Siemens MS41

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For more info: **www.ecuconnections.com**
Revision: 1.0

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Introduction:

The Siemens MS41 ECU's are used in:

Series 3 (E36) 2.0i, Series 3 (E36) 2.5i, Series 3 (E36) 2.8i,

Series 5 (E39) 2.0i, Series 5 (E39) 2.5i,

Series 7 (E38) 2.8i,

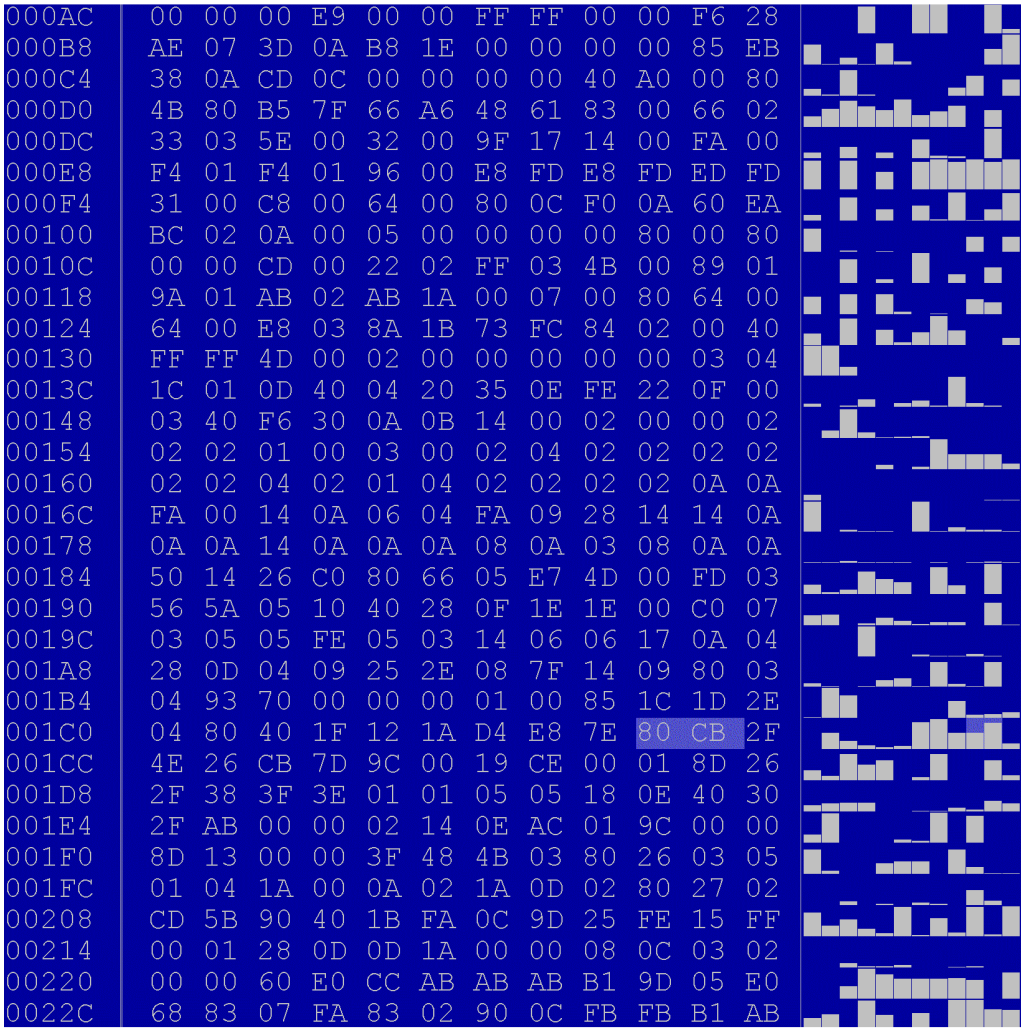
Z3 Roadster 2.0 and Z3 Roadster 2.8.

The eprom inside the ECU is 28F200 with 256KB memory. The content of the eprom can be extracted in two ways. The first one is with using the KWP2000+ or Galletto 1250/1260 and the second one is by desoldering the eprom from the ECU and reading it with an eprom programmer. The first two tools will do partial extraction and they will give 24KB file. The third tool will give a complete 256KB file. Winols is used to change the maps. No matter the size of the file, when the file is imported in the program, it will be automaticly recognized. MS41 ECU's have only one software bank.

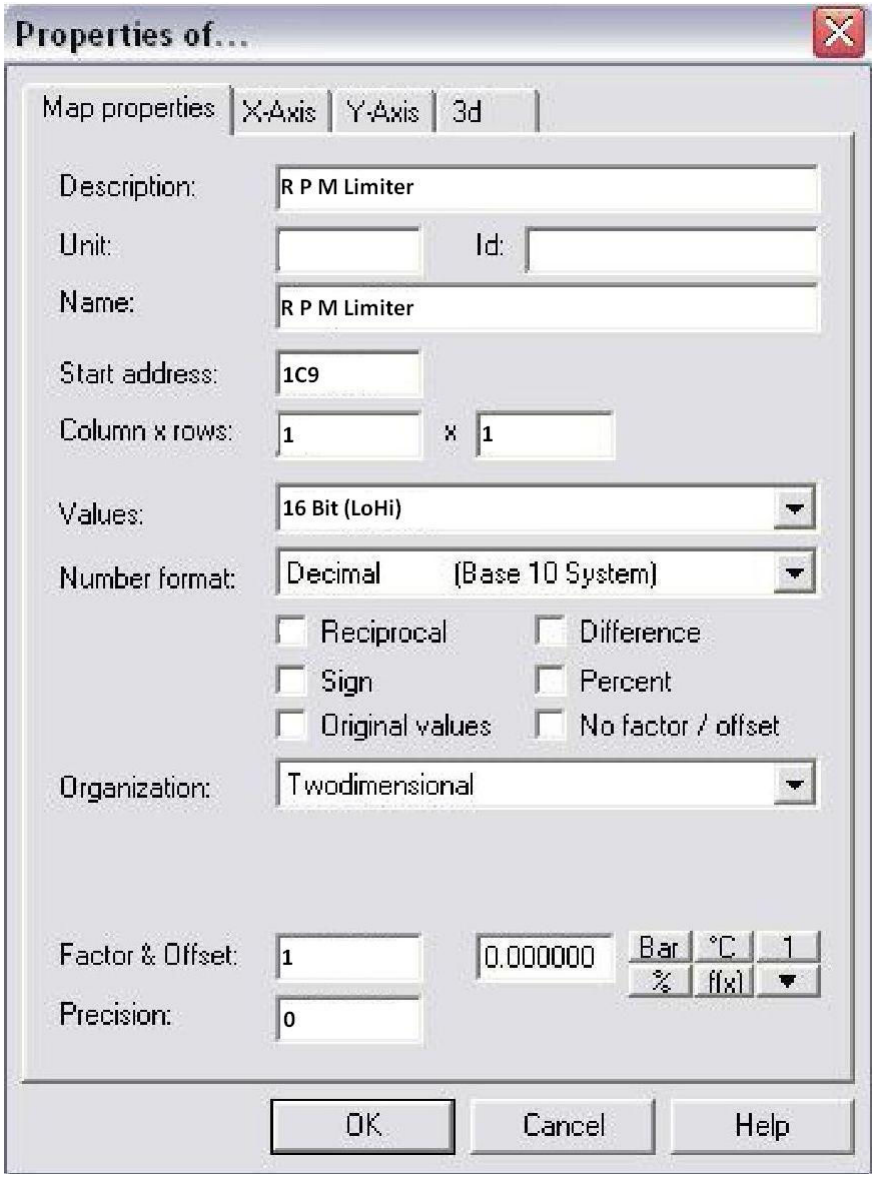
1. The rev limiter:

The rev limiter in Siemens MS41 is very easy to find. The rev limiter is located in front of the maps. Open the file in Text mode, choose Properties, and set the values in the following order:
Columns: 12
Values: 8bit
Number Format: Hexadecimal (Base 16).

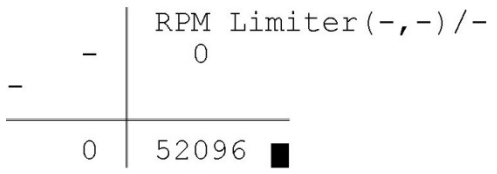
Search for the values 80 CB or E3 CB. The rev limit is set at 6512 or 6524 rpm. Depending on the size of the file the rev limiter is located in 001C9 for 24KB file and in 141C9 for 256KB file. Select and open the map.



Factors & offsets:



When you input correct factors and offsets you will get a single value in the hex dump.



Text view of Rev Limiter

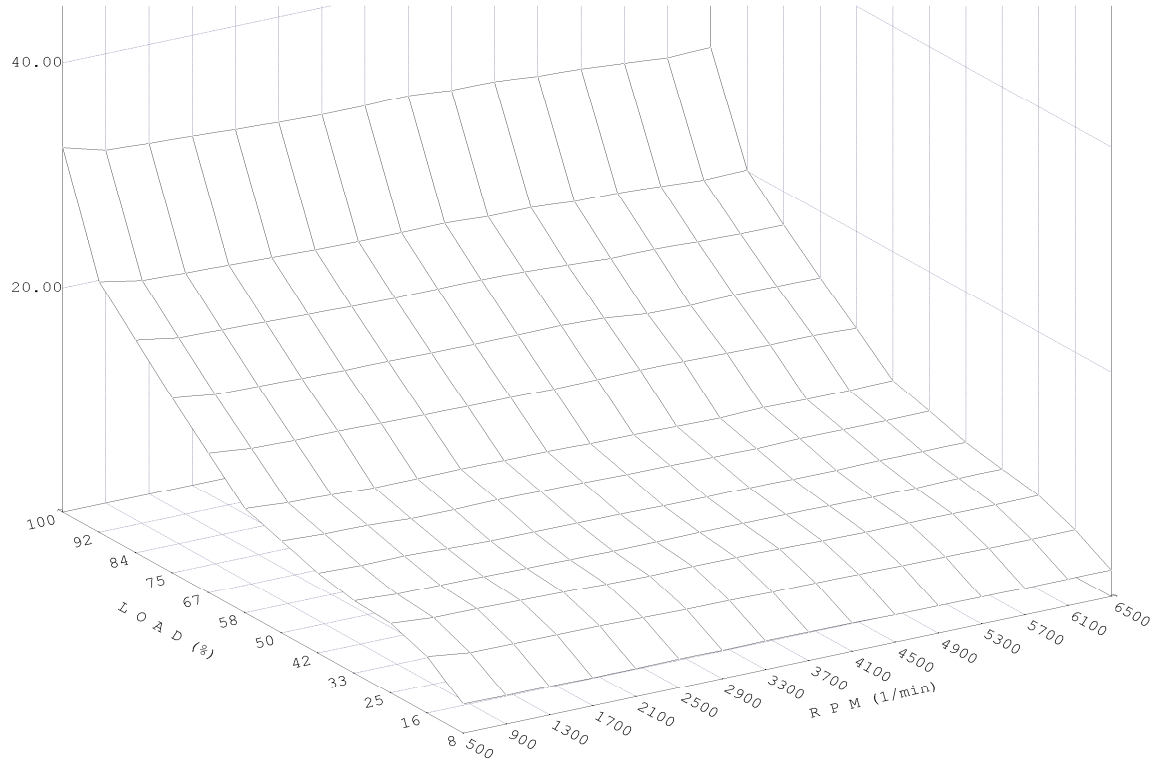
The calculation method for the rev limiter is as follows:

52096 * 0.75 / 6 = 6512 rpm

52195 * 0.75 / 6 = 6524 rpm

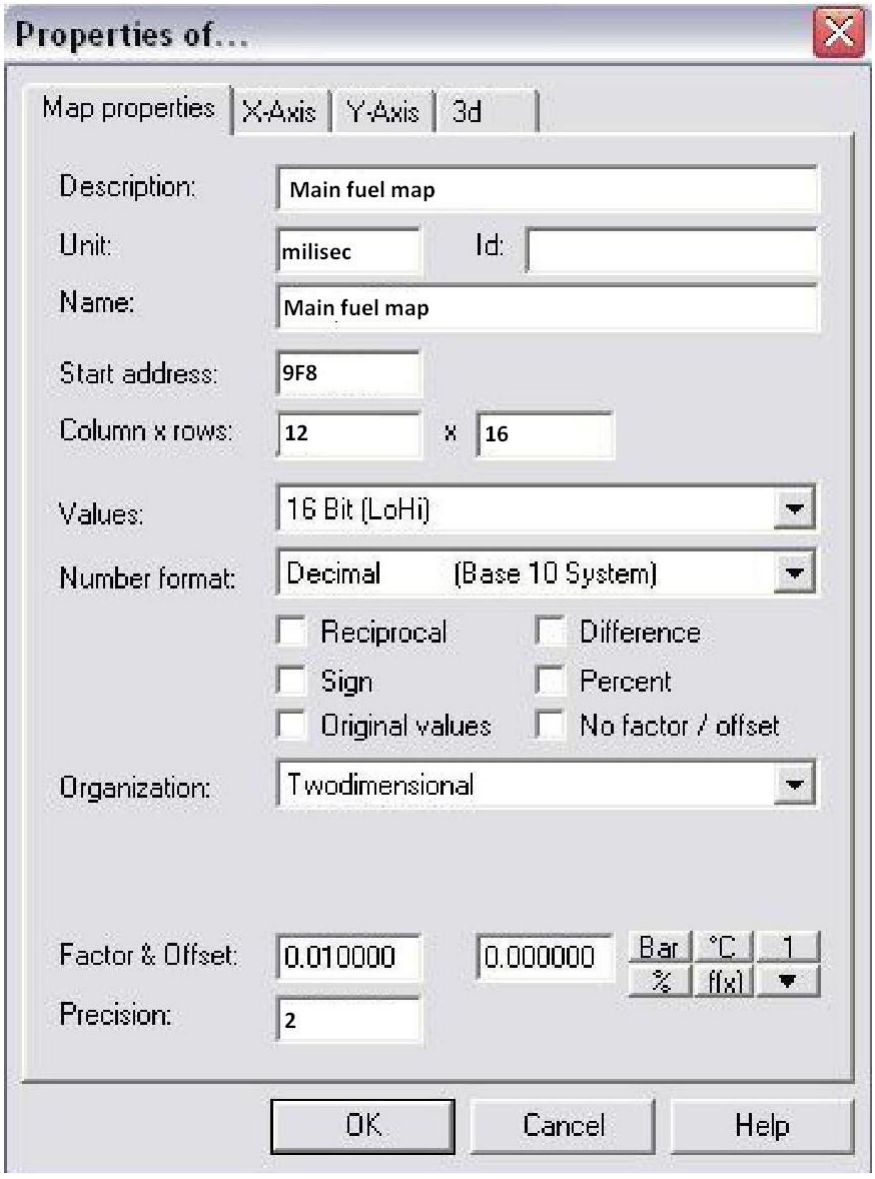
2. Injection at Part Throttle (main fuel map)

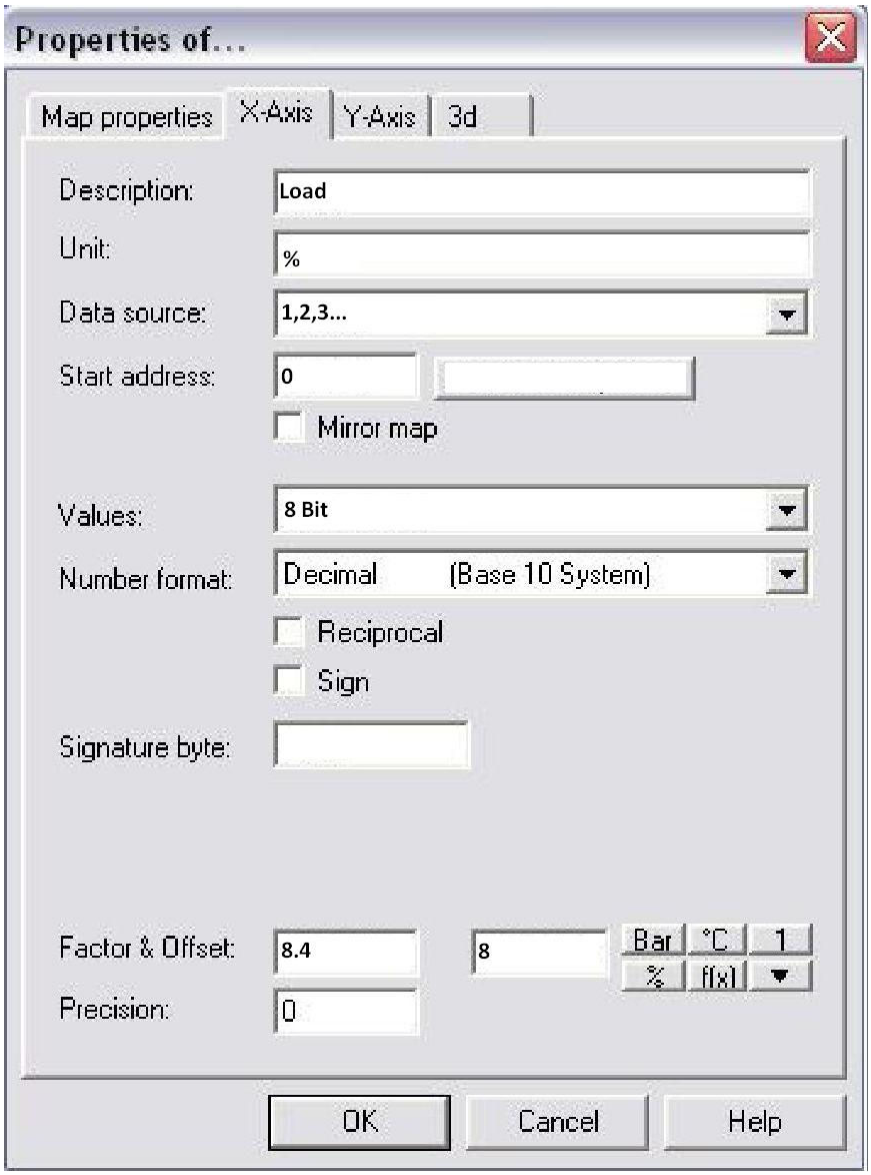
This map shows the injection time in milliseconds depending on the RPM and the engine load. In other words, the map shows how long the injectors stay open to deliver the needed fuel to the engine at a given RPM and load. Main fuel map is a 12x16 map. In 24KB file the map is located at 009F8. In 256KB file the map is located at 149F8.

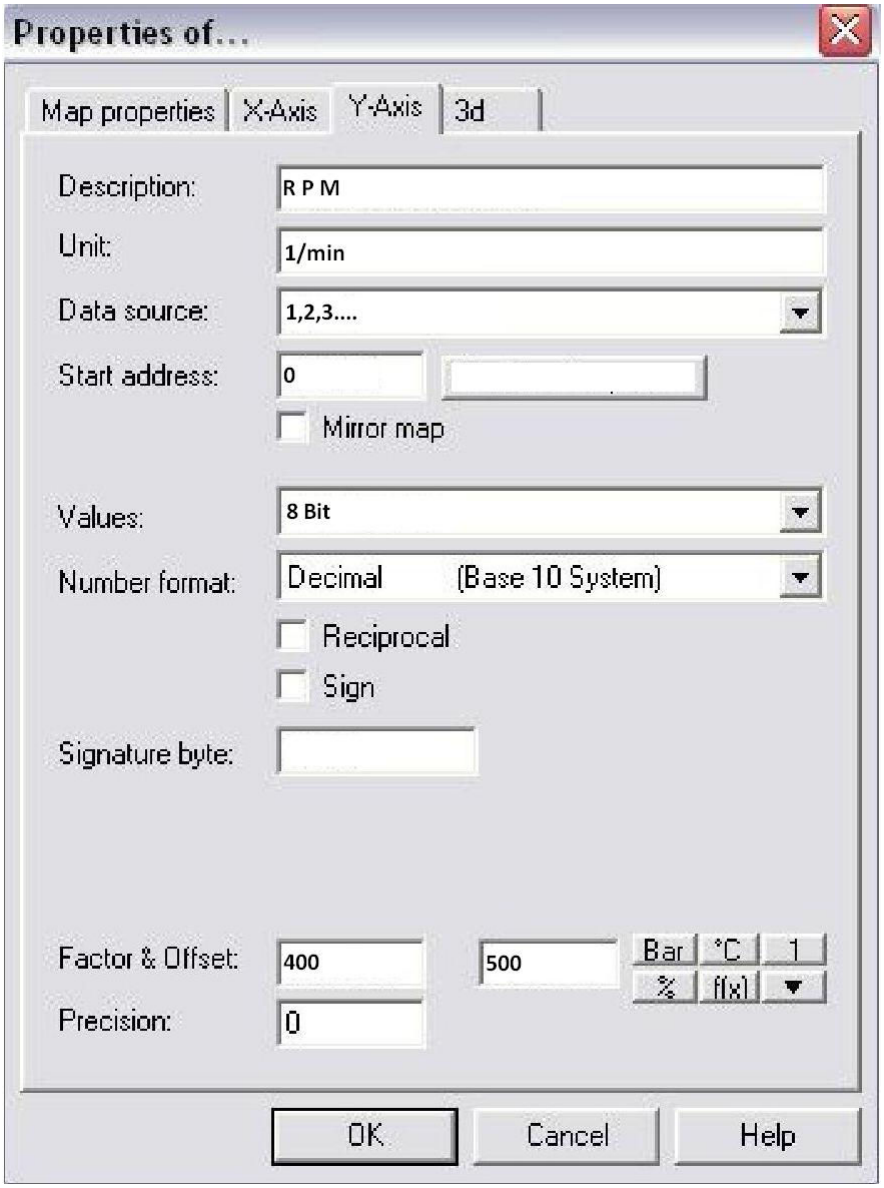


3D view of main fuel map.

Factors & offsets:

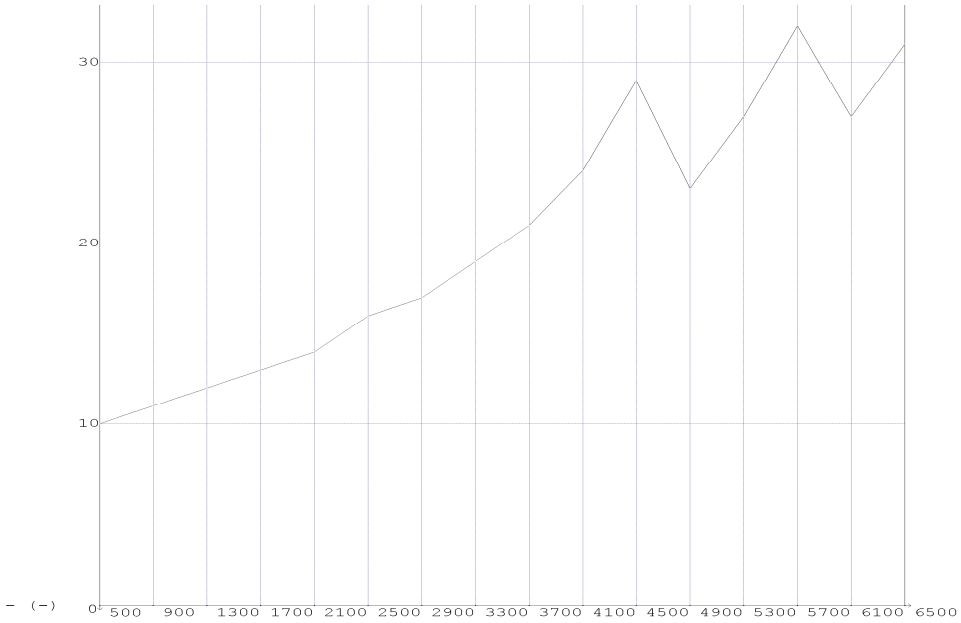

Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Main fuel map
Unit:
milisec
Id:
Name:
Main fuel map
Start address:
9F8
Column x rows:
12
x
16
Values:
16 Bit (LoHi)
Number format:
Decimal (Base 10 System)
Reciprocal
Difference
Sign
Percent
Original values
No factor / offset
Organization:
Twodimensional
Factor & Offset:
0.010000
0.000000
Bar
°C
1
%
f(x)
Precision:
2
OK
Cancel
Help


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Load
Unit:
%
Data source:
1,2,3...
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
8.4
8
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
R P M
Unit:
1/min
Data source:
1,2,3....
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
400
500
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

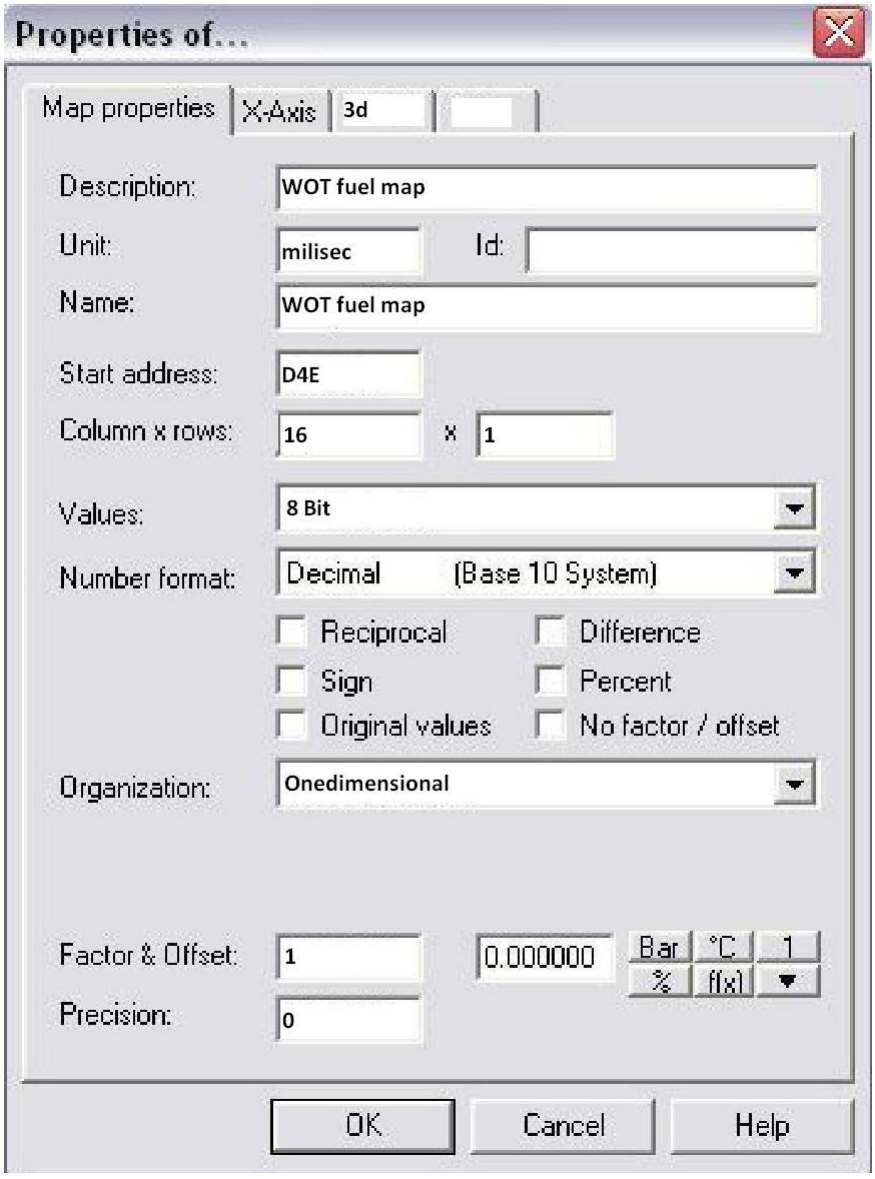
3. Injection at Wide Open Throttle (fuel enrichment during acceleration)

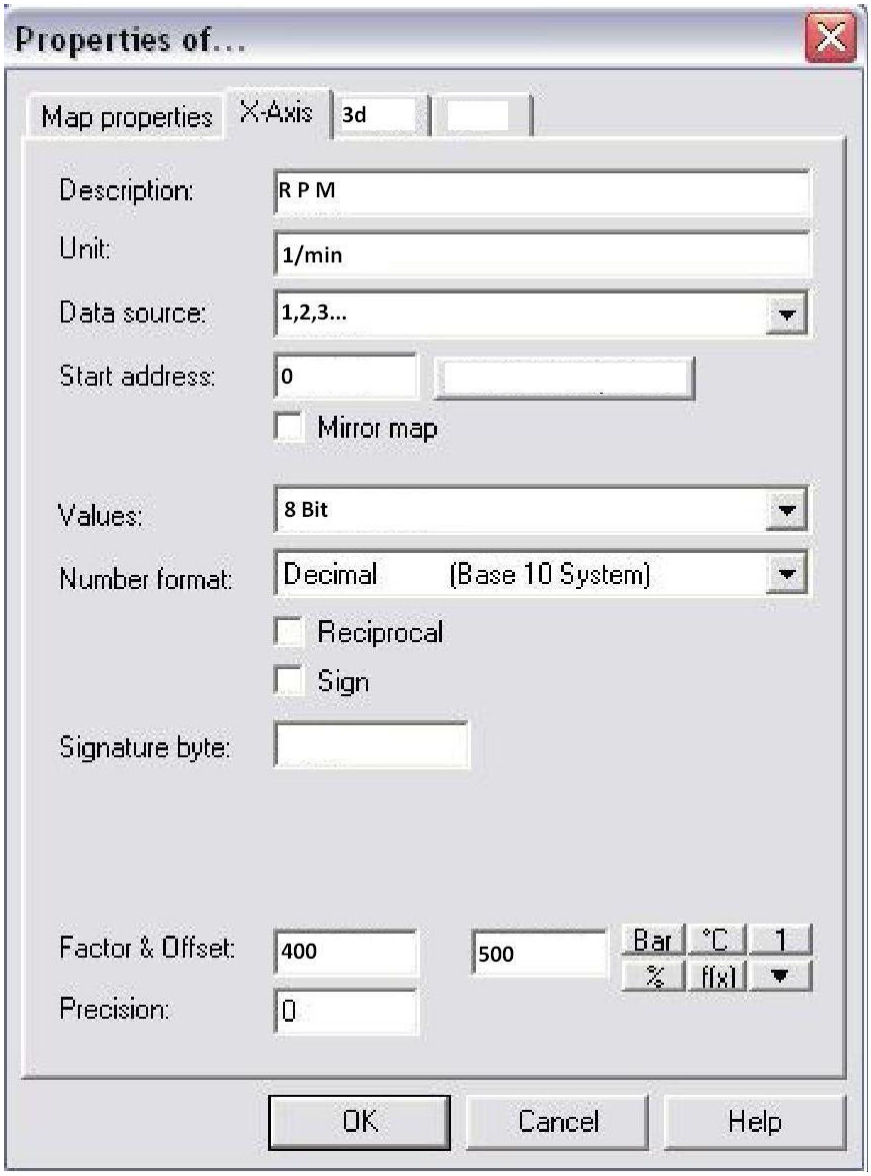
This map shows the injection time in milliseconds depending on the RPM and load when accelerator pedal is in WOT position. The map shows how long the injectors stay open to deliver the needed fuel to the engine at a given RPM and WOT pedal position. The Injection at WOT is a 1x16 map. In 24KB file the map is located at 00D4E. In 256KB file the map is located at 14D4E.



3D view of WOT fuel map.

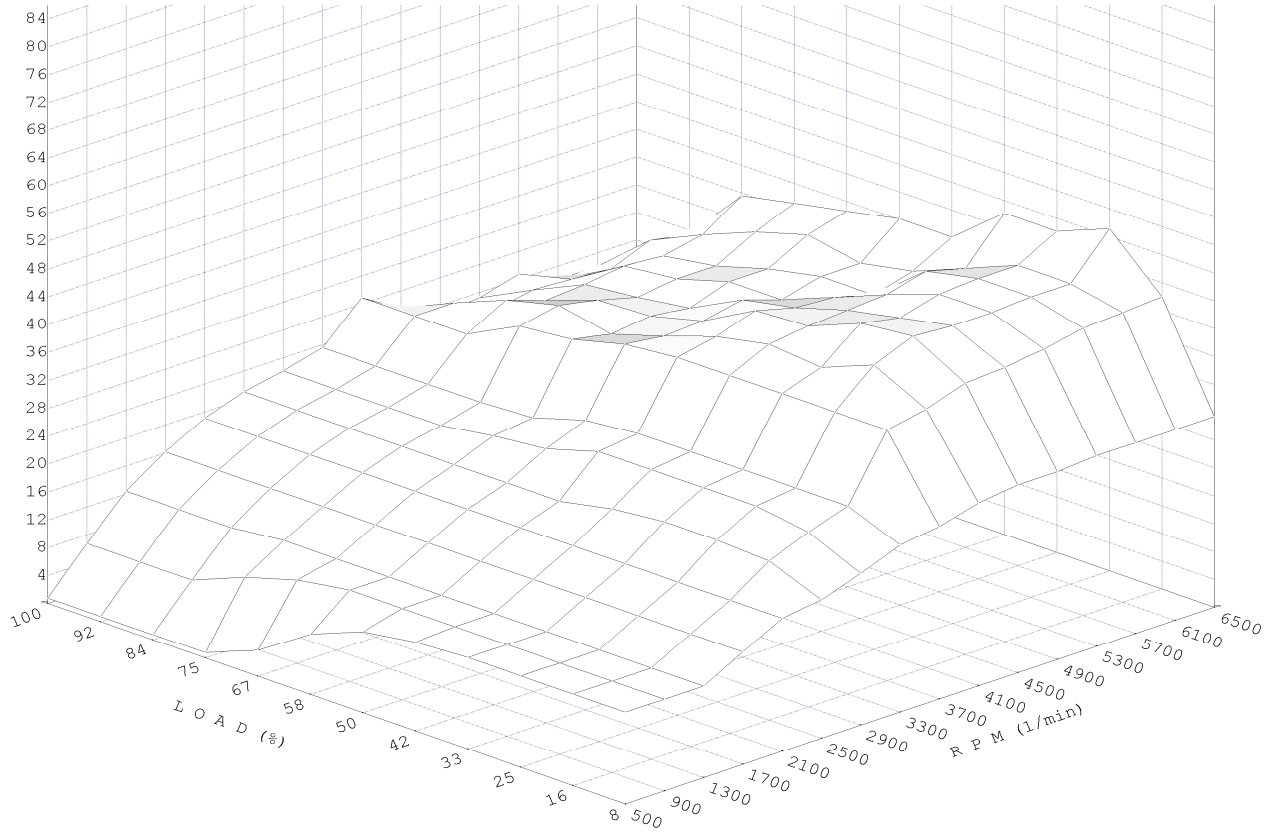
Factors & offsets:


Properties of...
Map properties
X-Axis
3d
Description:
WOT fuel map
Unit:
milisec
Id:
Name:
WOT fuel map
Start address:
D4E
Column x rows:
16
x
1
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Difference
Sign
Percent
Original values
No factor / offset
Organization:
Onedimensional
Factor & Offset:
1
0.000000
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help


Properties of...
Map properties
X-Axis
3d
Description:
R P M
Unit:
1/min
Data source:
1,2,3...
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
400
500
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

4. Spark advance at Part Throttle

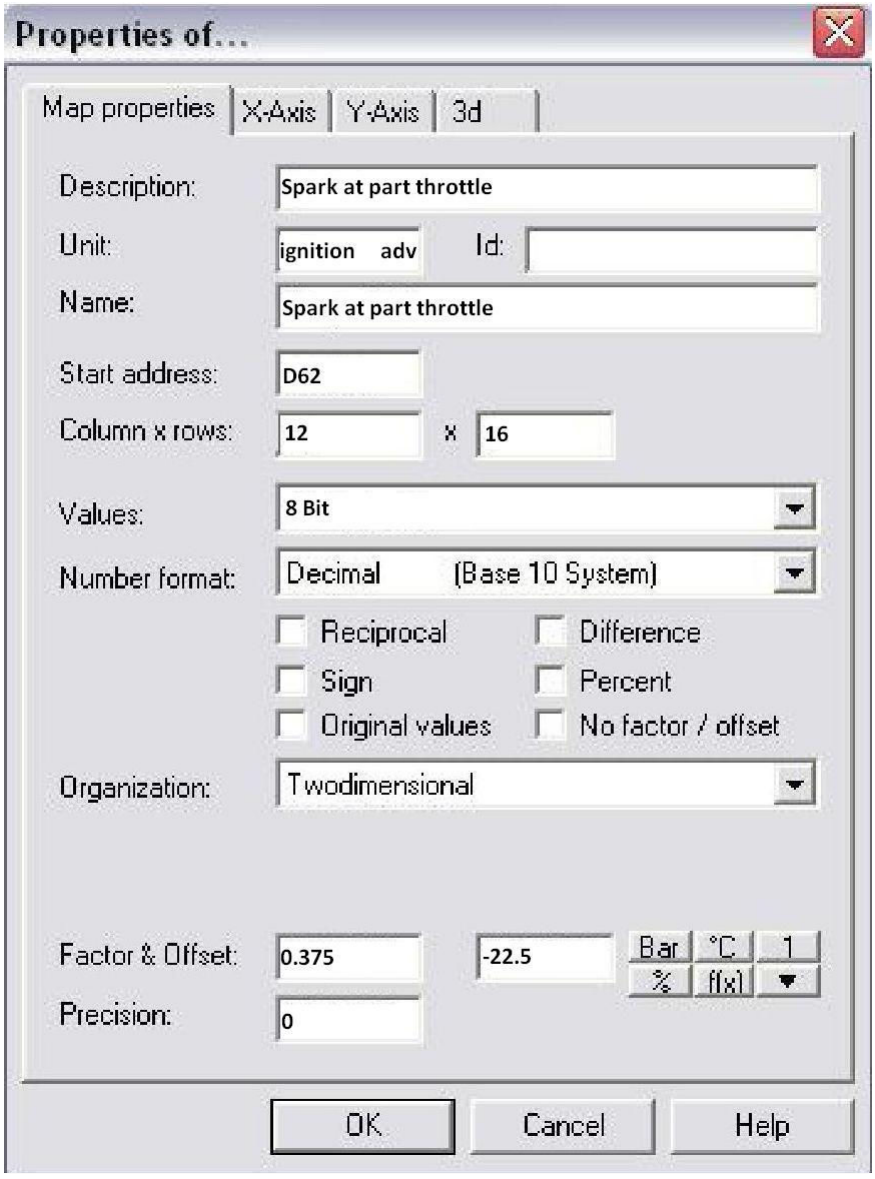
The map shows the spark advance depending on the RPM and the engine load at part throttle. This map also controls the spark at closed throttle. Spark at part throttle is a 12x16 map. In 24KB file the map is located at 00D62. In 256KB file the map is located at 14D62.

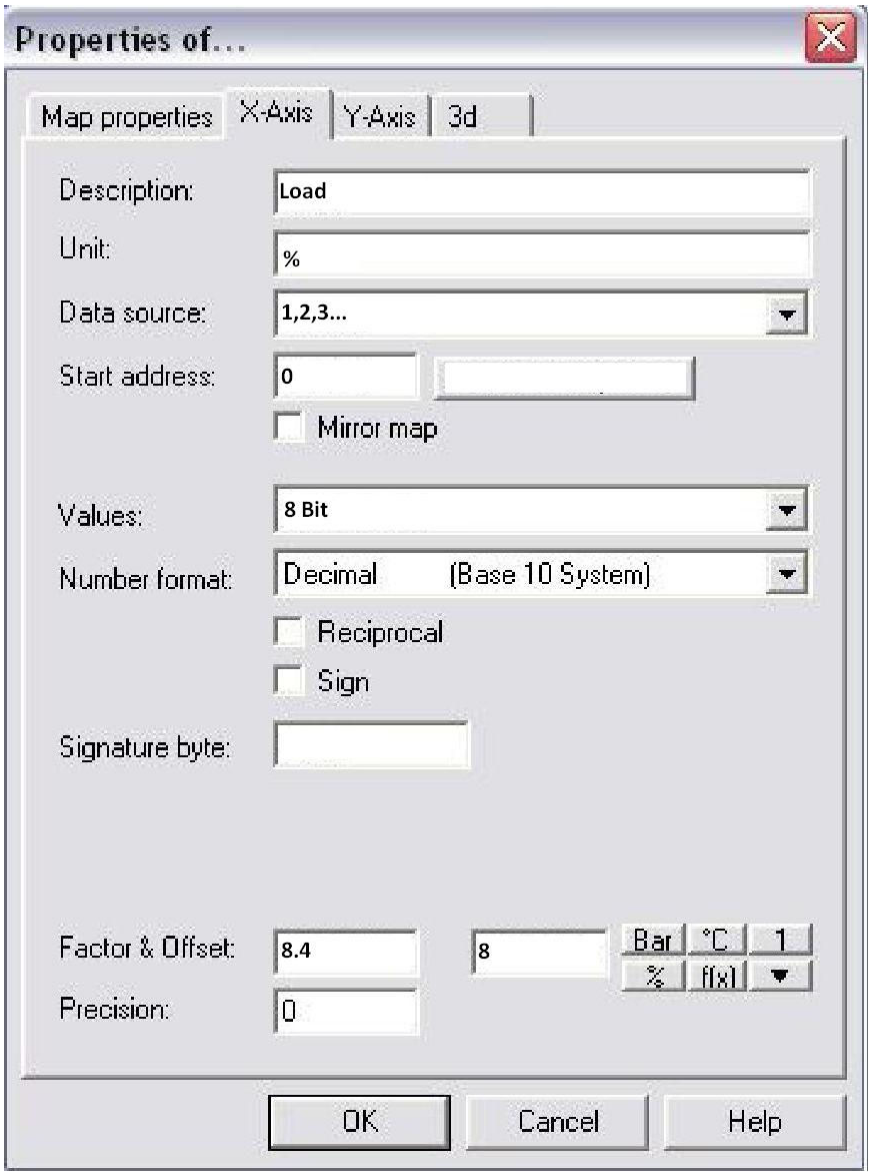


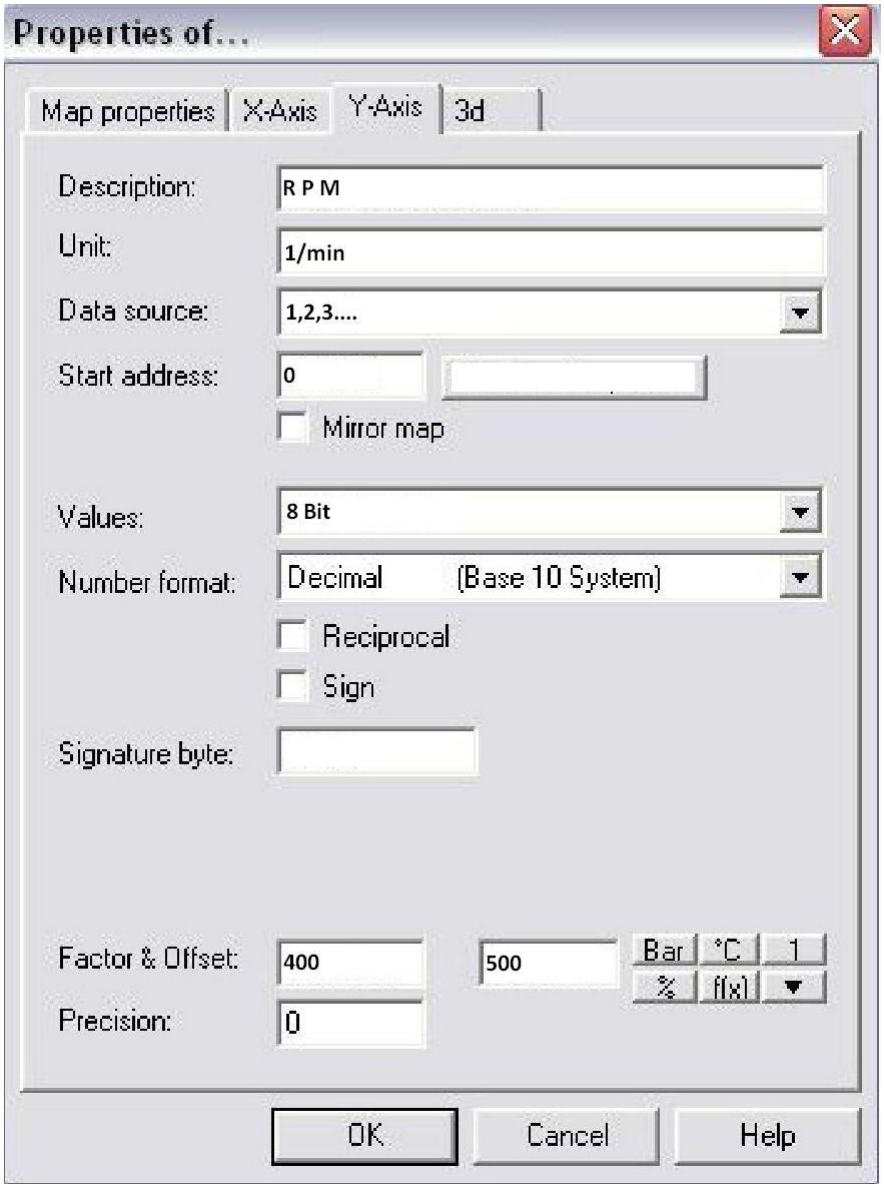
3D view of spark advance at part throttle map.

Factors & offsets:

Note: In map properties of this map you can use precision of 2, but it is easier to work with precision 0.

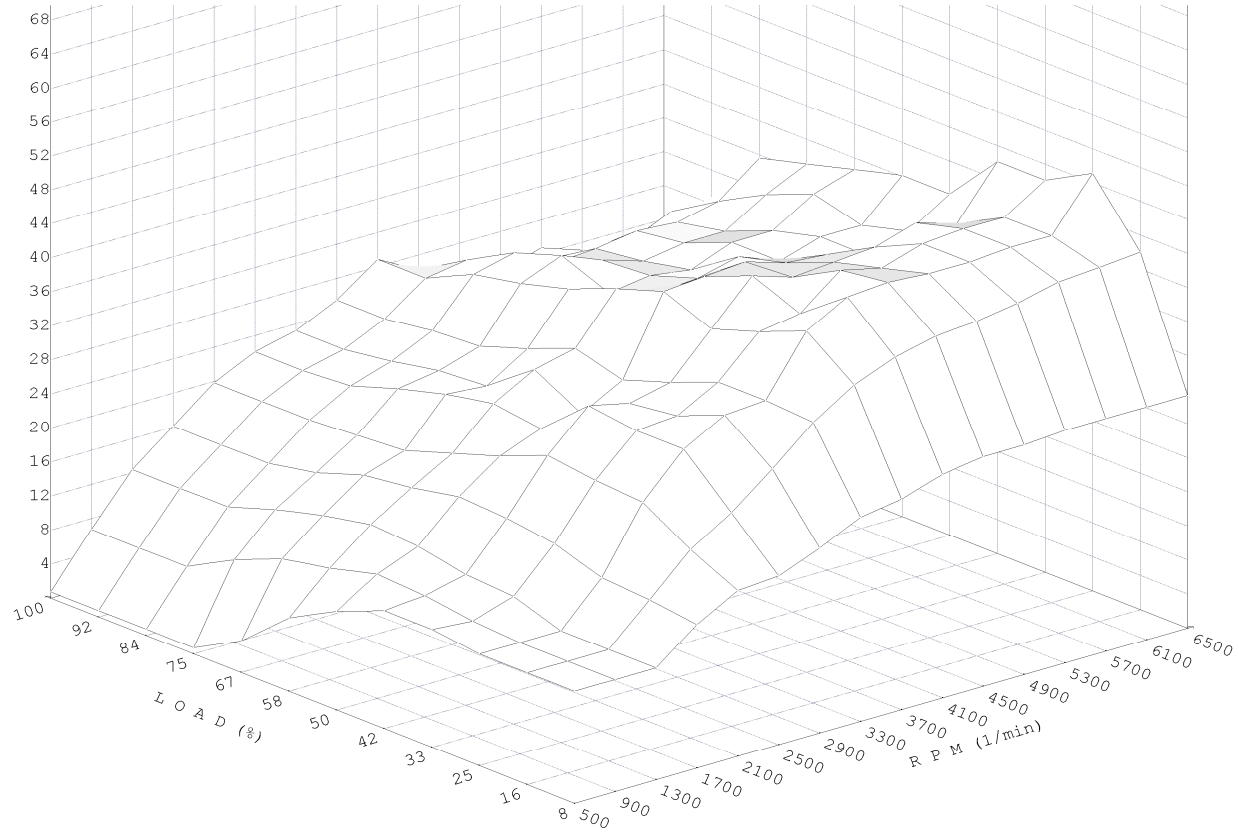

Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Spark at part throttle
Unit:
ignition adv
Id:
Name:
Spark at part throttle
Start address:
D62
Column x rows:
12
x
16
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Difference
Sign
Percent
Original values
No factor / offset
Organization:
Twodimensional
Factor & Offset:
0.375
-22.5
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Load
Unit:
%
Data source:
1,2,3...
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
8.4
8
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
R P M
Unit:
1/min
Data source:
1,2,3....
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
400
500
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

5. Spark advance at Wide Open Throttle

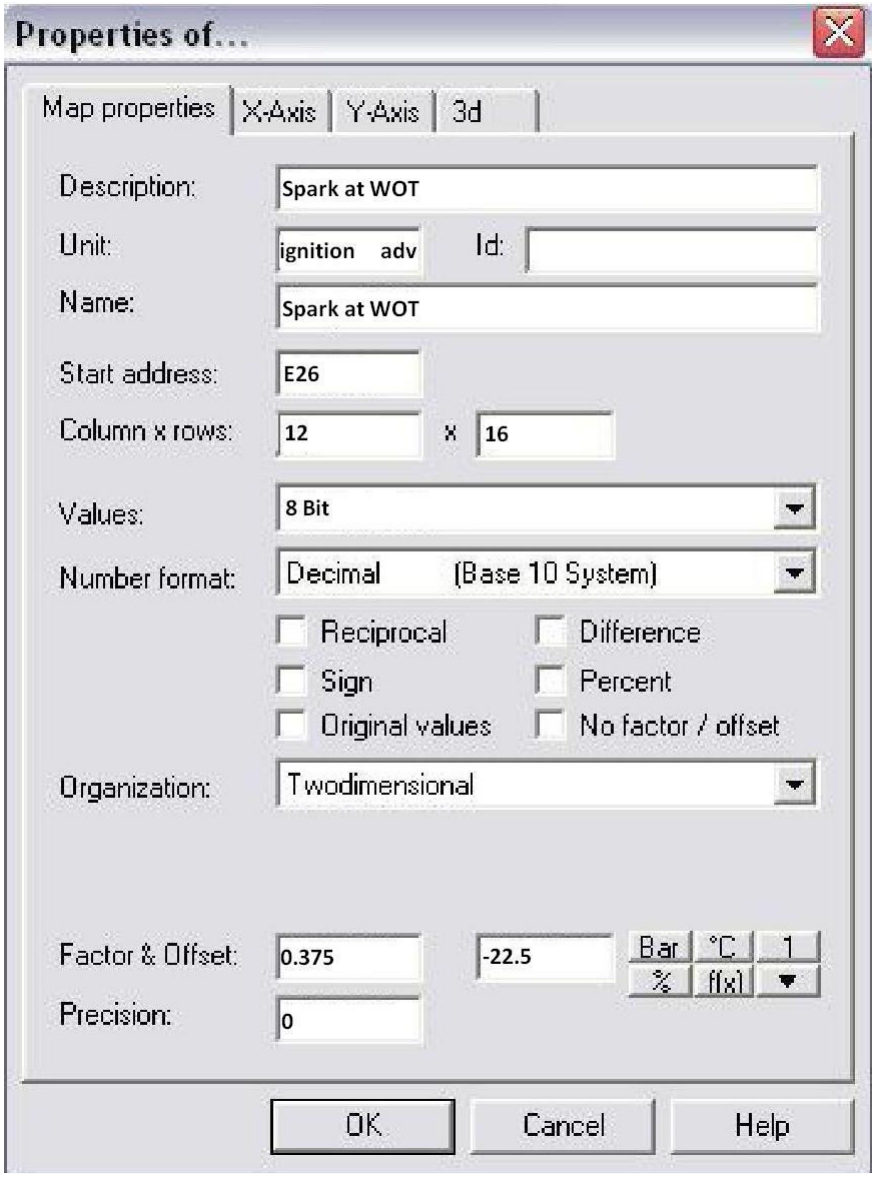
The map shows the spark advance depending on the RPM and the engine load when accelerator pedal is in WOT position. Spark at WOT is a 12x16 map. In 24KB file the map is located at 00E26. In 256KB file the map is located at 14E26.

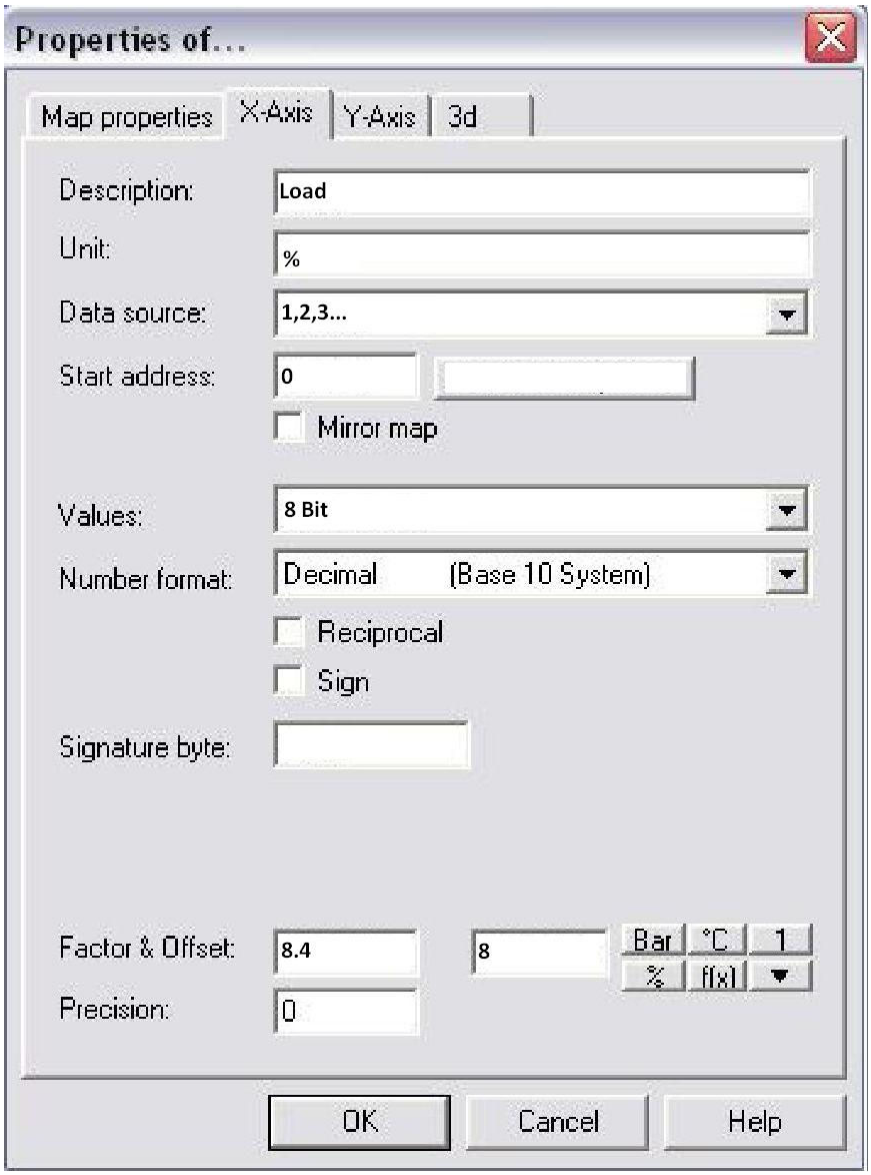


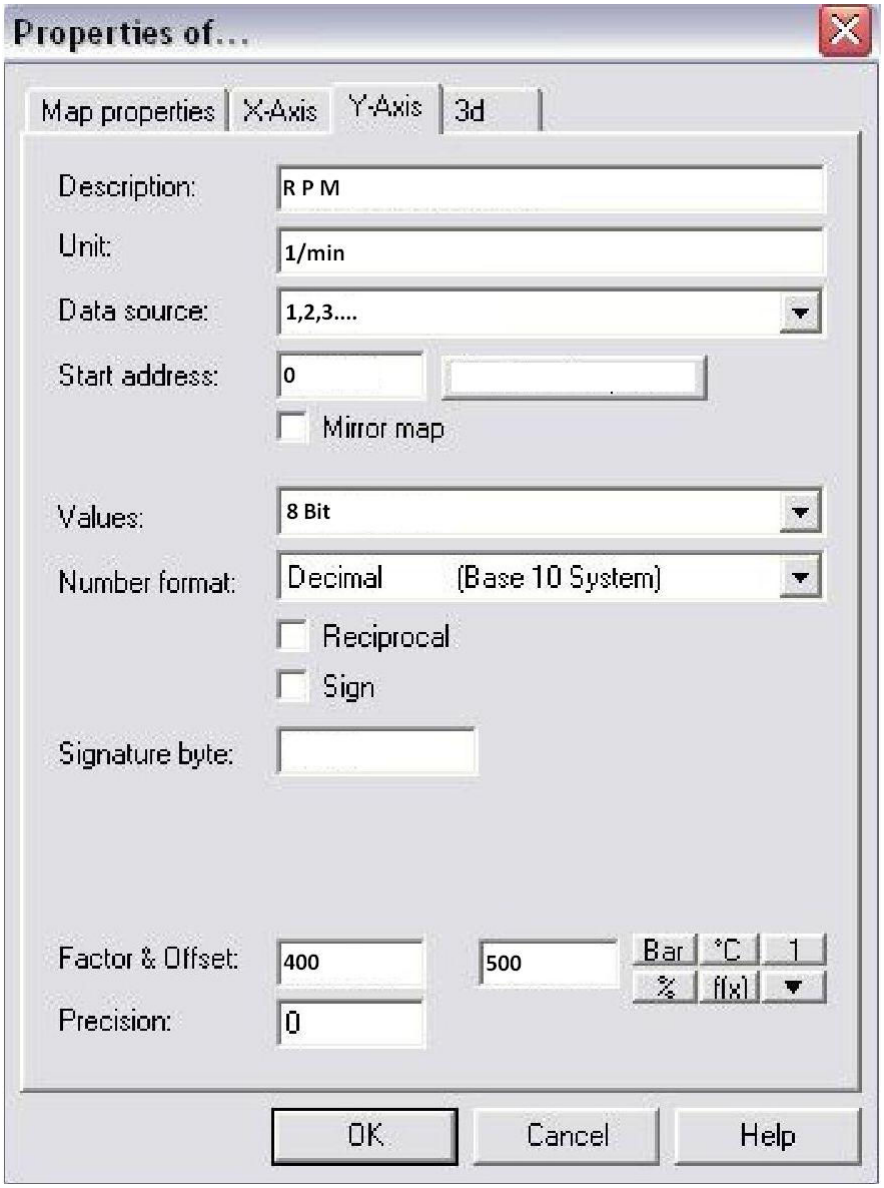
3D view of spark advance at WOT map.

Factors & offsets:

Note: In map properties of this map you can use precision of 2, but it is easier to work with precision 0.

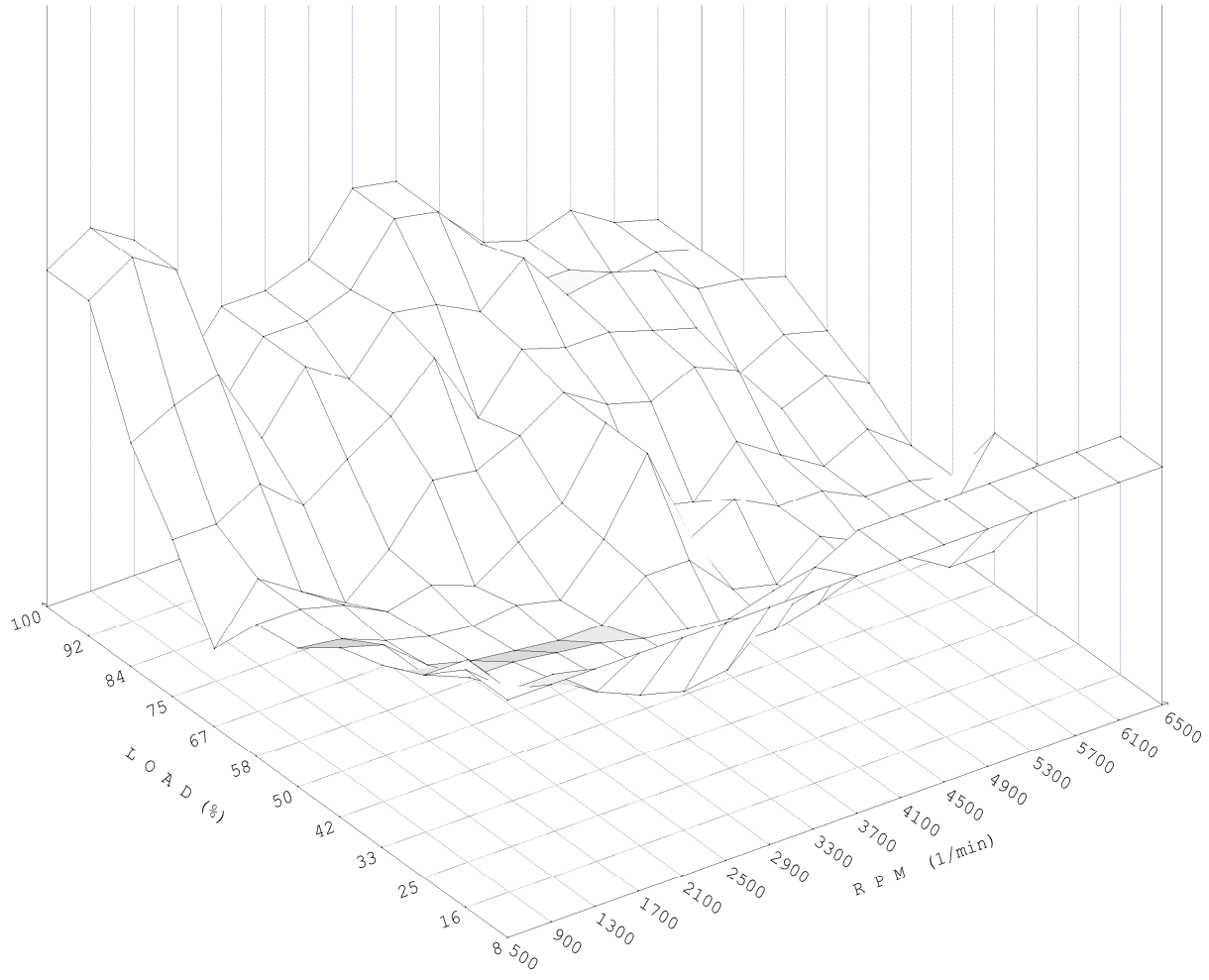

Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Spark at WOT
Unit:
ignition adv
Id:
Name:
Spark at WOT
Start address:
E26
Column x rows:
12
x
16
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Difference
Sign
Percent
Original values
No factor / offset
Organization:
Twodimensional
Factor & Offset:
0.375
-22.5
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Load
Unit:
%
Data source:
1,2,3...
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
8.4
8
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

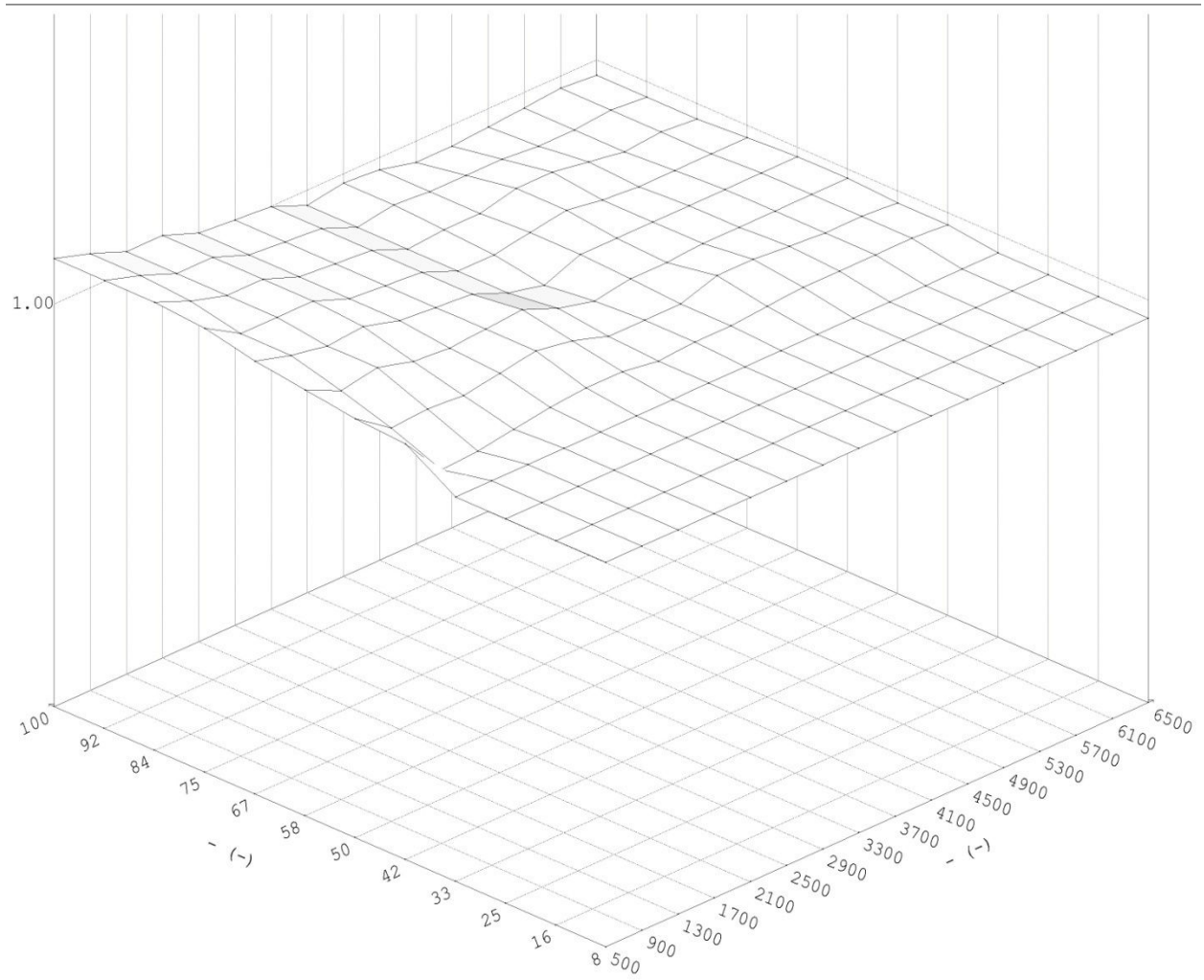

Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
R P M
Unit:
1/min
Data source:
1,2,3....
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
400
500
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

6. Lambda map

The Lambda map in closed loop is controlling the air to fuel ratio of the engine. Lambda correction is used in part throttle situations, when maximum engine power is not needed and fuel consumption is important. Lambda 1 (λ =1 14.7/1) gives us the stoichiometric ratio. Ratios less than 1 represent excess fuel – rich mixture. Ratios greater than 1 represent deficiency of fuel – lean mixture. In 24KB file the map is located at 011C8. In 256KB file the map is located at 151C8.

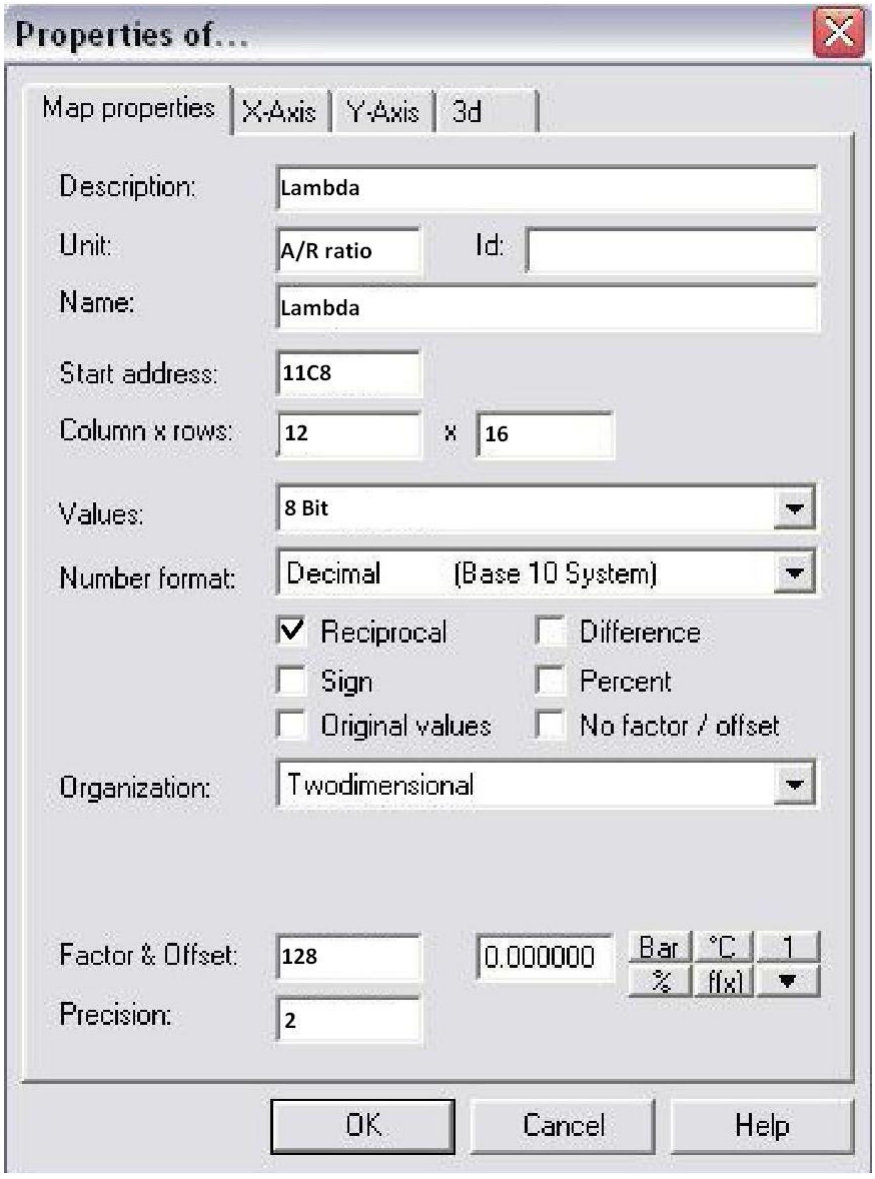


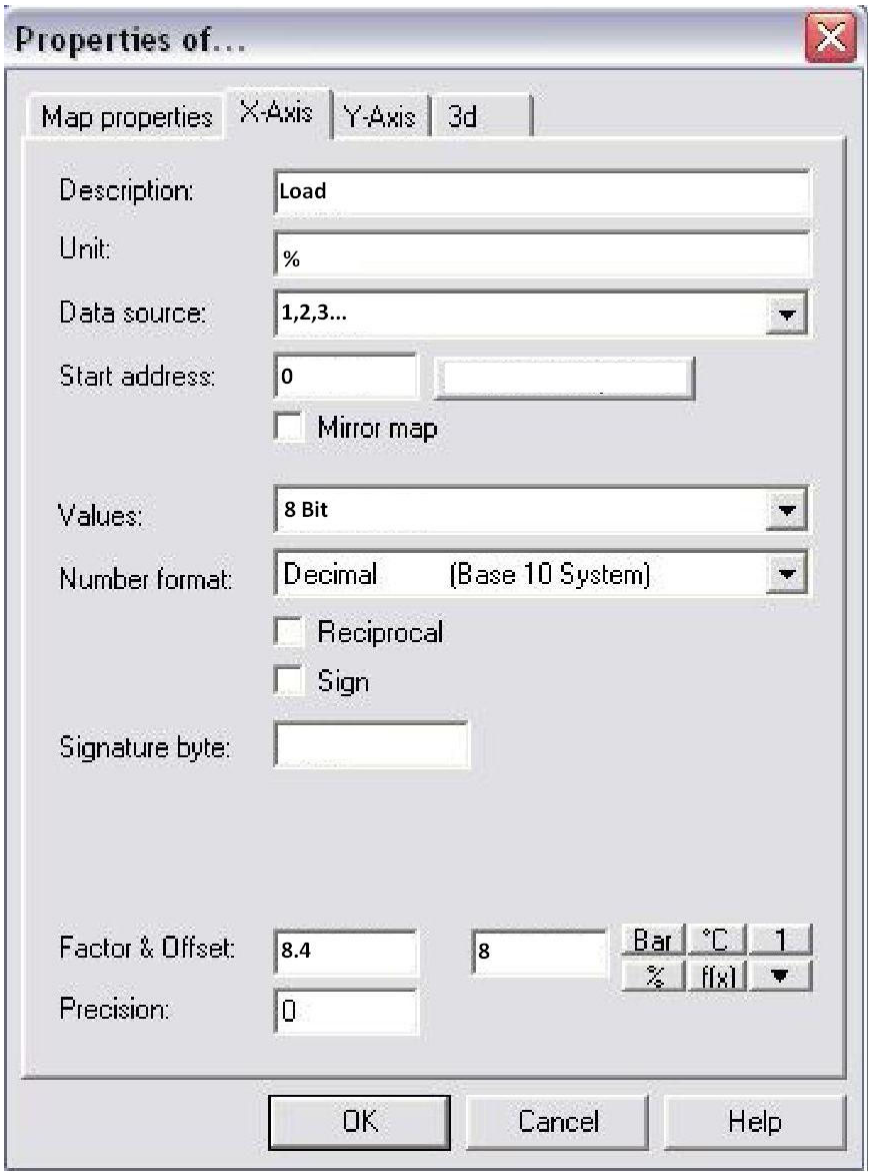
3D view of 2.0L lambda map.

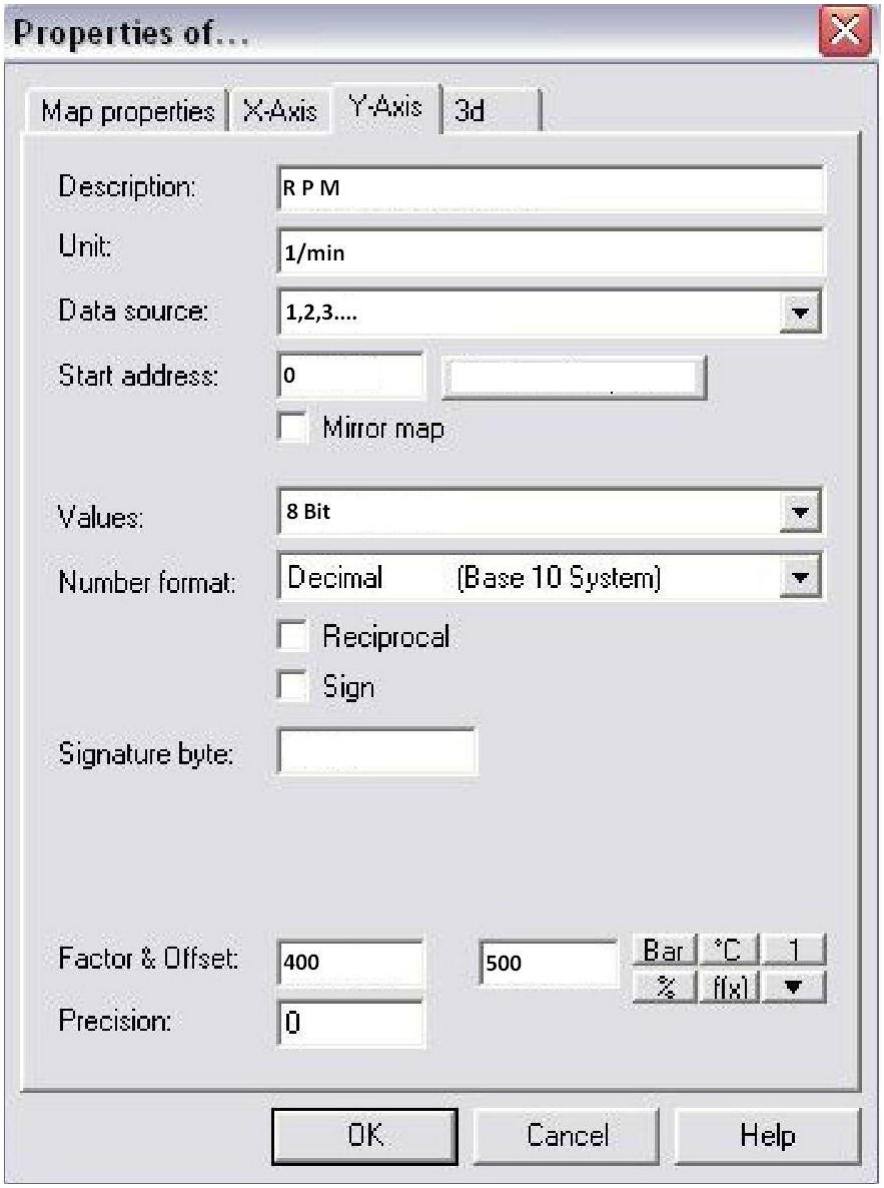


3D view of 2.8L lambda map.

Factors & offsets:


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Lambda
Unit:
A/R ratio
Id:
Name:
Lambda
Start address:
11C8
Column x rows:
12
x
16
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Difference
Sign
Percent
Original values
No factor / offset
Organization:
Twodimensional
Factor & Offset:
128
0.000000
Bar
°C
1
%
f(x)
Precision:
2
OK
Cancel
Help


Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
Load
Unit:
%
Data source:
1,2,3...
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
8.4
8
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

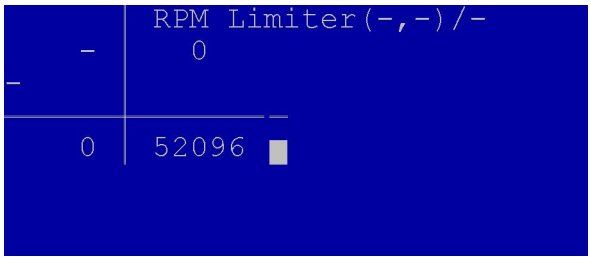

Properties of...
Map properties
X-Axis
Y-Axis
3d
Description:
R P M
Unit:
1/min
Data source:
1,2,3....
Start address:
0
Mirror map
Values:
8 Bit
Number format:
Decimal (Base 10 System)
Reciprocal
Sign
Signature byte:
Factor & Offset:
400
500
Bar
°C
1
%
f(x)
Precision:
0
OK
Cancel
Help

7. Tuning the engine

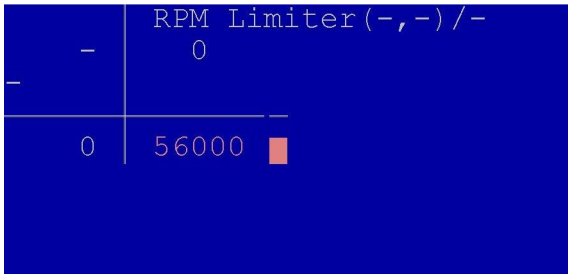
When you want more power out of the stock car it is enough to change the ignition an injection part throttle and WOT maps. Also you can change the lambda map but the only proper way to do that is by measuring the AFR with wide band lambda sensor.

a. The rev limiter: If we want to set the rev limiter at higher rpm we need to invert the calculation for the stock limiter. So if we want the rev limiter to be at 7000 rpm, we will do the next calculation:
7000 * 6 / 0.75 = 56000

Text-view of the original Rev Limiter



Text-view of the mod Rev Limiter



b. Injection at Part Throttle (main fuel map): If you tune a stock engine, the main fuel map can stay the way it is.

c. Injection at Wide Open Throttle (fuel enrichment during acceleration): In this map we can add between 1 and 3 miliseconds of injection duratation. How much we add depends on that how rich mixture we want. When we tune this map we can use only whole values like 14, 15, 17. Values like 14.50, 15.75 or 17.30 are not accepted by the program.

Text-view of the original map

	W O T F U E L (R P M)/milisec							
1/min	500	1300	2100	2900	3700	4500	5300	6100
	900	1700	2500	3300	4100	4900	5700	6500
	10 11 12 13 14 16 17 19 21 24 29 23 27 32 27 31							

Text-view of the tuned map

	W O T F U E L (R P M)/milisec							
/min	500	1300	2100	2900	3700	4500	5300	6100
	900	1700	2500	3300	4100	4900	5700	6500
	10 11 12 14 15 17 18 20 22 25 30 24 28 33 29 33							

d. Spark advance at Part Throttle: This map also controls the spark at closed throttle, so you can keep the original values for 500 and 900 rpm, or you can raise them by 3 degrees if premium pump fuel is used. From 1300 rpm and up I suggest adding not more than 7 degrees spark advance when premium pump fuel is used. If you use higher octane fuel like LPG which is 110 octane you can advance even more. If you tune with values higher than 7 degrees with pump fuel, you will need knock-detection equipment. If you raise the rev limiter more than 300 rpm, in the last cell of the map, at 100% load and 6500 rpm you can add 8 or 9 degrees advance for premium fuel.

Note: The maps below are for LPG converted engine so you can see that the values are higher than 7 degrees advance.

Text-view of the original map

	SPARK AT PART THROTTLE(L O A D,R P M)/ignition advance											
%	8		25		42		58		75		92	
l/min		16		33		50		67		84		100
500	13	13	13	13	13	12	9	4	1	1	1	1
900	13	13	13	13	13	13	13	12	10	7	7	7
1300	13	13	13	13	13	13	13	13	13	12	12	12
1700	16	16	16	16	16	16	16	16	16	16	16	16
2100	19	19	19	19	19	19	19	19	19	19	19	19
2500	20	23	23	23	23	21	21	21	21	21	21	21
2900	22	25	26	26	26	26	24	23	22	22	22	22
3300	24	27	27	27	27	27	26	24	24	24	24	24
3700	25	36	36	36	36	36	35	33	33	29	29	29
4100	26	37	41	38	39	37	35	32	34	32	29	26
4500	27	39	43	42	39	39	35	33	33	30	26	23
4900	27	39	43	41	40	38	36	32	31	30	27	23
5300	27	40	43	43	40	37	34	34	32	31	27	25
5700	27	41	43	43	42	36	36	34	32	31	26	22
6100	27	42	43	43	40	37	36	37	35	32	29	22
6500	27	42	49	46	46	40	40	39	37	36	27	19

Text-view of the tuned map

	SPARK AT PART THROTTLE(L O A D,R P M)/ignition advance											
%	8		25		42		58		75		92	
1/min		16		33		50		67		84		100
500	17	17	17	17	17	16	13	8	5	5	5	5
900	17	17	17	17	17	17	17	16	14	11	11	11
1300	20	20	20	20	20	20	20	20	20	19	19	19
1700	25	25	25	25	25	25	25	25	25	25	25	25
2100	28	28	28	28	28	28	28	28	28	28	28	28
2500	29	32	32	32	32	30	30	30	30	30	30	30
2900	31	34	35	35	35	35	33	32	31	31	31	31
3300	33	36	36	36	36	36	35	33	33	33	33	33
3700	34	45	45	45	45	45	44	42	42	38	38	38
4100	35	46	50	47	46	46	44	41	43	41	38	35
4500	36	48	52	51	48	48	44	42	42	39	35	32
4900	36	48	52	50	49	47	45	41	40	39	36	32
5300	36	49	52	52	49	46	43	43	41	40	36	34
5700	36	50	52	52	51	45	45	43	41	40	35	32
6100	36	51	52	52	49	46	45	46	44	41	38	32
6500	36	51	58	55	55	49	49	48	46	45	36	30

e. Spark advance at Wide Open Throttle: Tuning this map is like tuning the spark at part throttle map.

Text-view of the original map

SPARK WOT(L O A D,R P M)/Ignition advance

%	8		25		42		58		75		92	
l/min	16		33		50		67		84		100	
500	13	13	13	14	14	12	9	4	1	1	1	1
900	13	13	13	14	14	15	13	12	10	7	7	7
1300	13	13	13	15	15	17	17	16	14	12	12	12
1700	17	18	18	20	21	21	20	19	17	16	16	16
2100	20	22	26	26	27	24	23	21	20	20	20	20
2500	20	25	30	30	31	26	27	26	24	23	22	22
2900	22	29	33	31	30	27	30	26	25	24	23	23
3300	24	33	33	33	31	29	31	29	27	26	26	26
3700	25	36	40	38	36	38	36	34	33	32	29	29
4100	26	38	43	39	41	39	35	32	35	33	30	26
4500	27	39	43	42	39	39	35	33	33	30	26	23
4900	27	39	43	41	40	38	36	32	31	30	27	23
5300	27	40	43	43	40	37	34	34	32	31	27	25
5700	27	41	43	43	42	36	36	34	32	31	26	22
6100	27	42	43	43	40	37	36	37	35	32	29	22
6500	27	42	49	46	46	40	40	39	37	36	27	19

Text-view of the tuned map

SPARK WOT(L O A D,R P M)/Ignition advance

%	8		25		42		58		75		92	
l/min	16		33		50		67		84		100	
500	17	17	17	18	18	16	13	8	5	5	5	5
900	17	17	17	18	18	19	17	16	14	11	11	11
1300	20	20	20	22	22	24	24	23	21	19	19	19
1700	26	27	27	29	30	30	29	28	26	25	25	25
2100	29	31	35	35	36	33	32	30	29	29	29	29
2500	29	34	39	39	40	35	36	35	33	32	31	31
2900	31	38	42	40	39	36	39	35	34	33	32	32
3300	33	42	42	42	40	38	40	38	36	35	35	35
3700	34	45	49	47	45	47	45	43	42	41	38	38
4100	35	47	52	48	50	48	44	41	44	42	39	35
4500	36	48	52	51	48	48	44	42	42	39	35	32
4900	36	48	52	50	49	47	45	41	40	39	36	32
5300	36	49	52	52	49	46	43	43	41	40	36	34
5700	36	50	52	52	51	45	45	43	41	40	35	32
6100	36	51	52	52	49	46	45	46	44	41	38	32
6500	36	51	58	55	55	49	49	48	46	45	36	30

f. Lambda map: This map can stay the way it is. If you are not a professional don't touch this map. If you like to tune the map you must use wide band lambda sensor to achieve the proper air to fuel ratio and knock-detection equipment to monitor knocking. At the example below we can see a type of eco tuning, where in the low rev range the lambda is set close to 1(to save fuel), but in the higher rev range lambda is set below 1, to achieve more power. When this map is tuned you will have to retune the spark advance maps.

Text-view of the original map

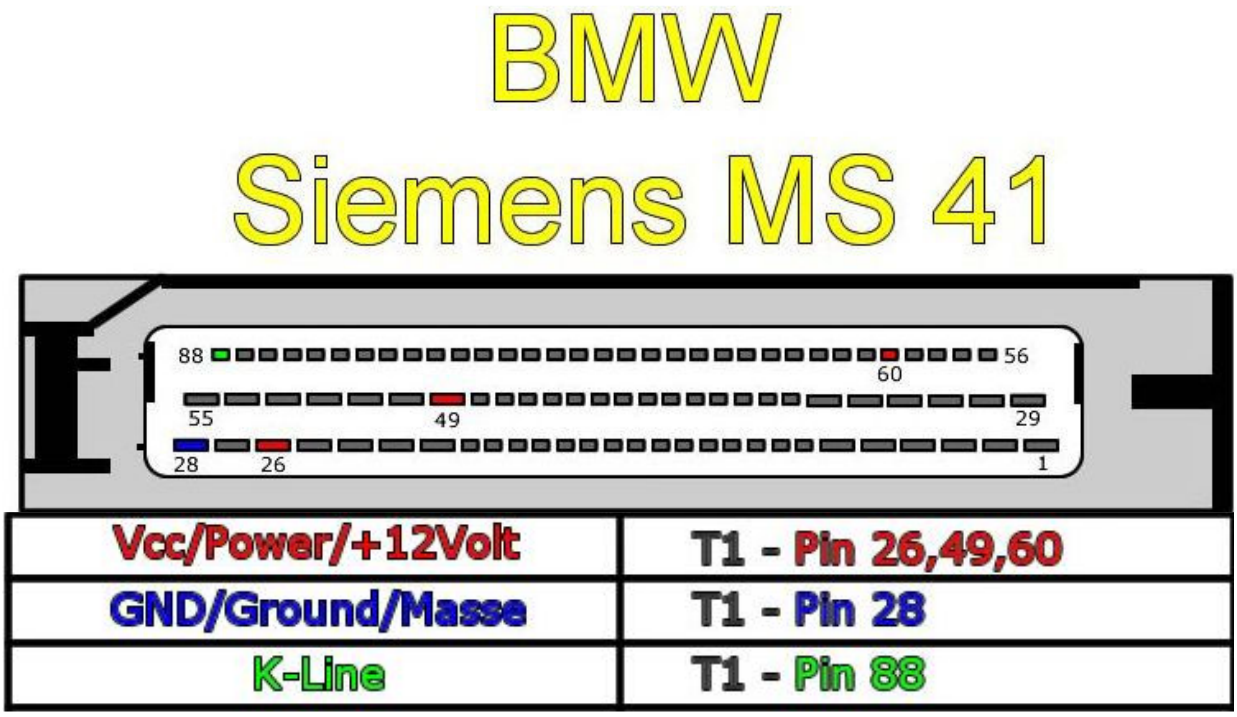
%	8		25		42		58		75		92	
l/min	16		33		50		67		84		100	
500	1.00	1.00	0.96	0.94	0.93	0.90	0.89	0.83	0.91	0.98	1.10	1.10
900	1.00	0.96	0.96	0.91	0.91	0.89	0.89	0.89	0.91	1.01	1.13	1.13
1300	1.00	0.96	0.91	0.90	0.88	0.87	0.88	0.86	0.94	1.02	1.10	1.10
1700	1.00	0.93	0.91	0.90	0.86	0.86	0.85	0.83	0.90	0.94	0.94	0.94
2100	1.00	0.91	0.90	0.89	0.86	0.85	0.86	0.87	0.93	1.00	1.00	1.00
2500	1.00	0.90	0.89	0.88	0.85	0.86	0.85	0.93	0.96	0.97	1.00	1.00
2900	1.00	0.90	0.88	0.87	0.85	0.85	0.88	0.92	1.01	1.02	1.02	1.02
3300	1.00	0.94	0.91	0.86	0.89	0.90	0.90	0.94	0.93	1.02	1.08	1.08
3700	1.00	0.98	0.92	0.83	0.89	0.97	0.97	0.97	0.98	0.99	1.07	1.07
4100	1.00	1.00	0.93	0.83	0.84	0.86	0.86	0.94	0.97	1.03	1.02	1.02
4500	1.00	1.00	0.94	0.84	0.83	0.89	0.85	0.93	0.97	0.98	0.96	0.97
4900	1.00	1.00	0.92	0.86	0.86	0.86	0.90	0.95	0.96	0.98	0.96	0.96
5300	1.00	1.00	0.91	0.86	0.84	0.86	0.87	0.93	0.94	0.97	0.93	0.97
5700	1.00	1.00	0.91	0.83	0.84	0.84	0.84	0.87	0.88	0.93	0.94	0.94
6100	1.00	1.00	0.91	0.83	0.84	0.84	0.86	0.89	0.90	0.93	0.93	0.93
6500	1.00	1.00	0.91	0.91	0.91	0.83	0.83	0.86	0.89	0.91	0.86	0.86

Text-view of the tuned map

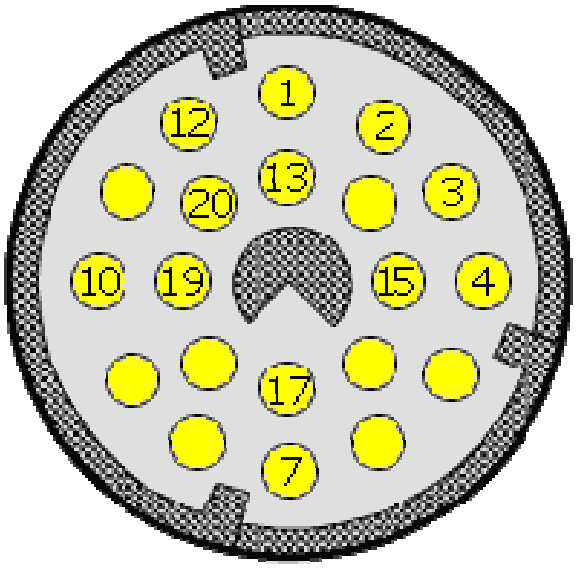
%	8		25		42		58		75		92	
l/min	16		33		50		67		84		100	
500	1.00	1.00	0.96	0.96	0.96	0.96	0.96	0.96	0.96	1.00	1.00	1.00
900	1.00	1.00	0.96	0.96	0.96	0.96	0.96	0.96	0.96	1.00	1.00	1.00
1300	1.00	1.00	0.96	0.96	0.96	0.96	0.96	0.96	0.96	1.00	1.00	1.00
1700	1.00	1.00	0.96	0.96	0.96	0.96	0.96	0.96	0.96	1.00	1.00	1.00
2100	1.00	1.00	0.96	0.96	0.96	0.96	0.96	0.91	0.91	1.00	1.00	1.00
2500	1.00	1.00	0.96	0.96	0.96	0.96	0.91	0.91	0.91	1.00	1.00	1.00
2900	1.00	1.00	0.96	0.96	0.96	0.91	0.91	0.91	0.91	0.91	0.85	0.85
3300	1.00	1.00	0.96	0.96	0.91	0.91	0.91	0.91	0.91	0.85	0.85	0.85
3700	1.00	1.00	0.96	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85
4100	1.00	1.00	0.96	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85
4500	1.00	1.00	0.96	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85
4900	1.00	1.00	0.96	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85
5300	1.00	1.00	0.91	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85
5700	1.00	1.00	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85	0.85
6100	1.00	1.00	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85	0.85
6500	1.00	1.00	0.91	0.91	0.91	0.91	0.85	0.85	0.85	0.85	0.85	0.85

8. Programming the new parameters in the ECU.

Programming the new parameters with eprom programmer is straight forward job. But sometimes when flashing the BMW Siemens MS41 via the 20 pin BMW round connector writing can cause some head ache. The reason for that is when we flash the new parameters, the tool rewrites the memory OK, but when we recheck, the memory is not rewritten. The solution for this can be found in the pictures below.



Pin	Signal	Description
1	Engine rotation speed	TD
2	OBD-II diagnostic	
7	Oil service and Inspection reset	
11	External starter turn on	
14	Battery power	+12V
15	ISO 9141-2 L Line	RXD- Diagnostic Data link
16	Ignition +12V	
17	ISO 9141-2 K Line	TXD - Diagnostic data link
18	PGSP	Programming line
19	GND	
20	ISO 9141-2 K Line	TXD - Diagnostic data link



On car 20 pin BMW round connector

Pins 26 and 49 of the ECU are connected to pin 14 of the 20 pin round connector which is +12V battery power.
Pin 88 of the ECU is connected to pins 17 and 20 of the 20 pin round connector which is K Line.
Pin 28 of the ECU is connected to pin 19 of the 20 pin round connector which is ground.
Pin 60 of the ECU is connected to pin 18 of the 20 pin round connector which is Programming line.

To rewrite the program, pin 18 must have constant +12V. Sometimes pin 18 in the flasher is not connected to nothing and this is why we cannot flash the ECU. The solution is to bridge pin 14 and pin 18 in the flasher.

Conclusion:

All information and values given in this document may be used at own risk. I do not stand in for any problems. I hope you enjoy it.