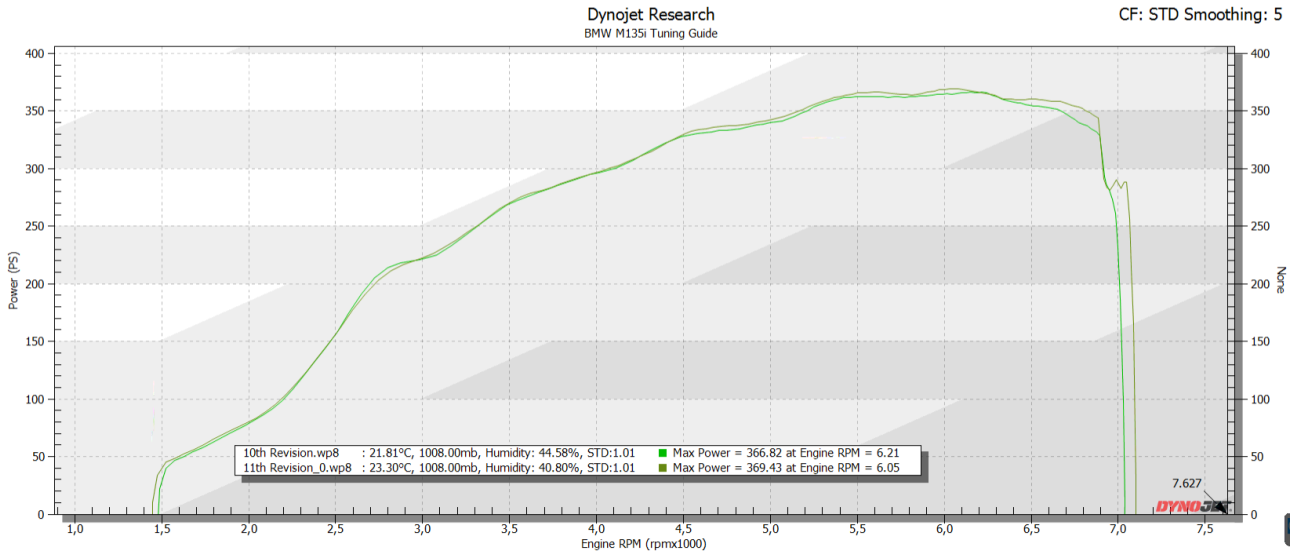
This time we see that the Turbine Power (Compressor Map) caps around 30kW (z-value) and MAF Pre-Turbine at around 50 lb/min (1360kg/h – Y-axis) and Boost Setpoint at 2.3-2.4 (X-axis).

The stock turbine table seem to be capped at around 1250kg/h on the Y-axis. Using the '+ by %' function, we increase the last value on the Y-axis by 20% and the Z-values in the last row of the Z-values by 25%:



Target mass flow [kg/h] \ Boost setpoint [-]	1.011	1.100	1.162	1.238	1.300	1.370	1.440	1.500	1.600	1.691	1.820	1.930	2.000	2.100	2.200	2.296	2.442	2.524	2.670	2.800
30.000	0.010	0.100	0.192	0.379	0.547	0.760	0.993	1.211	1.629	2.057	2.785	3.521	3.800	4.876	6.582	7.129	9.020	10.165	11.683	13.812
120.406	0.100	0.260	0.390	0.449	0.681	0.941	1.160	1.300	1.824	2.300	2.741	3.925	4.000	5.559	7.637	8.443	9.812	11.020	12.570	14.688
188.500	0.193	0.290	0.393	0.607	0.869	1.086	1.250	1.437	1.888	2.463	3.126	4.026	4.200	5.962	7.205	8.882	10.681	11.500	12.929	15.674
265.188	0.335	0.396	0.450	0.650	0.900	1.176	1.486	1.953	2.150	2.600	3.200	4.122	4.461	5.670	7.470	9.539	11.362	12.042	13.535	16.530
340.594	0.550	0.598	0.667	0.750	0.950	1.295	1.727	2.100	2.999	3.300	3.600	4.219	4.727	5.814	7.875	10.196	11.949	12.928	14.241	17.000
416.594	0.980	0.990	1.000	1.010	1.035	1.400	1.894	2.229	3.055	4.100	5.300	5.400	5.500	6.033	8.104	10.963	12.638	13.248	14.646	17.457
492.594	1.105	1.323	1.323	1.378	1.425	1.767	1.980	2.700	3.800	4.750	6.351	6.976	7.200	7.854	8.880	11.840	13.045	13.461	14.993	18.087
567.906	1.651	1.767	1.984	2.058	2.200	2.375	2.850	3.364	4.046	4.940	6.560	7.550	8.000	8.740	11.700	12.686	13.793	14.400	15.652	19.187
643.500	2.691	2.821	3.092	3.148	3.150	3.439	3.947	4.200	4.900	5.826	6.987	7.760	8.600	9.660	13.482	14.300	15.600	16.464	18.053	19.791
719.688	3.698	4.026	4.316	4.508	4.600	4.998	5.238	5.650	6.100	7.266	7.858	8.487	9.200	10.841	15.126	15.890	16.204	18.200	19.945	21.555
794.906	5.336	5.659	5.954	6.396	6.684	7.350	7.600	7.900	8.167	8.800	10.100	11.200	11.900	12.342	17.614	18.330	19.163	20.192	21.805	23.000
870.500	7.641	7.900	8.180	8.613	8.853	9.326	9.600	9.774	10.175	11.110	12.000	13.500	14.250	15.799	18.424	20.580	21.209	22.359	23.640	25.642
946.188	10.427	10.555	10.790	11.173	11.210	11.313	11.625	11.754	12.700	13.600	14.080	15.900	16.855	18.220	20.370	21.870	23.176	25.581	26.848	30.790
1022.000	14.458	14.424	14.673	14.633	14.880	15.070	15.098	15.272	15.427	17.400	18.938	19.427	20.113	20.714	21.687	23.986	26.073	28.813	30.900	33.967
1110.000	18.203	19.246	18.898	19.594	19.942	20.039	20.170	20.499	20.742	21.000	21.921	22.711	22.970	23.804	25.382	26.948	28.923	31.800	34.000	36.000
1500.000	29.046	29.365	29.589	29.994	30.442	31.087	31.780	32.188	33.490	33.823	34.649	35.639	38.304	41.309	41.611	42.240	42.840	44.981	46.240	47.502

Dyno:



Datalog (Revision 11th): www.bootmod3.net/log?id=614da52dae729b7e99771485

The last and final revision results in slightly more topend, approx. 12-13 whp more just before redline. Turbine Power (Compressor Map) has an increase in the datalog by 3kW and our AFR is seem to follow our target at around 12.1-12.2.

Baseline and the final revision: