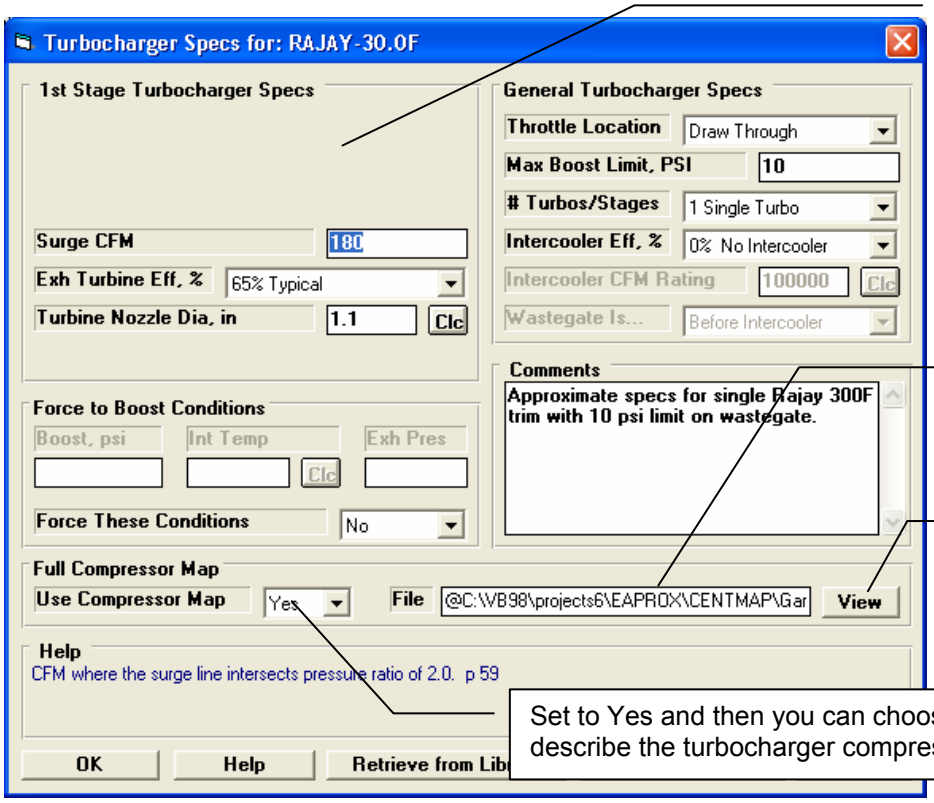
Appendix 12: New Features in v 3.9 Enterprise Edition

The Enterprise Edition of Engine Analyzer Pro has some very advanced features the typical user would not use. These include:

- You can use a full compressor map to define the performance of a turbocharger compressor. Figs A57 and A58.
- You can specify a particular turbocharger boost level, intake manifold temperature (after the turbocharger compressor), and exhaust backpressure level. This gives you more freedom to simulate some particular situation which may be difficult to simulate using the turbocharger compressor and turbine model specs in the program. Fig A59.
- You can view the compressor map when calculations are being performed to see what area of the map is being used. Fig A60.
- You can use a full compressor map to define the performance of a centrifugal supercharger compressor. Figs A61 and A62.
- You can design a system where a centrifugal supercharger feeds into a roots blower supercharger. Fig A63.
- You can interface to the Compression Ratio Calculator program and transfer data back and forth between them. Figs A64 through A67.
- You can run a part throttle performance "map". This map can be useful for calibrating electronic engine controllers, or just understanding part throttle performance. Fig A68 and A69.
- There is a new Preference which lets you choose a different language for certain labels in the program. Fig A70.
- Two new Preferences are provided to adjust the valve train dynamics calculations. One allows you to increase the stiffness of the lifter/cam interface. The other allows you to increase the stiffness of the rocker arm for Overhead Rocker Arm styles of valve trains. The factor you pick is multiplied by the default stiffness. For example, if you pick 1.5, the default stiffness is increased 50%. Fig A70.
- A Preference has been added to allow for adjusting intake runner wall friction for the Intake Runner and Port. The program picks a certain amount of wall friction based on manifold type, Runner Flow Coef, etc. Your choice here will change it by the percentage you pick. Fig A70.
- A Preference has been added to let you adjust how much valve toss (separation between follower and cam) will be called Valve Toss in the tabular results. The default used by the program for many years. is .020". If the program sees more than .020" separation between cam lobe and follower, it is flagged as Valve Toss in the calculated results. Your choices will let you pick a certain percentage of the lobe's maximum lift. Fig A70.

Figure A57 Using a Full Compressor Map for Turbochargers



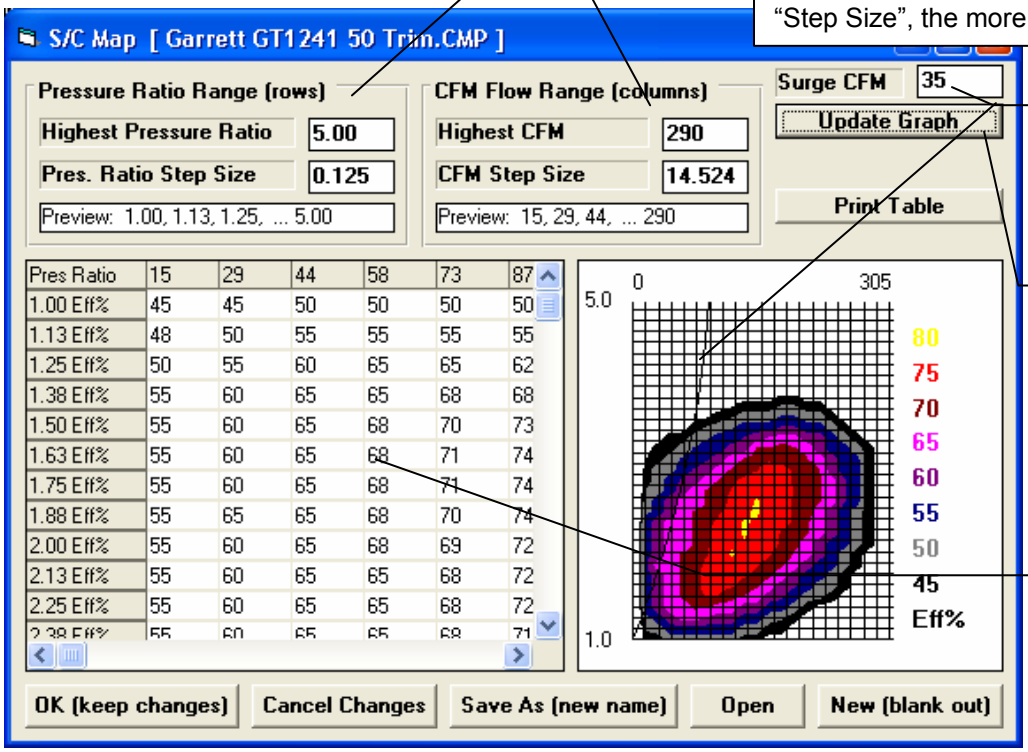
Note that some specs are not needed when you choose to use a Map.

Current Map File Name

Click on View for screen below, to enter, open or edit Map settings.

Set to Yes and then you can choose a Map File to describe the turbocharger compressor.

Choose settings which describe how large the Map will be and how many "cells" you have to fill in for the Map, the smaller the "Step Size", the more cells.

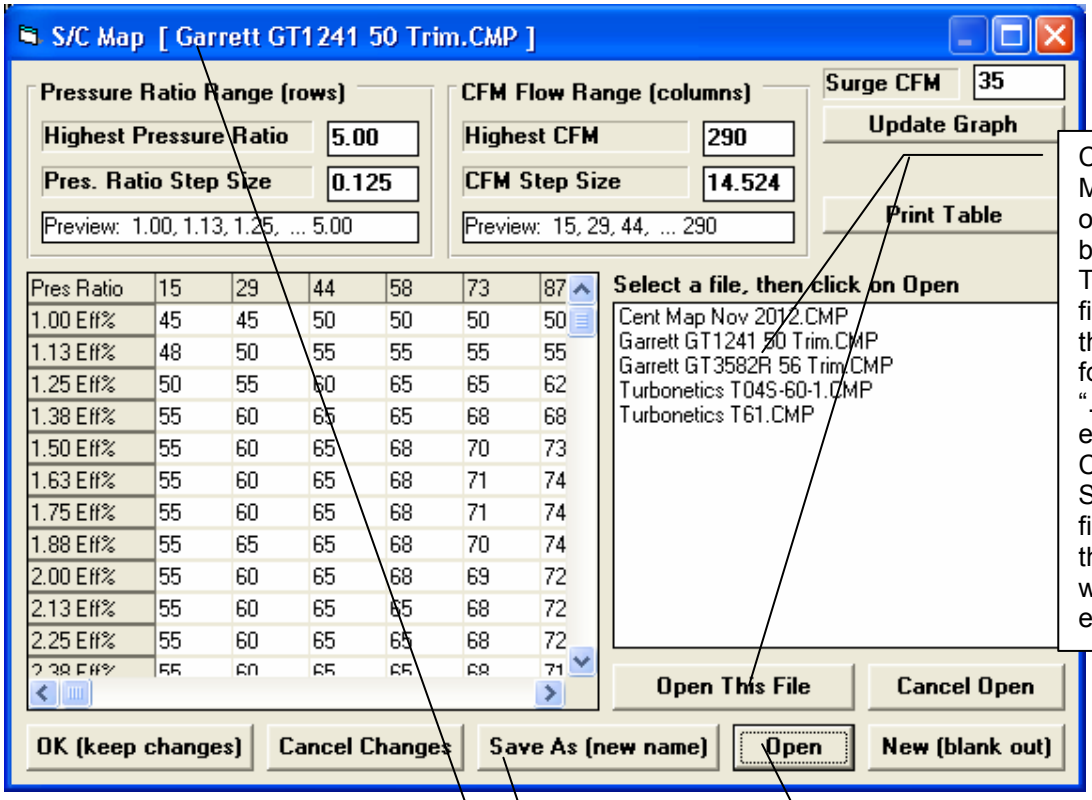


Surge CFM is still used with Map and drawn on Map.

The Graph is not automatically updated with each change you make. Click here to update the graph.

Click on a grid cell to enter the Thermal Efficiency at that Pressure Ratio and CFM flow, then press <Enter> to advance to next cell.

Figure A58 More Compressor Map Features



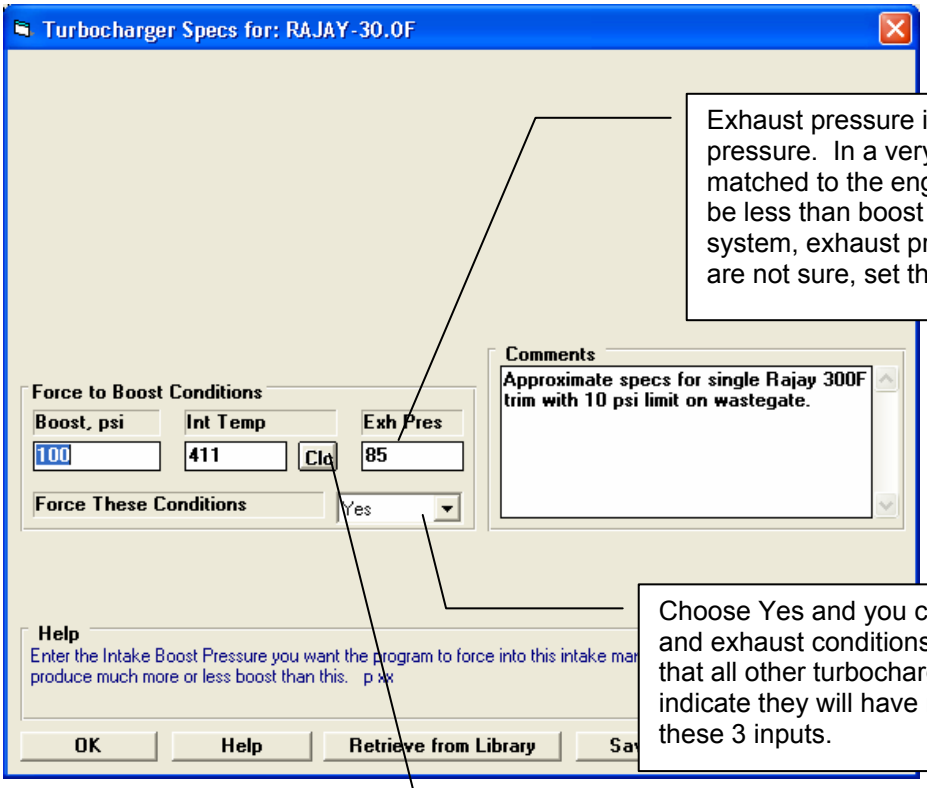
Click on a saved Map file, then click on Open This File button to open it. Turbocharger Map files are saved in the CENTMAP folder with a ".CMP" file extension. Centrifugal Supercharger Map files are saved in the same folder with a .CMC extension.

Click this Open button to display the list of saved files shown above.

Click here to save this Map to a new name.

Current Map file name. Note: A Map file is just the specs you see in this screen. It is just a part of the total Turbochager component file.

Figure A59 User Specified Turbo Boost and Backpressure



Exhaust pressure is typically close to the Boost pressure. In a very efficient, turbo which is well matched to the engine, the exhaust pressure can be less than boost pressure. In an inefficient system, exhaust pressure will be higher. If you are not sure, set this equal to Boost pressure.

Choose Yes and you can produce most any intake and exhaust conditions you want. You will notice that all other turbocharger settings are not shown to indicate they will have not affect on the results, just these 3 inputs.

Click on this Clc button for the screen to the left, where you can enter some inputs about the turbo system and get a good estimate of the Intake Air Temperature going into the engine after the turbocharger.

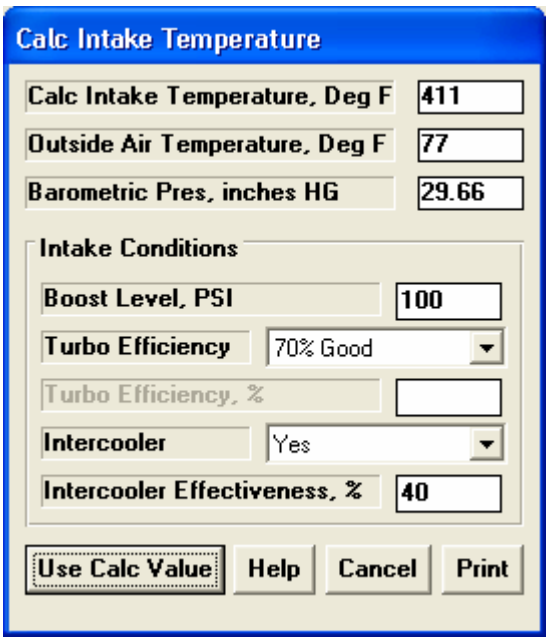


Figure A60 Watching the Compressor Map during Calculations

If you are using a Map file, this button will appear on the Progress Form. If you select to Show S/C Map, you have choices to show continuously or Pause at different steps.

For most situations, "Pause Each RPM" is a good choice.

Click mouse button down on the blue title bars of these small screens and ***hold down*** to grab these screens. While holding mouse button down, slide mouse to place where you want to see what you need.

Current conditions shown here as numbers and graphed on Map as dot.

Dots are shown for each intermediate step. Note that these dots top out at a pressure ratio of about 2.0 because of the Max Boost setting of 30" in the Turbocharger Specs screen.

At the end of each step, click on these new buttons to advance to the next step, print the Map, or go back to Continuous running.

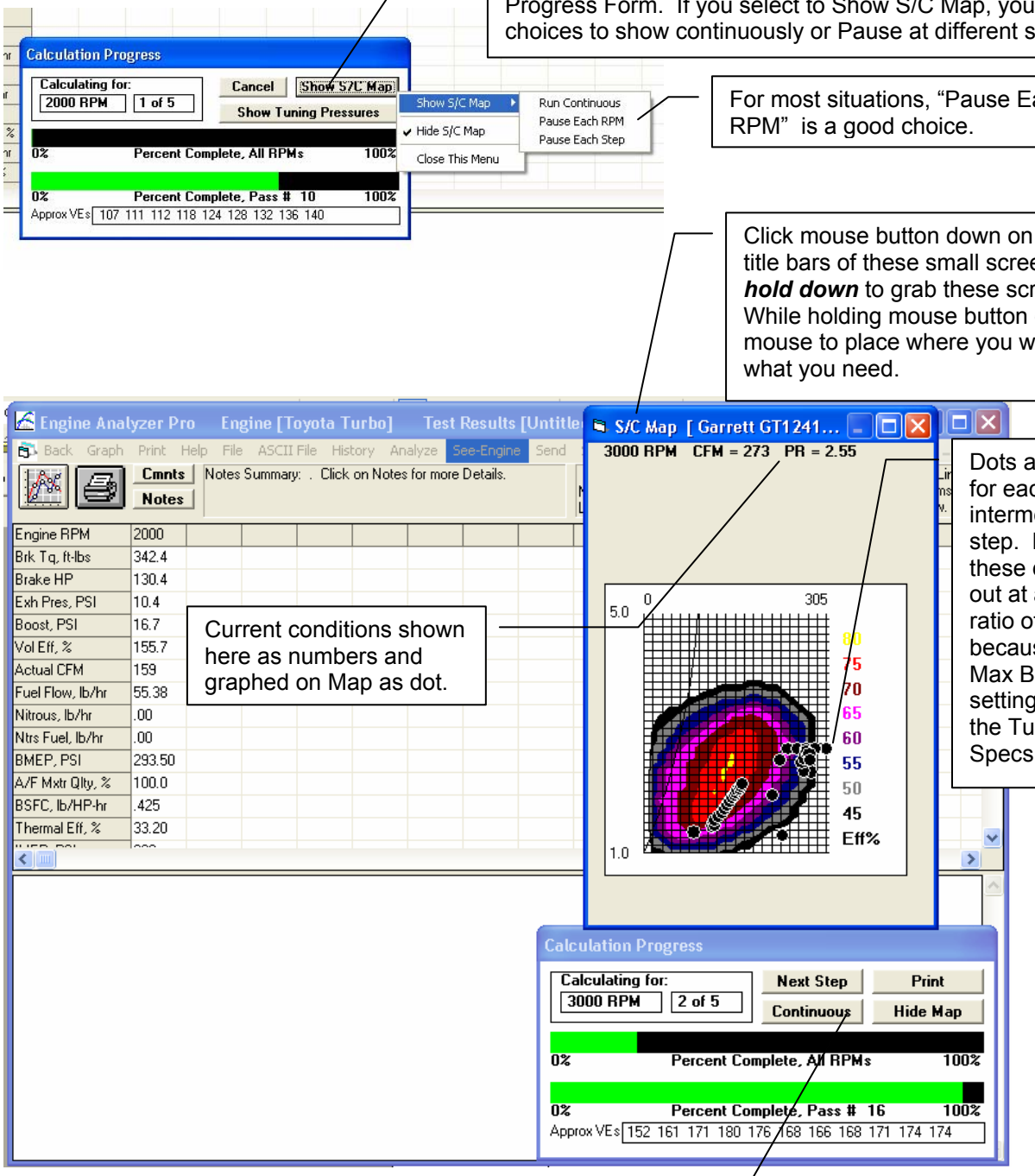
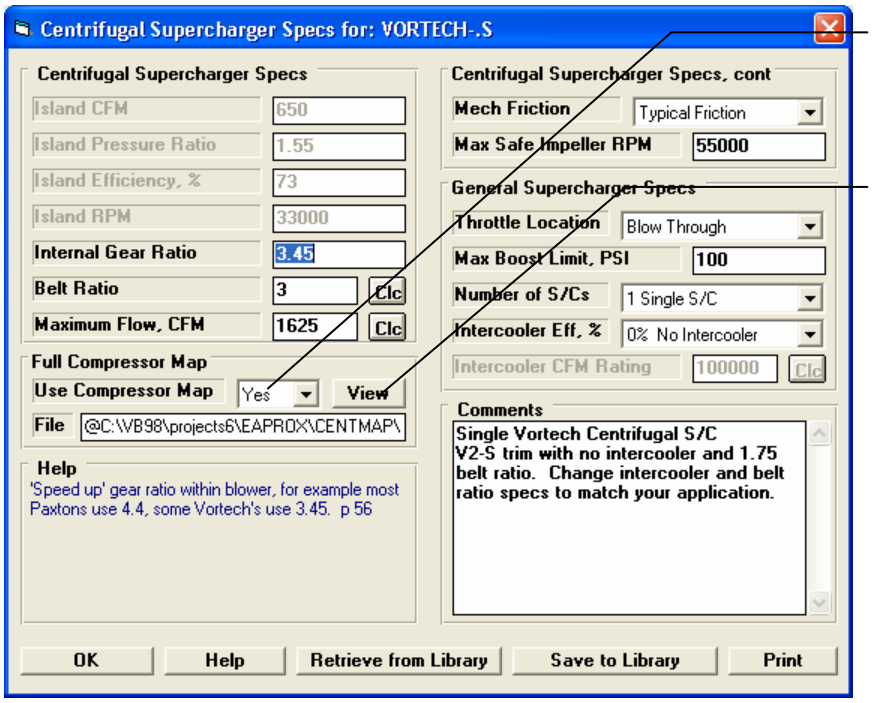


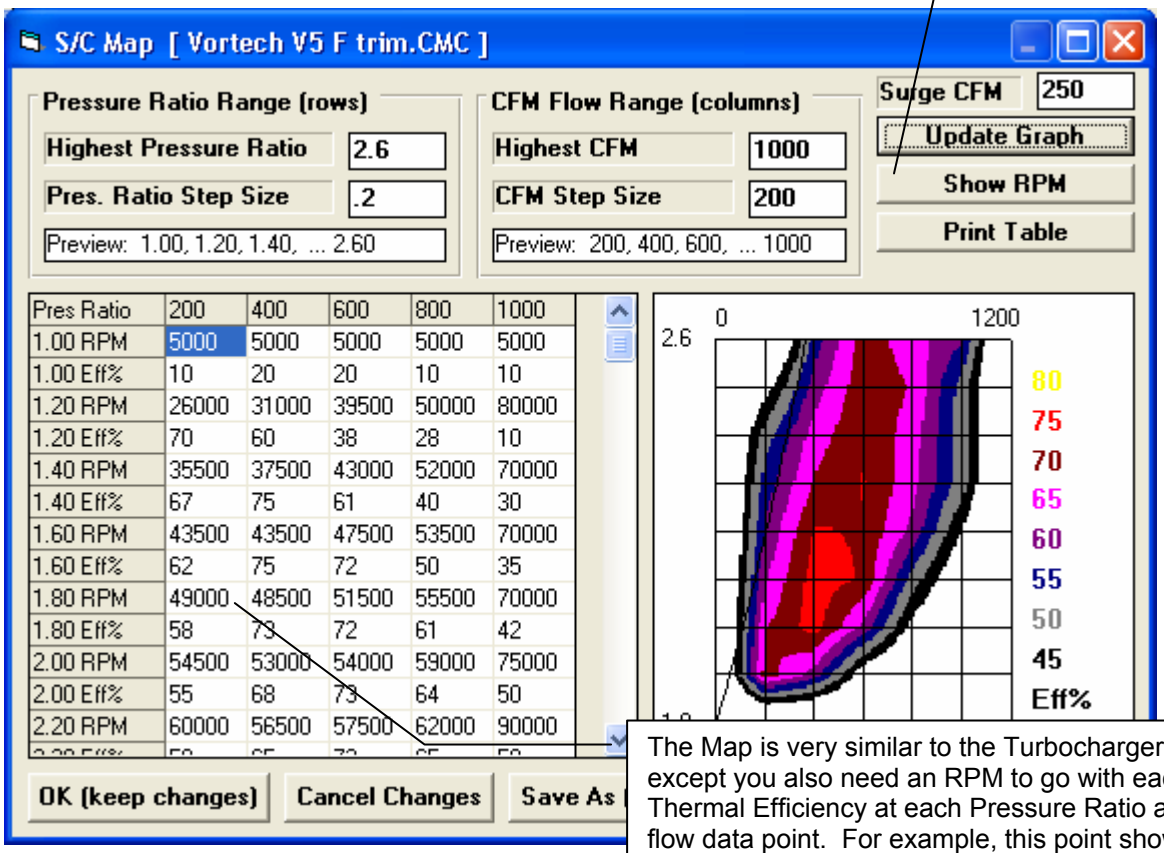
Figure A61 Centrifugal Supercharger using Full Compressor Map



Click here to choose to use a full map.

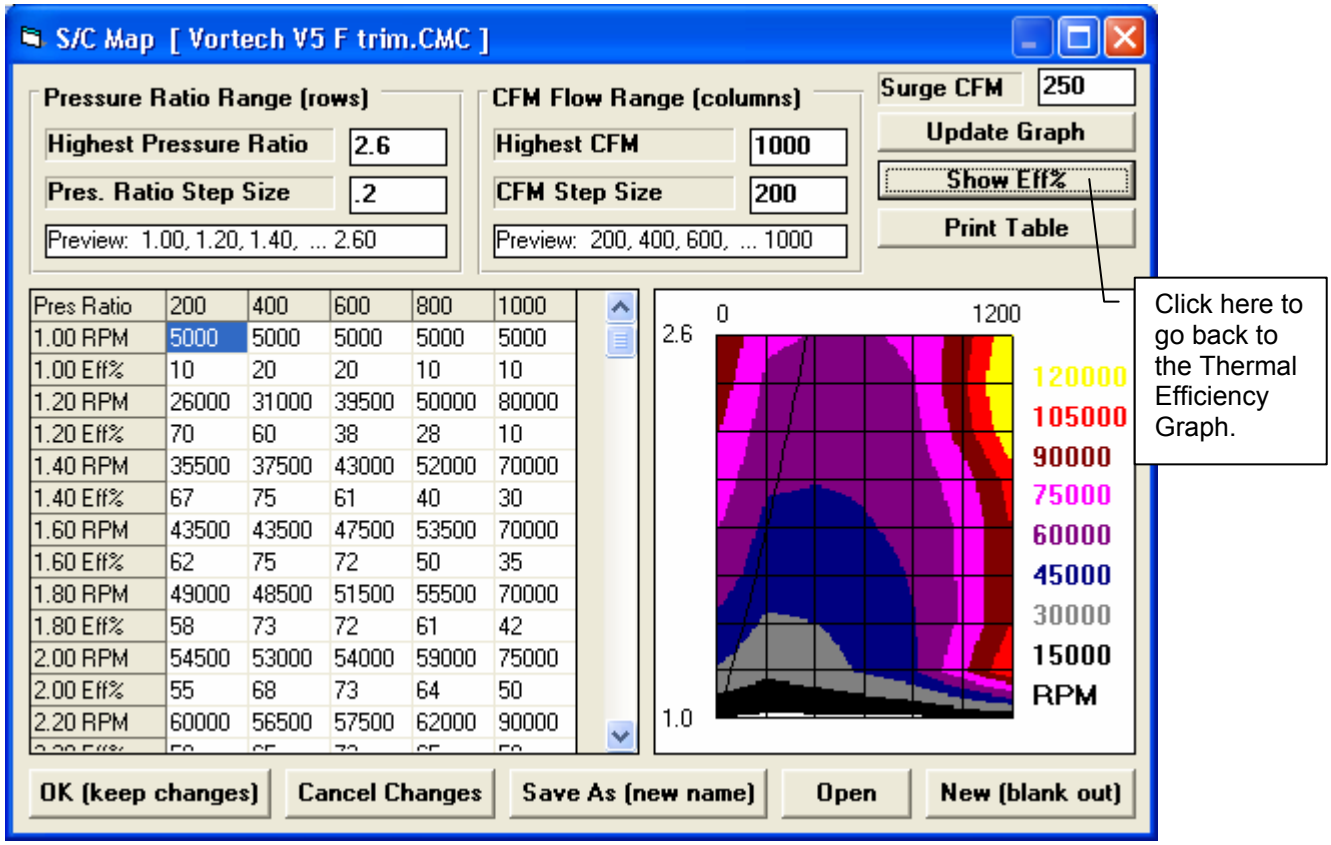
Click here to bring up screen shown below

Click here to show the RPM Graph.



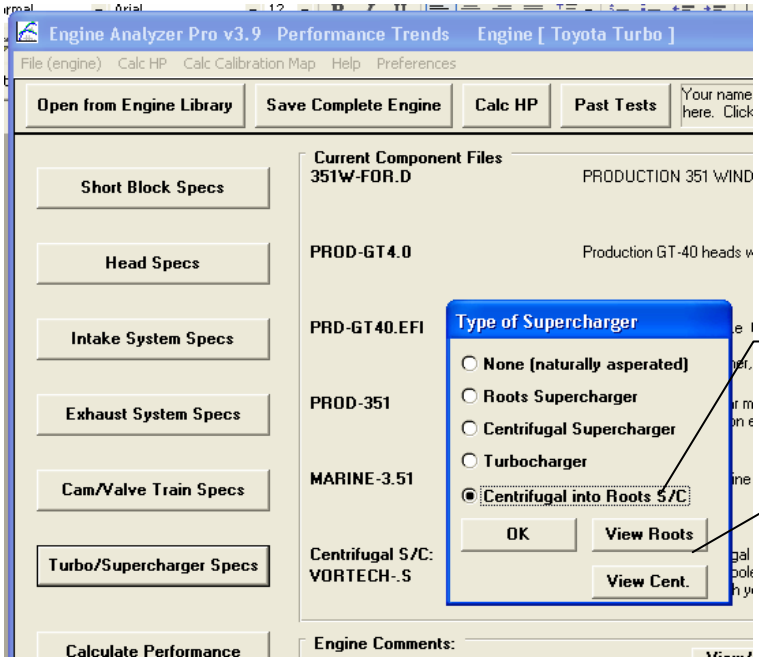
The Map is very similar to the Turbocharger Map except you also need an RPM to go with each Thermal Efficiency at each Pressure Ratio and CFM flow data point. For example, this point shows the blower is spinning at 49000 RPM and produces 58% efficiency at a Pressure Ratio of 1.80 at a CFM of 200.

Figure A62 Centrifugal Supercharger using Full Compressor Map, RPM Graph



Click here to go back to the Thermal Efficiency Graph.

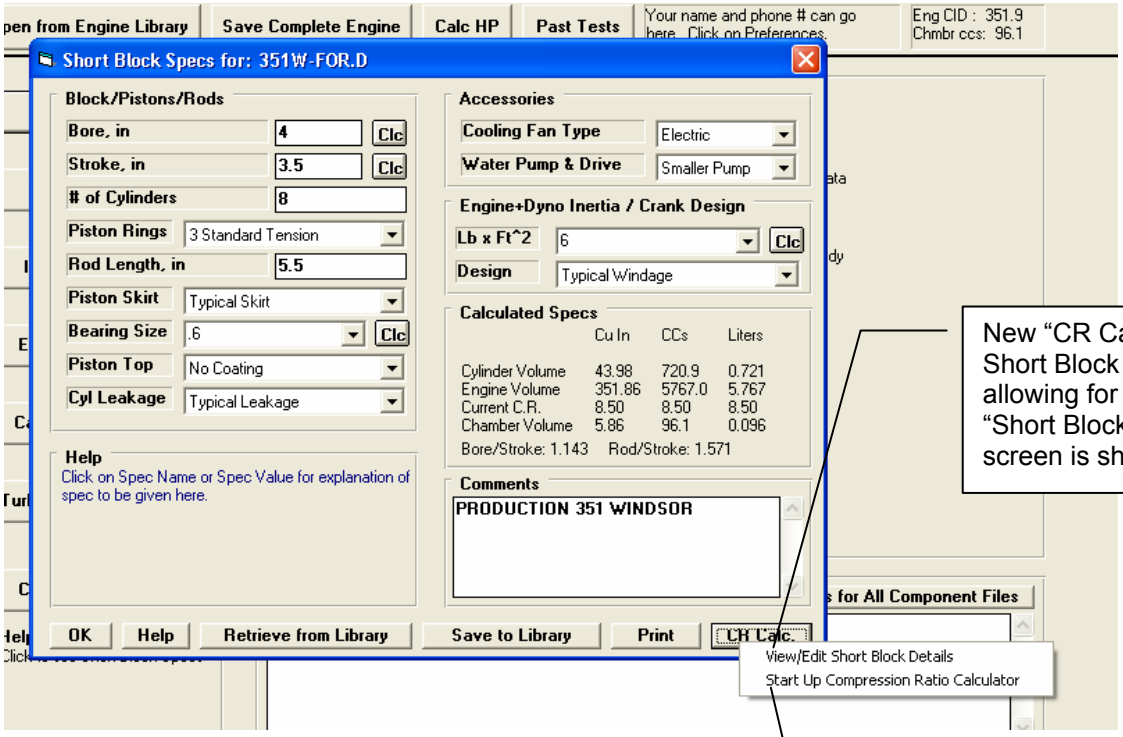
Figure A63 New Supercharger Type, Centrifugal Feeding into a Roots Supercharger



New choice of a Centrifugal Supercharger feeding into a Roots Supercharger.

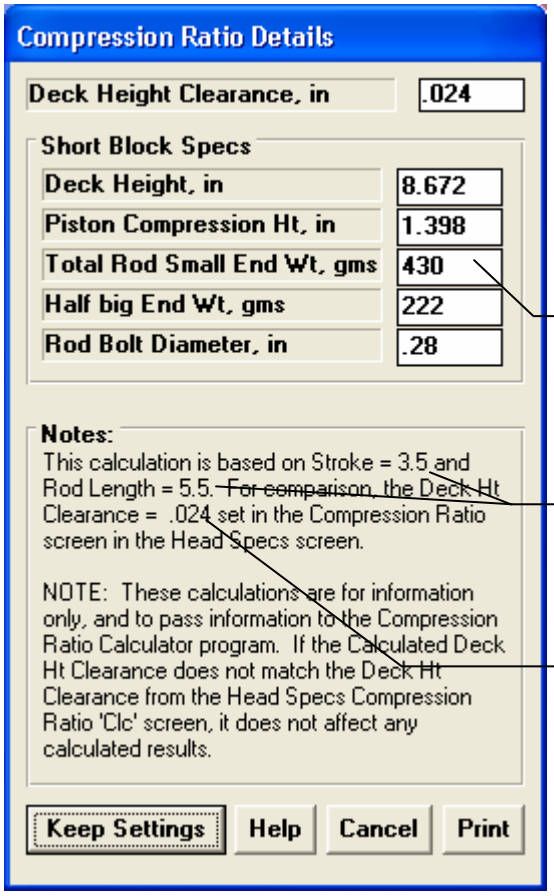
You can view both types of supercharger specs.

Figure A64 "Talking" to the Compression Ratio Calculator, Short Block Specs



New "CR Calc" button in Short Block Specs, allowing for 2 options. The "Short Block Details" screen is shown below.

Starting up the Compression Ratio Calculator is shown if Figures A65 and A66

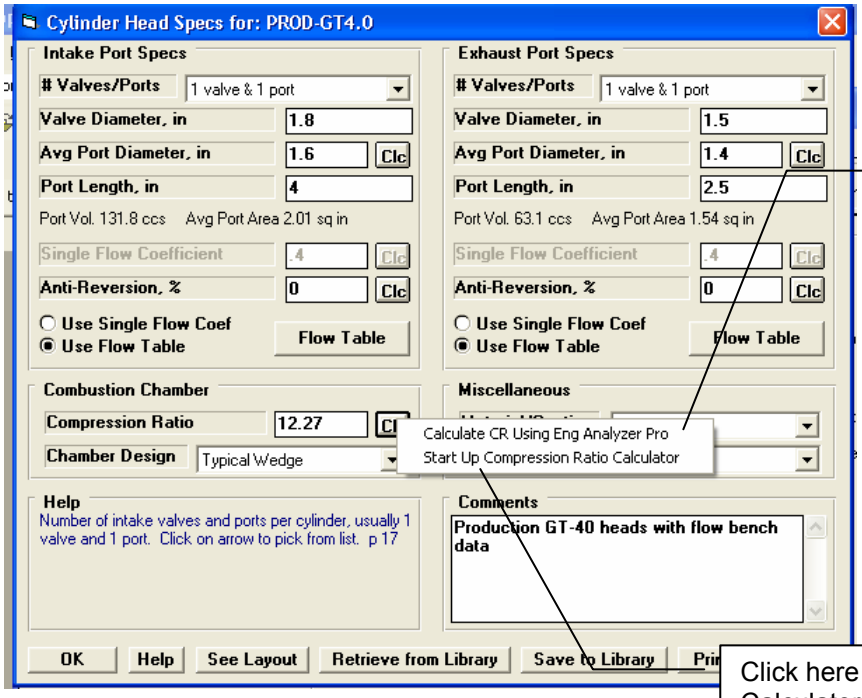


Total Small End Weight includes the piston, wrist pin and keepers, and rings in addition to just the small end of the rod. This is used in the Compression Ratio Calculator to estimate loads on the rod bolts at a particular RPM.

Current Stroke and Rod Length used for the Deck Height Clearance calculation.

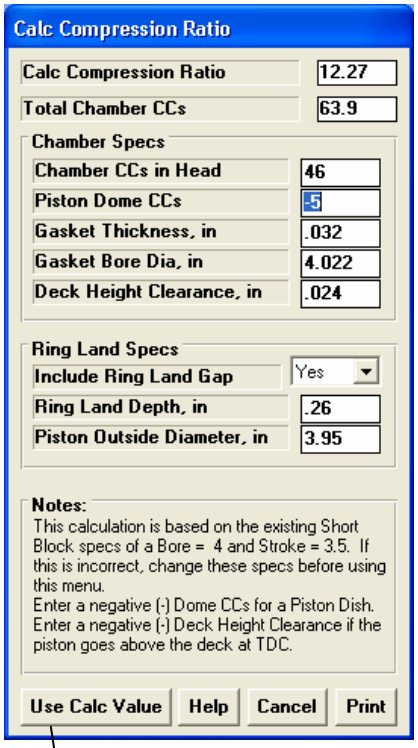
Current Deck Height Clearance which has been set in the Compression Ratio utility menu in the Heads Specs screen. See Figure A64. Ideally you will adjust specs either on this screen or the Compression Ratio utility screen to get these to match each other.

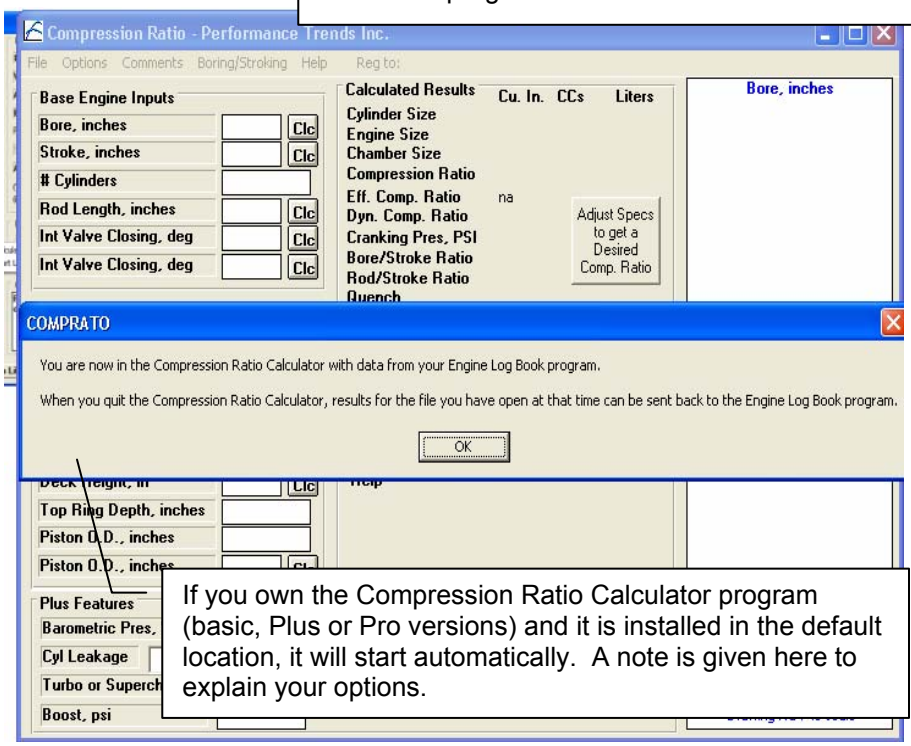
Figure A65 "Talking" to the Compression Ratio Calculator, Cylinder Head Specs



Two options from the Cylinder Head Specs screen. The top option shows the same Compression Ratio utility screen in the standard Engine Analyzer Pro. However, in the Enterprise Edition, now these inputs are saved when you leave this screen so they can be transferred to the Compression Ratio Calculator program.

Click here to start up the Compression Ratio Calculator program shown below.





If you own the Compression Ratio Calculator program (basic, Plus or Pro versions) and it is installed in the default location, it will start automatically. A note is given here to explain your options.

Compression Ratio utility screen in Engine Analyzer Pro (standard version and Enterprise Edition).

Figure A66 Actual Compression Ratio Calculator Program Called from Engine Analyzer Pro Enterprise Edition

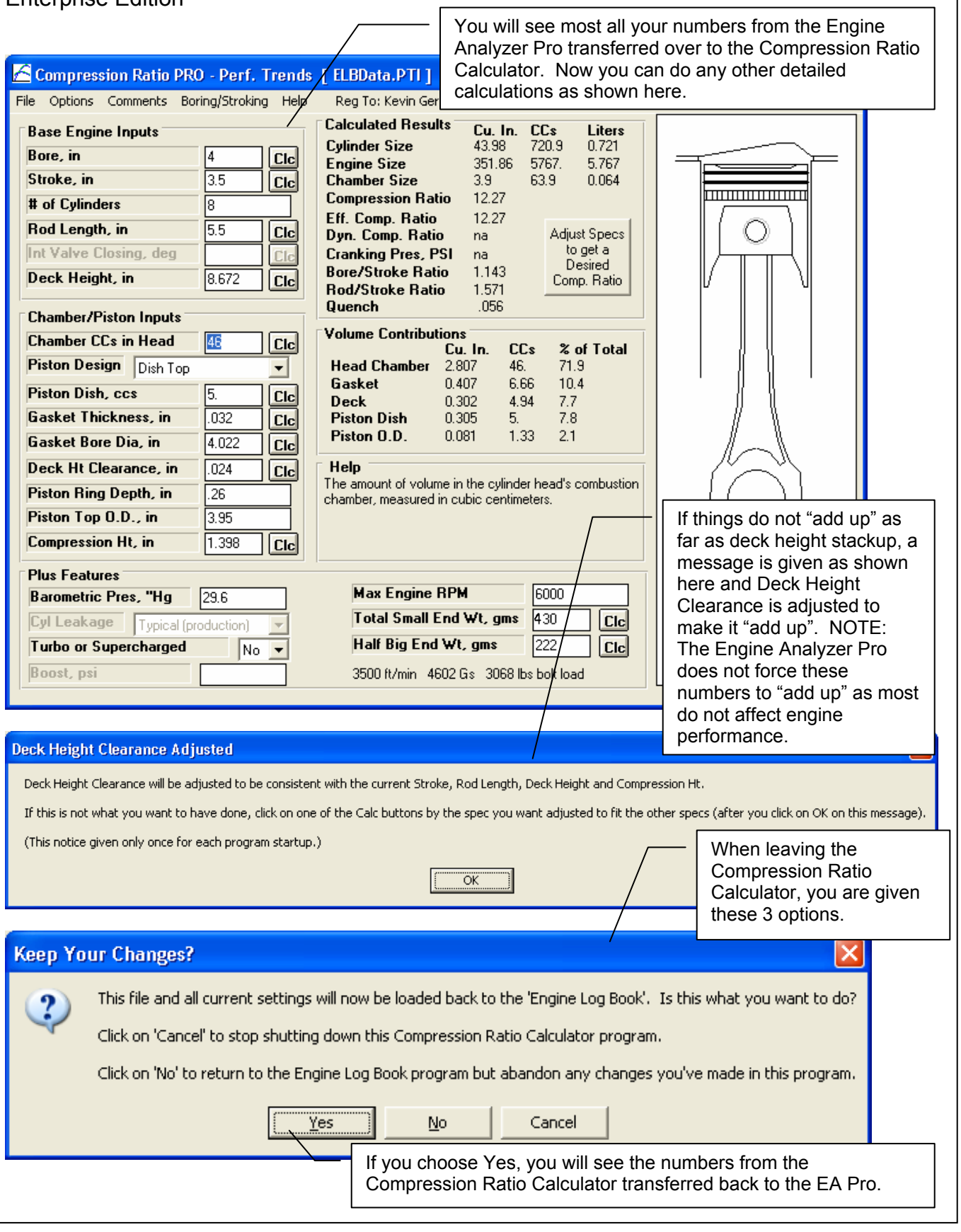
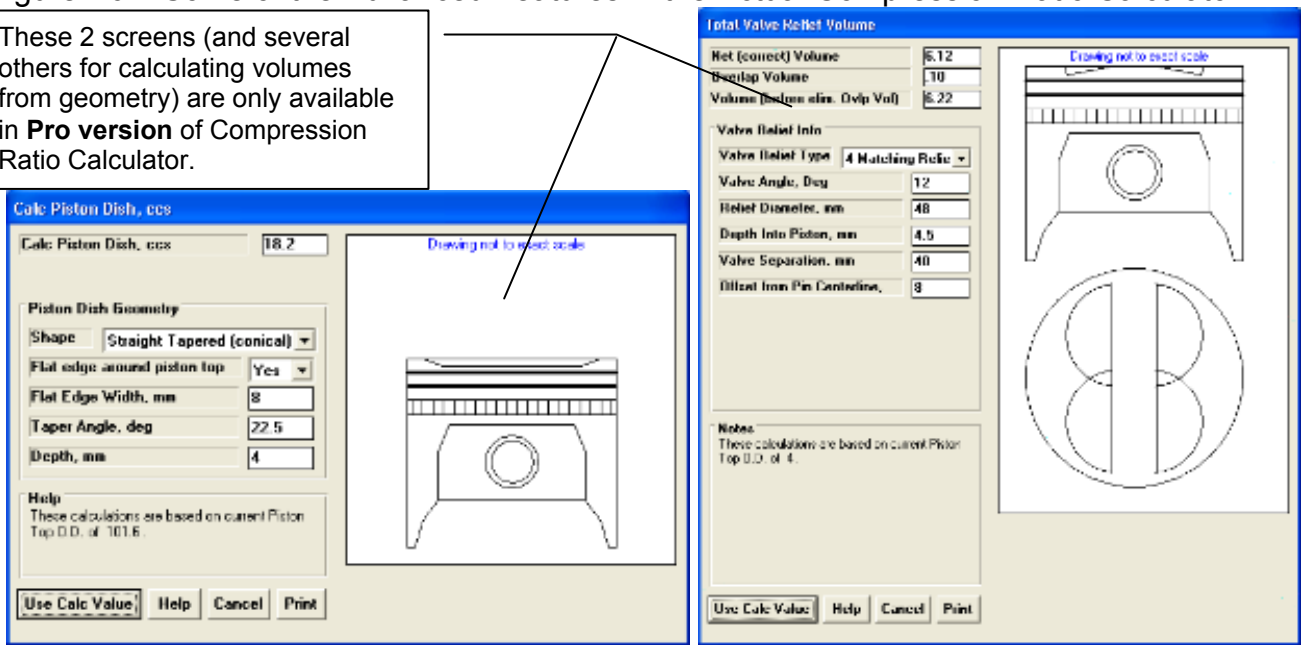
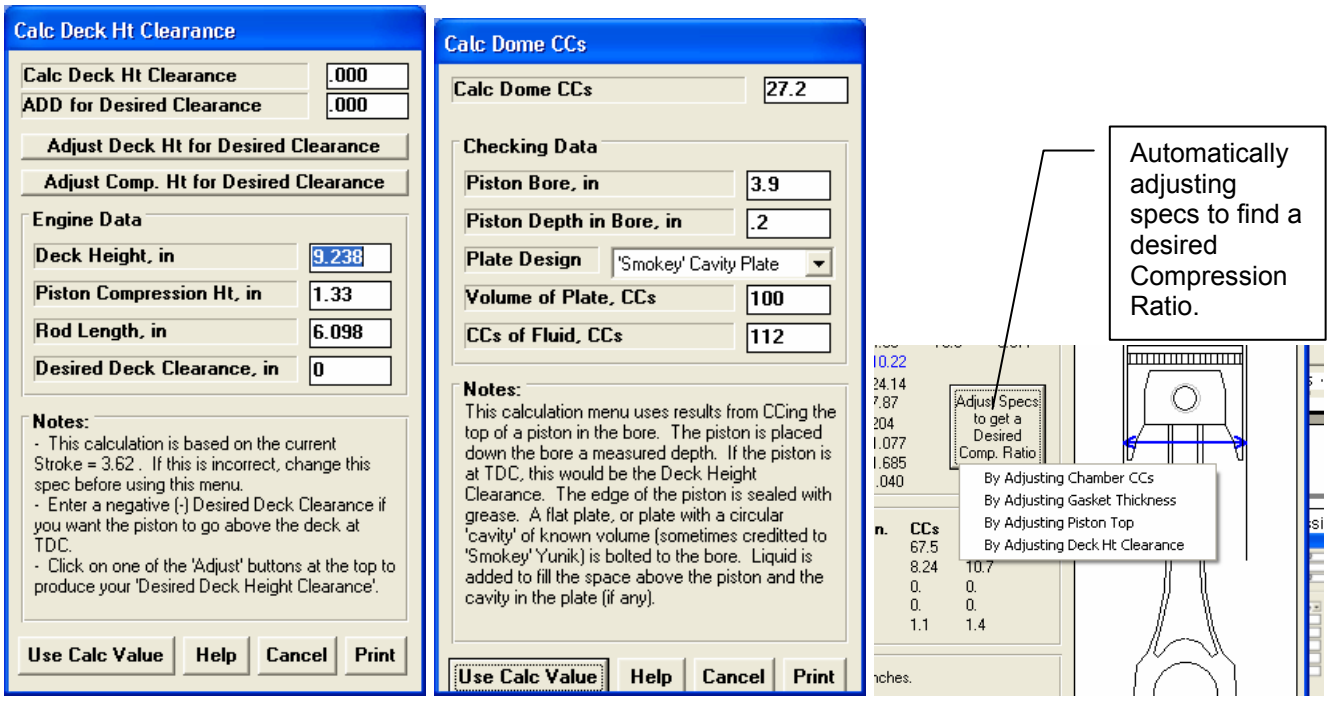


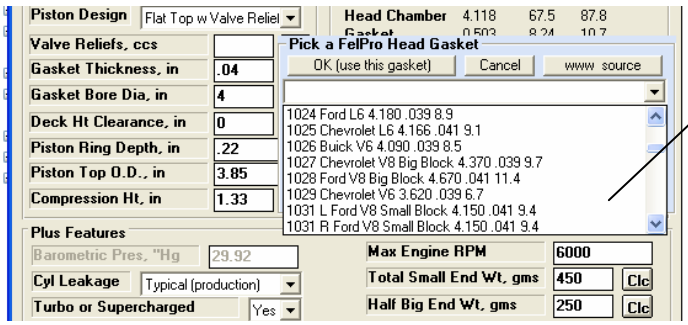
Figure A67 Some of the Advanced Features in the Actual Compression Ratio Calculator

These 2 screens (and several others for calculating volumes from geometry) are only available in **Pro version** of Compression Ratio Calculator.



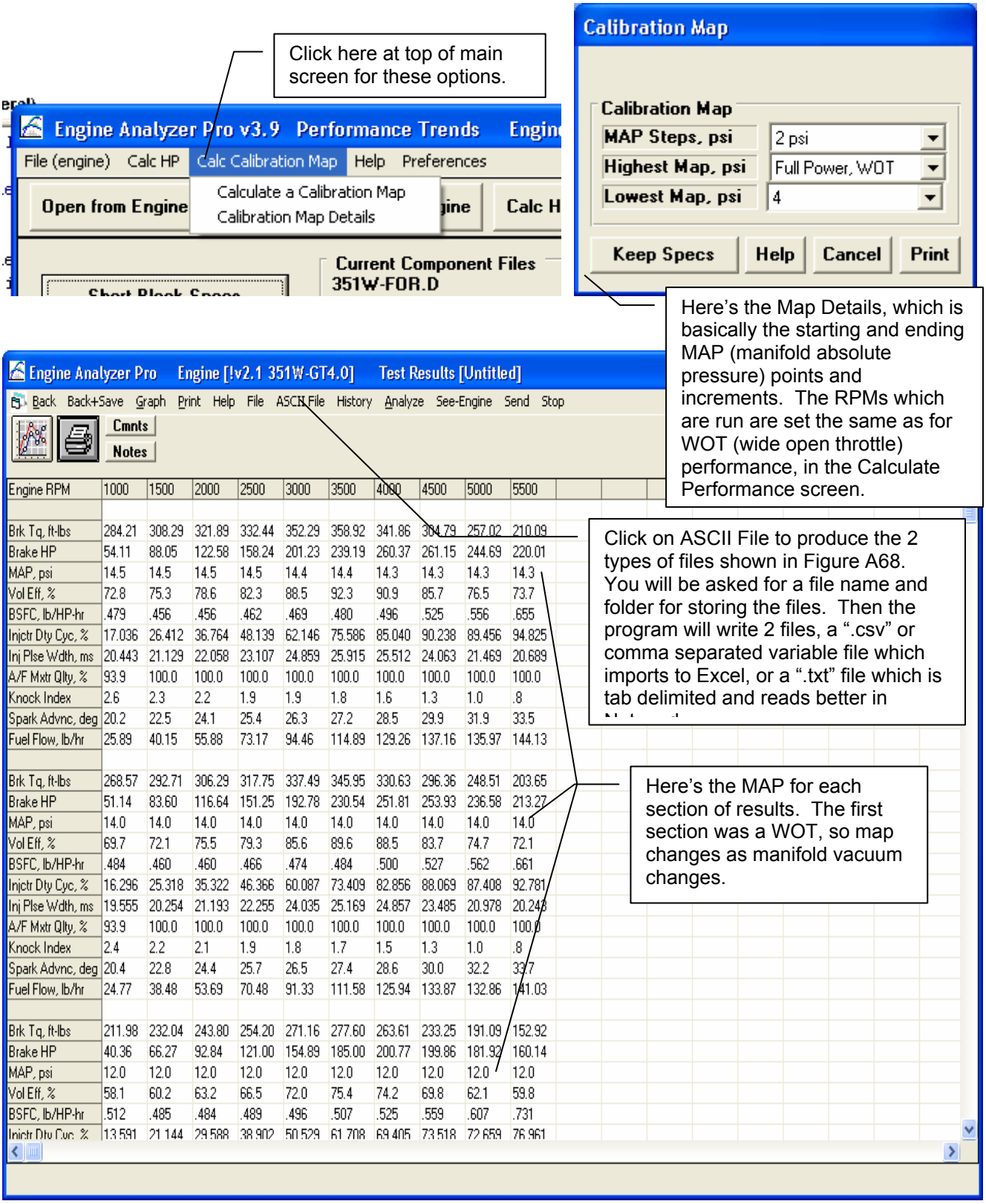


Automatically adjusting specs to find a desired Compression Ratio.



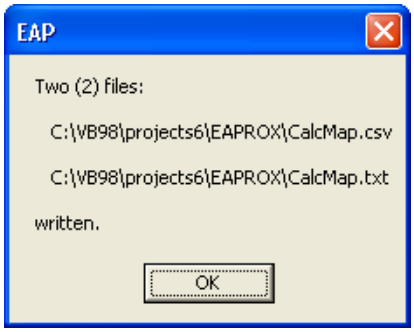
Picking gasket specs from pre-loaded list of gaskets.

Figure A68 Calculating a Part Throttle "Calibration" Map



Engine RPM	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500
Brk Tq, ft-lbs	284.21	308.29	321.89	332.44	352.29	358.92	341.86	304.79	257.02	210.09
Brake HP	54.11	88.05	122.58	158.24	201.23	239.19	260.37	261.15	244.69	220.01
MAP, psi	14.5	14.5	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.3
Vol Eff, %	72.8	75.3	78.6	82.3	88.5	92.3	90.9	85.7	76.5	73.7
BSFC, lb/HP-hr	.479	.456	.456	.462	.469	.480	.496	.525	.556	.655
Injctr Dty Cyc, %	17.036	26.412	36.764	48.139	62.146	75.586	85.040	90.238	89.456	94.825
Inj Plse Wdth, ms	20.443	21.129	22.058	23.107	24.859	25.915	25.512	24.063	21.469	20.689
A/F Mxtr Qlty, %	93.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Knock Index	2.6	2.3	2.2	1.9	1.9	1.8	1.6	1.3	1.0	.8
Spark Advnc, deg	20.2	22.5	24.1	25.4	26.3	27.2	28.5	29.9	31.9	33.5
Fuel Flow, lb/hr	25.89	40.15	55.88	73.17	94.46	114.89	129.26	137.16	135.97	144.13
Brk Tq, ft-lbs	268.57	292.71	306.29	317.75	337.49	345.95	330.63	296.36	248.51	203.65
Brake HP	51.14	83.60	116.64	151.25	192.78	230.54	251.81	253.93	236.58	213.27
MAP, psi	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Vol Eff, %	69.7	72.1	75.5	79.3	85.6	89.6	88.5	83.7	74.7	72.1
BSFC, lb/HP-hr	.484	.460	.460	.466	.474	.484	.500	.527	.562	.661
Injctr Dty Cyc, %	16.296	25.318	35.322	46.366	60.087	73.409	82.856	88.069	87.408	92.781
Inj Plse Wdth, ms	19.555	20.254	21.193	22.255	24.035	25.169	24.857	23.485	20.978	20.243
A/F Mxtr Qlty, %	93.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Knock Index	2.4	2.2	2.1	1.9	1.8	1.7	1.5	1.3	1.0	.8
Spark Advnc, deg	20.4	22.8	24.4	25.7	26.5	27.4	28.6	30.0	32.2	33.7
Fuel Flow, lb/hr	24.77	38.48	53.69	70.48	91.33	111.58	125.94	133.87	132.86	141.03
Brk Tq, ft-lbs	211.98	232.04	243.80	254.20	271.16	277.60	263.61	233.25	191.09	152.92
Brake HP	40.36	66.27	92.84	121.00	154.89	185.00	200.77	199.86	181.92	160.14
MAP, psi	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Vol Eff, %	58.1	60.2	63.2	66.5	72.0	75.4	74.2	69.8	62.1	59.8
BSFC, lb/HP-hr	.512	.485	.484	.489	.496	.507	.525	.559	.607	.731
Injctr Dty Cyc, %	13.591	21.144	29.588	38.902	50.529	61.708	69.405	73.518	72.659	76.961

Figure A69 Part Throttle "Calibration" Map" Written to ASCII Files (see Fig A67)



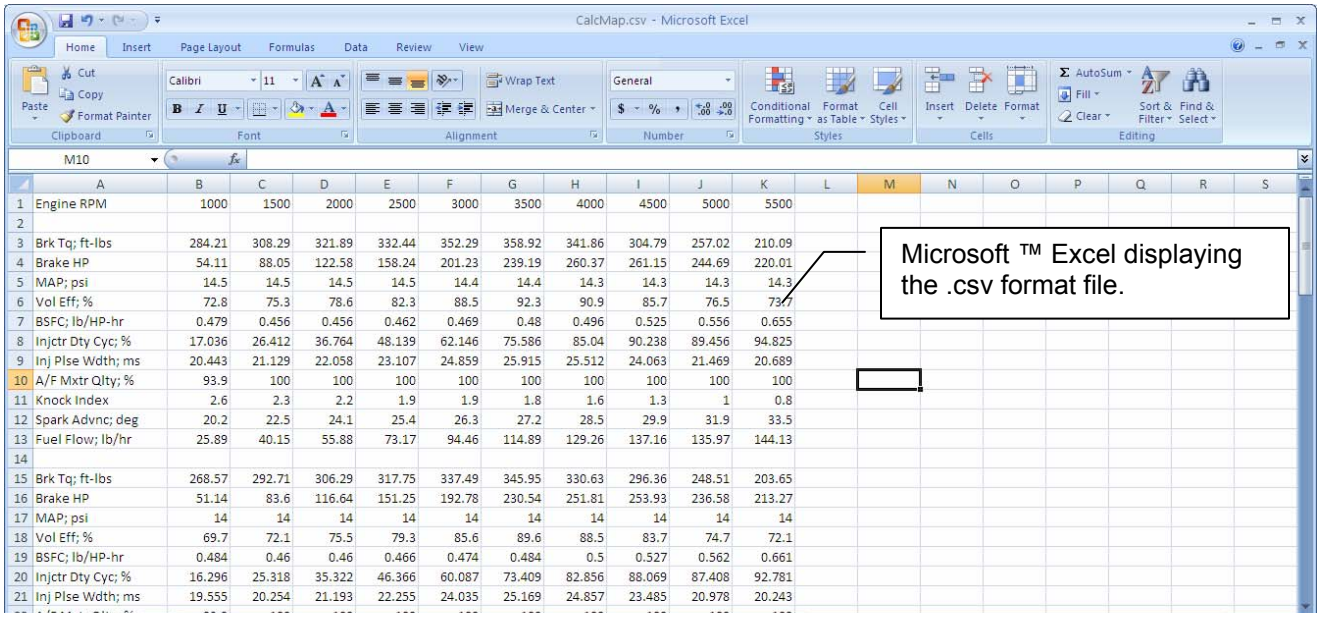
Notepad displaying the .txt format file.

CalcMap.txt - Notepad

File Edit Format View Help

Engine RPM	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500
Brk Tq; ft-lbs	284	308	322	332	352	359	342	305	257	210
Brake HP	54.1	88.1	122.6	158.2	201.2	239.2	260.4	261.1	244.7	220.0
MAP; psi	14.5	14.5	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.3
Vol Eff; %	72.8	75.3	78.6	82.3	88.5	92.3	90.9	85.7	76.5	73.7
BSFC; lb/HP-hr	.479	.456	.456	.462	.469	.480	.496	.525	.556	.655
Injctr Dty Cyc; %	17.036	26.412	36.764	48.139	62.146	75.586	85.040	90.238	89.456	94.825
Inj Plse Wdth; ms	20.443	21.129	22.058	23.107	24.859	25.915	25.512	24.063	21.469	20.689
A/F Mxtr Qlty; %	93.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Knock Index	2.6	2.3	2.2	1.9	1.9	1.8	1.6	1.3	1.0	.8
Spark Advnc; deg	20.2	22.5	24.1	25.4	26.3	27.2	28.5	29.9	31.9	33.5
Fuel Flow; lb/hr	25.89	40.15	55.88	73.17	94.46	114.89	129.26	137.16	135.97	144.13
Brk Tq; ft-lbs	269	293	306	318	337	346	331	296	249	204
Brake HP	51.1	83.6	116.6	151.3	192.8	230.5	251.8	253.9	236.6	213.3
MAP; psi	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Vol Eff; %	69.7	72.1	75.5	79.3	85.6	89.6	88.5	83.7	74.7	72.1
BSFC; lb/HP-hr	.484	.460	.460	.466	.474	.484	.500	.527	.562	.661
Injctr Dty Cyc; %	16.296	25.318	35.322	46.366	60.087	73.409	82.856	88.069	87.408	92.781
Inj Plse Wdth; ms	19.555	20.254	21.193	22.255	24.035	25.169	24.857	23.485	20.978	20.243
A/F Mxtr Qlty; %	93.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Ln 1, Col 1



	A	B	C	D	E	F	G	H	I	J	K
1	Engine RPM	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500
2											
3	Brk Tq; ft-lbs	284.21	308.29	321.89	332.44	352.29	358.92	341.86	304.79	257.02	210.09
4	Brake HP	54.11	88.05	122.58	158.24	201.23	239.19	260.37	261.15	244.69	220.01
5	MAP; psi	14.5	14.5	14.5	14.5	14.4	14.4	14.3	14.3	14.3	14.3
6	Vol Eff; %	72.8	75.3	78.6	82.3	88.5	92.3	90.9	85.7	76.5	73.7
7	BSFC; lb/HP-hr	0.479	0.456	0.456	0.462	0.469	0.48	0.496	0.525	0.556	0.655
8	Injctr Dty Cyc; %	17.036	26.412	36.764	48.139	62.146	75.586	85.04	90.238	89.456	94.825
9	Inj Plse Wdth; ms	20.443	21.129	22.058	23.107	24.859	25.915	25.512	24.063	21.469	20.689
10	A/F Mxtr Qlty; %	93.9	100	100	100	100	100	100	100	100	100
11	Knock Index	2.6	2.3	2.2	1.9	1.9	1.8	1.6	1.3	1	0.8
12	Spark Advnc; deg	20.2	22.5	24.1	25.4	26.3	27.2	28.5	29.9	31.9	33.5
13	Fuel Flow; lb/hr	25.89	40.15	55.88	73.17	94.46	114.89	129.26	137.16	135.97	144.13
14											
15	Brk Tq; ft-lbs	268.57	292.71	306.29	317.75	337.49	345.95	330.63	296.36	248.51	203.65
16	Brake HP	51.14	83.6	116.64	151.25	192.78	230.54	251.81	253.93	236.58	213.27
17	MAP; psi	14	14	14	14	14	14	14	14	14	14
18	Vol Eff; %	69.7	72.1	75.5	79.3	85.6	89.6	88.5	83.7	74.7	72.1
19	BSFC; lb/HP-hr	0.484	0.46	0.46	0.466	0.474	0.484	0.5	0.527	0.562	0.661
20	Injctr Dty Cyc; %	16.296	25.318	35.322	46.366	60.087	73.409	82.856	88.069	87.408	92.781
21	Inj Plse Wdth; ms	19.555	20.254	21.193	22.255	24.035	25.169	24.857	23.485	20.978	20.243

Microsoft ™ Excel displaying the .csv format file.

Figure A70 Language Translation and Other Preferences