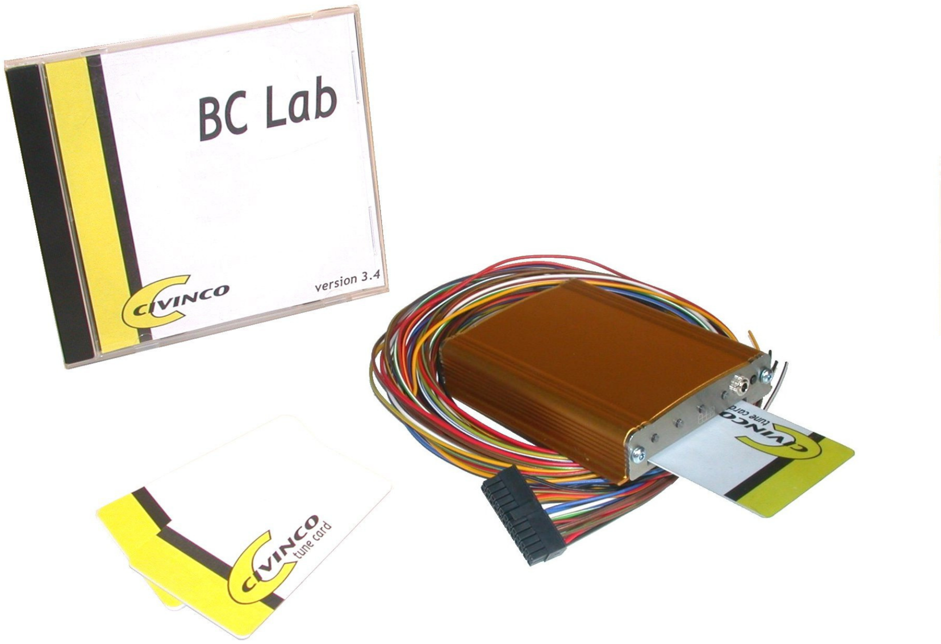

CIVINCO
SA500 & SA1000 G3 v2

Software manual
Installation guide
Tuning guide

Dataset ID 204

Feb 2009

SOFTWARE MANUAL
SA500G3 / SA1000G3

CIVINCO ENGINEERING AB ▪ HILDEDALSGATAN 24 ▪ SE-417 05 GÖTEBORG ▪ SWEDEN
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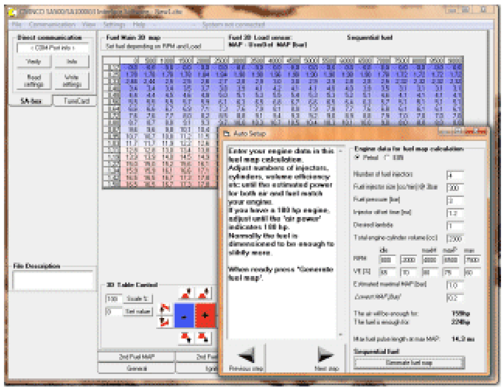
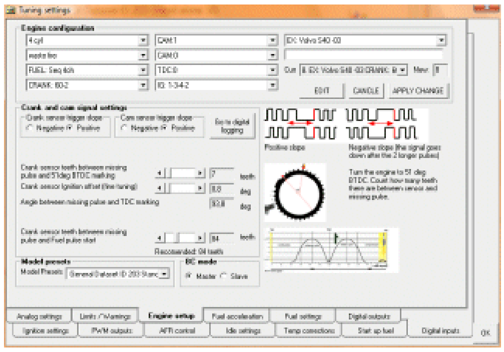
NEWS 2009

1. Start up guide which guides you through all steps to get a base map ready for your first start attempt.
2. Auto tune, long term adaptiv fuel.
3. Tunable extra idle air at engine start
4. Tunable temperature to start AFR-control.
5. Deceleration fuel
6. In the log program you can open and compare to log files.
7. BCLab's windows can be resized to full screen.

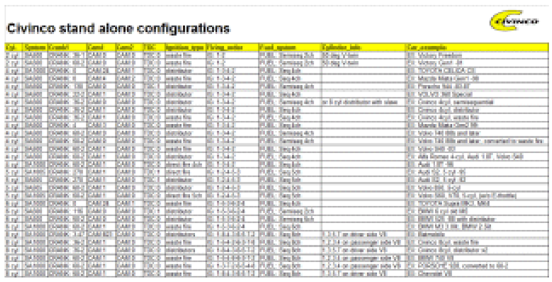
Auto setup
A guide that step by step guides you through all steps to get a base map for fuel and ignition and some initial tests to get crank and cam right.
Some base maps are also provided in the installation.



Simplified guide for selection of engine model
Step by step guide where you select your engine configuration based on number of cylinders, fuel system, ignition sequence, cam- and crank sensor.



Support for more engine types, like 5 cyl
Many new engine types supported with different versions of direct fire and different crank sensors.
Support for more Audi 5 cyl and Volvo 5 cyl, with distributor and direct fire.



INTRODUCTION

With Civinco's Engine management system SA500G3 or SA1000G3 you will easily optimize your engine. The system controls all the critical parameters like fuel, ignition, boost and warning systems. All the data are stored at smart card memories and can easily be changed during run. Civinco AB in Sweden can help you with most things in car tuning via a broad network of resellers worldwide.

Civinco offers two families of engine management systems; **InSeries systems** which works together with the stock ECU/PCM, and **Stand Alone** systems for more advanced tuning were you replace the stock ECU/PCM.

FUNCTION OVERVIEW SA500G3 & SA1000G3

- 3D fuel map with selectable number of cells up to18*19 cells
- 2 fuel maps, which can be combined as preferred.
- Fuel compensation
  - Extra load sensor
  - Coolant temp, Air temp, Battery voltage
  - Acceleration enrichment
- Ignition map based on 21 RPM cells, and selectable load sensor with 33 cells.
- Sequential fuel timing
- Over 25 different cam and crank sensor configurations (60-2, 22-2, 24, 36-2 etc)
- Most ignition orders for 4, 6 and 8 cylinders
- AFR closed loop
  - Short and long term adaptive
- Launch control for boost spool up
  - Tunable Ignition retard, Rev limit and extra fuel
- Idle control
  - Ignition
  - Idle control valve with 1 or 2 PWM
- Boost control
  - Open or closed loop (PID) via PWM
- Warning systems and error codes
  - RPM limiter
  - Fuel cut at over boost
- ASD output to control supply voltage to fuel pump etc
- All out and input can be reconfigured for different functions
- Uses all original sensors, so no extra sensors are needed to be bought
- USB communication with PC
- Log up to 75 engine and sensor signals to PC via USB

SYSTEM OVERVIEW SA500G3

- 4 fuel channels for high ohm injectors
- 2 ignition channels for external igniters
- 6 analog inputs
    - MAP
    - Coolant temp
    - Throttle position*
    - AFR*
    - IAT / AUX1*
    - 12V battery / AUX2*
- 4 digital inputs
    - Cam sensor
    - Crank sensor
    - Launch control
    - Ignition cut or Speed
- 3 digital output
    - ASD, fan control, tach output, gearing indicator, error code lamp, programmable output based on RPM and analog input
    - +5V voltage supply for external sensors
- 2 PWM output for boost control, idle control, VTEC, Vanos**

SYSTEM OVERVIEW SA1000G3

- 8 fuel channels for high ohm injectors
- 4 ignition channels for external igniters
- 10 analog inputs
    - MAP
    - Coolant temp
    - Throttle position*
    - AFR*
    - IAT / AUX1*
    - 12V battery / AUX2*
    - 2 extra inputs for options AUX3 / AUX4
- 6 digital inputs
    - Cam sensor
    - Crank sensor
    - Launch control
    - Ignition cut or Speed
    - 2 extra inputs for options
- 5 digital output
    - ASD, fan control, tach output, gearing indicator, error code lamp, programmable output based on RPM and analog input
    - +5V voltage supply for external sensors
- 4 PWM output for boost control, idle control, VTEC, Vanos**

** can be used to log other signals as well.*
*** all outputs can be used to control selectable functions*

WHICH SYSTEM SHOULD YOU SELECT

1. What type of cam and crank signal?
   - Inductive or digital
     SA500G3/1000G3 supports both types, but inductive sensors could need some extra tuning.

2. Number of pulses per rev for the cam and crank sensor
   - SA500G3/1000G3 supports more than 25 different combinations

3. Number of cylinders, ignition coils and ignition principle?
   - 4-8 cyl with 1-4 coils
     SA500G3 supports up to 4 cylinders and 2 coils
     SA1000G3 supports up to 8 cylinders and 4 coils

1) Installation of BCLab

Part 1 of this manual is PC-software manual and describes all the system functions and how to tune the car.

Installation:
Insert the CD in the computer and start the installation by double click at setup.exe.
Follow the instructions.

2) Installation of system

Part 2 of this manual describes how to install the system to the engine, and what you need to think about.

3) Tuning of engine

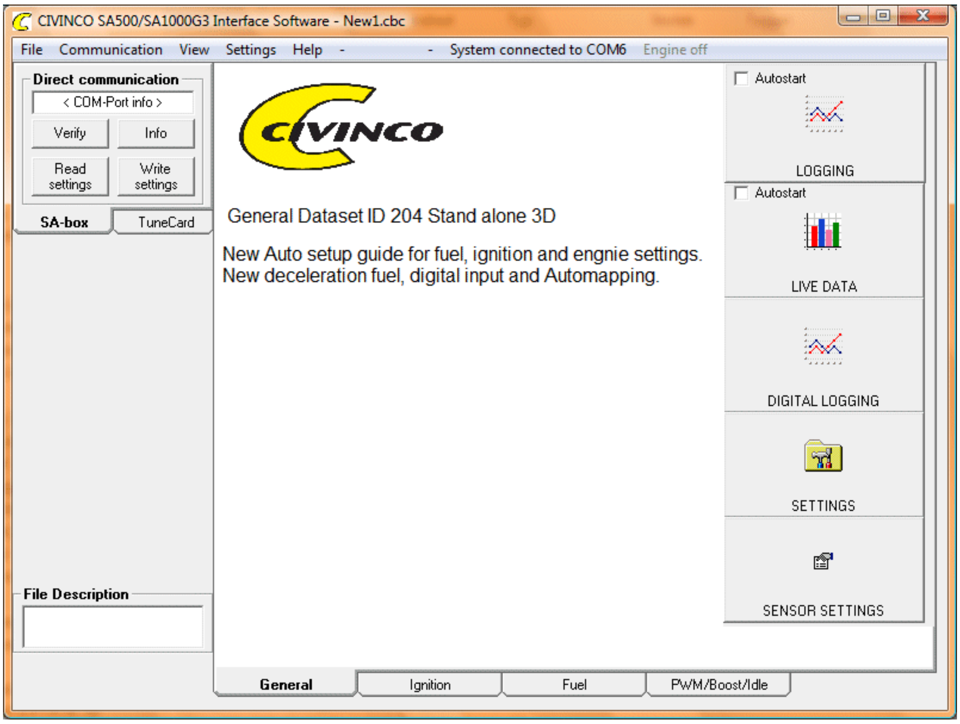
Part 3 describes some tuning basics and strategies to create a first time start up map.

IMPORTANT

**Civinco are responsible that the engine management system is working correctly at delivery, presupposed it has been correctly installed.
Civinco offers a 10 year warranty.**

Civinco does not take responsibility for damage on engine, car or person in connection to the use of Civinco's system

General controls in BCLab

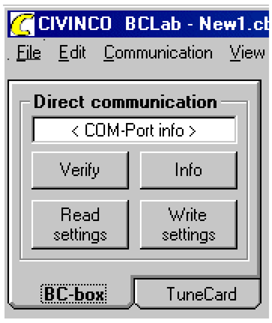


USB Status / Todos Status

There are three ways to communicate with your box or TuneCards. In the upper left corner you will see the chosen communication mode. You may switch between these in the menu Edit-Toggle Interface or by pressing Ctrl+T.

- USB serial communication between PC and BC-box
- Chipdrive connected to the PC that read/writes TuneCards
- Use of the BC-box as a TuneCard reader when the BC-box is connected via USB

Direct communication with the system



Handles the USB-communication with connected BC500/BC1000G3.
Write - Saves the BCLab current tuning to the BC-box
Verify - Verifies that the BC-box tuning is the same as the BCLab tuning
Read - Reads the BC-box tuning and displays them in BCLab
Info - Reads some general information from the BC-box

Live Data changes during logging

If you do changes in the mapping or settings during logging, these changes will take part immediately. You do not have to press “Write” for the changes. This makes it easier to make changes in the mapping and immediately see the changes in the log file. I.e if you make fuel adjustment, you can see the AFR change right away.

Todos card reader

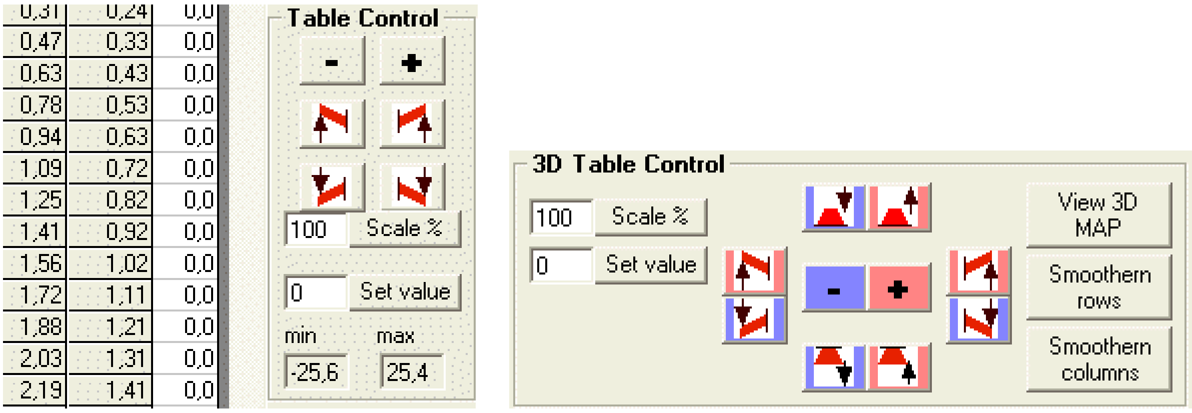
Handles the TuneCard reader if it is connected to the PC.
Find Writer - The program tests the connection with the Todos reader
Write Card - Saves the BCLab current tuning to the TuneCard
Read Card - Reads the TuneCard tuning and displays them in BCLab

FILE DESCRIPTION

This area in the lower left corner can be used to write text to describe the new settings. The text is saved at the same time as you save the settings to the harddrive. They are not saved to the TuneCard or when you write to the box.

USE OF ALL PAGES WITH TABLES

Table Control



All BCLab pages that have tuning tables also have a "Table Control" box. This is used to easily adjust the tuning values in the table. You can also use this to edit several tuning values at the same time by marking the desired values. To mark all table values click on "Deg", "ms" or "%" in the table upper right corner.

- ”+” increase the selected values 1 step
- ”-” decrease the selected values 1 step
-  increase slope of the selected values to the right
-  decrease slope of the selected values to the right
-  decrease slope of the selected values to the left
-  increase slope of the selected values to the left
-  decrease slope of the selected values in the bottom
-  increase slope of the selected values in the bottom
-  decrease slope of the selected values in the top
-  increase slope of the selected values in the top
- "Scale%" Scales the marked values with the selected % value
- "Set to" Sets the marked values to the selected value.
- ”min", "max" Informs the user of the possible values in this table

You can also mark a cell and write the value directly into the box without using the commands above.

Smoother data

There are two functions which evens out the data in 3D tables to make it easier to remove unwanted dip and tops. You can even out in horizontal and in vertical direction.

- **"Smoother Rows"**
  If you have values on the first and last row in a selection, and want to even it out on the rest of the rows, you just press "Smother rows"

	0	500	1000	1500
0,13	2,02	2,02	2,02	2,02
0,21	2,02	2,02	2,02	2,02
0,29	2,02	2,02	2,02	2,02
0,36	2,02	2,02	2,02	2,02
0,44	2,02	2,02	2,02	2,02
0,52	2,02	2,02	2,02	2,02
0,60	10,0	10,0	10,0	10,0

results in

	0	500	1000	1500
0,13	2,02	2,02	2,02	2,02
0,21	3,1	3,1	3,1	3,1
0,29	4,5	4,5	4,5	4,5
0,36	5,8	5,8	5,8	5,8
0,44	7,2	7,2	7,2	7,2
0,52	8,6	8,6	8,6	8,6
0,60	10,0	10,0	10,0	10,0

- **"Smoother Cols"**
  If you have values on the first and last columns in a selection, and want to even it out on the rest of the columns, you just press "Smoother columns"

	0	500	1000	1500
0,13	0,0	0,0	0,0	10,0
0,21	0,0	0,0	0,0	10,0
0,29	0,0	0,0	0,0	10,0
0,36	0,0	0,0	0,0	10,0
0,44	0,0	0,0	0,0	10,0
0,52	0,0	0,0	0,0	10,0
0,60	0,0	0,0	0,0	10,0

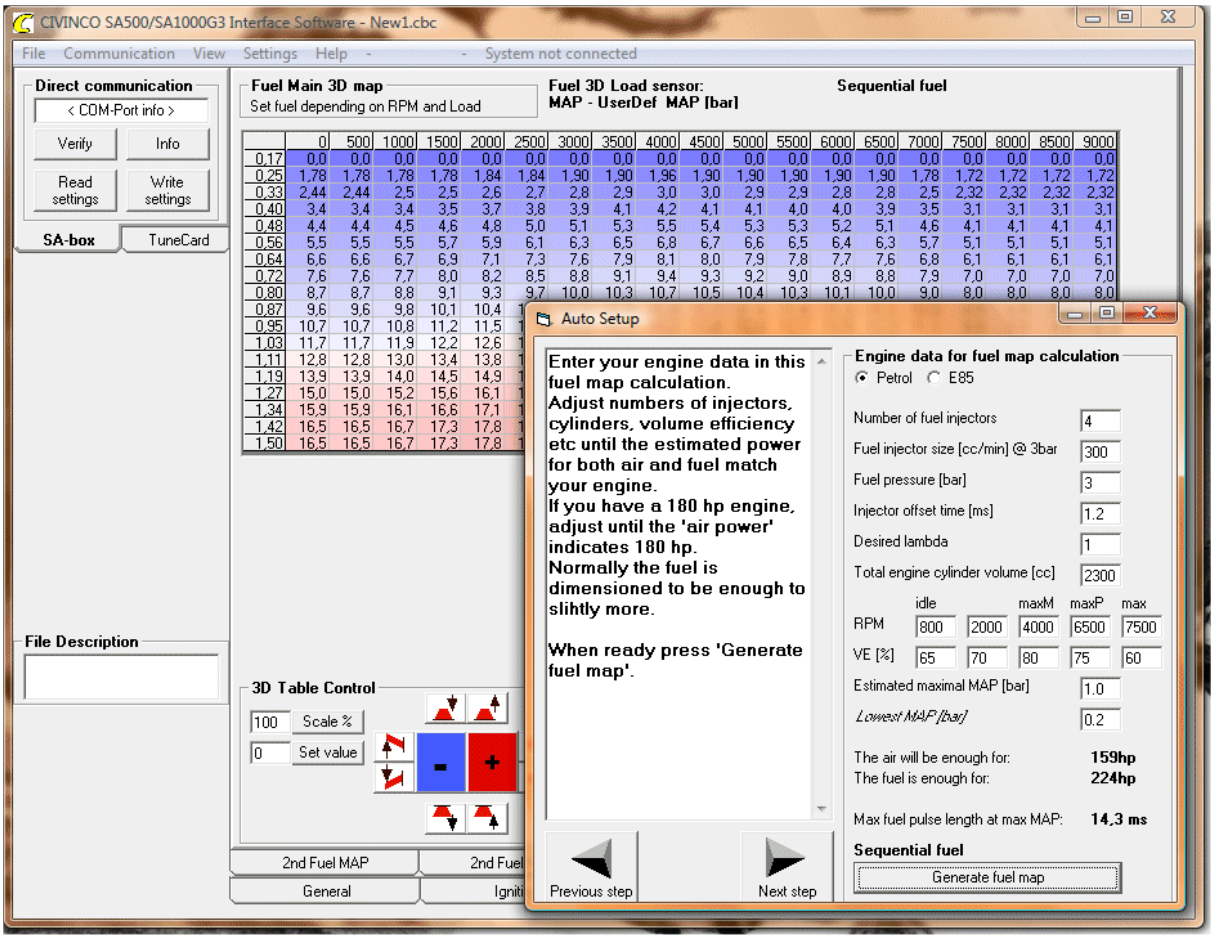
results in

	0	500	1000	1500
0,13	0,0	3,3	6,7	10,0
0,21	0,0	3,3	6,7	10,0
0,29	0,0	3,3	6,7	10,0
0,36	0,0	3,3	6,7	10,0
0,44	0,0	3,3	6,7	10,0
0,52	0,0	3,3	6,7	10,0
0,60	0,0	3,3	6,7	10,0

AUTOSETUP

If you want to create your absolutely first base map, there is a guide which helps you step by step to get the first fuel and ignition map

You find this guide under the menu Settings / Auto setup guide.



Follow the guide and click next step when you are ready with current step. Sooner or later you will end up with a setting made for your first start attemt.

FUEL

Before you start to tune the fuel, you need to decide how the basic principles of your tuning should be, load sensor, ignition order, number of fuel cells etc.

Choice of load sensor

SA500G3/1000G3 handles 2 fuel maps - 3D Main MAP and 2nd Fuel MAP. The user can select which load sensor to use for respective MAP.

Normal alternative

- 3D Main - MAP & 2nd fuel – not used
- 3D Main - MAP & 2nd fuel – Throttle position
- 3D Main – Throttle position & 2nd fuel - MAP

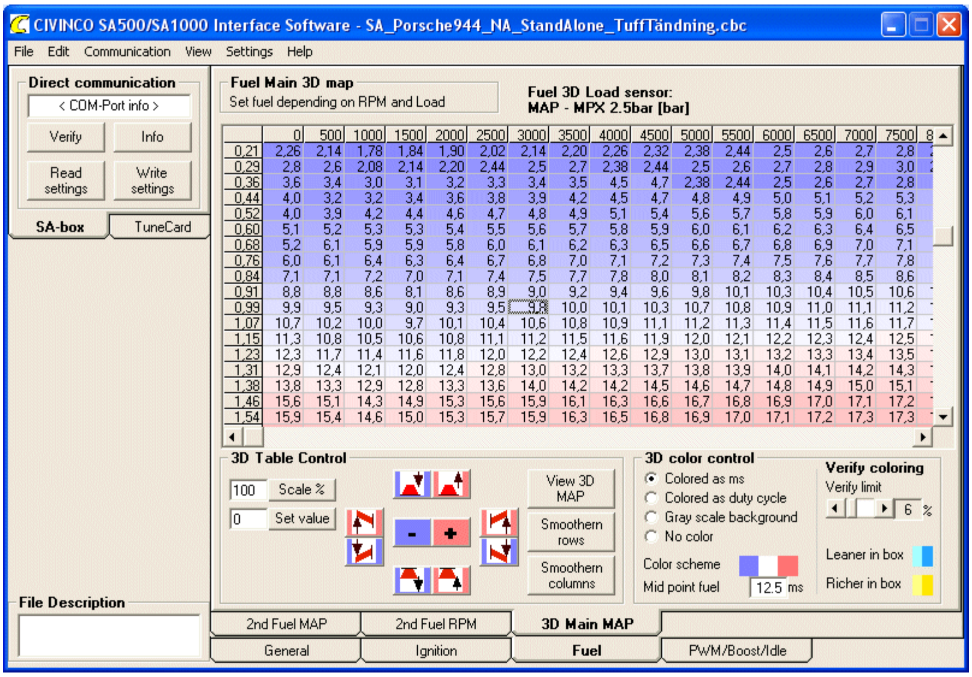
Combining the fuel maps

How the fuel MAP's should be combined is selectable. The normal mode is that the fuel maps are added together.

RPM and load resolution (number of cells)

You can adjust the number of load and rpm cells you want to have in the fuel map. You can also select which load and rpm values to use in each cell, to make sure you map exactly as you desire. If you already have made a map and want to change axis in some way, you can save this map and convert it to the new axis setting.
These settings are made under Settings – fuel maps.

MAIN FUEL MAP BASED ON LOAD AND RPM



For each rpm and each load you set the desired fuel pulse length.

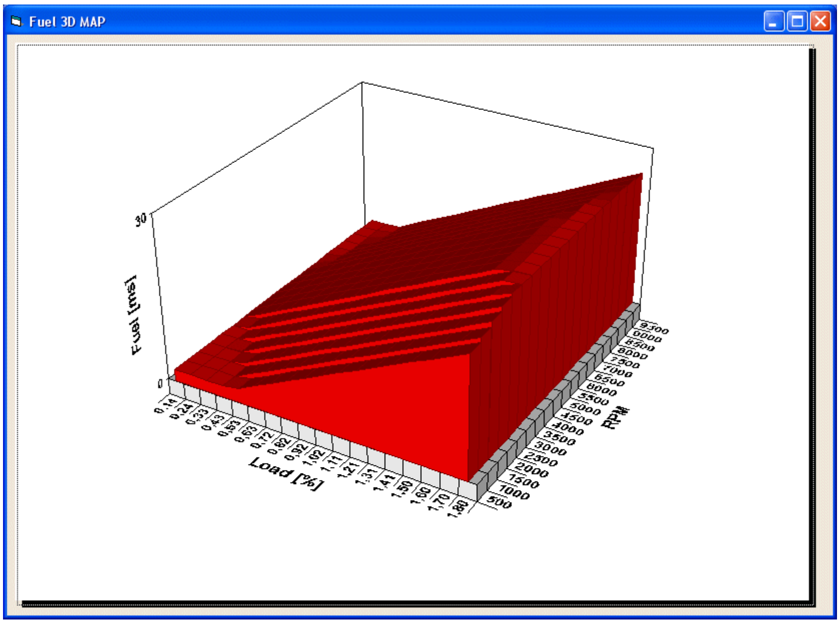
In this example at 3000 rpm and 1.11 bar MAP, the engine gets 16.3 ms fuel.
The system linearize between the cells, so at 3250 rpm, the engine gets 16.75 ms fuel.

3D Table control

All cells can be adjusted in "group" to more easily adjust and change the slope of the fuel.
See also Table Control

View 3D MAP

Opens a separate window and shows the 3D graph visualizing the fuel setting.



3D color control

Controls how the fuel values should be represented in colors.

Verify coloring

When using "Verify" the system compares the fuel map with the current map in the SA500 box. If there is a difference, the difference is represented in different colors depending on how large the difference is.

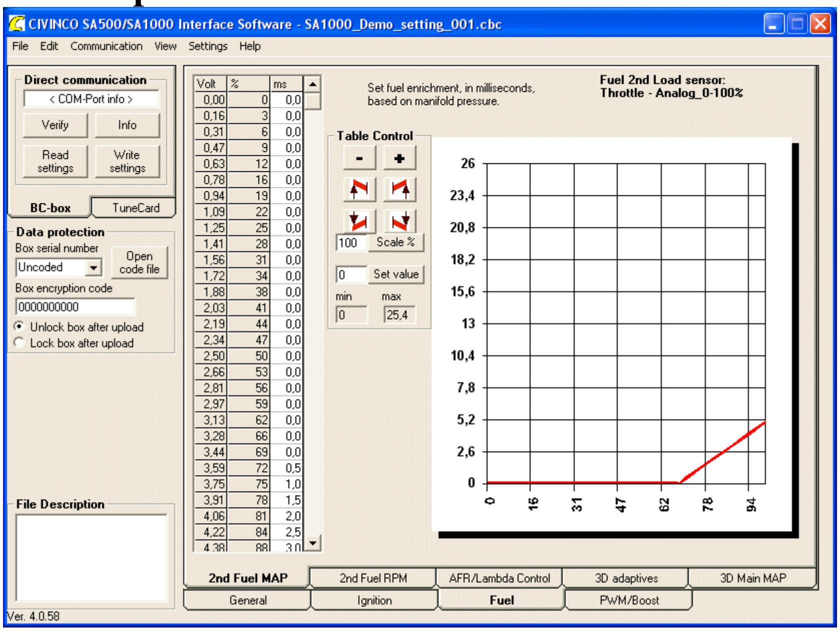
FUEL MAP 2

The normal reason to use two fuel maps is if you have a turbo- or supercharged engine that is modified in a "extreme" way so there is not much vacuum in idle and maybe very choppy MAP signal on high load. The more extreme engine needs to be tuned at throttle position (main map), but also needs compensation when the boost kicks in (2nd fuel map).

Fuel map 2 are of the type 2.5D, i.e. you tune load and rpm separately. You set desired fuel depending on load, and then how you want this fuel to be compensated by the rpm. Click F6 to see the resulting 3D-graph.

See page Setting – fuel map.

Fuel map 2 based on load



First tune how fuel should depend on load. Normally more fuel at increased load.

Table data

In the left column the input voltage for selected sensor is shown.
The value in the middle column varies depending on which kind of sensor you choose in "Used Analog Sensor".
In the column to the right, you choose fuel (in mille seconds) depending on load.

Fuel map 2 based on rpm

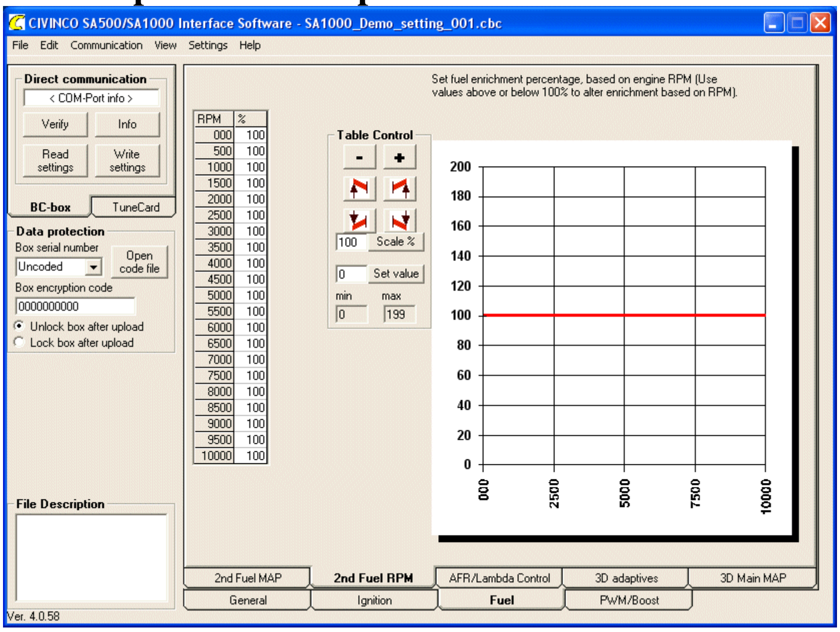
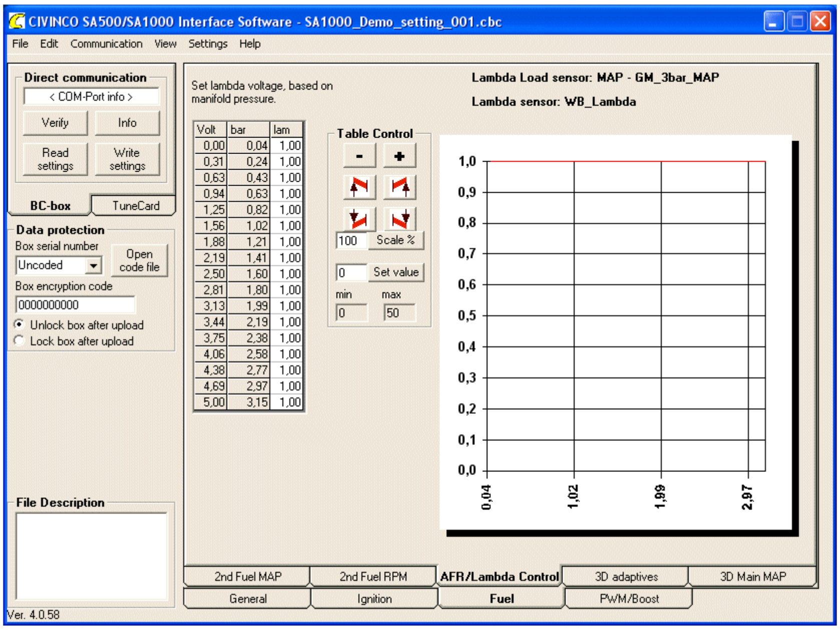


Table data

In the column to the right you enter the fuel compensation depending on the RPM, compared to the value you entered in the ”Fuel Load”-tab. Example: if you have a specific load which specify 3 ms extra fuel and you have entered 50% at 2000 rpm and 150% at 3000rpm in this RPM table, the resulting fuel will be 1.5 ms at 2000rpm and 4.5 ms at 3000rpm.

FUEL BASED ON AFR



If you have selected to use closed loop wide band AFR control, you can in this table specify different AFR at different load. See also Settings – AFR closed loop.

IGNITION

Before you start to tune the ignition, you need to decide how the basic principles of your tuning should be, load sensor, ignition order, number of fuel cells etc.

Choice of load sensor

SA500G3/1000G3 handles 2 ignition maps - 3D Main ignition and 2nd Ignition load. The user can select which load sensor to use for respective MAP.

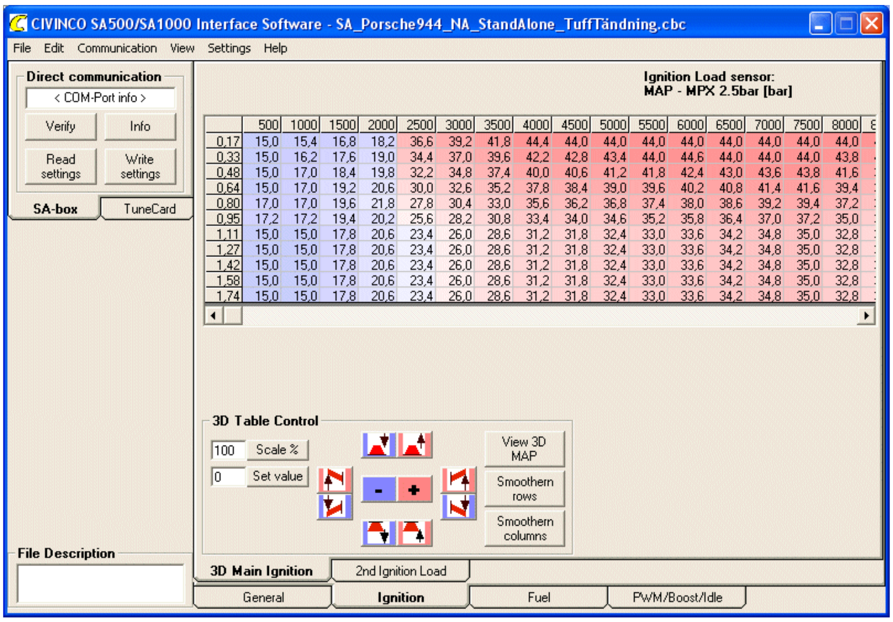
Normal alternative

- 3D Main - MAP & 2nd ignition – not used
- 3D Main - MAP & 2nd ignition – IAT or knock sensor
- 3D Main – Throttle position & 2nd ignition - MAP

RPM and load resolution (number of cells)

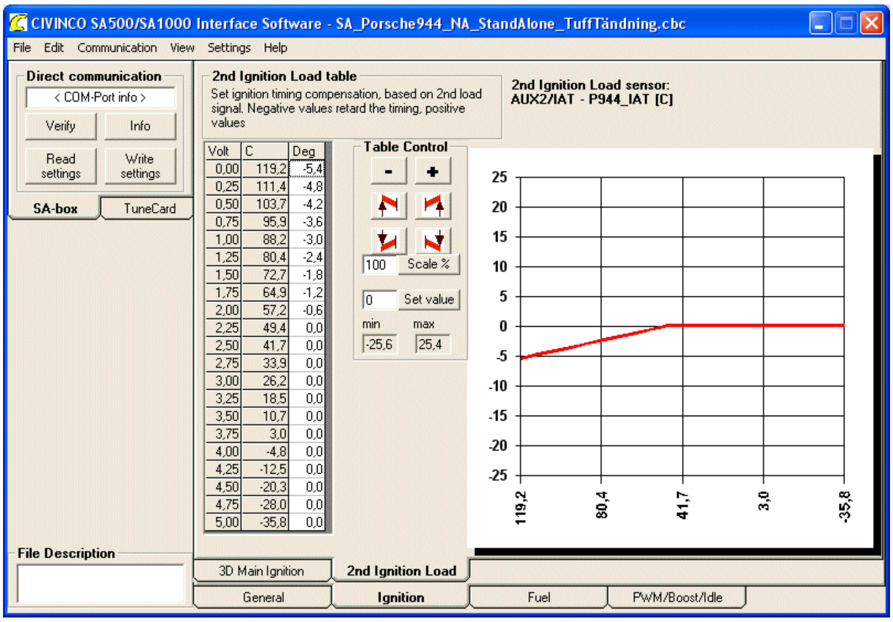
You can adjust the number of load and rpm cells you want to have in the ignition map. You can also select which load and rpm values to use in each cell, to make sure you map exactly as you desire. If you already have made a map and want to change axis in some way, you can save this map and convert it to the new axis setting.
These settings are made under Settings – ignition maps.

IGNITION BASED ON RPM & LOAD



Normally you need more advanced timing at higher RPM. This used to be controlled by centrifugal weights in the distributor.

2ND IGNITION BASED ON LOAD

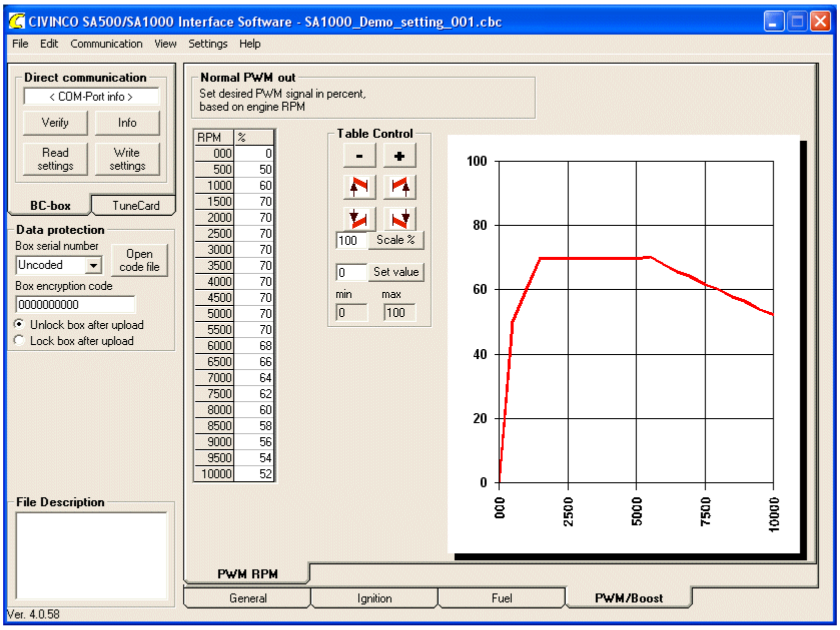


There are 2 independent ignition maps for use with two different load signals. This can be used to retard ignition at high intake air temperature. It can also be used with a knock sensor that can retard the ignition. You can adjust the timing +-25 degrees.

PWM1-4, BOOST CONTROL AND IDLE CONTROL

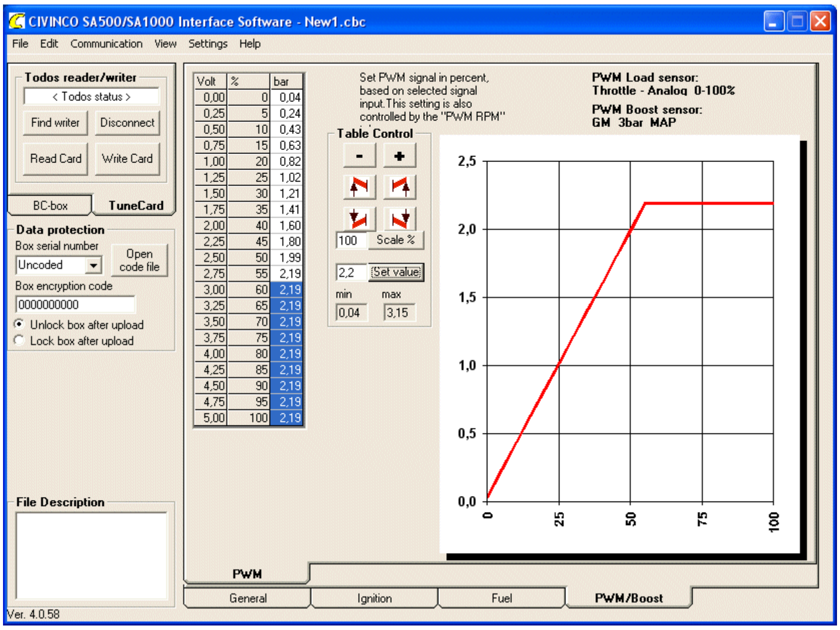
The BC-system has 4 independent PWM outputs which can be mapped depending on load or rpm. PWM1 can also be used for closed loop boost control.
Also see chapter PWM-signals to better understand what a PWM-signal is.
To set desired PWM function see page Settings - PWM

BOOST/PWM BASED ON RPM



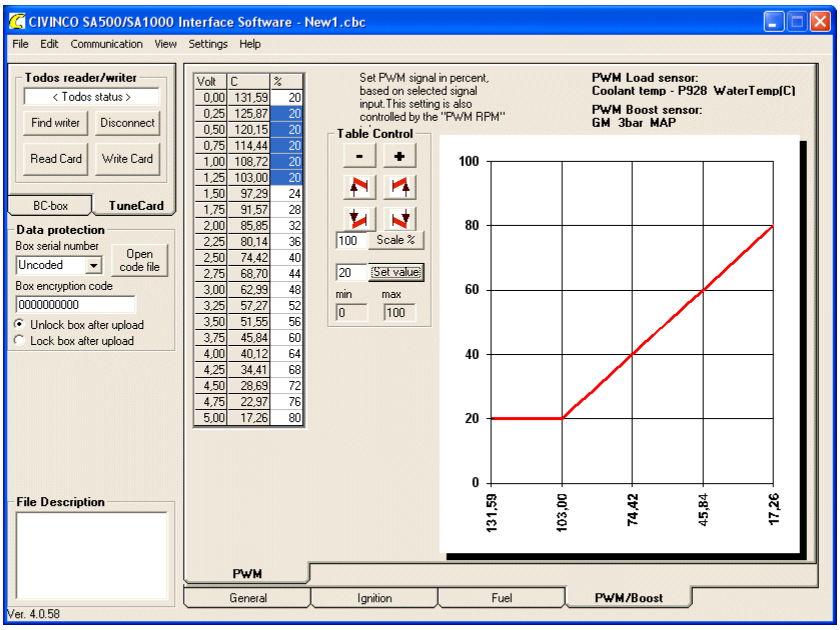
Here you can set desired PWM-duty cycle depending on load.

BOOST DEPENDING ON ANALOG INPUT SIGNAL AND CLOSED LOOP



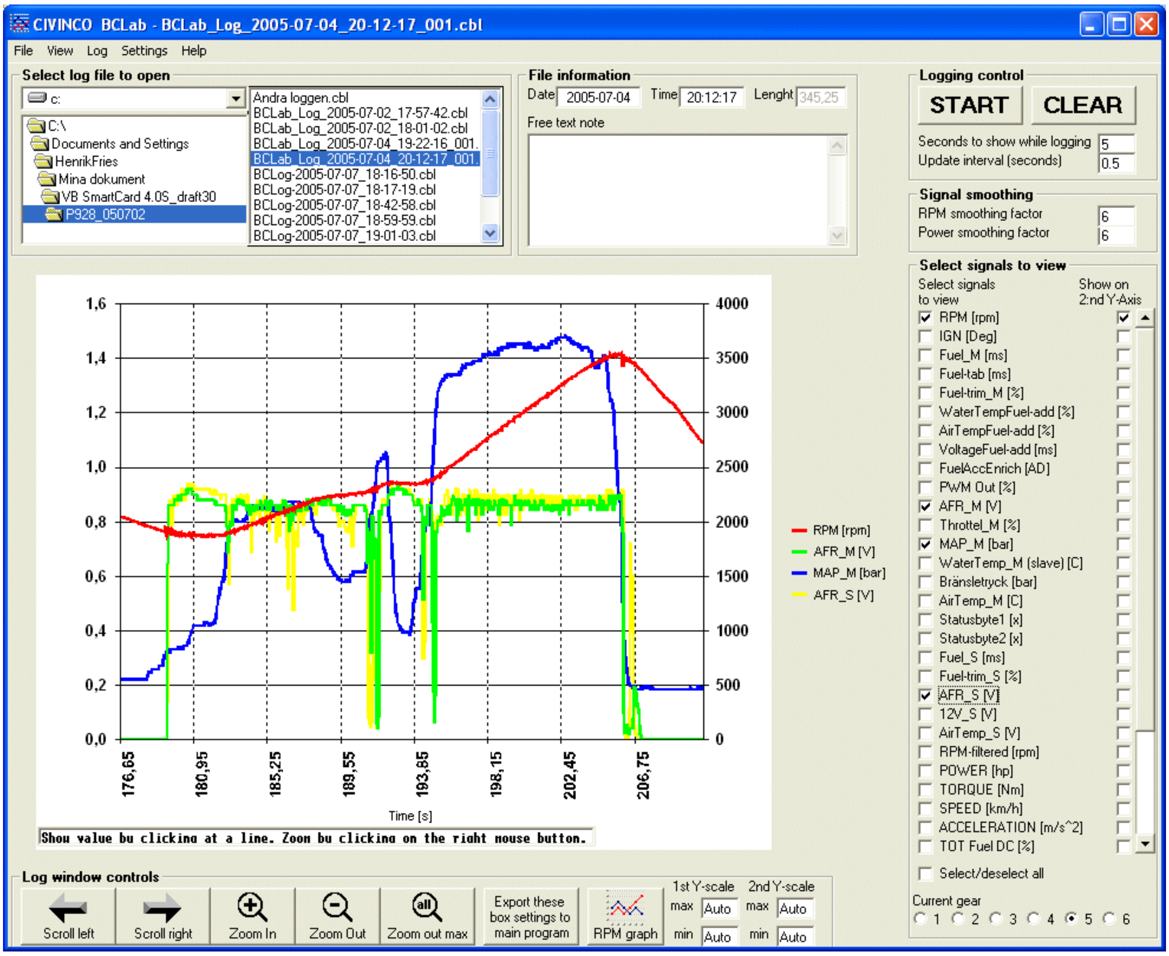
With this tab, you can set which boost you desire depending on an analog input signal for instance throttle position. With this you can create more “economic” setting to save the turbo charger and get a smother response.

PWM BASED ON COOLANT TEMPERATURE



If you have set the engine temperature as load signal for one of the PWM-outputs, you can select desired PWM depending on temperature. If you connect the PWM-output to an idle engine, you can adjust the idle rpm depending on engine temperature.

LOGGING



In BCLab you can log all engine signals that is connected to the system in real time with 20 samples per second. BCLab can also calculate and present a number of extra signals like:

- Power and torque
- Speed and acceleration
- Duty Cycle on output fuel
- Fuel consumption

BCLab presents all the logged data in a graph, which also can be saved to a file for later use.

Select log file to open

Double click at a file in the window to open it. If you only click on the file, you will see a preview without open it to enable easy browsing the files.

File information

At logging the date and time will automatically set. In the free text window it is possible to write your own comments.

Logging
Starts, stops and clear the logging. Make sure the system is connected first via an USB cable

Seconds to show while logging
Here you set how many seconds of the log that should be visible during logging (running window). If you have a slow computer you should decrease the number of seconds. Normally 5-10 seconds.

Update interval
Here you set how often the window should be updated during logging. Normally 0.1-1 seconds.

Chart scale options
Here you set the maximal and the minimal value on respective y-axle. If it says "Auto" it is automatically adjusted for best view.

Select signals to view
Here you select which signals to view. You can also select if the signal should be visible on the left or right y-axle. This is good if you look at signals with a big difference in value (example RPM and Volt). Normally the RPM is showed on the 2nd axle and all the other signals on the 1st axle.

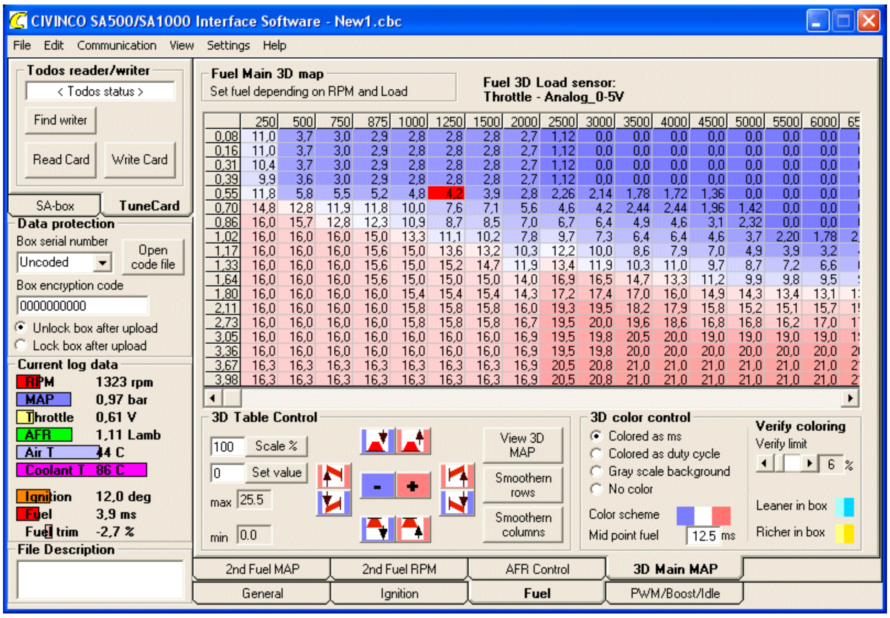
Chart controls
Scroll left
Moves the graph to see earlier values
Scroll right
Moves the graph to see later values
Zoom in
Zoom in the graph 2 times.
Zoom out
Zoom out the graph 2 times.
Zoom all
Zoom out so that all values are visible.
Redraw
Redraw the graph.

Export these settings to box
All engine settings are automatically saved together with the log data. If you open an old log file, you can click on this button to transfer the settings from the log file to the main program. This makes it possible to restore the settings you had when you made the current log.

Also see chapter BC Log settings for all log settings.

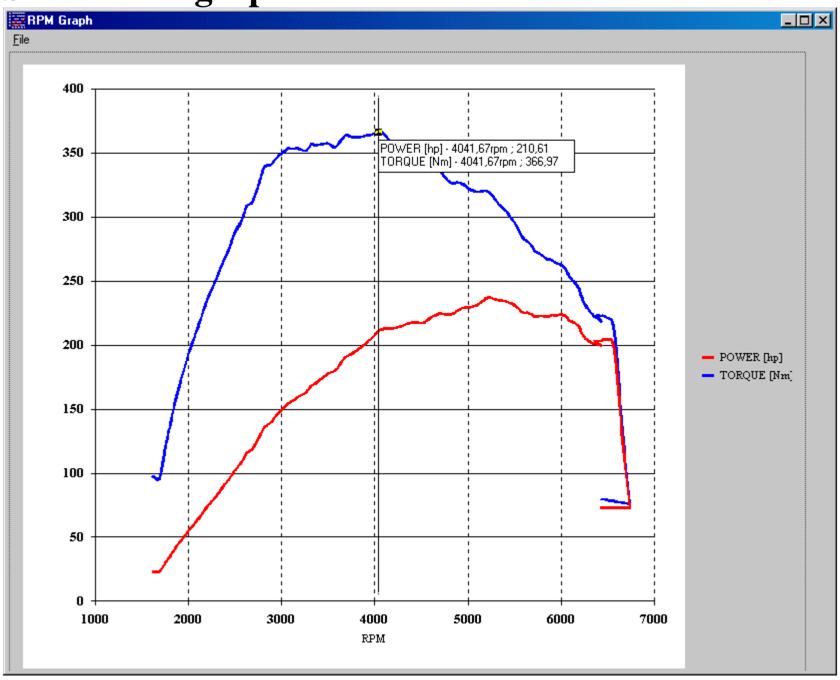
Live Data changes during logging

If you do changes in the mapping or settings during logging, these changes will take part immediately. You do not have to press “Write” for the changes. This makes it easier to make changes in the mapping and immediately see the changes in the log file. I.e if you make fuel adjustment, you can see the AFR change right away.



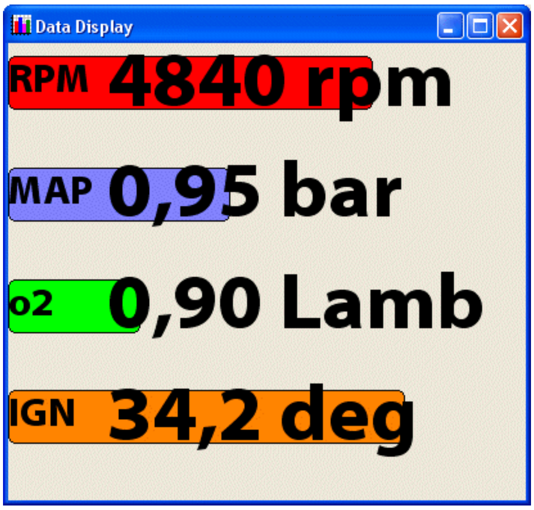
The log data is also shown in the tuning program as a red cursor in current load/RPM cell.

Show RPM graph



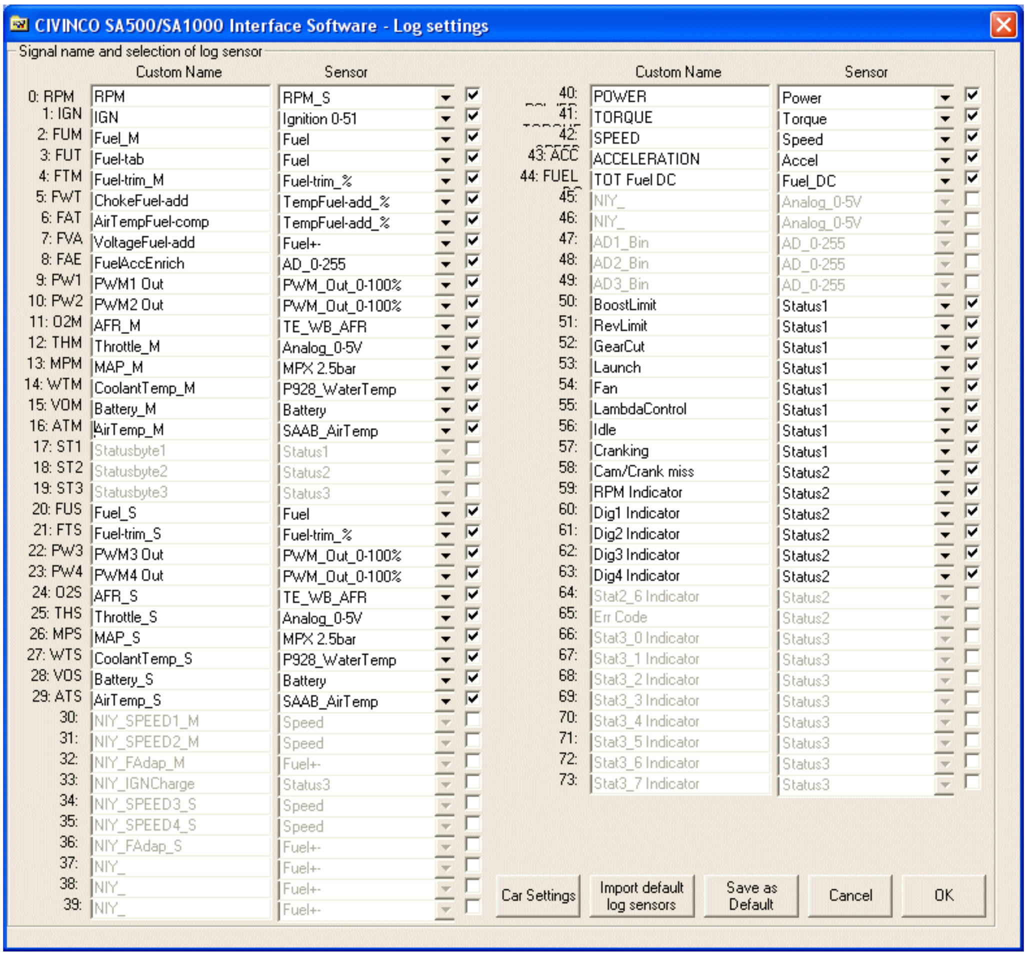
In the RPM-graph all the log data is showed with rpm instead of time on the x-axle. This is good for analyzing data that depends on RPM like power, torque, AFR etc.

LOGGING WITH EXTERNAL DISPLAY



If you only want to view some parameters from the log window you can open a separate window that shows the same parameters as in the log window but as bars and numbers. Short command to open the display is Shift + F8

LOG SETTINGS



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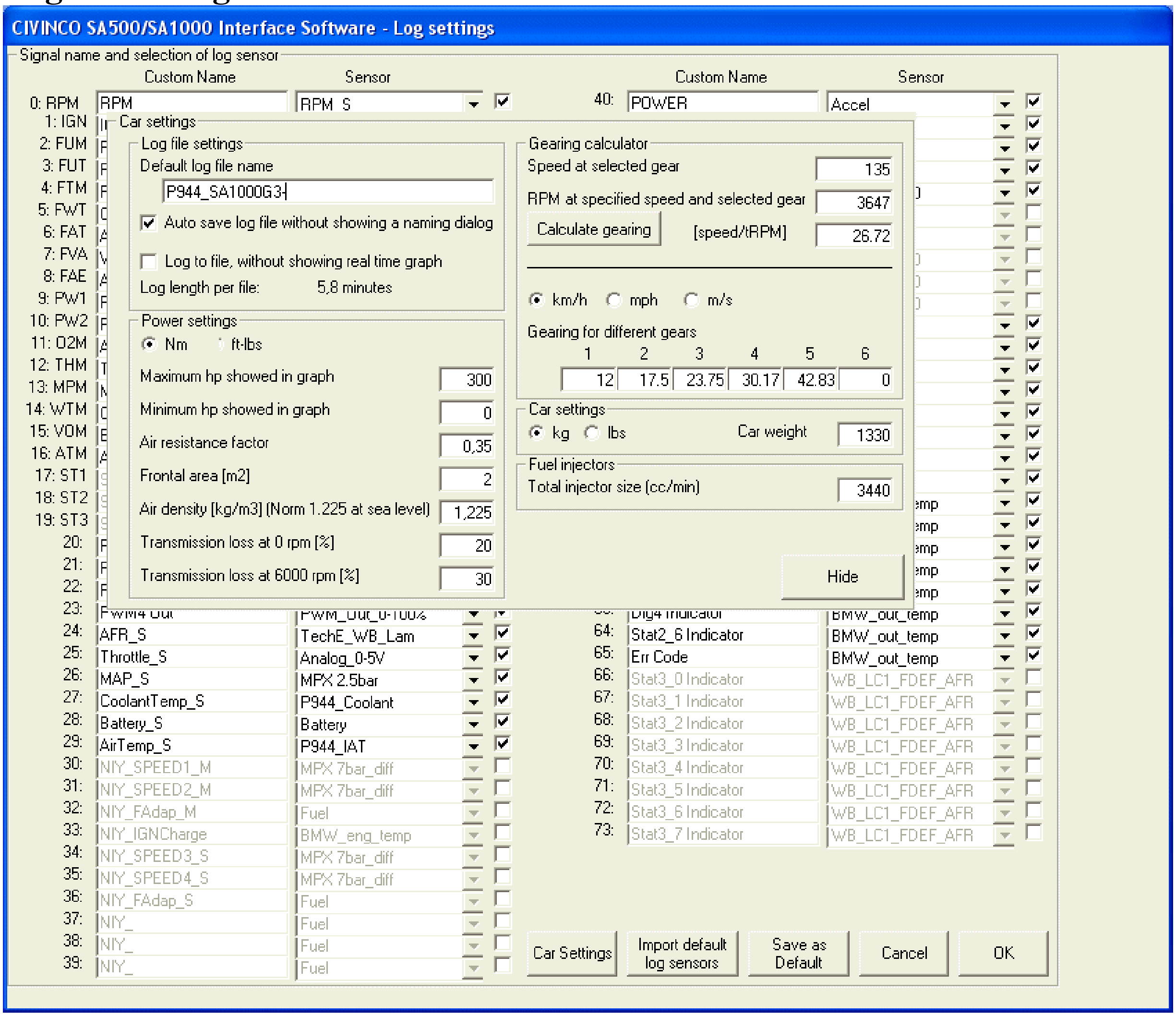
Signal name and selection of log sensor

BCLab can log up to 75 signals. All the signals have got a default name, which can be changed by the user to simplify the reading depending on your specific situation. For each signal you can also select different sensor definitions depending on if you like to analyze the signals in Volt or AFR etc.

Also have a look at chapter Sensor specifications for more information about sensors.

Log file settings



Default log file name

The name you want to show as default.

Auto save

If you like the files to automatically be saved when stop logging. The log file will automatically be named with default name and time.

Fuel injectors

Specify the size of the fuel injectors for the fuel calculations.

Other settings

Import default log sensors

If you open an old log file, you can import newest sensor definitions from the default file to the old log file.

POWER CALCULATION

The power calculation is based on the acceleration of the car at full throttle. To make sure the power calculation is as correct as possible you must make sure you know the weight of the car, is running on absolutely flat road and also know the air resistance and the power train losses. If you make two runs without changing these parameters you can be sure that you can compare the runs with high accuracy. .

First of all you need to set the right gearing ratio. Normally it is suitable to make full throttle pulls at 3rd gear. Easiest to find the gearing is to make sure how fast you run at a certain RPM at a certain gear, and use the calculator. The best way is to use a GPS to detect true speed, but speed meter is almost as good. Just make sure you do not change tire to different size.

Next the weight is very important, just as the car was at the run. Either you weigh the car, or make estimation. The power is proportional to the weight, so if you enter half the weight the power also is halved

It is also important to add losses for the air resistance. If you want to see exactly how much the air resistance adds, enter car weight 0lbs and transmission losses to 0.
Typically the air resistance is 12hp at 60 mph and 100 hp at 120 mph

Finally you need to estimate the power train losses if you want to know the power at the crankshaft. Typically this is 15-25%.

If you want to compare the numbers with Dyno numbers or car manufactures, it is good to know that the power numbers is given from a specific standard. For instance normally the power is given at a specific temperature (70F) An engine produces more power if it is cold, so the standard compensates for this and lower the numbers if it is cold during the run.

Car weight

Specify the weight of the car. This is used for power calculations.

Gearing calculator

You can write the cars gear ratio directly in the box ”Gearing”. If you don’t have access to this the program can calculate it for you. Specify rpm, speed and gear and click “Calculate gearing” and the program calculates your gear ratio on that gear. This matters when you calculate engine power and speed. The graph values are only correct for the calculated gear. You can choose which gear you want the program to use during engine power calculation in the log window.

Power settings

Min/max values

Here you can filter how large and how small values you want to see in the graph to hide wrong values during gearing etc.

Air resistance

If you know the air resistance of the car, the Cw number, and the frontal area of the car, you can compensate for it in the power calculation. The resulting power will then be true wheel horse power. The Cw and frontal area numbers you can sometimes find in the technical manual of the car. Typically the Cw varies from 0.3 to 0.35. A medium sized car has frontal area of about 2 m^2.

Power train losses

If you know the transmission losses or want to make an estimation to have the power on the crankshaft this is possible. You enter the estimated loss in % at 1000 rpm and 6000 rpm. If you think you have 20% for all rpm, you enter this in both boxes.

MAIN MENU FOR LOGGING - FILE

Open

Open an old log file, called .cbl files

Save

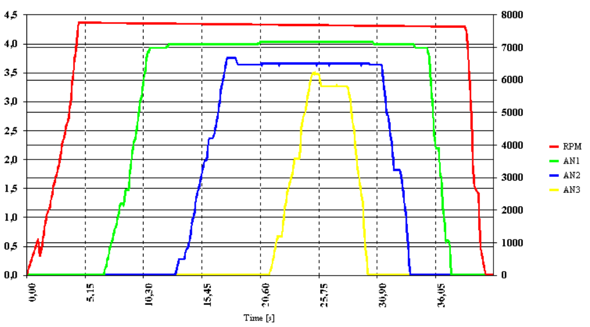
Save current log file.

Save As

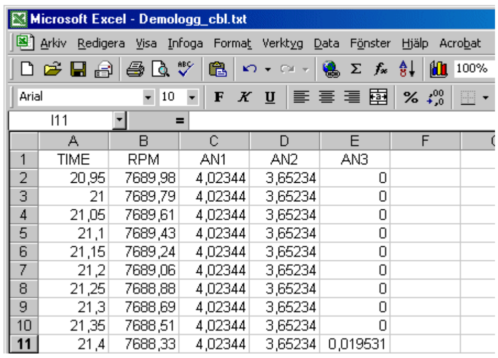
Save current log file with new name.

Export log data

Save the log data as a image or as an text file which can be opened in Excel.



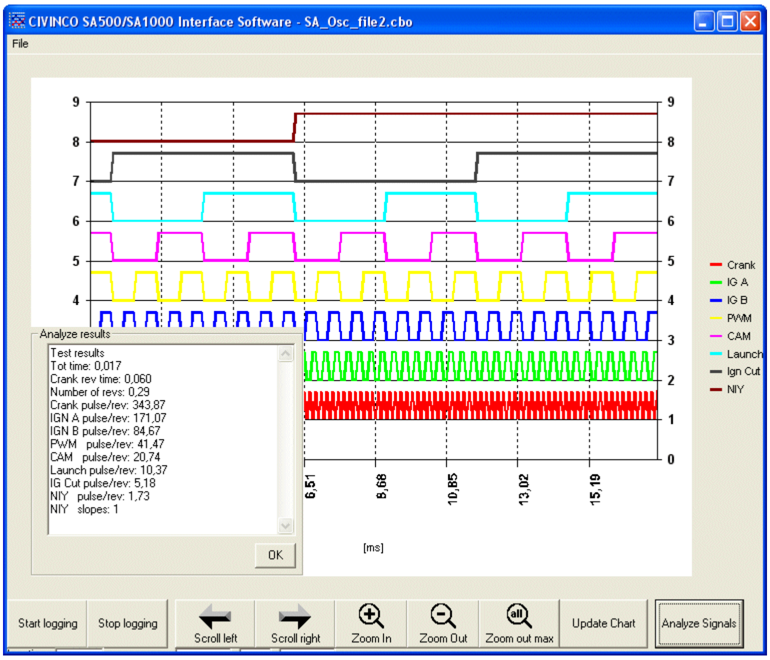
Current log exported as image



	A	B	C	D	E	F
1	TIME	RPM	AN1	AN2	AN3	
2	20,95	7689,98	4,02344	3,65234	0	
3	21	7689,79	4,02344	3,65234	0	
4	21,05	7689,61	4,02344	3,65234	0	
5	21,1	7689,43	4,02344	3,65234	0	
6	21,15	7689,24	4,02344	3,65234	0	
7	21,2	7689,06	4,02344	3,65234	0	
8	21,25	7688,88	4,02344	3,65234	0	
9	21,3	7688,69	4,02344	3,65234	0	
10	21,35	7688,51	4,02344	3,65234	0	
11	21,4	7688,33	4,02344	3,65234	0,019531	

current log exported to Excel

OSCILLOSCOPE LOGGING



This is a high speed log mode for logging of the digital inputs with 1000 samples per seconds. This makes it possible to log cam and crank to find timing or errors.

MAIN MENU

MENU – FILE

Open
Open Tune card files with car settings, named .cbc files.

Save
Save current settings to a TuneCard-file.

Save As
Save current settings to a TuneCard-file, with a new name

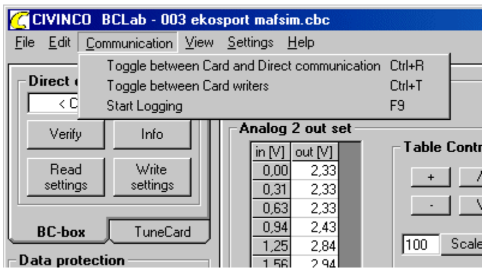
Exit
Quit BCLab

MENU – EDIT

Undo
Regret latest change.

Redo
Redoes the latest "Undo"

MENU – COMMUNICATION



For more details see page General/Chipdrive status

Toggle between Card and Direct communication (Ctrl+R)
Change between communication with the BC-system and the Tune Card writer. Same as click on the tab ”BC-box” or ”TuneCard”

Toggle between Card writers (Ctrl+T)
Toggle between different tune card writer types. Currently Chipdrive and Todos are supported.

Start Logging
Start logging without first opening the log window.

MENU – VIEW

3D-view

Opens a separate window and shows the 3D view for the ignition map, 2nd fuel map and the PWM map. Also have a look at 3D-view.

Log window

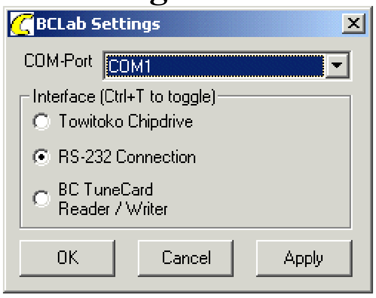
Opens the log window. See also Logging.

Oscilloscope

Opens high speed logging. See Oscilloscope logging.

MENU – SETTINGS

PC settings



Com-port (Virtual USB Com port)

Here you select to which com port the system is connected. When installing the USD driver which is provided with the system, each USB connector on your PC will get a dedicated com port number.

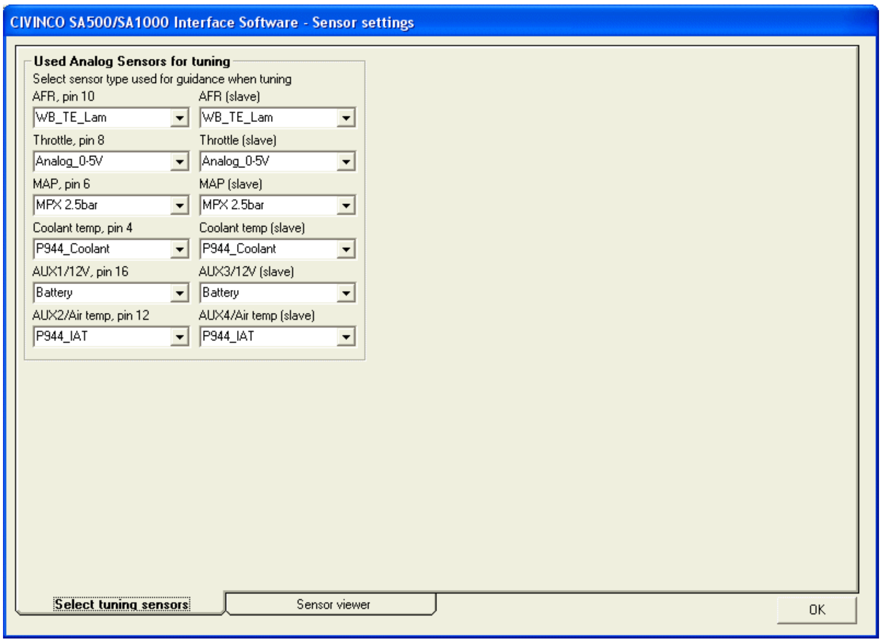
Interface

Here you select how you like to communicate with your tune cards. See also The tab General/Chipdrive status

Log settings

Open the log settings window. See also log settings.

MENU-SENSOR SETTINGS



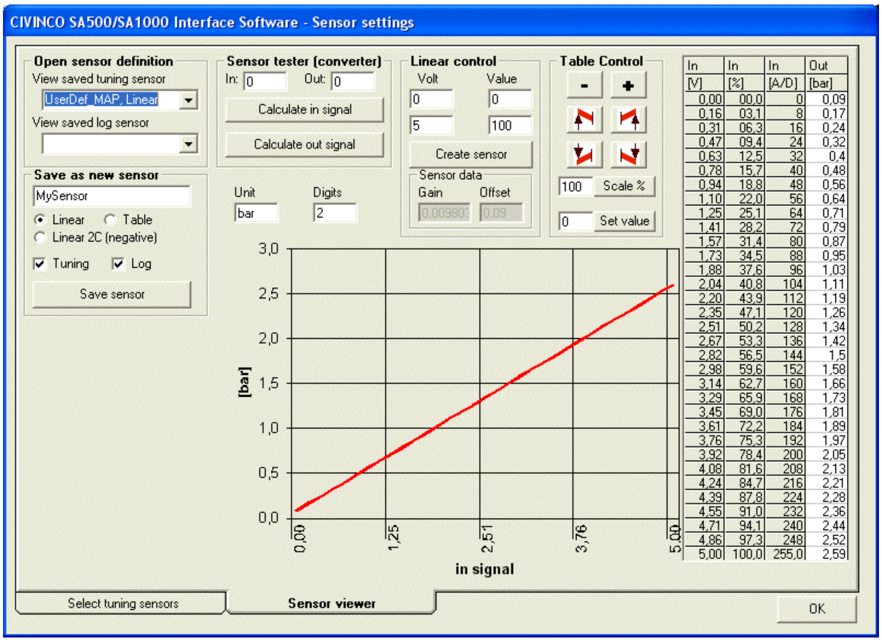
You can connect many different analog sensors to the BC-system. Most likely the stock sensors of the car, but also AFR, MAP etc. All the sensors sends an analog signal that varies between 0 and 5 Volt. The sensor definitions is a translation between Volt and the unit you prefer to view the signals in (bar, inches of vacuum, AFR, Fahrenheit etc.)

In the BCLab there is two sensor setups which are separated. One for the tuning part of the program, and one for the logging part of the program. The sensor definitions can be totally independently set up. These setups handle the tuning part.

Used Analog Sensor
Specify what kind of sensor you like for each analog input.

The sensors used for logging is adjusted in log settings

MENU - SENSOR VIEWER



Here you can have a look at a specific sensor..

There are 3 different types of sensors.
Linear, - Saved as a straight line.
Linear with special negative values – Saved as a line, but made to represent negative values which is sent from the BC-system to the PC.
Table sensors. – Saved as a 33 rows table with 0.16V per step, where you for each voltage can specify the sensor data. This is typically used for unlinear temperature sensors.
These tuning sensors are stored in the setup file with ending .ini in the program folder.

Open sensor definition

Open an already saved tuning or log sensor.

Save as new sensor

If you have edited an existing sensor or created a new one, you can save it by this control.

Enter desired name. If you use a name which already exists, it will replace the existing.

Select which type of sensor you have created, and select the right alternative.

Finally choose if you want to save as tuning sensor, log sensor or both.

The sensor definitions used for tuning are stored in the folder where you installed the program in the SA500_1000.ini file.
Sensors used for the log part of the program are stored in each log file (xxx.cbl) which are located where you selected to store them.

The log sensor definitions that are used as default when you start the program are stored in the file Default_Log_Settings.cbl file that is located in the same folder as the program installation.

Sensor tester
A calculator which is used for testing your sensor definitions. You can use it both for forward and backward calculation.

Linear control
If you have created a linear sensor or a 2c sensor, you create the definition by specifying two points at the line.

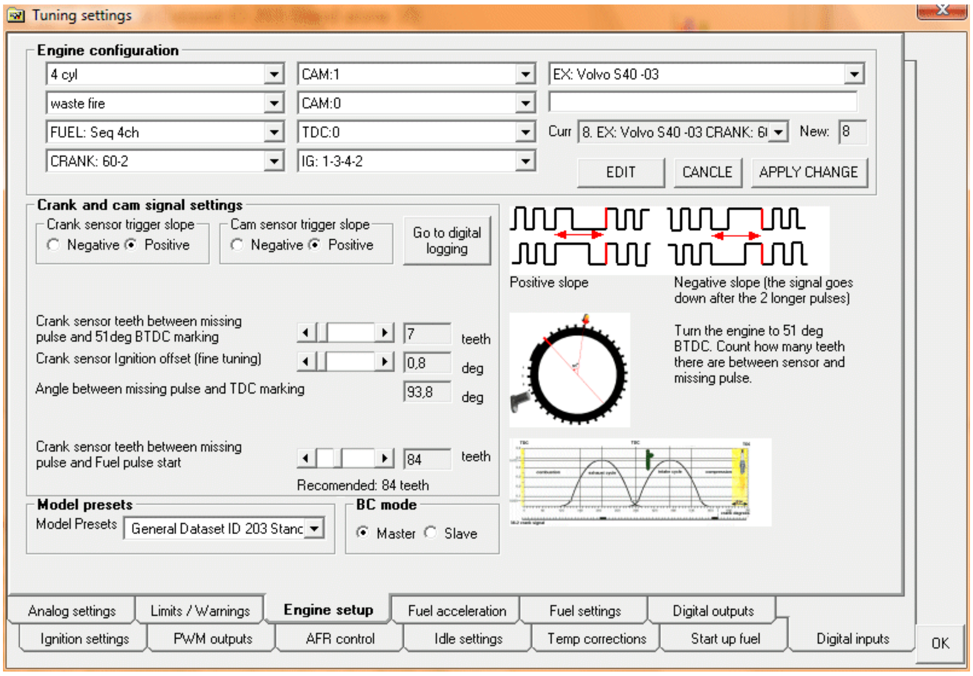
Table control
If you have created a tab sensor, you are free to change all values in the table with help of this tool. You can also enter the values directly into the table.

MENU – HELP

Go to Civinco
Opens the Civinco home page www.civinco.com in your browser
Help file
Opens up this help file
About
Tells you which BClab version you currently have installed

SETTINGS – BOX SETTINGS

SETTING – ENGINE SETUP



Engine configuration

Choose which cam and crank sensor setup your engine has.

Engine types supported:

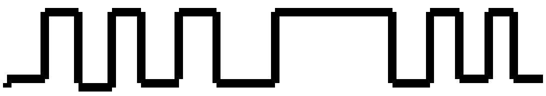
Cyl.	Crank1	Cam1	Ignition	Firing_order	Fuel_system	Car_example
2 cyl	CRANK: 36-1	CAM:0	waste fire	IG: 1-2	FUEL: Semiseq 2ch	EX: Victory Freedom
2 cyl	CRANK: 60-2	CAM:0	waste fire	IG: 1-2	FUEL: Semiseq 2ch	EX: Victory Gen1 -01
4 cyl	CRANK: 0	CAM:24	distributor	IG: 1-3-4-2	FUEL: Seq 4ch	EX: TOYOTA CELICA CS
4 cyl	CRANK: 0	CAM:4	waste fire	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Mazda Miata Gen1 -98
4 cyl	CRANK: 130	CAM:0	distributor	IG: 1-3-4-2	FUEL: Semiseq 4ch	EX: Porsche 944 -83-87
4 cyl	CRANK: 22-2	CAM:1	distributor	IG: 1-3-4-2	FUEL: Seq 4ch	EX: VOLVO 360 Special
4 cyl	CRANK: 36-2	CAM:0	distributor	IG: 1-3-4-2	FUEL: Semiseq 4ch	EX: Civinco 4cyl, semisequential
4 cyl	CRANK: 36-2	CAM:1	distributor	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Civinco 4cyl, distributor
4 cyl	CRANK: 36-2	CAM:1	waste fire	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Civinco 4cyl, waste fire
4 cyl	CRANK: 4	CAM:3	waste fire	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Mazda Miata Gen2 99-
4 cyl	CRANK: 60-2	CAM:0	distributor	IG: 1-3-4-2	FUEL: Semiseq 4ch	EX: Volvo 740 88b and later
4 cyl	CRANK: 60-2	CAM:0	waste fire	IG: 1-3-4-2	FUEL: Semiseq 4ch	EX: Volvo 740 88b and later, mod to WF
4 cyl	CRANK: 60-2	CAM:1	waste fire	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Volvo S40 -03
4 cyl	CRANK: 60-2	CAM:1	distributor	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Honda CRX -91
4 cyl	CRANK: 60-2	CAM:1	direct fire	IG: 1-3-4-2	FUEL: Seq 4ch	EX: Audi 1.8T -96
5 cyl	CRANK: 270	CAM:1	direct fire	IG: 1-2-4-5-3	FUEL: Seq 5ch	EX: Audi S2, 5 cyl -95
5 cyl	CRANK: 270	CAM:1	distributor	IG: 1-2-4-5-3	FUEL: Seq 5ch	EX: Audi S2, 5 cyl -92
5 cyl	CRANK: 60-2	CAM:1	distributor	IG: 1-2-4-5-3	FUEL: Seq 5ch	EX: Volvo 850, 5-cyl
5 cyl	CRANK: 60-2	CAM:1	direct fire	IG: 1-2-4-5-3	FUEL: Seq 5ch	EX: Volvo S60, V70, 5-cyl, (w/o E-thottle)
6 cyl	CRANK: 0	CAM:24	waste fire	IG: 1-5-3-6-2-4	FUEL: Seq 4ch	EX: TOYOTA Supra MK3, MK4
6 cyl	CRANK: 116	CAM:0	distributor	IG: 1-5-3-6-2-4	FUEL: Semiseq 2ch	EX: BMW 6 cyl old M5
6 cyl	CRANK: 60-2	CAM:0	distributor	IG: 1-5-3-6-2-4	FUEL: Semiseq 6ch	EX: BMW 525 -88 with distributor
6 cyl	CRANK: 60-2	CAM:1	waste fire	IG: 1-5-3-6-2-4	FUEL: Seq 6ch	EX: BMW M3 3.0lit, BMW 2.5lit
8 cyl	CRANK: 3-47	CAM:82	distributors	IG: 1-8-4-3-6-5-7-2	FUEL: Seq 8ch	EX: Batmobile
8 cyl	CRANK: 36-2	CAM:1	waste fire	IG: 1-5-4-2-6-3-7-8	FUEL: Seq 8ch	EX: Civinco 8cyl, waste fire
8 cyl	CRANK: 36-2	CAM:1	distributors	IG: 1-8-4-3-6-5-7-2	FUEL: Seq 8ch	EX: Civinco 8cyl, distributor x2
8 cyl	CRANK: 60-2	CAM:1	waste fire	IG: 1-5-4-8-6-3-7-2	FUEL: Seq 8ch	EX: BMW 740 V8
8 cyl	CRANK: 60-2	CAM:1	waste fire	IG: 1-3-7-2-6-5-4-8	FUEL: Seq 8ch	EX: PORSCHE 928, converted to 60-2
8 cyl	CRANK: 60-2	CAM:1	waste fire	IG: 1-8-4-3-6-5-7-2	FUEL: Seq 8ch	EX: Chevrolet V8

Cam and Crank signal settings

Crank sensor trigger slope

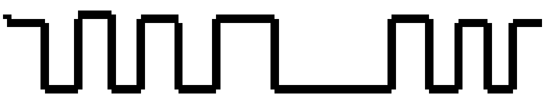
Select if the system should use the positive or the negative slope of the crank signal.

If you have a trigger wheel with missing tooth, the signal can look like this, when observed by oscilloscope or BC-systems high speed logging:

Alt 1: 

Alt 2: 

In alt 1-2 you should select the **negative slope**, because the signal goes down right after the two longer pulses.

Alt 3: 

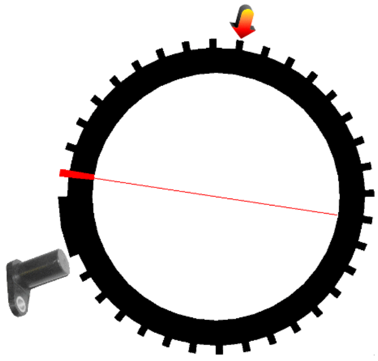
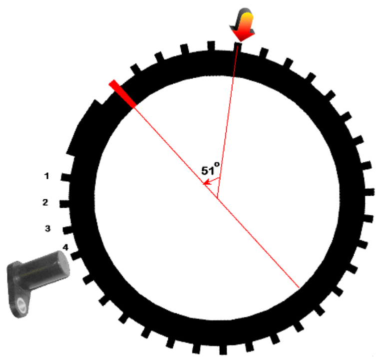
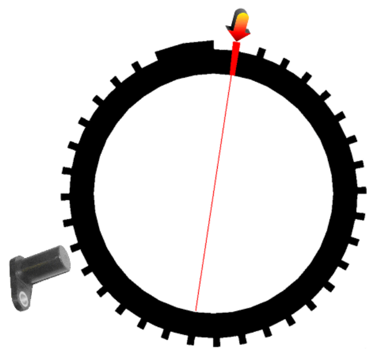
Alt 4: 

In alt 3-4 you should select the **positive slope**, because the signal goes up right after the two longer pulses.

Cam sensor trigger slope
Select if the system should use the positive or the negative slope of the cam signal. Avoid selecting a cam flank that is close to the end of the missing pulse.

Crank sensor teeth
Select how many crank teeth there are between missing pulse and 51 degrees before top dead center of No:1 cylinder.
When the system for the first time sees the missing tooth, it must now exactly where at the rev it is. The BC-system starts it's timing at 51 degrees before top dead center, because the ignition can be trigged from 51° to 0° before TDC. That's why you need to specify the number of tooth between the missing pulse and the 51° before TDC.

Example with 36-2 trigger wheel:

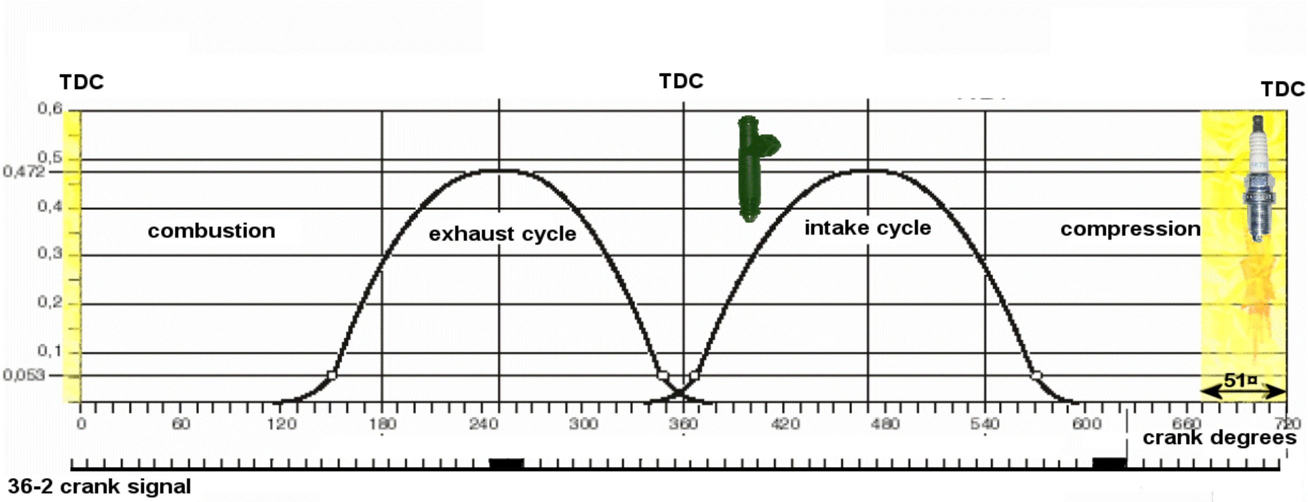
		
Missing tooth has just passed the sensor	Engine at 51 deg BTDC, and it has passed 4 teeth in front of the sensor.	At TDC

Forbidden teeth
For each crank sensor setting, there are a few teeth that are forbidden as base for ignition and fuel. The program automatically detects this and gives a warning if you select a forbidden tooth

Crank sensor offset
If there is not a whole number of crank sensor teeth before the "magic" 51 deg BTDC, this is a fine tuning of the ignition setting. In the example above it could have been 4 ½ tooth.
To make sure you have the right timing, lock the ignition tables to for instance 10 deg all over, and test with a timing lamp that the ignition is really shoot at right spot.

Crank sensor fuel teeth
Select how many crank teeth there are between missing pulse and when you like to start the fuel pulse.

This is important if you want to optimize the fuel at idle and low load when the fuel pulses are short. At full load, the injectors are open most the time anyway and therefore this is not as critical.
BCLab automatically gives a recommendation of which tooth that is the best, 50 degrees after the intake valve is opened.



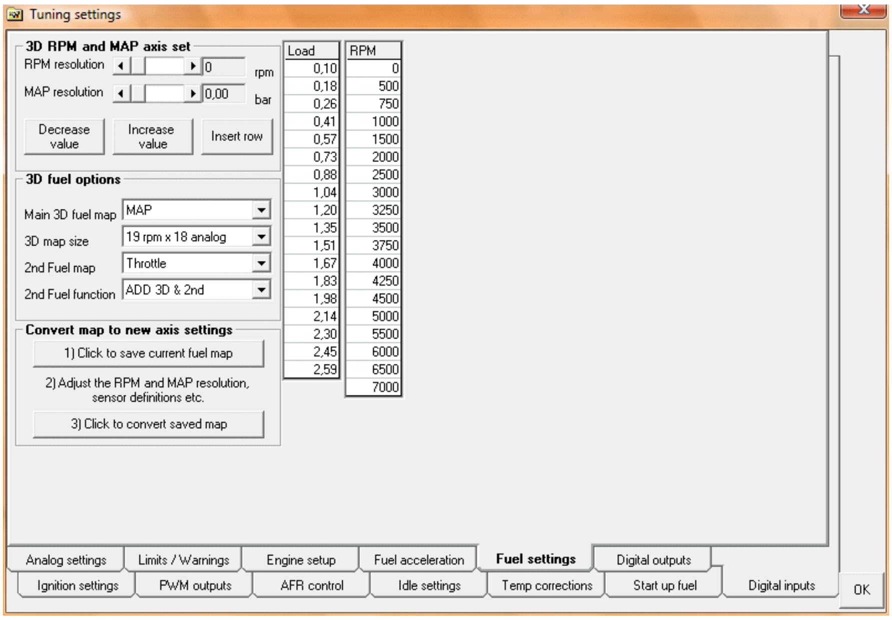
In this example with 36-2 crank sensor, it is optimal to select about 50 pulses, because it is first one whole rev + about 14 tooth before the intake valve is starting to opening. This is valid if you have a sequential system.
If you do not have a cam sensor and therefore using a semi sequential system, so you should select only 14 teeth. (Because the system is reset every revolution, and shoots fuel every rev.

Model preset
Set which software version of BC-system you use. Normally you select the one with highest number. If you try to use the wrong one, the BC-system will give you error message

BC Digital I/O mode
Always "Stand Alone" for stand alone systems.

Box settings
Open the box settings window, from where all the fundamental engine settings are made. See also Settings – box settings.

SETTING – FUEL MAP



3D fuel options

Main 3d fuel map sensor

Select main load sensor to use as base for the fuel map.

3d map size

Select the size of the fuel map. Number of rpm cells x number of load cells

2nd fuel map sensor

Select load sensor to use as base for the 2:nd fuel map

2nd fuel map function

Select how the 2:nd fuel map should be combined with the main fuel map.

- Always add the two maps
- Compensation of main map 0-255%
- Compensation of main map 0-511%

Convert map to new axis

If you already have made a map, but want to change number of cells or desired range, it is possible to convert the current map to the new selection.
1) Save the current map by click at ”Save current map”. The current map is then saved in a new window.
2) Next step is to make all the changes you have in mind (Change size, rpm steps, load or sensors)
3) Finalize by ”Convert saved map” and BCLab will automatically convert the old map to the new format as well as it is possible.

You must be observant and review the map one extra time just to make sure there where no unwanted effects in the conversion. If you have a map from 0-8000 rpm and reduce the range to 0-5000rpm, BCLab is capable to calculate the right value
BUT If you have a map from 0-5000 rpm and increase the range to 0-8000rpm, BCLab have

to guess for the extra 3000 rpm, and the best guess is to use same values as for 5000 rpm column.

Table control

You are free to select RPM and load points for the fuel map. Select which cells to modify and press desired button.

Increase

Increases selected cell. All the cells below automatically changes as well.

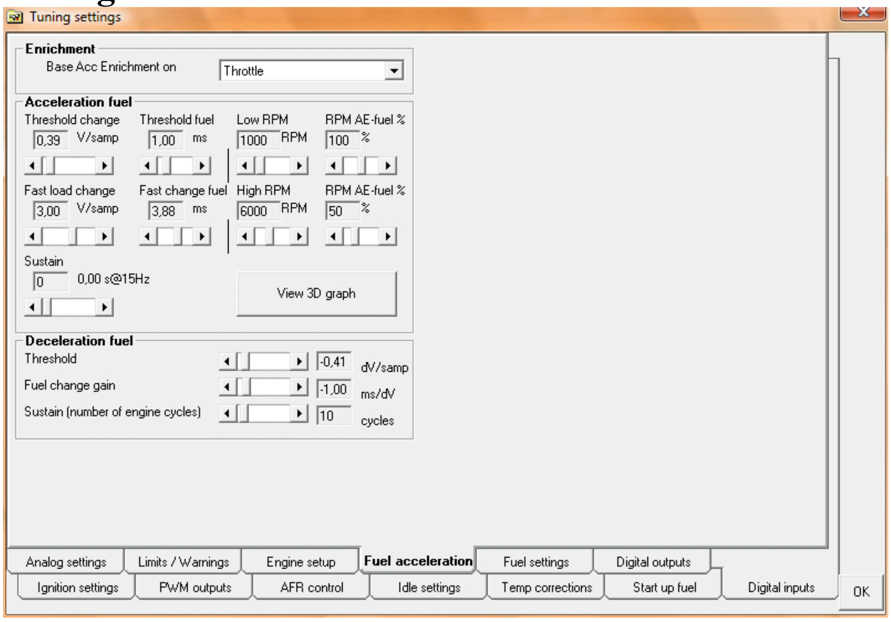
Decrease

Decreases selected cell. All the cells below automatically changes as well.

Insert row

Inserts a new row to make more tuning points in a specific area. This removes the last cell.

Setting – Acceleration fuel enrichment



The system can add acceleration fuel enrichment, based on how fast you press the throttle. The system is measuring the throttle position 20 times/sec.

The acceleration fuel is controlled by three parameters.

Threshold

Threshold sets how much the throttle should be changed to activate the fuel enrichment.

Threshold fuel

Sets fuel pulse length when acceleration fuel is activated.

High load change

Sets a higher load point where you want to specify the acceleration fuel enrichment.

High load fuel

Sets fuel pulse length when high load change acceleration fuel is activated.

Low RPM

Sets a tuning point where you want to specify acceleration fuel.

Low RPM acceleration fuel %

Sets fuel pulse % at low RPM.

High RPM
Sets a high RPM tuning point where you want to specify acceleration fuel.
High RPM acceleration fuel %
Sets fuel pulse % at high RPM.

Sustain
Set how many acceleration fuel pulses the system should give after activation.

View acceleration 3D graph
Show a window with a 3D graph showing the resulting acceleration fuel, depending on RPM and thresholds.

Setting – Deceleration fuel

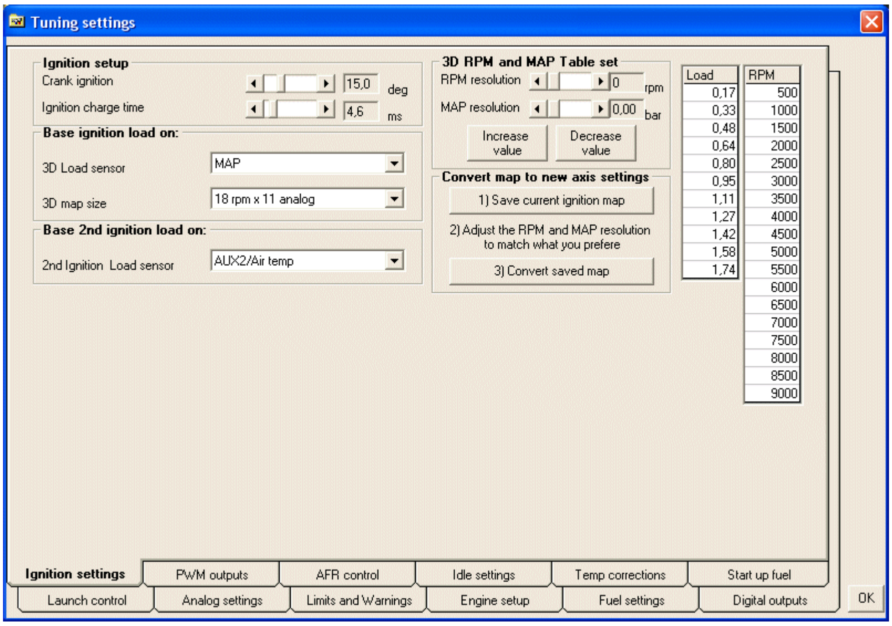
You can also remove fuel when throttele is closed rapidly.

Threshold
Threshold specify minimum change of TPS to start deceleration fuel

Fuel change gain
Set how much the fuel should be reduced. If you enter 1 ms/dV , the fuel pulses are shorten 1 ms if the TPS signal decrease with 1V at 1/20 sec.

Sustain
Sustain sets the numver of engnie cycles the deceleration fuel should be active

SETTING - IGNITION



Ignition setup

Crank ignition

Fixed ignition setting during cranking (engine start up)

Ignition charge (Dwell) time

Charge time for the coil before each spark

Ignition setup

3D ignition load sensor

Select load sensor for the ignition map ignition map

3D ignition map size

Selection of map size for the ignition map. There are 3 different sizes

- 18 rpm x 11 load
- 15 rpm x 13 load
- 11 rpm x 18 load

2nd ignition load sensor

Select load sensor for the 2nd ignition map ignition map

Table control

You are free to select RPM and load points for the fuel map. Select which cells to modify and press desired button.

Increase

Increases selected cell. All the cells below automatically changes as well.

Decrease

Decreases selected cell. All the cells below automatically changes as well.

Insert row

Inserts a new row to make more tuning points in a specific area. This removes the last cell.

Convert map to new axis

If you already have made a map, but want to change number of cells or desired range, it is possible to convert the current map to the new selection.

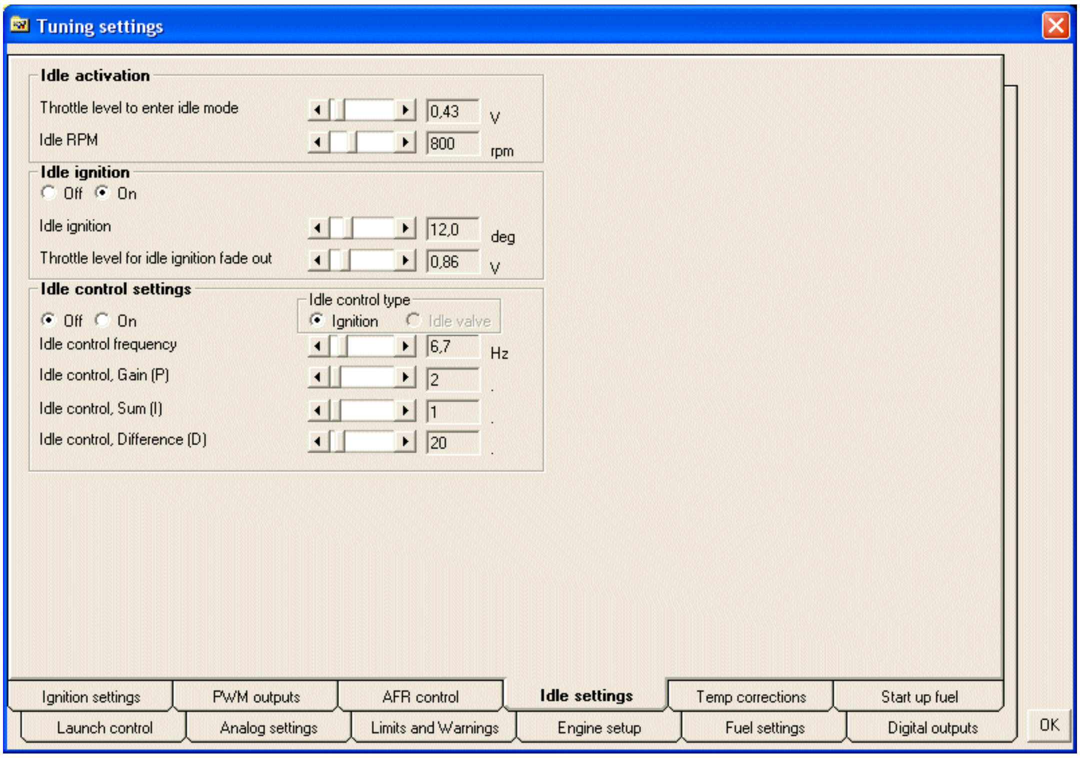
1) Save the current map by click at ”Save current map”. The current map is then saved in a new window.

2) Next step is to make all the changes you have in mind (Change size, rpm steps, load or sensors)

3) Finalize by ”Convert saved map” and BCLab will automatically convert the old map to the new format as well as it is possible.

You must be observant and review the map one extra time just to make sure there where no unwanted effects in the conversion. If you have a map from 0-8000 rpm and reduce the range to 0-5000rpm, BCLab is capable to calculate the right value
BUT If you have a map from 0-5000 rpm and increase the range to 0-8000rpm, BCLab have to guess for the extra 3000 rpm, and the best guess is to use same values as for 5000 rpm column.

SETTING - IDLE



Idle activation

Throttle level to enter idle mode
Lowest throttle position level to activate special idle settings.
Idle RPM
Define which RPM that should be considered as desired idle RPM.
Used by idle control and AFR-control

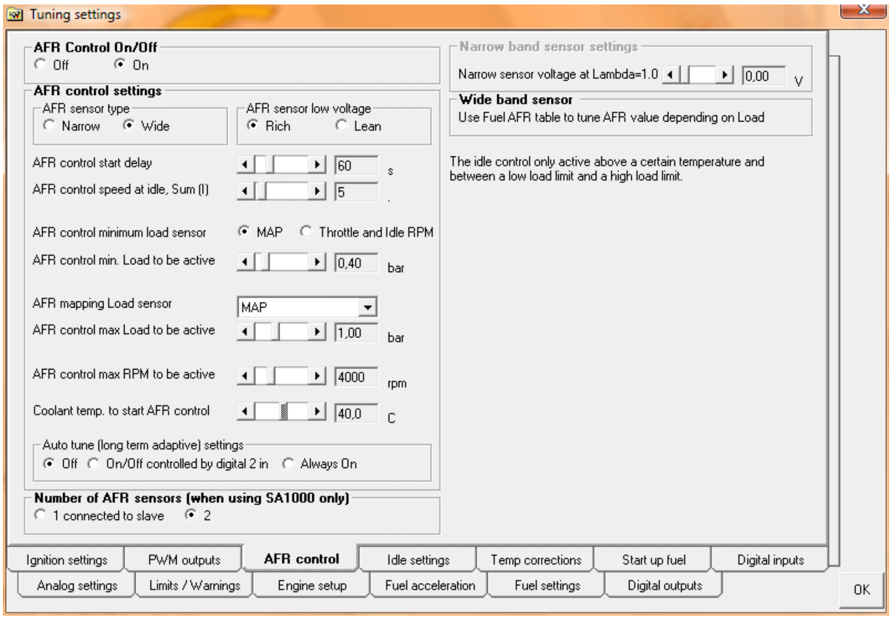
Idle ignition

Idle ignition
Select if you want to use fixed idle ignition setting
Throttle level for idle ignition fade out
Sets at which throttle level the fixed idle ignition should be totally faded out. Normally set this a bit higher than ”Throttle level to enter idle mode”

Idle control settings

Idle control frequency
Select the speed of the idle control
Idle control Gain, Sum and Difference
PID parameters to control the speed and behavior of the ignition idle control.

SETTING – AFR CONTROL



AFR settings

AFR sensor type
Set wide band or narrow band type
AFR sensor low voltage
Sets if the narrow band sensor gives low voltage at rich or lean AFR
AFR start delay
Sets the AFR start up delay until the AFR control should be activated after start up. This is to make sure the AFR sensor is heated.
AFR control, Sum parameter
Sets the AFR control speed at idle. Too fast control can result in an oscillating idle.

AFR min load to be active
Sets the minimum load to still use AFR-control. This is made to prevent AFR control during engine brake.
AFR max load to be active
Sets the maximum load to still use AFR-control. This is made to prevent AFR control at full load.
AFR max RPM to be active
Sets the maximum RPM to still use AFR-control. This is made to prevent AFR control at high rpm.
Load level to start AFR supervising
Specify at which load the system should start supervising the AFR and set error codes. Typically you want to get warning if the AFR is to lead at boost..

AFR min load sensor
Sets if you want AFR-control to be deactivated depending on low load or when RPM and Throttle is low.
AFR max load sensor
Sets which load sensor that should be used as max load sensor for AFR-control (normally throttle or MAP.

Narrow band sensor
If narrow band sensor is used and no real AFR value is read you set which voltage that is considered as AFR=14.7 (Lambda=1). Normally a narrow band sensor toggles between 0V and 1V, and a suitable value could then be 0.5V.

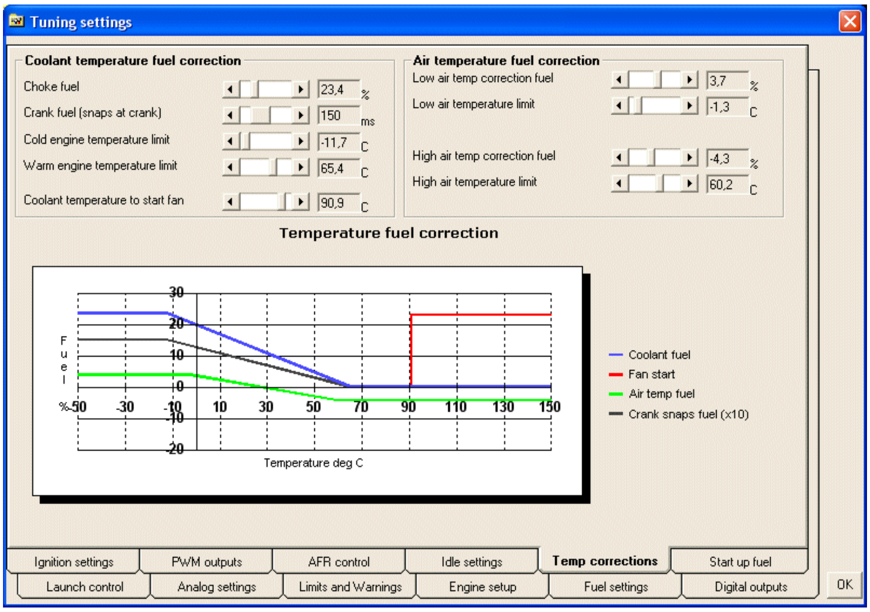
Wide band sensor
If a wide band sensor is used, you can set which AFR-value you desire for each load in a normal table in the main program AFR-table.

SETTING – AFR CONTROL AUTO TUNE

Normally the AFR-control is of the type ”short term adaptive”, ie the AFR-signal is tested several times per second and immediately the fuel is corrected .
With Auto tune the system can rewrite the fuel map continuously, which makes the fuel map better and better the longer the engine is running.
You can select if the Auto tune should be on/off or be controlled by Digital 1 in. Civinco recommends that you actively selects if the Auto tune should be on or off so you know when it is happening.

WARNING!
Auto tune is a slow long term tuning, and will not replace the need for a good fuel map to start with. It will not help replace the need for manually tune the full load etc, but on the other hand is this the easy part of tuning.
It also demands that the AFR signal is correct, or otherwise the fuel map will be rewritten by mistake.

SETTING – TEMPERATURE COMPENSATION



Coolant temperature fuel correction

Choke fuel

Set percentage of extra fuel depending on low temperature. The system is linear and adds less and less fuel until the engine is considered warm.

Crank snaps fuel

Sets one fixed long fuel pulse which occurs as soon as the engine starts to turn around when it is cold (at start up). The system is linear and adds less and less fuel until the engine is considered warm. This is particularly good to use when running on ethanol (E85).

Cold engine temperature

Set which temperature that should be considered as cold limit.

Warm engine temperature

Set which temperature that should be considered as normal engine temperature.
The AFR control will not start until the engine has reached this temperature.

Coolant temperature to start fan

Set at which temperature the electric fan should start at. When the fan has been started, it turns off when the temperature has reached about 5 deg below this temperature

Air temperature fuel correction

Sets how much the intake air temperature should compensate the total fuel with. The system is linear between the cold and the warm temperature limit. Normally IAT that is 30 deg Celsius colder, needs 10% more fuel.

Low air temp fuel

Sets the extra fuel percentage below the “Low air temp limit”.

Low air temp limit

Sets the temperature that should be considered as cold temperature.

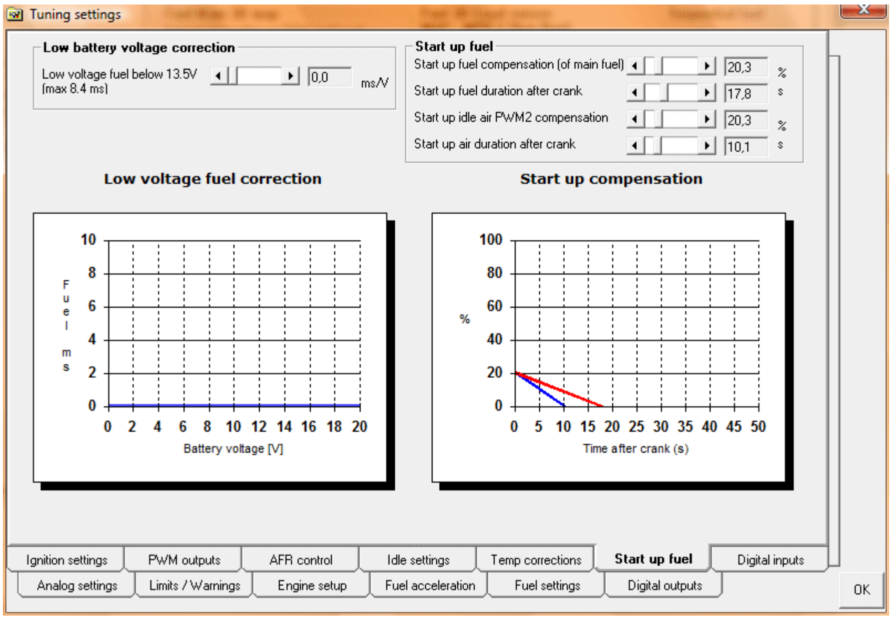
High air temp fuel

Sets the extra fuel percentage above the “High air temp limit”

High air temp limit

Sets the temperature that should be considered as warm temperature.

SETTING – BATTERY VOLTAGE AND START UP COMPENSATION



Low battery correction

Sets how much the fuel injector pulses should be extended at low battery voltage. At engine start the battery voltage normally drops, which slows down the performance of the fuel injectors.

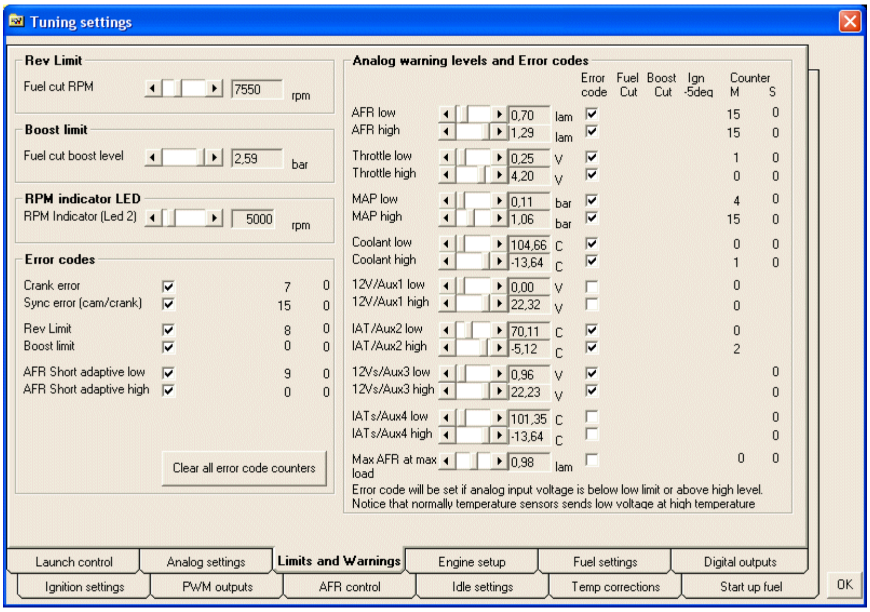
Start up fuel

Sets extra fuel that will be added to the main fuel at start and a specified time after start up. Most engines need some extra fuel a few seconds after start.

Start up idle air

Sets extra air that will be added at start and a specified time after start up. This demands that the idle air control is set to PWM2.

SETTING – LIMITS AND WARNINGS



Rev limit (fuel cut)

Sets a specific RPM where fuel should be cut off (the Rev limit)

Boost limit

Sets at which boost (MAP), the fuel should be cut off.

RPM indication

At the front side of the system there is one LED that can be turned on at this specific RPM. If one of the digital outputs is set to be used as gearing indicator this output will also be set.

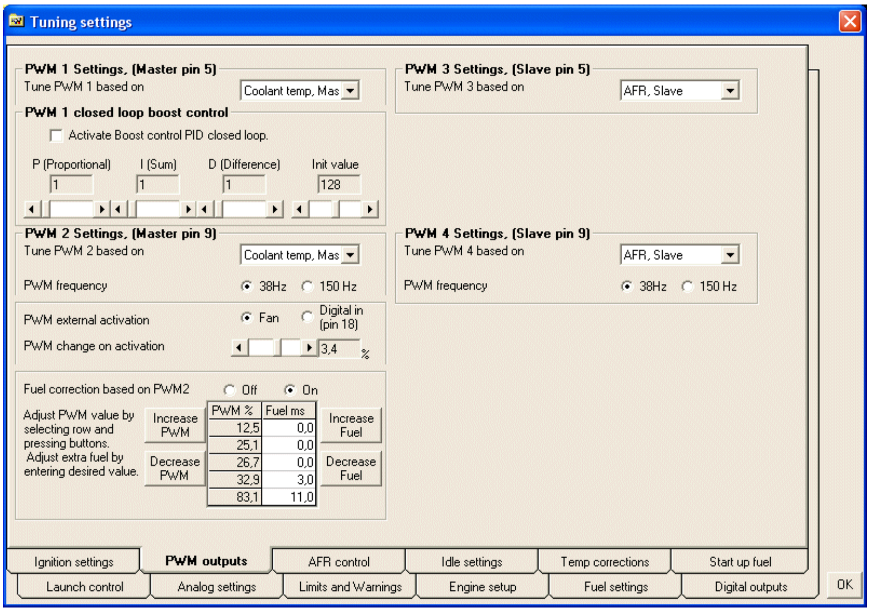
Warning levels and error codes

Sets valid range for the analog inputs, and if the Error code output should be set if the signal is outside the valid range.

Counters

Every time an error occurs in the system the error counter is increased. Errors are tracked both on master and slave board. By pressing clear error codes, the counters are cleared. (Make sure also to write settings to box)

SETTING – PWM AND BOOST CONTROL



The BC-system has 2 (SA500G3) respective 4 (SA1000G3) PWM-outputs which can be tuned depending on load or RPM.

Tune PWM based on

Each of the four PWM outputs can set to use RPM or any load as base for the tuning

PWM1

PWM1 also supports closed loop boost control with PID. The basic principle is that the current boost is measured all the time and depending on desired boost, the control signal to the boost control valve is regulated.
At each sample you measure the current boost and compare to the desired boost. The difference is called the “error”.
The P-factor controls how much the control signal should increase depending of the error. (Proportional factor).
The I-factor controls how the control signal should increase if the error stays over time. After each measurement the control signal is increase a little more if the error stays.
The D-factor controls how much the control signal should change if an sudden error occurs. This is to take care of sudden changes like boost drop.

Out signal=Error*P + Long time error*I + Sudden signal change*D

If you need more information regarding PID, Civinco has a separate documentation of this.

Boost sensor

Selects which sensor that is used as boost sensor. Only used for PID.

PWM2

PWM2 and PWM4 also supports two different PWM frequencies 38Hz and 150Hz. The higher speed is used by idle engines.

PWM external activation

PWM2 can be externally activated by electric fan control or one of the digital inputs. This is good if you want to increase the PWM to the idle engine when electric fan is turned on.

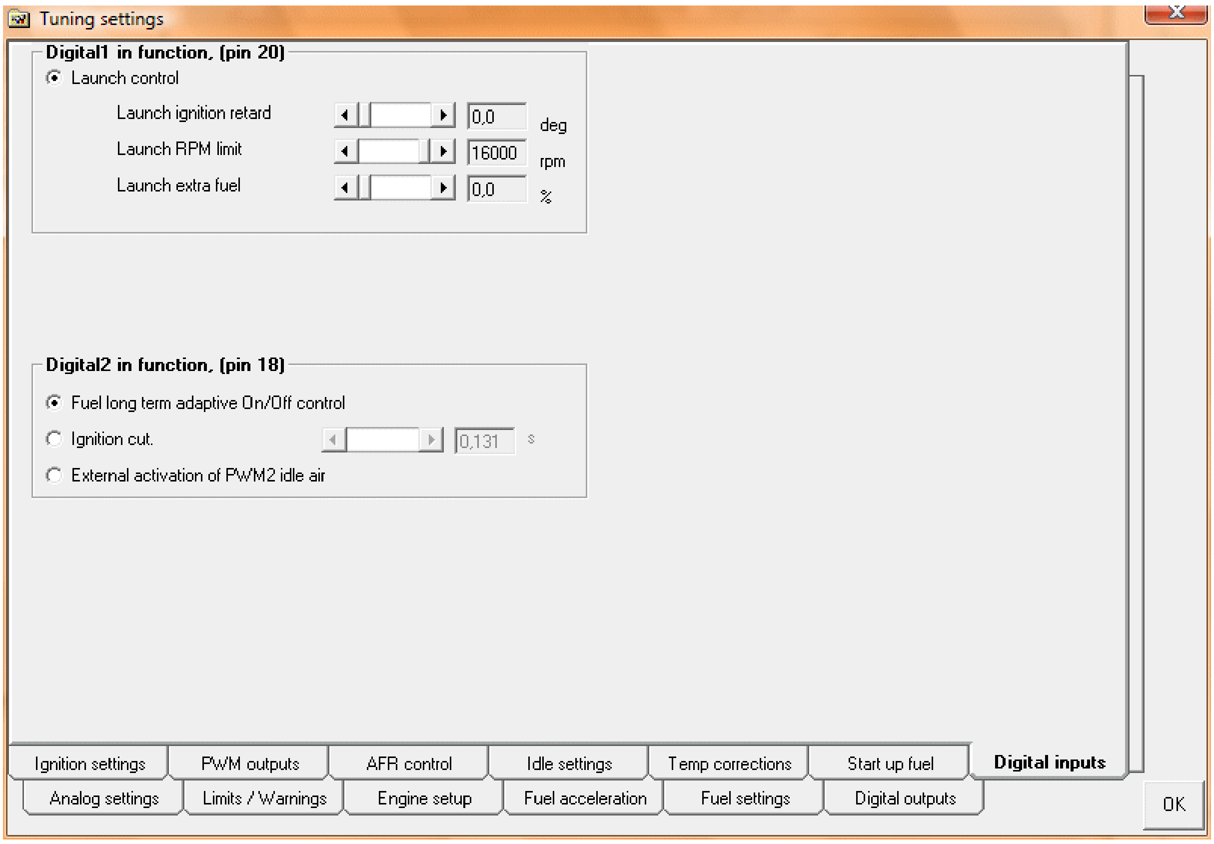
Fuel correction based on PWM

If you run a throttle based map, and idle control you must add extra fuel when increasing the idle engine control. In this table you tune the idle fuel.

PWM 3-4

Straight forward PWM outputs.

SETTING – DIGITAL IN



Setting – Launch control

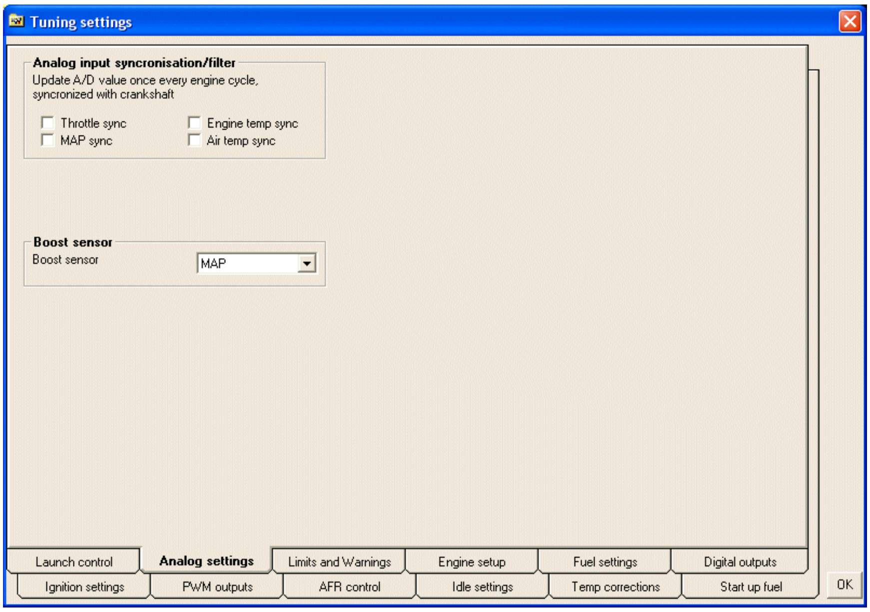
Launch control is a function to spool up the turbo at start line. This is done by activating launch control by grounding the launch control signal input, and press the throttle. The engine will the rev up to the set rev limit and at the same time retard the ignition and give extra fuel. The result is that the fuel is burned in the exhaust, which spins up the turbo. It is very dangerous to use this function any long time (more than a few seconds), because the exhaust gets very hot.

Launch ignition retard
Selects how much to retard the ignition when launch control is activated.
Launch RPM limit
Sets a temporary rev limit when launch control is activated.
Launch extra fuel
Sets how much extra fuel to add when launch control is activated.

Inställning – Digital 2 in

Fuel long term adaptive
Control the Auto tune via digital 2 in. Demands that the AFR control tab also is set to digital 2 in.
Ignition cut
Control the ignition cut at gearing with digital 2 input. When activated the ignition is cut during selected milliseconds.
External activation of PWM idle air
Digital 2 can also control if the idle air should be increased. If you connect to the signal from the A/C, you could increase the idle air to get stable idle. This also demands that the PWM tab is set to the same setting.

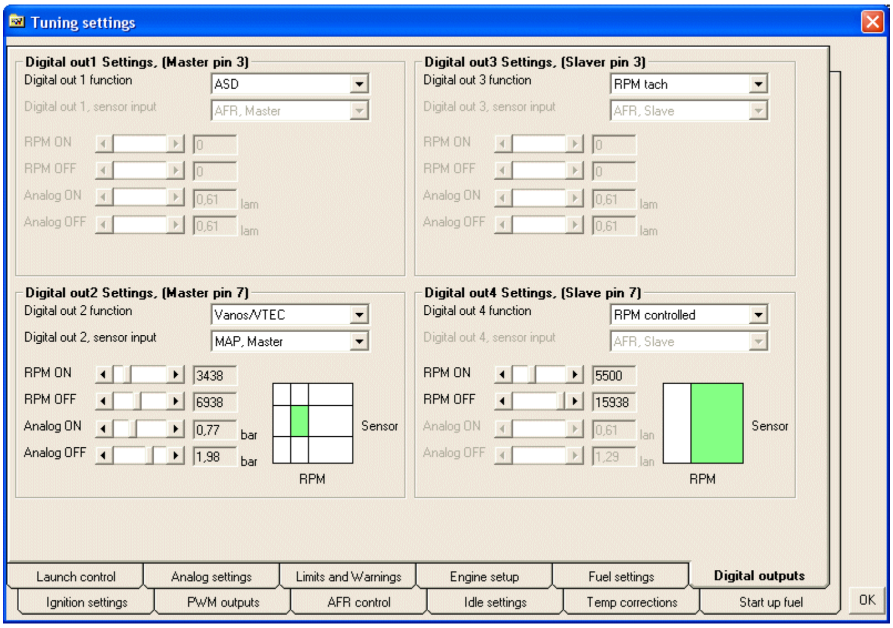
SETTING – ANALOG



Analog input synchronization

There can occur pulse phenomenon at some signals (mostly MAP-signal) during the engine cycle. To avoid strange values of the MAP it is possible to synchronize the measurement with the engine rev (instead of always use fixed sample rate 600 Hz).

SETTING – DIGITAL OUTPUT



There is 4 digital output that can be individually controlled by RPM and load

Following functions are supported:

- ASD-relay To control the fuel pump, ignition system etc. On as long as the engine is reving

- RPM tach Output signals for tachometer.
  - Sends same number of pulses as number of cylinders

- Fan control Signal to control fan relay.
  - On temperature is set under temperature settings

- Error code Set when an error code is set. Could control an error code lamp

- RPM controlled
  - RPM On RPM when the output is activated
  - RPM Off RPM when the output is deactivated

- Analog controlled
  - Analog On The level of the analogue signal that should activate the output
  - Analog Off The level of the analogue signal that should deactivate the output

- VANOS/Vtec Controlled by both RPM and analogue signal.
  - RPM On
  - RPM Off
  - Analog On
  - Analog Off

The green box represents the working area where the output is activated (grounded). If you want to control a relay or lamp etc. you should supply the relay with +12V.

SHORTCUTS

Ctrl+O	Open file
Ctrl+S	Save file
Ctrl+Q	Quit program
Ctrl+Z	Undo
Ctrl+Y	Redo
Ctrl+M	Read Tune Card
Ctrl+R	Write TuneCard
Ctrl+E	Read from system
Ctrl+W	Verify settings
Ctrl+T	Write to system
F1	Help
F2	Box settings
F3	BCLab settings
F4	Log settings
F5	Sensor settings
F6	3D-view
F7	Main Window
F8	Log Window
F9	Start logg
F10	
F11	Redraw
F12	Setting summary

FILE FORMAT

.cbc	Engine settings file
.cbl	Log file (log data, log settings and engine settings)
.bcc	Password file.
.csv	File with exported log data. Can be read by ex. Excel
.bmp	File with exported log data as a picture.
SA500_1000.ini	PC-program default settings.

SA500_1000_Default_Log_Settings.cbl

Default log settings. Can be opened as a normal log file and edited. By editing this file you can control how the log program will look like at start up.

WORDLIST AND DEFINITIONS

Load	Definition of how much torque the engine tries to create at a specific moment. This is normally measured by MAP, MAF or Throttle position. This load signal together with the RPM signal is normally the base for all the mapping
MAF	Mass air flow, the amount of air that flow in to the engine (gram/sec)
MAP	Manifold absolute pressure, the pressure in the intake manifold.
SmartCard	The type of memory cards all the settings can be stored at (Tune Cards)
TuneCard™	Civinco's name of the smart cards
Chipdrive	Product name of one of the supported SmartCard-readers.
Todos	Product name of one of the supported SmartCard-readers.
Boost	The pressure that the turbo creates. Normally relative to the barometric pressure and therefore sometimes negative and sometimes positive.
RPM	Revolution per minute
ms	Millisecond =1/1000 second
AFR	Air to Fuel Ratio

2.5D

For some tables, Civinco does not use full 3D maps, but instead one table for load and one for RPM. This is then by the program automatically recalculated as a 3D map. Civinco call this system 2.5D. This means that the user does not have to enter the right data for all the tuning points in a RPM x Load matrix. Instead the user only have to enter values for RPM and Load separately.

Example: If you have a simplified map with 3 x 3 cells looking at 0-2000 rpm, 2001-4000rpm and 4001-6000 rpm and also 3 different Loads. In a full map you normally enter 9 different values, but with 2.5D you enter 3+3 values. (In a 20x20 matrix you only enter 40 values instead of 400 values)

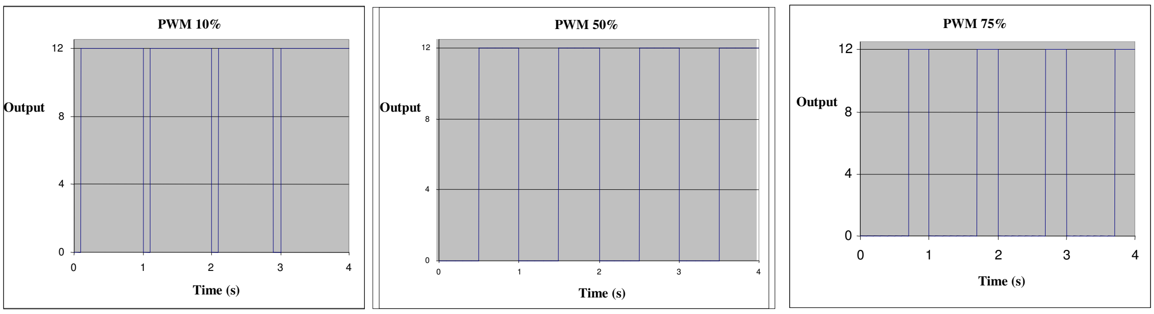
Simplified example

MAP	**Fuel depending on Load**	*Calculated 2.5D values*		
2-3 bar	*10 ms*	*10ms*1.0=10ms*	*10ms*1.0=10ms*	*10ms*1.1=11ms*
1-2 bar	*2 ms*	*2ms*1.0=2ms*	*2ms*1.0=2ms*	2ms*1.1=2.2ms
0-1 bar	*0 ms*	*0ms*1.0=0ms*	*0ms*1.0=0ms*	*0ms*1.1=0ms*
	Fuel depending on RPM	**100 %**	**100 %**	**110%**
	RPM	**0-2000 rpm**	**2001-4000rpm**	**4001-6000 rpm**

PWM SIGNALS

PWM means Pulse Width Modulation and is a method to create and analog signal out of a digital signal. This is the most common way to control speeds of valves and engines which need a little more power. In practical use it's like switching on and off the 12V signal very fast. If it is on half the time and off half the time the engine runs on half speed. So, the signal is set by giving the percentage that the signal is on.

The SA-500 system is grounding the signal, so you supply +12V on the other side.
100% means all the time grounded, and 0% never grounded. The frequency which is used can be selected in the PWM settings, but default is 38.6 Hz.



SA500 system is using PWM to control:

- Boost control valve
- VTEC
- NOS
- Water injection

Upgrade of BCLab

Civinco is all the time releasing the latest software upgrades for free at:
http://www.civinco.com/downloads .

Versions and updates of the SA-500/1000 box

Civinco sends a notice to customers if there are any important upgrades that must be made of the system software. You must send the system to Civinco for upgrade.

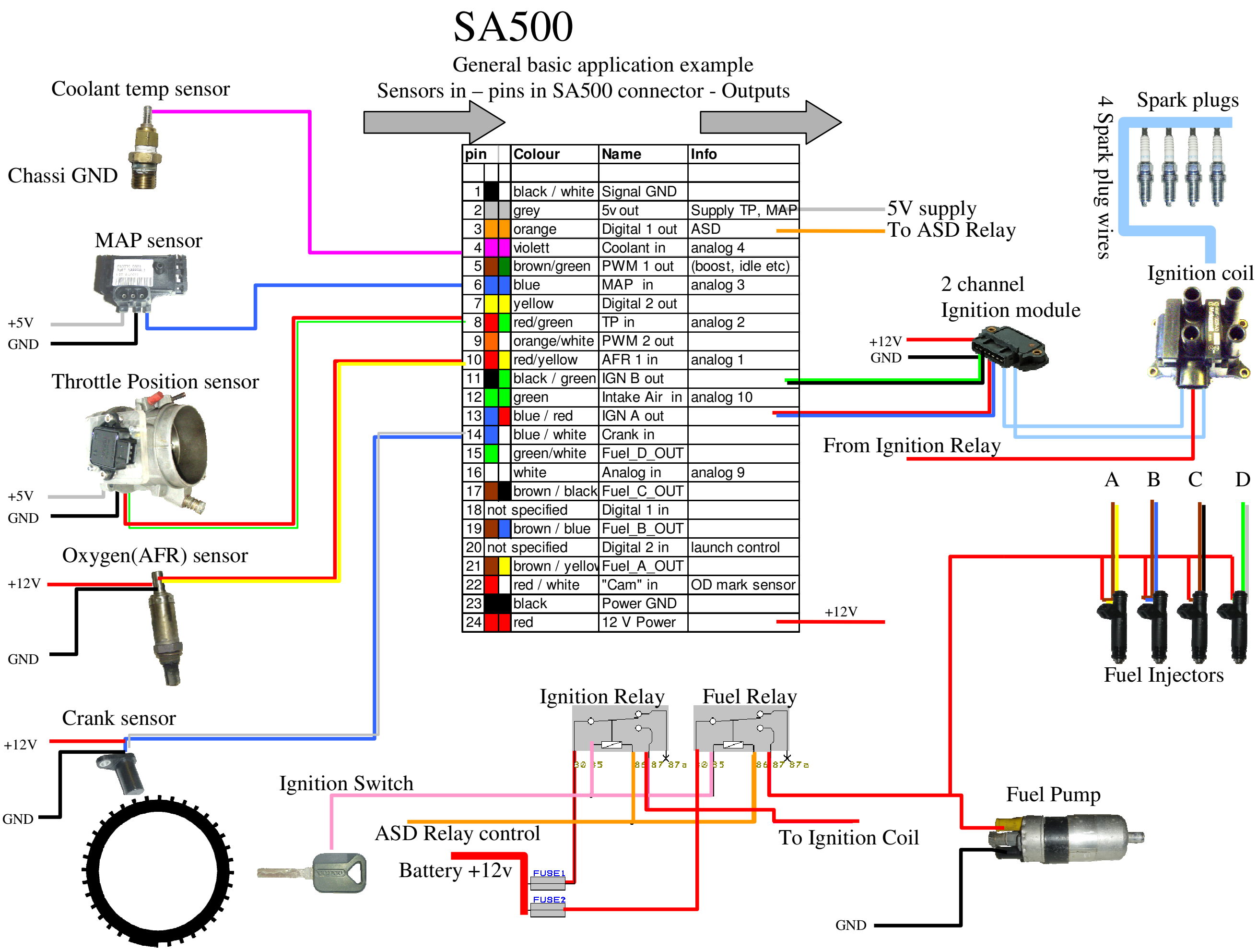
Current versions of Stand Alone

BC500/1000 1.0	July 2005		
BC500/1000 1.1	Feb 2006	upgraded system with internal coil adapter	ID 200
BC500/1000G2 2.0	July 2006	4 times more memory, double fuel maps, USB,	ID 201
BC500/1000G2 2.1	March 2007	double ignition maps	ID 202
BC500/1000G3 3.0	Dec 2007	3D ignition maps	ID 203
SA500/1000G3 3.1	Feb 2009	Deceleration fuel, Autotune.	ID 204

INSTALLATION OF SA500G3 & SA1000G3

INSTALLING THE SYSTEM

To run an engine which is not connected to the ECU at any way demands only a few connections and this is normally done relatively fast. If you have access to the electrical scheme of the stock ECU the easiest way is then to cut the right cables and solder them into the BC-harness instead.



pin	Colour	Name	Info
1	black / white	Signal GND	
2	grey	5v out	Supply TP, MAP
3	orange	Digital 1 out	ASD
4	violett	Coolant in	analog 4
5	brown/green	PWM 1 out	(boost, idle etc)
6	blue	MAP in	analog 3
7	yellow	Digital 2 out	
8	red/green	TP in	analog 2
9	orange/white	PWM 2 out	
10	red/yellow	AFR 1 in	analog 1
11	black / green	IGN B out	
12	green	Intake Air in	analog 10
13	blue / red	IGN A out	
14	blue / white	Crank in	
15	green/white	Fuel_D_OUT	
16	white	Analog in	analog 9
17	brown / black	Fuel_C_OUT	
18	not specified	Digital 1 in	
19	brown / blue	Fuel_B_OUT	
20	not specified	Digital 2 in	launch control
21	brown / yellow	Fuel_A_OUT	
22	red / white	"Cam" in	OD mark sensor
23	black	Power GND	
24	red	12 V Power	

1. +12V Power supply **pin 24**
   - **a.** Connect +12V to the box (red wire). Switched by the ignition. **NB: It's important that the power is still on while cranking the engine.** The box doesn't need a lot of power so you can use a thin wire.
   - **b.** Connect all the ground wires (2-4 wires) to a good grounding point in the cars chassis. There's a lot of power going thru pin no 1, 23 and you want to connect these with short and thick wires.

2. +5V Power supply **pin 2**
   - **a.** Connect +5V from the box to the sensors that need power
     - i. MAP sensor

ii. Throttle position sensor
iii. Camshaft sensor
iv. Crankshaft sensor

b. Connect ground to the sensors from signal GND pin no 1.

3. Fuel **pin 21, 19, 17, 15**
   a. Connect all the injectors to different pins in the box.
   b. Connect +12V to the other connections on the fuel injectors. Connect the power supply via a relay that is controlled by the BC-systems ASD output.
   c. Control the fuel pump thru a similar relay.

4. Ignition **pin 13, 11**
   a. Connect the box to the ignition module (amplifier). (Follow the instructions from the supplier)
   b. Connect the ignition module with the ignition coil (Follow the instructions from the supplier)
   c. Connect +12V to the ignition coils and the ignition module. The power supply should go thru a relay controlled by the BC-systems ASD output.

5. Crankshaft sensor **pin 14**
   a. The crankshaft sensor is most often an inductive signal with 2 wires. Connect one wire to the BC-box and the other one to signal GND. Try to use good quality shielded wire and connect the shield near the box.

6. Camshaft sensor **pin 22**
   a. If you have a digital camshaft sensor then connect the signal to the box.
   b. Make sure that the sensor is connected to a power supply.

7. MAP-sensor **pin 6**
   a. Connect the sensor to the box.
   b. Make sure that the sensor is connected to a power supply.

8. Throttle position sensor **pin 8**
   a. Connect the sensor to the box.
   b. Make sure that the sensor is connected to a power supply.

9. Coolant temperature sensor **pin 4**
   a. In most cases the coolant temp sensor is a 2-way resistive sensor that is connected to GND in one end and is measured and powered by the box thru an internal resistance of 3.3 kOhm. Connect pin no 4 to one end.
   b. Connect the other end to GND.

10. Oxygen sensor **pin 10**
    You are able to run the engine without the oxygen sensor, but it's very helpful during tuning of the car.
    a. Connect the signal wire from the oxygen sensor to the BC-box.
    b. Make sure that the sensor is connected to a power supply and GND.

CONNECTOR SPECIFICATION BC1000S G3

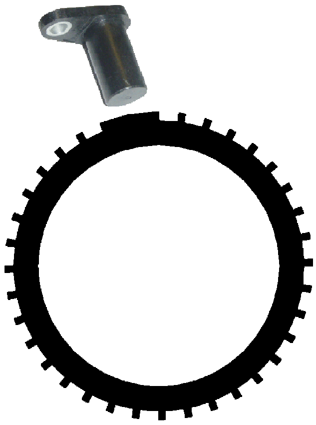
THE BOX FRONT PANEL

There are 4 LEDs above the TuneCard slot. These are from the left:

1. Green power - The BC is powered up
2. Red This LED will light up at pre selected rpm chosen in BCLab, see page Box settings-"RPM ind"
3. Red Read/Write operation in progress. Also LED for error codes
4. Green steady: TuneCard read/write operation completed. Flashing (two flashes repeatedly): TuneCard read/write operation completed and the slave-PCB data is verified

The button next to the LEDs is used like this:
If the button is held pressed while a TuneCard is inserted the current BC-box data is transferred to the TuneCard, - the TuneCard data is replaced by the data in the BC-box.

CRANK SENSOR



The crank sensor gives information about the position of the crankshaft, and is used to determine ignition and fuel pulse timing.
The most common crank sensor setup is 60-2, but the BC-system supports many different sensors.
The BC-system can handle both inductive and digital signals. An inductive sensor consists of a magnet and a coil that generates a signal when a magnetic material is passing the sensor.
The BC-system detects when the sensor changes polarity. If you are uncertain if the signal you're getting is strong enough then you can use the oscilloscope mode to do a high-speed log of the cam and crank settings and determine if it looks right. With normal logging you are able to check the status of 60-2 error, and check if the error occurs more seldom.

CAM SENSOR

The Cam sensor sends information about the position of the camshaft, and we therefore know the engines intake and combustion cycle. There are two crankshaft rotations per working cycle in a four-stroke engine. Because of this the BC-system can't determine in what position the engine is, based on the crankshaft. The most common is for the cam sensor to send a signal every other crankshaft rotation. The BC-system needs this signal to be run sequentially.

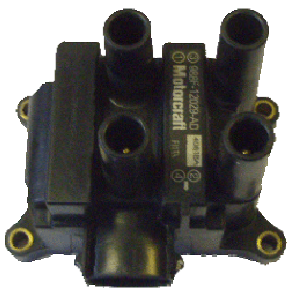
The BC-system can handle both inductive and digital signals.

FUEL INJECTORS

The BC-system is able to run fuel injectors with higher resistance than 6 Ohm (this is normally measured with a multimeter). The system is normally able to run 2 injectors / fuel channel.

IGNITION COILS

The BC-system needs an external igniter (amplifier) to be able to run the ignition coils. The system can be configured in the following ways.



- 4 cyl with 1 coil and distributor
  - SA500G3
  - BC1000S
- 4 cyl with 4 coils
  - SA500G3 waste fire
  - BC1000S direct ignition
- 6 cyl with 1 coil and distributor
  - BC1000S
- 6 cyl with 6 coils

- BC1000S waste fire
- 8 cyl with 1 coil and distributor
  - BC1000S
- 8 cyl with 4 coils
  - BC1000S waste fire

Igniter

The igniter is a power transistor that can handle the high current and voltage peaks you're getting from running the ignition coils.

Another advantage with an external igniter is to be able to isolate the interference by using separate power supply to the igniter and the ignition coils as regards to the BC-system.
One normal pinout of a typical igniter like Volvos are:

1. Output to ignition coil
2. Power ground
3.
4. +12Volt supply voltage
5.
6. Ignition input from BC-system
7.

BOOST CONTROL VALVE

The BC-system handles most PWM-type boost control valves.

IDLE CONTROL VALVE

There are many different types of idle controls, and the BC-system supports PWM-type with both 1 and 2 signals.

OXYGEN SENSOR

The oxygen sensor measures if the engine is running lean or rich. There are mainly two different kinds, narrowband- and wideband oxygen sensors.

Narrow band oxygen sensor

This one generates a voltage between 0 and 1 V which tells you if the engine is running lean or rich. When tuning the fuel so that this signal is pending back and forth the AFR=14.7. This kind of sensor can be used to tune partial load for better fuel economy.
The narrow band sensor is available with different numbers of connection wires (1-4), but the principle is the same.
Some of the wires for the signal and the others to preheat the sensor.

1-wire	Signal in the wire, GND in the chassis.
2-wires	Signal in one wire, GND in the other.
3-wires	Signal in one wire, GND in the chassis, 12V to the heating element in two wires.
4-wires	Signal in one wire, GND in one wire and 12V to the heating element in two wires.

Wide band Oxygen sensor

This sensor is a lot more complicated than the narrow band sensor, and requires special devices to be run. However there's almost always a signal that delivers a voltage that's proportional to the AFR value. There are often special outputs that delivers 0 to 5V depending on the oxygen level, i.e. 0V=AFR 10, 5V=AFR 20. This signal should be connected to the BC-system.
By measuring the AFR you can control the fuel to the exact right AFR value depending on load. On partial load to get the best fuel economy and also maximum load to get AFR=12.5
The BC-system can't run a single wide band oxygen sensor; it must have an aftermarket system built for this purpose.

Coolant temperature sensor

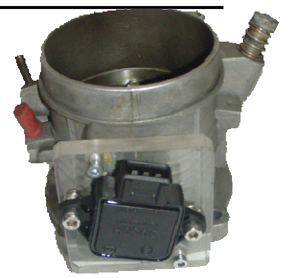
The most common is that coolant sensors are resistive and change resistance depending on temperature. This means it has two electrically connections, but the most common is that the sensor is grounded in engine block and therefore only one cable is connected. This single wire should be connected to the BC-system, which is measuring the resistance via an internal pull up resistor to +5V. The internal resistance in the BC-system is 3.3 kOhm, witch is supporting temperature sensors with resistance from 100 Ohm up to 10 kOhm.

The most common for temperature sensors is that the resistance (and the Voltage) is decreasing when the temperature is increasing.

Intake air temperature sensor (IAT)

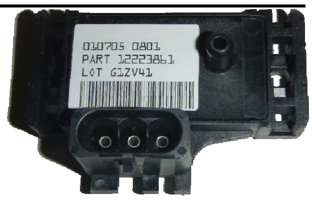
Typically the same type as coolant sensors, but more often with 2 wires, where you have to ground one wire your self. In cars with MAF sensors the IAT-sensor is often built in the MAF.

Throttle position sensor (TPS)



TPS is a sensor which is located at the throttle body, and measure the butterfly angle. Often this is made by a 3 pin rotating potentiometer. This potentiometer is supplies by +5V and signal ground, and gives a signal varying from 0.5-4.5V. If you end up with a signal with "mirrored behavior, you can often just swap the +5V and ground to have a signal which is increasing with increased throttle.
Modern throttle bodies can also have more signals, like both real signal and mirrored signal.

MAP-SENSOR



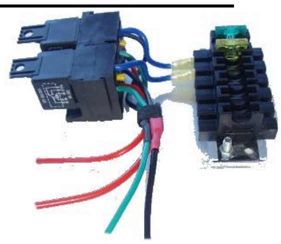
MAP is a sensor which is measuring the pressure in the intake manifold. This pressure is maybe the most common to use for tuning, so it is very important that this is mounted correctly. Either you mount the sensor in the engine compartment and connect to the system with wires, or you can have the BC-system delivered with internal MAP-sensor.
Typically the MAP-sensor is supplied with +5V and ground, and then it sends a signal which varies from 0 to +5V depending on pressure.

MAF-SENSOR

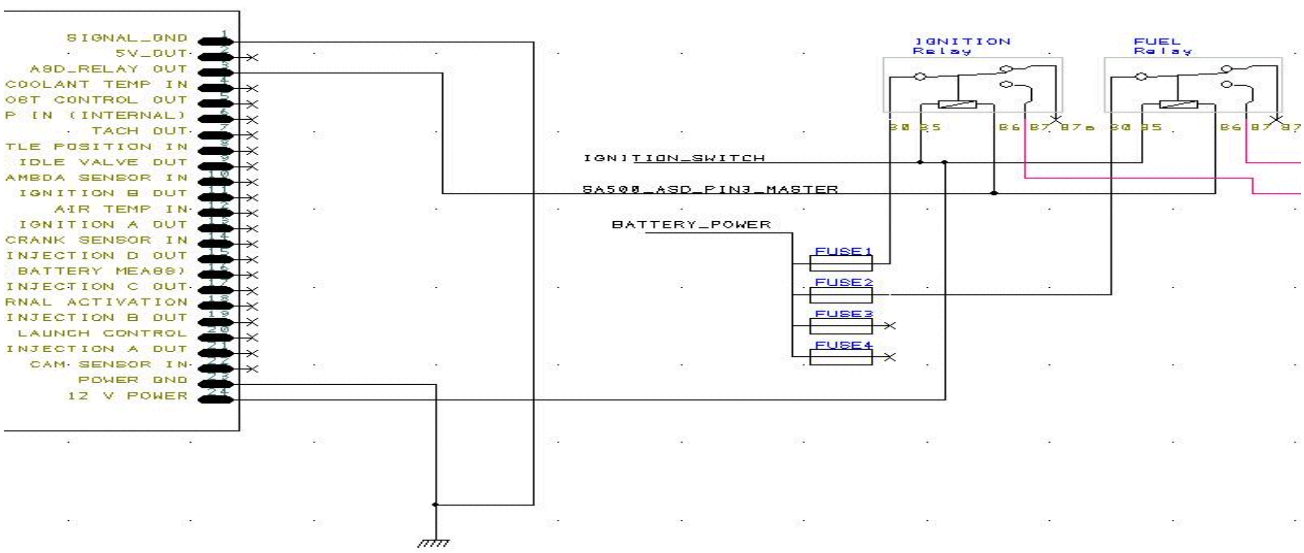
A sensor which measure the air flow into the engine. In modern cars it is quite common that the stock PCM uses MAF instead of MAP as load sensor and base for the tuning. The BC-system does not normally use this as load sensor, instead it uses MAP, throttle and temperature.

Typically the MAP-sensor is supplied with +5V and ground, and then it sends a signal which varies from 0 to +5V depending on air flow. At older Volvo and Porsche it can be supplied with +7V instead.

ASD/DME-RELAY



Normally you do not want the fuel pump, coils and injectors to be supplied with battery voltage unless the engine is running. This to make sure the fuel is not flushing if there is an accident.
The BC-system can control such relays with a dedicated output with this function. When the ignition is turned on the ASD output will only be activated 3 seconds until the engine is turning.



KNOCK SENSOR

An knock sensor is a microphone which can detect if the engine is pinging/knocking. Pinging is something you under all cercomstances like to avoid because it is very harmfull, specially at high load. Many modern engines are deliverd with knock sensors, but there are also after market systems to buy.
The BC-sysstem can not hook up with a knock sensor directly, but instead need an aftermarket system which is amplifying the signal first and convert it to a 0-5V signal.

One way to avoid ping is to use higher octane fuel, reduce the boost or reduce the ignition timing. If you reduce the timing it is important to understand that the axhaust gas temperature is increasing.

TUNING WITH SA500G3/1000S G3

Pretuned settings for specific make and models are available. Please contact Civinco for more information.

CHECK ALL THE INPUT SIGNALS

When the system is installed you should start with checking that all the input signals are correct.

- What are the maximum and minimum values.
- Without interference
- Check the cam-and crank signal

(1) Power supply and ASD-function

1. Turn the ignition ON.
2. Check that the ignition coils and fuel pump is powered up for 3 sec, and then shut down. (if there’s an ASD-relay connected).

(2) Check the analog input signals

1. Turn the ignition ON.
2. Start logging and select to view the analog signals.
3. Titta på de analoga signalerna och kolla att varierar på rätt sätt
    a. Try to suck on the MAP-sensor.
    b. Step on the gas pedal all the way down for a couple of times.
    c. Heat up the coolant temp sensor.

If you’re not sure what kind of voltage the sensors deliver at different pressure, temperatures etc. then it’s a good idée to test this and write down the results to be able to do sensor definitions. This also helps you while tuning, if any of the sensor values are unreasonably high or low.

(3) Check the Cam and Crank signals

1. Disconnect the power supply to the fuel pump, injectors and ignition coils.
2. Turn the ignition ON.
3. Start high speed logging.
4. Crank the engine for a few seconds.
5. Stop the high speed logging.
6. Check the cam and crank signals and make sure they look reasonable.
7. Check that the ignition fires correctly with a timing light.

(4) Check the ignition

1. Reconnect the power to the ignition coils, but **not** to the fuel.
2. Turn the ignition ON.
3. Crank the engine for a few seconds.

4. Check that the ignition fires correctly (set on crank ignition) with a timing light. If the ignition fires incorrectly you have to adjust **Crank sensor teeth** and **Crank sensor offset**, see page Engine setup.

CREATE YOUR FIRST TUNING PARAMETERS

Now it's time to make your first engine tuning. The only important thing to get the engine started is that the ignition and fuel settings are somewhat set correctly. To get the engine running is quite easy, but to the find the right tuning and getting the engine to run perfect takes lots of time. This guide is only to get you started.

Autosetup

To create a first map, there is a guide which guides you step by step to a good base map. You just have to enter information of fuel injectors and cylinder volume etc

Fuel injectors

If the fuel injectors are dimensioned correctly they will be open 80% of the time on maximum load and RPM. A rule of thumb is that 60 lbs/h is enough for 100hk. If you have an engine with 200 hk and 4 cyl, then each fuel injector should deliver 30 lbs/h.

Fuel map

On maximum load the injectors delivers about 16 ms of fuel.
While idling the same engine often requires about 2.5 - 3.5 ms.
In between these two you could start with letting the fuel vary linear.

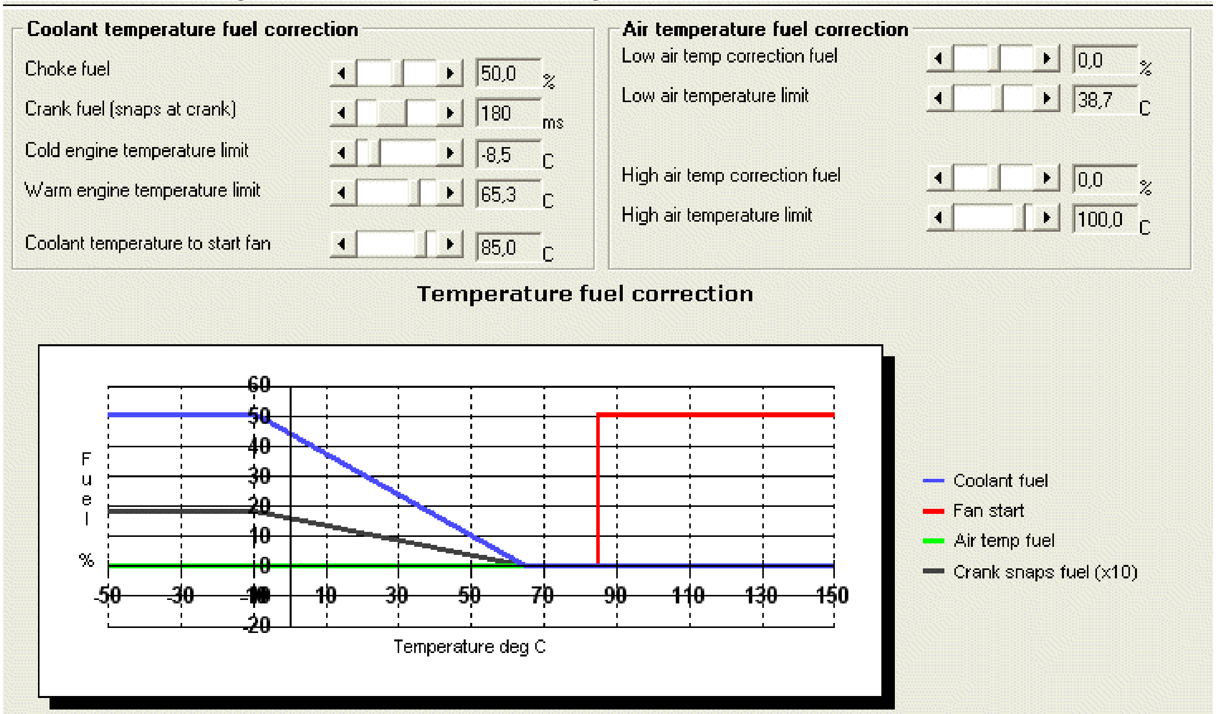
Fuel Main 3D map
Set fuel depending on RPM and Load

Fuel 3D Load sensor:
MAP - SAAB_MAP 2.5bar [bar]

	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
0,12	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
0,22	3,2	3,0	2,5	2,5	2,6	2,6	2,6	2,6	0,0	0,0	0,0	0,0	0,0	0,0
0,32	3,6	2,8	2,7	2,8	2,9	3,0	3,0	3,1	3,3	3,4	3,4	3,4	3,4	3,4
0,42	3,4	3,2	3,4	3,5	3,6	3,6	3,6	3,6	3,8	4,0	4,2	4,2	4,2	4,2
0,52	4,8	4,8	4,8	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7
0,61	5,0	6,0	5,7	5,5	5,3	5,4	5,4	5,4	5,4	5,5	5,5	5,5	5,5	5,5
0,71	6,1	6,1	6,3	6,1	6,0	6,3	6,3	6,4	6,4	6,5	6,5	6,5	6,5	6,5
0,81	7,5	7,4	7,4	7,0	7,0	7,3	7,3	7,4	7,4	7,5	7,5	7,5	7,5	7,5
0,91	9,8	9,6	9,3	8,5	8,6	8,9	8,9	9,0	9,1	9,2	9,2	9,2	9,2	9,2
1,01	10,8	10,2	9,8	9,2	9,5	9,7	9,9	10,0	10,0	10,2	10,2	10,2	10,2	10,2
1,11	11,9	11,1	10,7	10,2	10,6	10,8	11,0	11,1	11,1	11,3	11,3	11,3	11,3	11,3
1,20	12,7	11,9	11,4	11,4	11,5	11,8	11,8	12,0	12,1	12,3	12,3	12,3	12,3	12,3
1,30	14,0	13,1	12,6	12,7	12,8	13,0	13,1	13,3	13,4	13,6	13,6	13,6	13,6	13,6
1,40	14,9	14,1	13,5	13,3	13,7	14,1	14,2	14,3	14,3	14,7	14,7	14,7	14,7	14,7
1,50	16,1	15,3	14,6	14,3	14,8	15,1	15,5	15,6	15,5	15,8	15,8	15,8	15,8	15,8
1,60	18,5	17,7	16,4	17,1	17,5	17,8	18,1	18,2	18,3	18,6	18,6	18,6	18,6	18,6

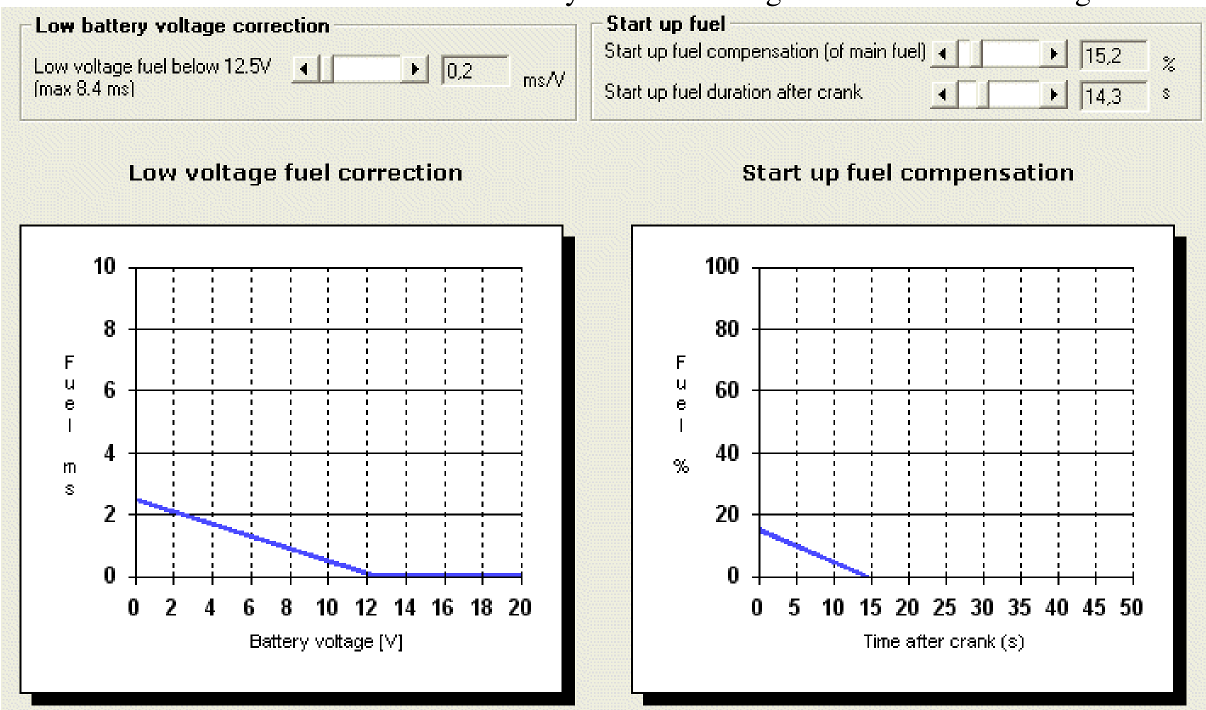
Cold start fuel

A cold engine often requires 30-50% choke fuel to start up.
If you running on ethanol and the engine is cold (<50F), you also need a lot of extra snapps fuel when cranking, 200ms at 20F is not strange.

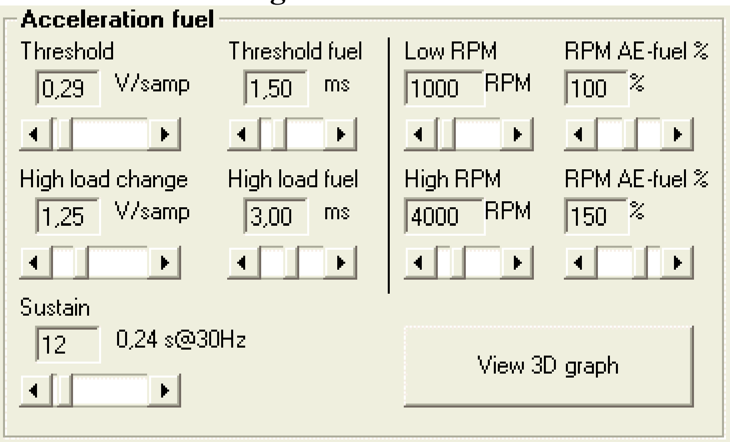


Startup fuel

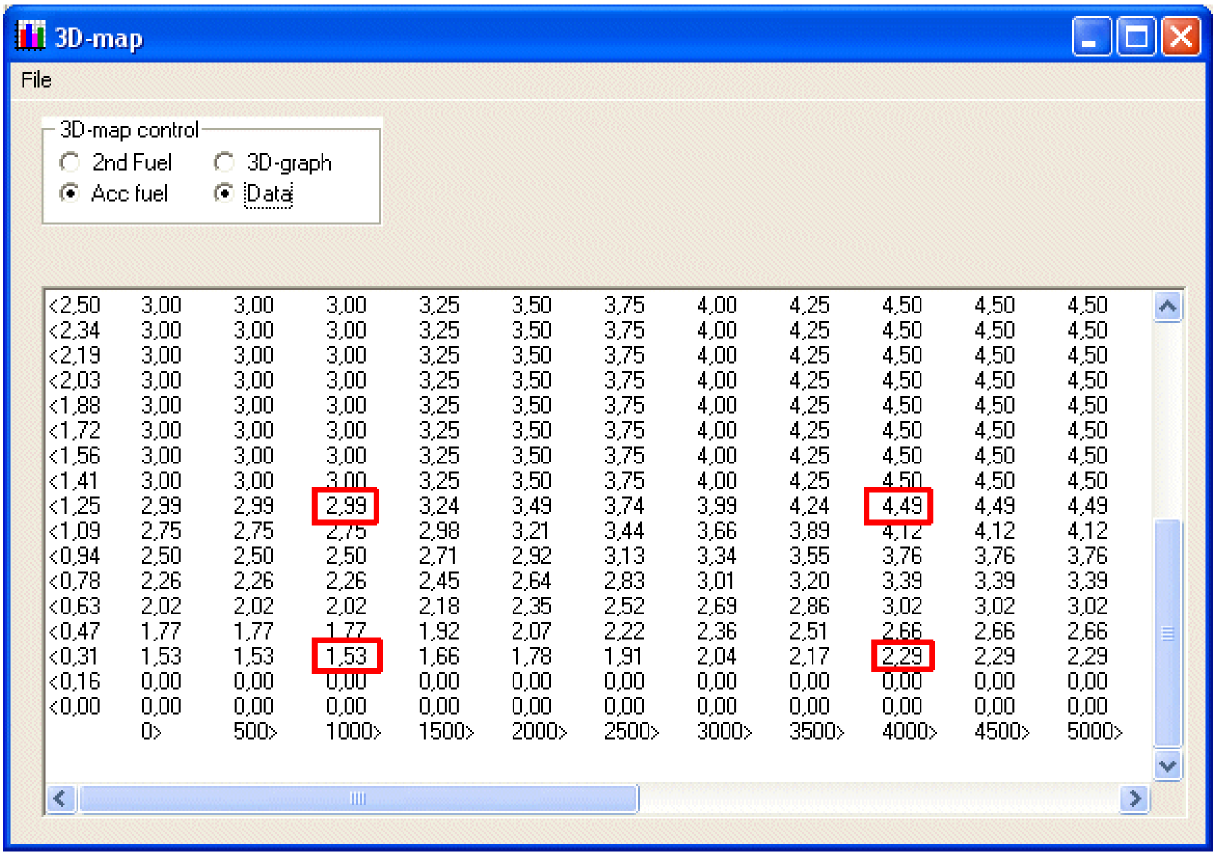
About 15% extra fuel at start which is slowly reduced during the first 15 seconds is good.



Accelerationsrikning



The amount of acceleration fuel an engine needs, varies a lot and can only be tested to find the right tuning. This is an example that shows the principle, and how to tune in the corners in the map.



<2,50	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<2,34	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<2,19	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<2,03	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<1,88	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<1,72	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<1,56	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<1,41	3,00	3,00	3,00	3,25	3,50	3,75	4,00	4,25	4,50	4,50	4,50
<1,25	2,99	2,99	2,99	3,24	3,49	3,74	3,99	4,24	4,49	4,49	4,49
<1,09	2,75	2,75	2,75	2,98	3,21	3,44	3,66	3,89	4,12	4,12	4,12
<0,94	2,50	2,50	2,50	2,71	2,92	3,13	3,34	3,55	3,76	3,76	3,76
<0,78	2,26	2,26	2,26	2,45	2,64	2,83	3,01	3,20	3,39	3,39	3,39
<0,63	2,02	2,02	2,02	2,18	2,35	2,52	2,69	2,86	3,02	3,02	3,02
<0,47	1,77	1,77	1,77	1,92	2,07	2,22	2,36	2,51	2,66	2,66	2,66
<0,31	1,53	1,53	1,53	1,66	1,78	1,91	2,04	2,17	2,29	2,29	2,29
<0,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
<0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	0>	500>	1000>	1500>	2000>	2500>	3000>	3500>	4000>	4500>	5000>

Below the threshold level there will not be any acceleration fuel.
Just at the threshold level it will be 12 pulses with each 1.5 ms.
Just at the threshold level, but at high rpm it will be 12 pulses with each 1.5x150%=2,29 ms.

Ignition map
The ignition is mostly based on the RPM. More advanced ignition at higher RPM.
E.g. 15 degrees (BTDC) while idling, up to 35 degrees on high RPM.

You also retard the ignition (delay the ignition) at higher pressure (higher load).
Typically you increase the timing 5-10 degrees at low load compared to full load

	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500
0,12	24,0	22,0	25,2	27,2	29,0	30,8	31,4	32,4	33,4	35,2	37,0	39,0	41,0
0,32	24,0	22,0	25,2	27,2	29,0	30,8	31,4	32,4	33,4	35,2	37,0	39,0	41,0
0,52	24,0	22,0	25,2	27,2	29,0	30,8	31,4	32,4	33,4	35,2	37,0	39,0	41,0
0,71	24,0	22,0	25,2	27,2	29,0	30,8	31,4	32,4	33,4	35,2	37,0	39,0	41,0
0,91	18,6	16,6	19,8	21,8	23,6	25,4	26,0	27,0	28,0	29,8	31,6	33,6	35,6
1,11	16,2	14,2	17,4	19,4	21,2	23,0	23,6	24,6	25,6	27,4	29,2	31,2	33,2
1,30	17,0	15,0	18,2	20,2	22,0	23,8	24,4	25,4	26,4	28,2	30,0	32,0	34,0
1,50	15,4	13,4	16,6	18,6	20,4	22,2	22,8	23,8	24,8	26,6	28,4	30,4	32,4
1,70	13,8	11,8	15,0	17,0	18,8	20,6	21,2	22,2	23,2	25,0	26,8	28,8	30,8
1,89	12,2	10,2	13,4	15,4	17,2	19,0	19,6	20,6	21,6	23,4	25,2	27,2	29,2

Other settings
Read all the pages about settings and make sure that everything looks reasonable.

FIRST ENGINE STARTUP

(1) Startup

1. Reconnect all the power supply.
2. Start the engine.
3. If the engine does not start there is either the ignition or the fuel that is the problem.
    a. Smell if there is a lot of fuel in the exhaust. This can be a sign that it is too rich.
        i. Reduce the fuel in the main map or the cold start fuel.
    b. If it does not smell fuel at all, there could be a too lean problem
        i. Check if the fuel pump is on
        ii. Check if it clicks in the fuel injectors when cranking

    c. If it seems to be good with the fuel, check the ignition
        i. Remove one spark plug cable, and mount a spark plug in the free air. Make sure the plug is grounded to the engine, and crank the engine. The spark should go every 2nd revolution. If it does not check power and cables.
        ii. If it is a newly built engine, it is also easy to by mistake connect the wrong ignition cable to the wrong spark plug.