



Zenit Blue Box
SOFTWARE MANUAL

AG Centrum

Zenit Autogas Systems

Radom 2017

Minimum hardware requirements.

PC equipped with:

- processor Pentium 1.8 GHz or faster
- memory RAM 1GB or more
- min. 100 MB disk space
- Windows XP SP3 or other newer version
- recommended Internet access (to download the required operating system updates)

Connecting the Zenit Blue Box ECU to a PC and the diagnostic program

RS232 and USB Interface connection

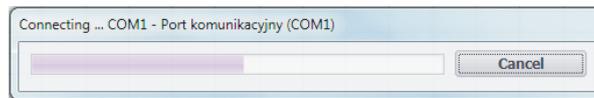
RS232 or USB interface is required when connecting Zenit Blue Box ECU to a computer. All the USB interfaces work with Zenit Pro and Zenit Compact and interfaces RS232 compatible with systems Zenit JZ-2005 are compatible and they allow connection to the Zenit Blue Box ECU.

You connect the suitable interface to the computer and to the diagnostic connector of the Zenit Blue Box system. The connector is placed on the wiring harness within about 30cm from the ECU main socket.

CAUTION!!! Prior to using the interface for the first time, it is important to install the drivers properly in the system first. This process is usually performed once when connecting interface for the first time. Installation is no different from installing other similar devices. To download the detailed description of installing drivers for Windows and the required drivers please visit our website www.agcentrum.pl

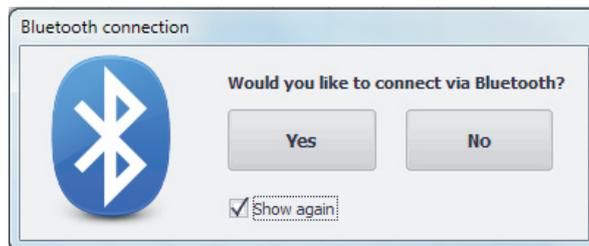
After launch, the program will automatically seek through all the active ports and try to connect with the ECU. Connection is possible with the ignition on or off, it is only necessary to connect the ECU to the main battery power source. When restarted, the program will begin searching from the last port that was used

Until getting a connection the display will show a window with progress bar.



Bluetooth interface

The Bluetooth wireless interface type AR 300 BT-LINK can also be used to establish connection with the ECU. In order to establish this type of connection, first make sure that Bluetooth has been properly installed and activated on your computer. Interface AR 300 BT-LINK does not require any special installation or pairing with the computer. The entire process has been simplified as far as possible, and all components required to establish this connection are contained in the Zenit Blue Box software. Having connected the interface to the diagnostic socket, switch on the ignition, and as soon as the program is started, confirm that you wish to connect via Bluetooth.



If the window is not shown when launching the program, go to the "Sundries" tab, and activate the option "Show Bluetooth window when launching". Communication via Bluetooth is also possible approx. 4 minutes after the ignition has been switched off. After the lapse of this time, the ECU will go to the sleep mode, and will switch off power supply in the diagnostic socket.

When connected interface is not properly installed or is not compatible with Zenit Blue Box, the software will not be able to connect and, after scanning your computer, switches to "off-line" mode (you will be able to navigate through the program, however you will not be able to take any readings).

Information panel - The information panel is located on the left side of the program window; it is available regardless of the chosen tab. It allows checking the basic system parameters.

Connection status indicator: Upon clicking it, automatic ECU search will begin

Ignition indicator

Electrovalves power indicator

Diagnostics status indicator; Green: No errors. Red: some errors have been recorded

Graphic display of petrol injector opening times

Graphic display of gas injectors' opening times

"CHECK" button: Upon clicking it, the "Diagnostics" tab will be activated

Petrol / Gas selector

Gas level indicator: Upon clicking it, gas level sensor calibration will be activated

Tahometer

Absolute pressure in inlet manifold

Gas pressure

Reducer temperature

Gas temperature

Petrol injector opening times: Upon clicking it, the program will round up readouts to one decimal point

Gas injectors opening times

Switching the particular gas injectors ON/OFF

Graphic display of the signal from the lambda sensor

Additional functions field that shows the supply strategies that have been activated

Connection indicator - Green: "On-line" status: The software has established connection with the controller. Red: "Off-line" status: No connection with the controller. Green: "Demo" status: The program is operating in the "Demo" mode; upon clicking this button, automatic ECU search will begin.

Ignition indicator - change of the indicator's color to green means that the ECU sees the ignition on.

The indicator should be active right after turning the ignition on. When the ignition is off it should go off immediately. In addition, it shows the current value of the supply voltage.

Electrovalve power indicators (EV1, EV2) - when the light is green it means that power supply was placed onto the right electrovalve.

Diagnostic indicator - when the light is red it means that there are system errors. The details can be found in the tab Diagnostics.

RPM - tachometer. Its indications should be consistent with the tachometer's reading on the car dashboard. Use function RPM divider in the tab Settings -> Gas system setup

MAP - display of the current vacuum/pressure in intake manifold

Gas pressure - displays current pressure in the gas system, behind the reducer.

Red. temp. - the reducer's temperature is read by the sensor placed on the reducer.

Gas temp. - displays the gas temperature in the flow by the sensor placed in the integrated pressure sensor.

Oxygen Sensor - voltage data from the oxygen sensor presented as a chart. The waveform will be displayed only in case of physical connection of the oxygen sensor and when in Settings -> Car setup the appropriate sensor type is selected.

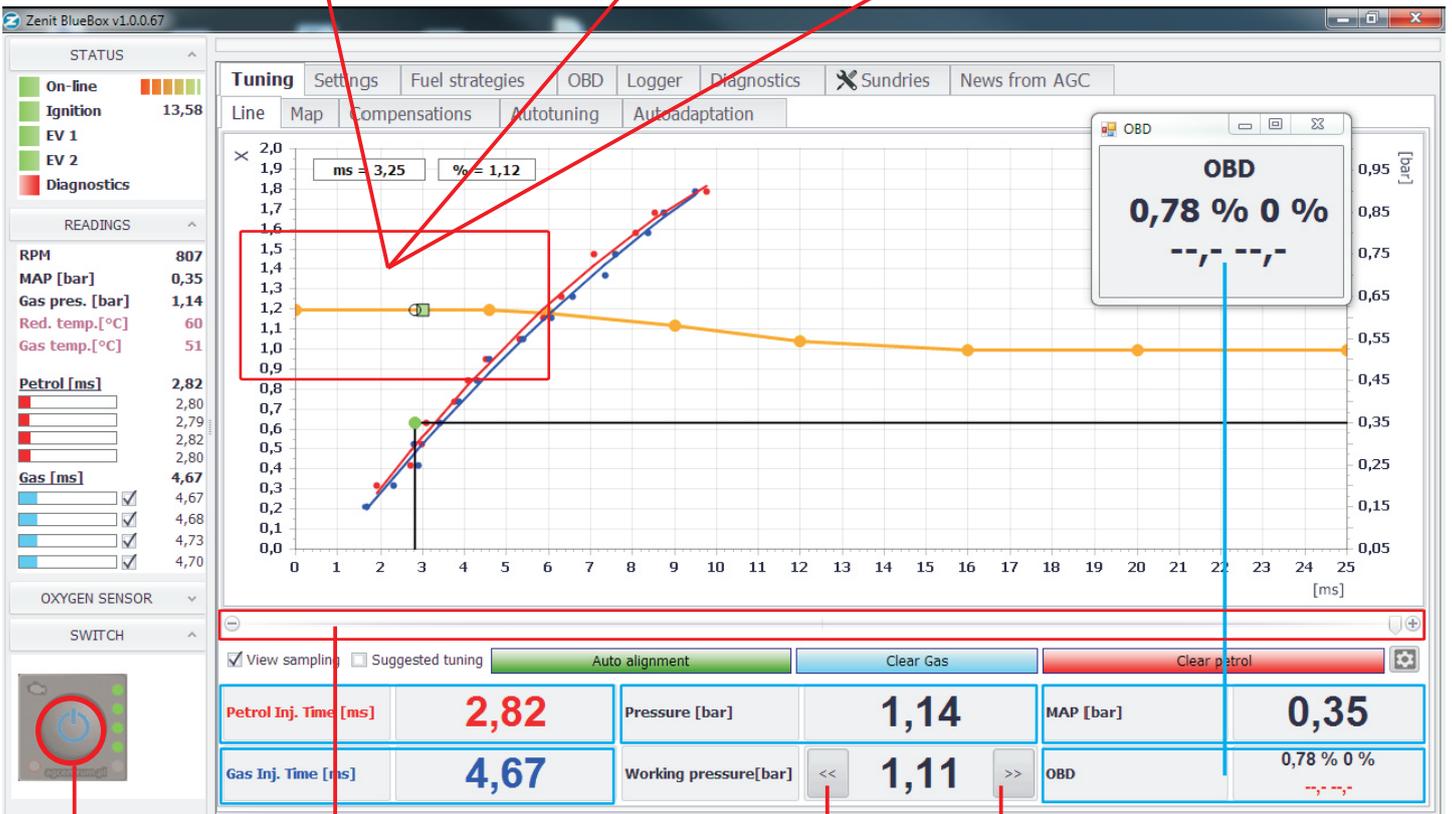
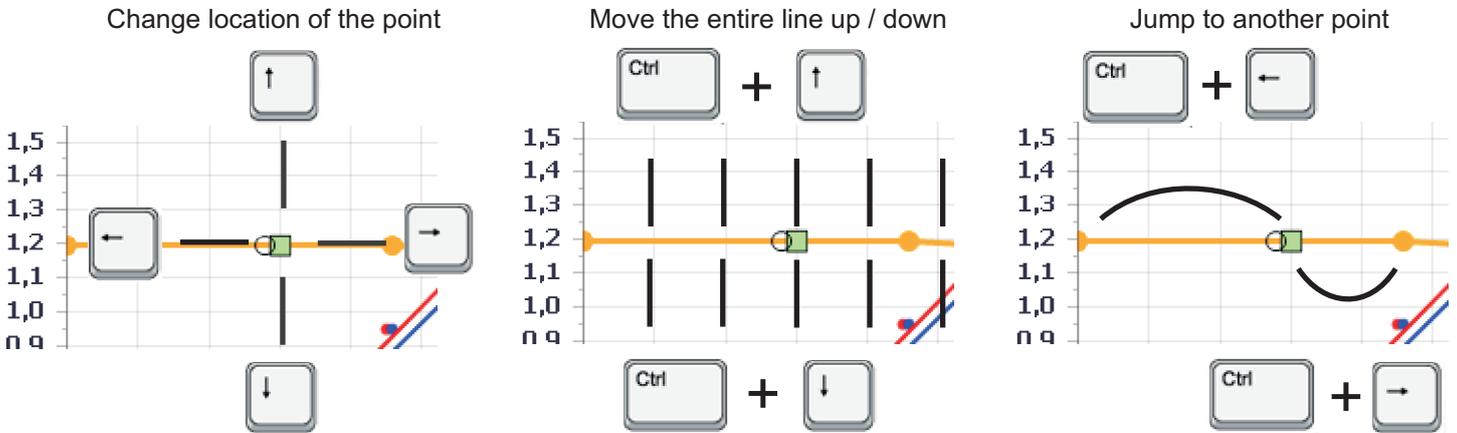
Additional function indicator - displays information about additional features i.e. fuel strategies.

Switch - it is a button with the same function as the one installed inside the car cabin. It switches on / off the gas installation and shows the level of gas in the tank.

Basic use of the software.

If you want to activate any specific point on the line of the model, move the mouse cursor towards it or over it (it will change into a green square).

You can change location of the activated point by catching it with the left button of the mouse being pressed, and dragging it to any other location on the map, or by using your keyboard.



Switch over to Petrol / Gas or **SPACEBAR** (on the Model tab only)
or **F1** (on all tabs)

Enlarge / reduce the size of the model

Change the working pressure value

After double-clicking on the field marked in blue, the selected parameter will occur in the window that can be seen in the foreground of all tabs. By increasing the size of the window, font size will be enlarged

Basic use of the software.

Fields are selected in tables with the left button of the mouse pressed. Having selected any field or fields, you can change values using your keyboard in the following two ways:

1. Using keyboard keys  or 

2. By pressing  and entering your value into the window.

Current position on the map  or  by 50 each time the key is pressed

[ms]/RPM	0	600	850	1100	1500	2000	2500	3000	3500	4000	4500	5000	6000
0,0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,5	0	0	0	0	0	0	0	0	0	0	0	0	0
2,5	0	0	0	0	0	0	0	0	0	0	0	0	0
3,5	0	0	0	0	0	0	0	0	0	0	0	0	0
4,5	0	0	0	0	0	0	0	0	0	0	0	0	0
6,0	0	0	0	0	0	0	0	0	0	0	0	0	0
8,0	0	0	0	0	0	0	0	0	0	0	0	0	0
10,0	0	0	0	0	0	0	0	0	0	0	0	0	0
12,0	0	0	0	0	0	0	0	0	0	0	0	0	0
14,0	0	0	0	0	0	0	0	0	0	0	0	0	0
16,0	0	0	0	0	0	0	0	0	0	0	0	0	0
18,0	0	0	0	0	0	0	0	0	0	0	0	0	0
20,0	0	0	0	0	0	0	0	0	0	0	0	0	0

Change the value using keyboard keys  or  by 0,1 each time the key is pressed

Modify value

Value

Absolute(=)

Linear(+/-)

Percentage(%)

Apply Cancel

Change the value using keyboard keys  or  by 1 each time the key is pressed

Current position in the table

Reducer temperature compensation

Active

°C	10	15	20	25	30	35	40	45	50	55	60	70	80	90	100
%	-8	-7	-6	-5	-4	-3	-2	-2	-1	-1	0	0	1	2	3

Gas temperature compensation

Active

°C	10	15	20	25	30	35	40	45	50	55	60	65	70	80	90
%	-8	-7	-6						0	1	2	3	4	6	8

Gas pressure compensation

Active

Acceleration compensation

Enabled Disable over temp.[°C]

Δt	2	3	3						7	8	8	9	9	10	11
%	0	0	-1	-2	-2	-3	-4	-5	-5	-6	-7	-7	-8	-9	-10

Modify value

Value

Absolute(=)

Linear(+/-)

Apply Cancel

Settings

In the Settings tab the main parameters of installation are to be set. The settings window is divided into 4 sections:

Tuning	Settings	Fuel strategies	OBD	Logger	Diagnostics	Sundries	News from AGC	
Car setup		Switch-over parameters						
Car brand and model		Hyundai i20 1.2 57kW						
Engine type		STANDARD						
Cylinders number		4						
Oxygen sensor type		DISABLED						
Gas system setup		Other options						
Fuel type		LPG						
RPM signal source		COIL						
RPM divider		1						
RPM signal sensitivity [V]		1						
Reducer type		Tomasetto Alaska						
Injectors type		Hercules GISM-i1000						
Nozzle diameter		1,5						
Injectors heating		ON						
Min. open time [ms]		2						
Extra-injections filter [ms]		0,1						
Gas level sensor		0-90						
Reducer temp. sensor [Ohm]		4k7						
Gas temp. sensor [Ohm]		4k7						
		Reducer temp. [C]						35
		Delay [s]						8
		Switch-over direction						Acceleration
		RPM						700
		RPM hysteresis (deceleration)						200
		Sequential switch-over [cycle]						5
		Fuels overlap [cycle]						1
		Min. gas pressure [bar]						0,6
		Sequential change back to petrol						OFF
		Emergency start						ON
		Fast start						67
		External devices control						OFF
		Switch LEDs brightness						8
		Pressure control						OFF

CAR SETUP

Car brand and model - informative field used to enter the make and model of the car, in which installation is mounted. To save the typed text it is necessary to confirm it with the button 'Enter' on the computer's keyboard. **It is optional to fill this field and it doesn't have any influence on the operation of the gas installation.**

Engine type - it is required to choose the engine type mounted in the vehicle:

- **standard** - for standard engines without turbo charge
- **turbo** - for charged engines - it extends the mapping of petrol and gas to 2 bars providing full support for turbine or compressor equipped engines
- **valvetronic** - for engines with the constant pressure in intake manifold (some models of BMW and Peugeot)
- **multiair** - for the engines with the variable valve timing and with air boost (some Fiat models)

Cylinders number - the number of the engine cylinders, i.e. the number of active petrol injectors. The Zenit Blue Box ECU can work with the engines 1-, 2-, 3-, 4-cylinder.

Oxygen sensor type - allows you to select the type of oxygen sensor installed in the vehicle.

CAUTION!!! Oxygen sensor readings are for information purposes only. Connecting the sensor is not necessary for correct function of the system.

GAS SYSTEM SETUP

Fuel type - the type of fuel that will be used in installation -> LPG or CNG

RPM signal source - type of RPM source:

- **coil** - choose when connecting RPM cable to the ignition coil
- **injectors** - engine speed is read on the basis of petrol injectors opening times. In this case RPM wire connection is not necessary. In this case the functions in the Fuel strategies tab are disabled.
- **camshaft1, camshaft2** - in case of connecting RPM cable to the camshaft sensor. In this case, we only support the Hall sensors (3-wire)

RPM divider - enables adjusting RPM view in the program to the real one.

RPM signal sensitivity - threshold voltage above which the rpm signal will be read. If the signal is taken from the ignition coil, the sensitivity needs to be set to about 3V - 7V, for camshaft sensor about 2.5V. For pulses from the petrol computer the threshold is to be set to about 2.5V.

CAUTION!!! In some cars e.g.: Nissan Micra, where the RPM signal is very weak threshold RPM signal must be set to 1V.

Reducer type - information field to enter type of reducer mounted in the car. To save the typed text it is necessary to confirm it with the button 'Enter' on the computer's keyboard. **It is optional to fill this field and it doesn't have any influence on the operation of the gas installation.**

Injectors type - the choice of gas injectors' field. Here you need to choose the injectors or the injection rail used in the installation.

Injectors' correction - after using the button on the right side new window pops up allowing you to control each injector individually. When there are differences in work of certain Banks or cylinders, they can be corrected by changing the value of Fixed correction.

CAUTION!!! Fixed correction doesn't replace calibration of gas injectors. When there are differences between certain cylinders you need to check the correctness of calibration of gas injectors and their output.



Additionally, you can set the Mode of an injector work:

Normal - work on gas considering the model and the corrections.

Off - petrol and gas injector is off.

Petrol - work on petrol (gas off - petrol on)

Save button- saves all changes, and **Close** - closes visible window without saving

CAUTION!!! ECU stores the settings even after the ignition is switched off, so be sure to set the desired configuration in the status window on the left before closing it. Switching mode from Normal (gas) to Petrol is also possible from the readout bar on the left side of the screen.

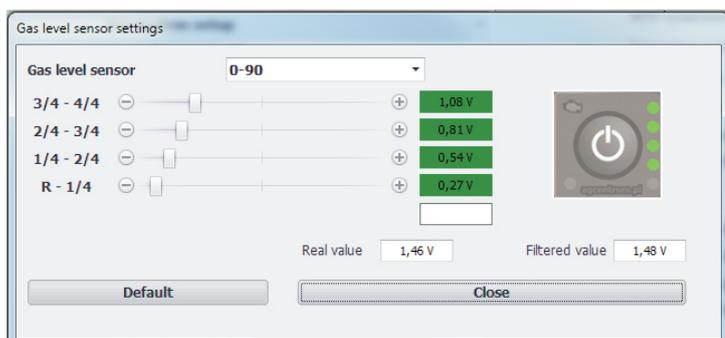
Nozzle diameter - info field to record nozzle sizes used in the installation. **It is optional to fill this field and it doesn't have any influence on the operation of the gas installation.**

Injectors heating - the function allows to warm up the gas injectors while the engine is still working on petrol. The pre-start of the gas injectors is designed to smooth the switch-over from petrol to gas (particularly useful with low outside temperatures).

Min. open time - prevents from controlling the injectors with very short timings during which the gas injector is not physically capable of opening. This value is automatically set during Autotuning process.

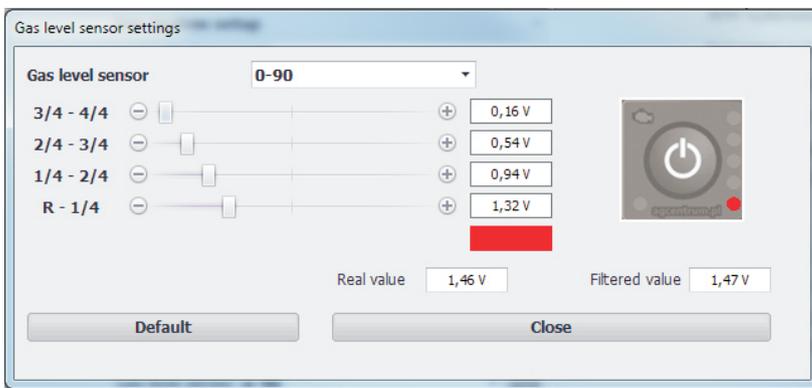
Extra-injections filter - petrol injectors signal filter. Below the set value the injectors' opening times will not be considered (elimination of the additional injection of petrol). **The filter is switched off for the value 0.1.**

Gas level sensor - possibility to select the sensor type which had been set up in the certain installation.



Gas level sensor settings - click on the button on the right side of the prompt box, launches the gas level sensor advanced calibration window. The calibration is done by setting the voltage thresholds above which certain diodes should light up. In order to do that, move the slider arrows to the left or right to set desired value. The **Save** button lets you save the voltage threshold. **Default** button lets you return to the default settings. Previously entered values can be saved by pressing **Save** button.

The **real value** informs about the voltage threshold read out directly from the gas level sensor, and in the **filtered value** window there is voltage value after filtering, and this value is displayed on the switch.



Gas level sensor settings on the 'left' multivalve. In this case, reverse voltage thresholds in relation to default settings (example to the left for 0-90 level sensor), and the system automatically adjusts the indication displayed on the switch.

Reducer temp. sensor - possibility of choosing the type of the temperature sensor installed on the reducer. **Recommended settings for the sensors from completion: 4K7.** In case "OFF" is selected, the ECU will not take into account real sensor indications, but will adopt a constant value (70 C deg) of the temperature.

Gas temp. sensor - possibility of choosing the type of the sensor used to measure the gas temperature. **Recommended settings for the sensors from completion: 4K7.** In case "OFF" is selected, the ECU will not take into account real sensor indications, but will adopt a constant value (50 C deg) of the temperature.

SWITCH-OVER PARAMETERS

Reducer temp. - It is a temperature beyond which the engine switches to gas power. **Recommended setting min. 30 o C.**

Delay - system delay time. After choosing another value than 0, the ECU will always wait for the preset number of seconds until it switches to gas. **0** - function off - switching to gas will take place immediately after reaching the set temperature and rpm. **Recommended setting min. 2 s.**

Switch-over direction: Indicates if the system is to switch over to gas supply when RPM is falling or rising

RPM - revolutions per minute above which the engine switches to gas power. **In case that system is set to switch on idle, it is recommended to activate the function Sequential switch - over.**

RPM hysteresis: This parameter is taken into account when "Switching direction" = Deceleration. It indicates how much RPM should fall for the system to switch over to gas.

Sequential switch - over - the number of cycles of injectors' opening after which switching another cylinder to gas will follow. The higher rotational speed the sooner another cylinder's switch will follow. **Recommended setting 5 - 15.**

Fuels overlap - the number of cycles for which, in the moment of switching, both fuels will be applied. Used mainly when switching to gas does not take place smoothly. **Recommended setting 0 - 1.**

Min. gas pressure - pressure threshold below which the system will revert back to petrol supply. **Recommended setting min. 1/2 of the working pressure value.**

Sequential change-back to petrol - a mode which enables sequential change-back to petrol (single cylinder to revert back to petrol) in the case of pressure drop in the installation below the one that had been set in the option **Min. gas pressure.**

Emergency start - activates the function that allows the engine to start directly on the gas. If you want to start the car on gas in an emergency, you have to push the switch petrol/gas while the ignition is off. Next, holding the switch down, turn the ignition on and wait for the long buzzer (2 sec.) confirming the emergency start. At this moment electrovalves are opening for 2 second in order to fill the system, we can release the button on the switch and start the engine. **The emergency start on gas will not work if of reducer temperature is below 10 degrees C.**

When you try to perform an emergency start of your engine on gas, you hear a short beep (0.5 sec.) and the ECU changes its status (e.g. the ECU is showing that you have switched over to petrol), it means that emergency start on gas has not been activated in the software.

Fast start - enables the start of warm engine directly on gas if after switching on the ignition, reducer temperature is above selected value. **Recommended setting: min. 50 o C.**

OTHER OPTIONS

External devices control - after activating this option, one of the output controlling electrovalves is turned on while the gas injectors are started. The blue and black wire is to be attached to electrovalves - it normally works, meaning it opens the valves earlier in order to fill the system. On the blue wire voltage appears in the moment of starting the first gas injector and it can be used to control external devices (e.g. petrol pressure or level emulator).

Switch LEDs brightness - allows you to change brightness of the LED switch. Value 1 is a minimum and 10 is a maximum brightness. In firmware version 302 onwards, changing the brightness of the LEDs is possible to achieve from the switch key. To change the LED brightness, switch on the ignition, press the switch and hold it for about 3.0 - 3.5 s. That will enter the controller into LED brightness change mode. During the procedure, all the LEDs are ON and the control starts from 1% brightness. Changing the brightness is performed in steps of about 10% upwards for approx. 1-1.5 [s].

After it reaches the maximum level of illumination the value goes back to 1%, and the procedure starts over again. To end the procedure of adjusting LED brightness, release the switch button. After a moment, appropriate LED to any given mode of operation will work.

Pressure control - to prevent excessive pressure increases on the reducer when engine braking under a heavy load. It is recommended to turn on this function if during the 'cut-off' pressure increases by 0.6 bar (or more) above the operating pressure. To activate this function, choose from the list suitable pressure value.

Recommended system pressure is 0.6-0.7 bar above the working pressure e.g. for working pressure 1.2 bar value should be 1.8-1.9 bar.

Fuel strategies

This tab contains options which enable unusual gas dosage strategies. They refer to the specific operating conditions: at high speed; at high speed and heavy load; descending at idle and at idle. Normally, after switching to gas, the engine is powered by the gas until the ignition is off or the pressure drops as a result of lack of gas in the tank. However, in certain situations described above, it is sometimes necessary to temporarily switch the engine to petrol.

You will also find here an additional function designed for engines with very long petrol injectors' opening times, which may cause looping of a petrol injection and also a special strategy for Mazda engines which change the way of fuel distribution under the influence of load change.

Section	Parameter	Value
High RPM	High RPM Strategy	DISABLED
	Switch over [RPM]	4400
	Petrol inj. time [ms]	18
	Max engine load [%]	90
	Petrol charge [ms]	1,02
	Full open	ON
Petrol contribution map		
Low RPM	Low RPM strategy	DISABLED
	Switch-over to petrol below [RPM]	900
	Change back to gas over [RPM]	300
	Petrol cycles number	8
Mazda leaning	Mazda leaning strategy	DISABLED
	Mixture leaning [%]	14
Gas dose limitation	Gas dose limitation strategy	DISABLED
	Max. time of open [ms]	20
	Disable strategy above [°C]	60
	Disable strategy above [RPM]	5000

High RPM

Disabled - the system works on high rpm on gas the same way as on petrol, means: until the rpm limiter kicks in.

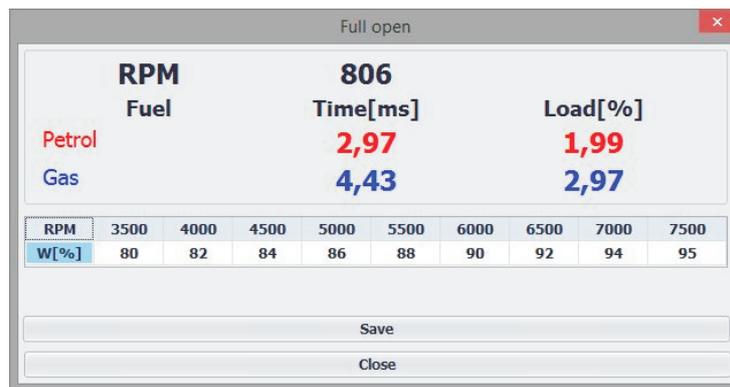
PETROL - the system, above the given rpm and injectors opening time, switches from gas to petrol. After falling below the preset value the system automatically returns to gas. The switch in the cab shows the normal operation on gas, whether in the program next to the virtual switch there is indication of this function.

MAX LOAD -the system, at a given engine load set in option "**Max engine load [%]**", regardless of rpm, switches to petrol with automatic return to gas at a lower load. Load is computed from **LPG injectors' opening time and RPM**. This function is useful for engines with very long petrol injectors' opening times and in the case of not very efficient gas injectors (e.g. the opening times of 25 ms at 4800 rpm means that the injector is still open and the engine load is equal to 100%). The ECU can for a moment control gas injectors in the same way, but in this situation it is no longer able to control the mixture, thus it is recommended (e.g. at 90% load) to switch to petrol earlier. The switch in the cab shows the normal operation on gas, whether in the program next to the virtual switch there is indication of this function.

Fuel Enrichment - above pre set RPM and petrol injectors opening time the system shortens LPG injectors' opening time and starts injecting additional amount of petrol by opening petrol injectors for the time set in **Petrol charge [ms]** window. After falling below the preset value of rpm and time the system automatically returns to work only on gas. This function is used primarily to support the gas injectors and make it more flexible and increase the dynamics of the engine on high loads. Gasoline can additionally be injected through the entire operating range of the engine and use this function also in cars with a fuel pressure sensor (instead of the emulator) or to protect valve seats. The switch in the driver's cab shows the normal operation on gas.

Petrol contribution map: Advanced function which makes it possible to supply the engine with a mix of two fuels: petrol and gas. The above-mentioned "Enrichment" is simplified as far as possible in the calibration, and makes it possible to replace part of gas dosage with constant petrol dosage set in [ms]. The petrol contribution map enables almost any change in fuel proportions, depending on the engine's RPM and loading. By changing values from 0 to 90%, you can define petrol share in the mixture, e.g. the default '0' setting means that only gas is supplied, whereas e.g. 40% means that 40% of the total fuel dosage will be petrol and the remaining 60% will be gas. Depending on the value selected, the ECU will automatically calculate petrol and gas injector opening times, provide for smooth entry into or exit from a given supply strategy, or toggle between fields with varying values. This function is available in firmware version no. 346 onwards.

Full open - this function allows to support engines with long opening times of the injectors in which may cause looping of a petrol injection(i.e. after chiptuning). If the system detects a full opening of the petrol injectors the ECU upholds gas dosage. Instead of numerical values for petrol and gas injection timing display shows "**F.OPEN**". In addition, it is possible to adjust the mixture during the looping of petrol injection. To do this, use the button on the right side of the window. New window opens allowing changing the opening time of gas injectors (70 to 95%) as a function of engine speed.



Low RPM

Disable - the system works on low rpm on gas.

Petrol - when the rpm fall below the threshold set by the installer (**Switch-over to petrol below (RPM)**) the system switches to petrol. Only if the speed increases by value (**Change-back to gas above (RPM)**) it gets back to gas. The system always switches all the injectors at the time, return to gas depends on the settings, if in the settings the cylinder sequential switching is chosen then return to gas will look the same. Switch in the cab shows the normal operation on gas, whether in the program, next to the virtual switch, there is an indication of this function.

Automat - when the rpm fall below the threshold set by the installer (**Switch-over to petrol below (RPM)**) the system switches to petrol and after the number of openings of the petrol injector set in the window (**Petrol cycles number**) it automatically returns to gas. The ECU always switches all the injectors at the time. Return to gas depends on the settings. If in the settings the cylinder sequential switching is chosen, then return to gas will look the same. **To activate this function, the rpm before drop should exceed the activation threshold by min. 250.** The switch in the cab shows the normal operation on gas, whether in the program next to the virtual switch there is indication of this function.

Mazda leaning - this function is used for the engines in Mazda cars, in which under some load the way of controlling the petrol injectors changes. Petrol injectors (and consequently the gas ones as well) start to open twice as often and for about twice as short a time (e.g. they shorten from 8 ms to 4 ms although the engine load does not change or increase). As a result of this change, when working on gas, there is a rich mixture and ignition loss and jerking may happen. Activating this function allows perfect adjustment of the mixture, both at low load at sequential work and under heavy load at non-sequential work. The ECU automatically detects the moment of change engine's fuel supply strategy. The installer's task is only to set the right value in the window **Mixture leaning (%)** so that after this change, the mixture can be optimal. The switch in the cab shows the normal operation on gas, whether in the program next to the virtual switch there is indication of this function.

Gas dose limitation (cold VAG)

This function is especially useful for cars from the VAG Group, in which very long petrol injection times occur while accelerating when the engine is heating up. Upon switch-over to gas, this may result in problems in accelerating from idle or in jerking while driving. Usually, the problem stops to occur completely as soon as the engine reaches its normal working temperature. The reason behind it is excessively rich fuel mixture on gas. If this function is activated, the gas controller does not calculate these very long petrol injection times when they begin to occur in the classical way, but limits gas dosage so as to prevent fuel mixture from being too rich.

Max time of open: Maximum gas dosage value in [ms], which is experimentally preset on a cold engine, so that there is no jerking when the gas pedal is depressed to quickly, and at the same time the engine does not lose its dynamics.

Disable strategy above [C]: This value should be close to the temperature reached by the reducer when the engine reaches its normal working temperature and jerking stops to persist.

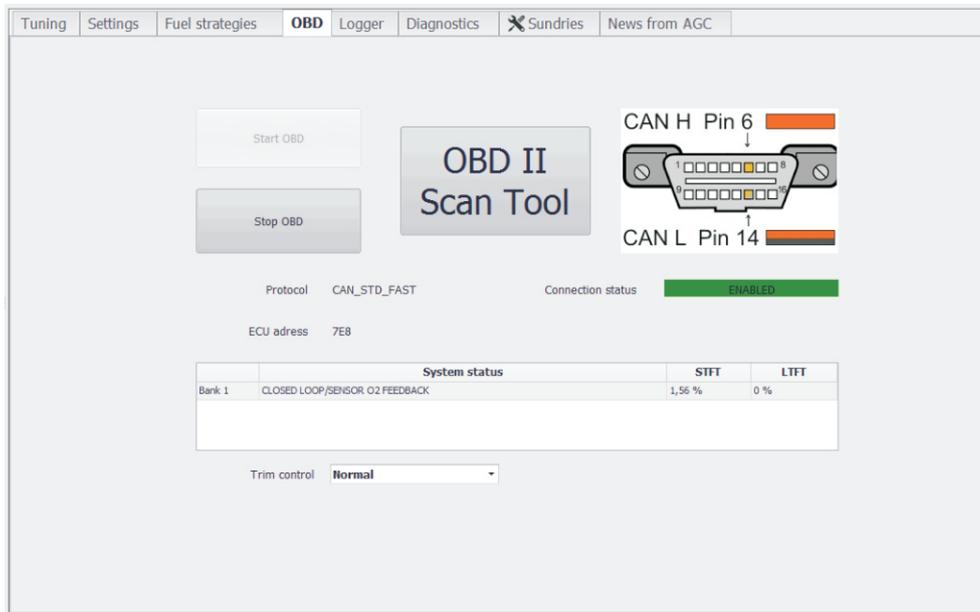
Disable strategy above [RPM]: RPM upper limit at which the limitation is switched off irrespective of temperature (so that the engine can reach its maximum power).

OBD (for ECUs in the OBD version only)

The Zenit Blue Box system in its OBD version has an advanced internal module that enables connection with the vehicle's OBDII on-board diagnostic system. In this way, it is possible to read current parameters, to read and erase OBD errors, and to dynamically adjust gas dosage based upon the parameters being read. The Zenit Blue Box system supports the CAN protocol only (ISO15765/SAE J2480).

Connecting cables to the OBD socket.

The dedicated car-wiring loom contains two cables that should be connected to cables being plugged into the OBD diagnostic socket, as per the drawing.



Connection with OBD

The OBD module in the Zenit Blue Box system should be activated within the program by clicking the "Start OBD" button in the "OBD" tab. During the first connection, ignition must be switched on, while the ECU's mode of operation does not matter (it can work both in the "Petrol" or the "Gas" mode). The scanning process may last up to 10 seconds. When this process is over, a message will be displayed whether or not communication has been established, and the program will display type of protocol, controller address, and the connection status will be updated to "CONNECTED". In normal operation, connection will be established immediately after the ignition has been switched on, provided that the system is in the "Auto" mode. If the ECU is in the "Petrol" mode at the time the ignition is switched on, it will not try to establish the connection, while the OBD module will remain in the "sleep" mode.

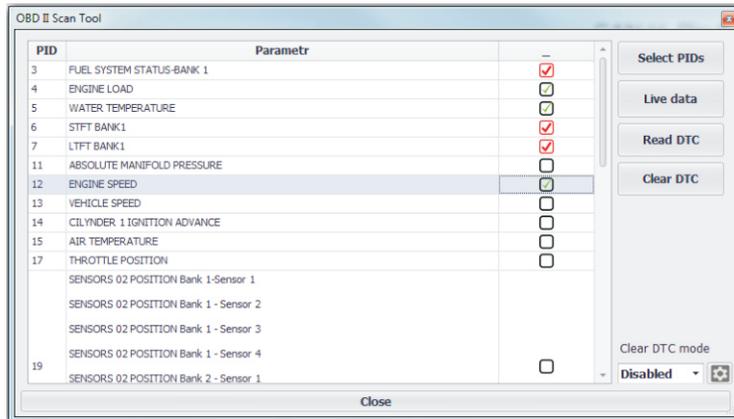
If after the ignition is switched on, the transmission channel is occupied because some other device (e.g. OBD scanner) is connected to the OBD socket, the ECU will switch over to the passive mode and will not try to establish the connection anymore till the next time the ignition is switched on.

It is possible to read OBD parameters while running on petrol, provided that the car was previously run on gas, the ECU established connection with OBD, and the system was switched over to petrol.

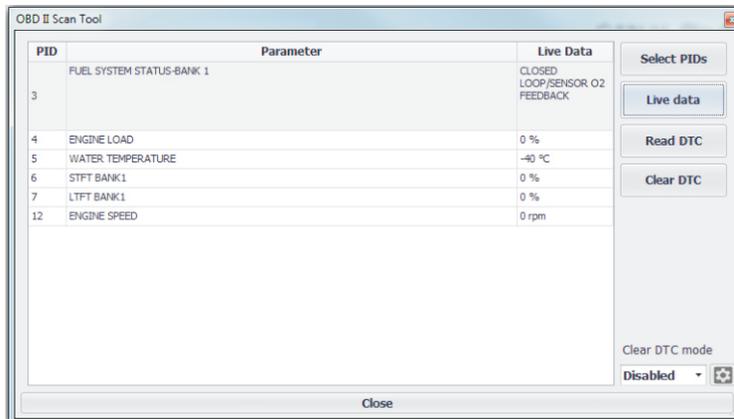
When OBD has been launched, a very important step is to set **Trim control: Normal** is a classical, most frequently occurring fuel control system in which positive trims means a tendency towards lean mixture and necessity to increase fuel dosage, whereas the negative adjustment means reach fuel mixture and necessity to reduce fuel dosage; **Reversed** is a very rare control system in which trims reversed, i.e.: the positive trim means the fuel mixture is reach, while the negative trim means the fuel mixture is lean (some cars from the VW Group cars)

OBD ScanTool

The **OBD ScanTool** is an additional tool that makes it possible to use the built-in OBD module as a universal OBD scanner. If you want to use the functionality of this tool to the full, the OBD module must be activated, and the connection status must be "Connected". When lunched, a new window will open (which you can see below).



Select PIDs: Displays a list of all available parameters (PIDs) that can be read from the vehicle's OBD. Some of them, marked in red, are reserved for the ECU and are being read out all the time; they cannot be disabled. Others are activated by selecting the window on the right. The maximum number of parameters you can watch at the same time is 8.



Live data: Starts readouts of previously selected parameters.

Read DTC: Displays diagnostic trouble codes (DTC) and descriptions of errors saved in the engine's controller (if any).

Clear DTC: On a one-off basis and immediately, clears the memory of errors recorded in engine controller memory. Note: For some cars, it is only possible to clear errors when the ignition is switched off and the engine is not running.

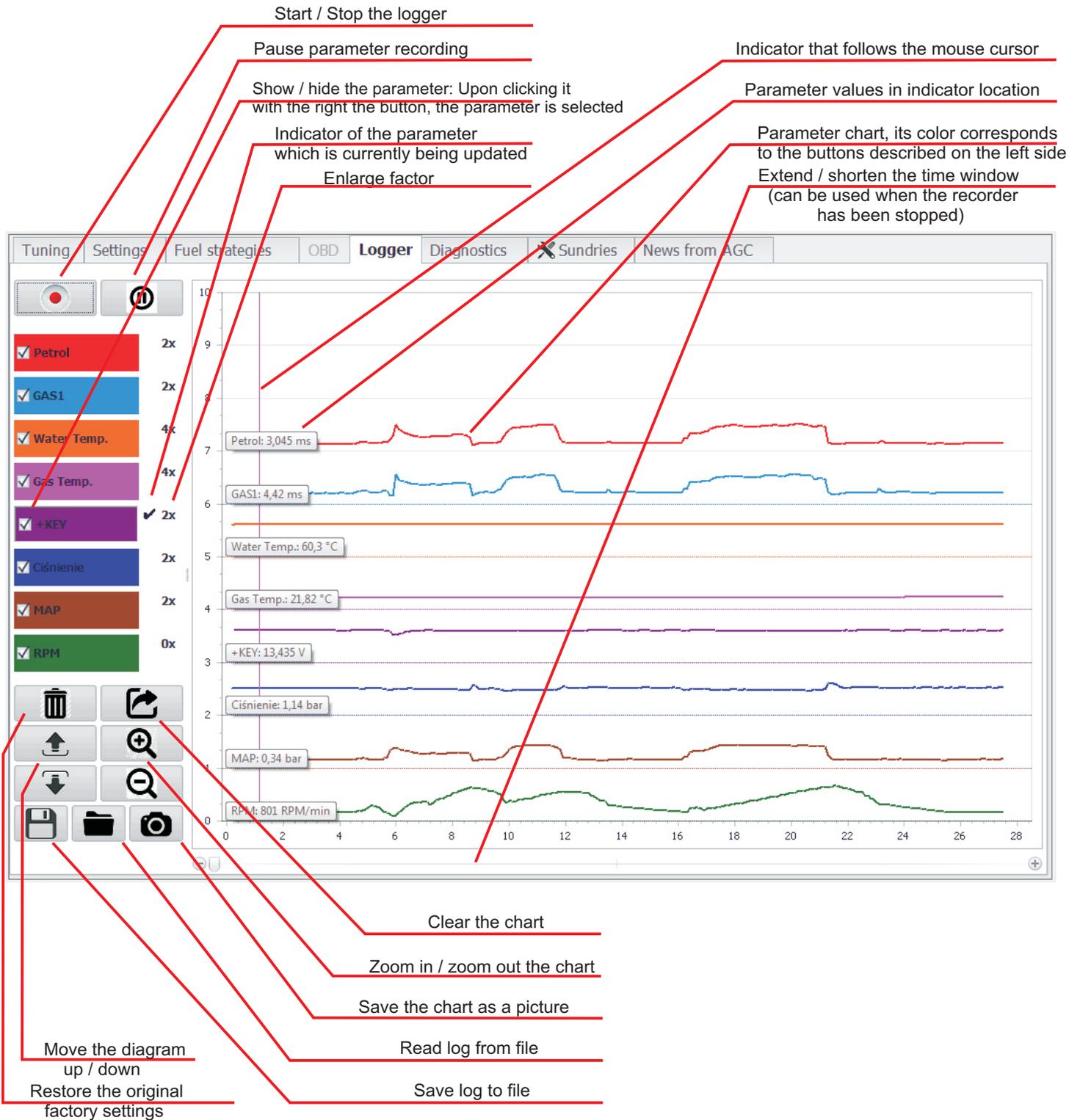
Clear DTC mode: Activates automatic erasing of OBD errors, which can take place in one of the following five available ways:

- Clear always
- Clear on key-on
- Clear on key-off
- Clear on key-on and key-off
- Selective clearing: The erase command will only be sent if an error from the user-defined list occurs

Logger

The Logger makes it possible to view data in the graphic form and to record eight selected operational parameters of the ECU; to move the charts, to zoom them in / out, and to save them to and read them from a file.

The logger is a very useful diagnostics tool, which the operator can use to easily assess the condition and behavior of the entire installation. Particular functions' trends can be saved to disk for later reference.



Diagnostics

Zenit Blue Box system has internal diagnostic tool that identifies and stores the errors occurring during operation of the system. On the errors tab, we can read the saved and the current errors and, after the removal of the cause, cancel them.

You can choose which errors in the system should switch supply to petrol and also which are to be monitored and reported by the system.

Current errors		Frozen Frame	
Error name	Status	Parameter	Value
		Injectors status	0,00
		RPM	778,00
		Lambda [V]	12,07
		Reducer temperature [°C]	-72,24
		Gas temperature [°C]	48,46
		Petrol [ms]	2,93
		MAP [bar]	0,29
		Pressure [bar]	1,55
		Power supply [V]	12,11
		Key-ignition voltage [V]	12,04
		Real gas level [V]	4,78
		Filtered gas level [V]	4,77
		Multiplier	135,81
		EV1 current [A]	0,99
		EV1 current [A]	0,99
		Gas 1 [ms]	3,91
		Switch status	33,00

Recorded errors	
Error name	Counter
> Reducer temp. below the limit ==>>	1
> Gas temp. over the limit ==>>	2

The tab is divided into three main windows. **Current errors** inform about the actual errors in the installation and its status. **Recorded errors** contain information about saved errors which had been reported in the system in the past. In this case the ECU saves the circuit name, status and the number of occurrences of error. In the **Frozen frame** are displayed parameters with which the system worked at the time of the error. **Caution! Frozen Frame are stores only parameters for the last four errors occurring in various circuits.**

In the bottom left part of the screen there are following buttons: **Erase errors** to delete all recorded errors. **Error reaction** opens a new window, where you can set which circuits will be diagnosed for common errors and which errors have to lead to automatically switch to petrol. **Beeper test** turns on the beeper inside the switch for 3 seconds.

When the Activate CHECK option is activated on the switch, the optical and acoustic signaling system will be also activated on the switch when the error is recorded (3 short beeps will be heard, and the CHECK button will pulse).

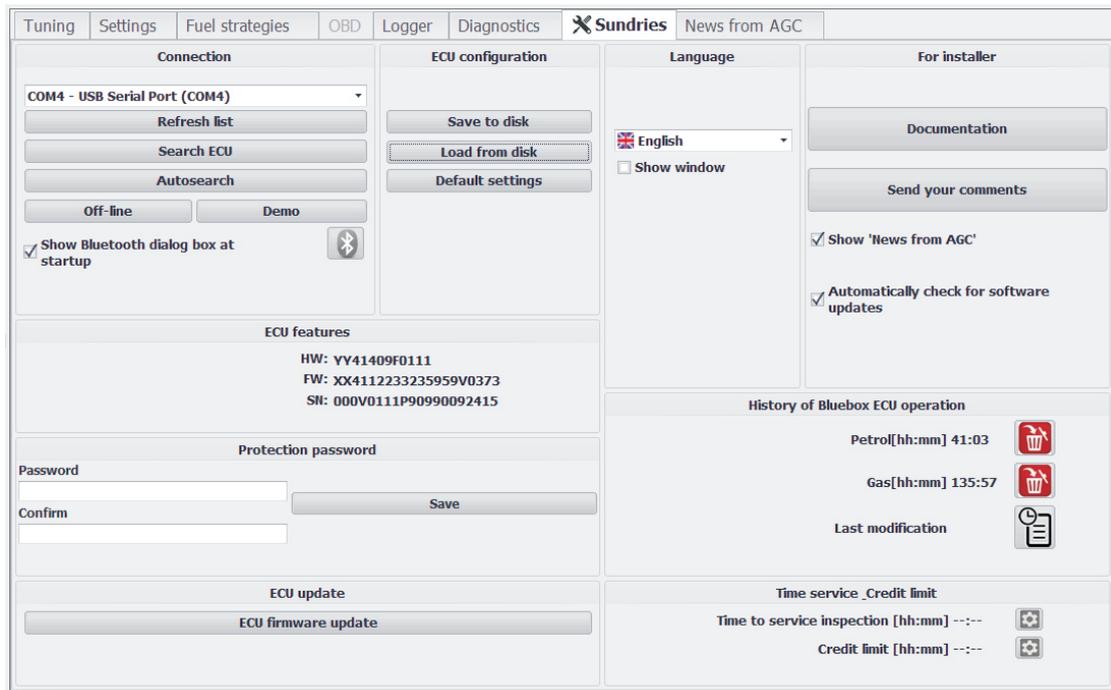
Section **Electrovalves** allows manual control of individual circuits of solenoid valves in order to verify the correctness of their actions. This function can be used also for maintenance purposes. Closing solenoid on a running engine can burn out residual gas, and thus facilitate the exchange of filters or regulator. **Graphic power display** tells you how much power is being currently drawn by devices connected to the solenoid valves' circuits. **The Zenit Blue Box system has two independent outlets used to control solenoid valves. Regardless of the number of circuits used - maximum power drawn from the system must not exceed 50 W. For example, you can connect up to 4 solenoid valves to one output without connecting anything to the other, or a maximum of 2 to one and 2 to another.**

Conditions of recording and possible causes of errors in control unit Zenit Blue Box

Diagnosed element	Possible messages	Conditions of error recording	Possible causes
Injector_GAS1...8 (gas injector 1 to 8)	OPEN LOAD	$I < 75 \mu A$	Break in the wiring loom or damaged injector coil.
	CUR. LIMIT	$I > 7A$ or $T > 150^{\circ}C$ ($I_{max}=12A$)	Short circuit in the wiring loom or damaged injector coil.
	HARDWARE FAIL		Irreversible damage to the gas injector control circuit
Gas pressure	UP LIMIT	$> 3.8 \text{ bar}$	Damaged or contaminated reducer, damaged pressure sensor.
	DOWN LIMIT	$< 50 \text{ mbar}$	Lack of gas in the tank or contaminated reducer or electrovalves. Damaged pressure sensor, multivalve or power pipe of the reducer.
M. A. P.	UP LIMIT	$> 3.8 \text{ bar}$	Damaged wiring loom or pressure sensor, incorrect mechanical connection.
	DOWN LIMIT	$< 50 \text{ mbar}$	Damaged wiring loom or pressure sensor, incorrect mechanical connection.
Temperature of the reducer	UP LIMIT	$> 105^{\circ}C$	Damaged sensor of the reducer temperature, short circuit in the wiring loom of the sensor, assembly near elements emitting large amounts of heat (e.g. exhaust manifold).
	DOWN LIMIT	$< 10^{\circ}C$	Damaged sensor of the reducer temperature, break in the wiring loom of the sensor, lack of circulation of coolant through the reducer or incorrect circulation, too low efficiency of the reducer.
Temperature of gas	UP LIMIT	$> 100^{\circ}C$	Damaged sensor of gas temperature, short circuit in the wiring loom of the sensor, assembly near elements emitting large amounts of heat (e.g. injectors assembly under the bonnet).
	DOWN LIMIT	$< -10^{\circ}C$	Damaged sensor of gas temperature, break in the wiring loom of the sensor.
Voltage	UP LIMIT	$> 18V$	Damaged alternator.
	DOWN LIMIT	$< 9V$	Discharged battery, damaged alternator.
Electrovalve 1	OPEN LOAD	$I < 50 \mu A$	Break in the wiring loom or damaged electrovalve coil.
	CUR. LIMIT	$I > 5A$ or $T > 150^{\circ}C$ ($I_{max}=6A$)	Short circuit in the wiring loom or damaged electrovalve coil.
Electrovalve 2	OPEN LOAD	$I < 50 \mu A$	Break in the wiring loom or damaged electrovalve coil.
	CUR. LIMIT	$I > 5A$ or $T > 150^{\circ}C$ ($I_{max}=6A$)	Short circuit in the wiring loom or damaged electrovalve coil.

Sundries

In this tab you will find other options for the program including communication port selection, save and load configuration files, firmware update, etc.



The tab is divided into few sections :

Connection: Contains all options of communication between the controller and the program. Each time the program is started, it will be trying to establish communication automatically. Searches through all active COM ports starting from the one that was used last. Therefore, while using the USB interface, we recommend connecting it always to the same socket, as it will make connection process with the ECU much shorter. When the connection is discontinued and the interface is disconnected, the program will automatically go to the Off-line mode. Connection can then be re-established in a number of ways.

Refresh list: Starts the computer scanning process, and searches through all active ports.

Search ECU: Makes it possible for you to select a port from the list on your own, and to connect it with the controller after clicking the button.

Autosearch: Activates the automatic ECU search.

Off-line: Ends the connection, and switches the program over to the off-line mode.

Demo: Starts the "Demo" mode.

Show Bluetooth dialog box at startup: If this option is selected, each time the program is started, it will enquire what kind of connection is to be used: Bluetooth or cable connection.

Bluetooth icon: Switches the program over into the mode in which Bluetooth will be used in the first sequence for do connection purposes.

ECU Configuration window contains options allowing saving configuration file, read the configuration file and save to the ECU, browse the folder with saved configuration files and restore the system to the factory settings (**Default settings** key)

Section **Language** enables various language version of the system. Option **Show window** activates the language choice options on program start up.

The **For the Installer** section contains a shortcut to documentation (incl. program operating manual, electrical connections diagram, and ECU pinout) and the **Send your comments** button that enables prompt communication with the AG Center's technical support service. In order to submit your remarks, it is necessary to have active connection with the Internet.

History of Zenit Blue Box ECU operation: Contains time counters of operation on petrol and on gas, as well as a list of most recent modifications, which contains date, time, and the code of the computer used to connect with the ECU.

ECU features window contains information about the hardware version (HW), the software version (FW) and serial number (SN) of the controller.

Section **Protection password** allows you to protect the controller with a password to prevent unauthorized access. To block access to the controller you should enter a predetermined password phrase in the **Password** window. To avoid any error re-submit password in the **Confirm** window (the password will appear as asterisks) and use the **Save** button. From now on, when connection with this controller has been established, only the "Sundries" tab will be shown with its active basic functions and the status line. All options of the program will only be enabled if you enter the password.

To unlock the ECU and remove the password, please delete the previously given phrase from the windows **Password** and **Confirm** leaving them blank and use the **Unlock** button.

ECU update allows you to change the firmware version of the controller. Zenit Blue Box gives you the ability to update and downgrade version of the firmware.

Time Service window displays the time remaining until the next service (only if the option is enabled).

Set service schedule

Service reminder

Average speed [km/h]

x

Time [h]

=

Distance [km]

Save

Close

To set up and activate the service reminder, please use the button on the right side. A new window appears in which you select the **Service reminder**. By default, maintenance is set to 200 hours of driving on gas with the average speed of 50 km/h, i.e. 10,000 km. You can set different service intervals. To do so you have to properly modify the values in the **Time** or **Average Speed** window. Program automatically calculates the **Distance** to the specified values. Click the **Save** button in order to save settings.

Credit limit settings

Credit limit on/off

Average speed [km/h]

x

Time [h]

=

Distance [km]

Save

Close

The way the **Credit limit** function works is very similar to maintenance reminder. It is also configured in the same way. The main difference is that after the lapse of the pre-set time, the system stops to switch over to gas and it can only be run on petrol. When activating this function, it is important to secure your ECU with a password at the same time in order to prevent from any unauthorized modification. Note: If the Credit function is active and the ECU is secured with a password, then, in case you forget your password, you should contact the manufacturer, as it is not possible to reset the ECU on your own.

Preliminary selection of nozzles

Preliminary selection of nozzles can be performed using the following chart. These values should be treated as estimated. The final nozzle size is determined by parameters of the multiplier after calibration is carried out.

WARNING! The following charts are applicable only in sequential injection systems.

In the case of half-injection or "full group" type use smaller nozzles.

HANA H2000 ,H2001/HERCULES GISM-i1000- sequential injection system

Injector type/nozzle	Pwr. for 1 cyl.	Pwr. for 4 cyl.	Pwr. for 6 cyl.	Pwr. for 8 cyl.
<i>Yellow</i> / 1.9 mm	< 20 HP	< 80 HP	< 120KM	< 160 HP
<i>Black</i> / 2.1 mm	17 – 27 HP	68 – 108 HP	102 – 162 HP	136 – 216 HP
<i>Red</i> / 2.4 mm	24 – 36 HP	96 – 144 HP	144 – 216 HP	192 – 288 HP
<i>Green</i> / none	33 – 47 HP	132 – 188 HP	198 – 282 HP	264 – 376 HP
<i>Blue</i> / BF	42 – 60 HP	168 – 240 HP	252 – 360 HP	336 – 480 HP

MATRIX HD 344- sequential injection system

Nozzle diameter	Pwr. for 1 cyl.	Pwr. for 4 cyl.	Pwr. for 6 cyl.	Pwr. for 8 cyl.
1,8 mm	10 – 13 HP	40 – 56 HP	60 – 78 HP	80 – 112 HP
2,1 mm	14 – 20 HP	56 – 84 HP	78 – 120 HP	112 – 168 K HP
2,4 mm	21 – 25 HP	84 – 100 HP	126 – 156 HP	168 – 200 K HP
2,7 mm	26 – 32 HP	100 – 128 HP	156 – 192 HP	200 – 256 K HP

VALTEK 3 OHM, RAIL 3 OHM, TOMASETTO IT01 -sequential injection system

Nozzle diameter	Pwr. for 1 cyl.	Pwr. for 4 cyl.	Pwr. for 6 cyl.	Pwr. for 8 cyl.
1,8 mm	18 – 23 HP	72 – 92 HP	108 – 138 HP	144 – 184 HP
2,1 mm	23 – 28 HP	92 – 112 HP	138 – 168 HP	184 – 224 HP
2,4 mm	28 – 33 HP	112 – 162 HP	168 – 198 HP	224 – 264 HP
2,7 mm	33 – 40 HP	132 – 160 HP	198 – 240 HP	264 – 320 HP

OMVL Reg Fast, HERCULES Blue - sequential injection system

Nozzle diameter	Pwr. for 1 cyl.	Pwr. for 4 cyl.	Pwr. for 6 cyl.	Pwr. for 8 cyl.
1,8 mm	12 - 17 HP	48 - 70 HP	72 - 105 HP	96 - 140 HP
2,1 mm	18 - 24 HP	70 - 98 HP	105 - 147 HP	140 - 196 HP
2,4 mm	25 - 32 HP	98 - 130 HP	147 - 195 HP	196 - 260 HP
2,7 mm	33 - 40 HP	130 - 162 HP	195 -243 HP	260 - 325 HP

Recommended working pressure form 1.0 to 1.3 bar.

Tuning - Autotuning

Autotuning of the system is pre-adjustment of Zenit Blue Box to a specific engine. The procedure is done at low RPM and should be carried out on a fully warmed engine. In the first step we have the ability to view and revise the basic system settings required for the proper conduct of the process. You should also choose calibration method: **Fast** or **Precise**. Option Fast relies on switching over all cylinders at once, and the Precise - switches each cylinder in specific order.

CAUTION! Before autotuning is recommended to disable vehicle's additional equipment that can introduce interference (air conditioning, ventilation, lights, radio, etc.). During autotuning, do not allow engine overheating (it may cause to start radiator fan) or turn the steering wheel. Failure to follow these instructions may have a significant impact on the accuracy of autotuning.

Tuning - Line

Line tab consists of a chart showing percentage multiplier ratio (on which LPG injection time is calculated) to the petrol injection time. The Line tab displays also petrol and gas maps. There are panels for managing a graph, maps, and readouts the most important parameters of the installation.



The main window shows **model line** and maps: **petrol (red)** and **gas (blue)**. On the left side is the **axis of the multiplier** and in the lower part - **axis of the injection time (adjusted using the slider below)**, and to the right **MAP axis**. In the upper left corner there is a display of the **injection time (ms)** and the percentage **multiplier (%)** for the current position cursor position on the map. This allows us to check the current parameters by hovering the cursor over the model line at any given point.

Model curve can be modified in several ways:

To **activate** a specific **point** on the model line move cursor close to the line or roll mouse over the line (curve point changes to a green square).

To change the position of the active point click and drag it anywhere on the map, or move it by using the arrow keys on the keyboard.

To switch between active points use **CTRL key and left or right arrow keys**

To move all the points of the model down or up, activate one of the points, then hold down the **CTRL key and use the keyboard arrow keys down or up**.

If you hold down **SHIFT key** to change the position of a particular point on the model line or all points they move in increments of 5 units.

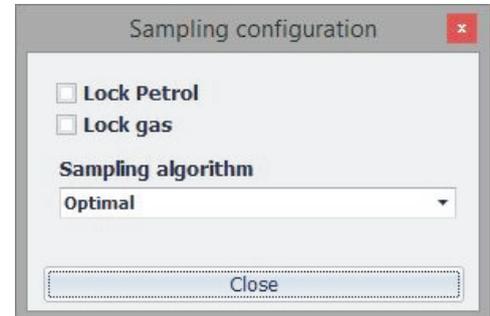
By increasing the multiplier value, i.e. by moving it up, gas dosage is increased. By decreasing the multiplier value, i.e. by moving it down, gas dosage is reduced.

You can **add points on the model line**. In order to do this, click the **right mouse button** on the line or use **Insert key** (model line may contain a **maximum of 16 points**).

To **delete the selected point**, click it with the **right mouse button** or use the **DEL** key from the keyboard.

In the bottom of the window there is the **View sampling** option that allows hiding petrol and gas maps at any time. The **Suggested tuning** displays a green line on which model should be developed to make the installation correctly set. **Auto alignment** automatically sets the model line in accordance with the Suggested tuning (Suggested tuning and Auto alignment features will be presented in more detail later in this manual). **Clear gas** removes gas map and **Clear petrol** removes petrol map.

On the right side there is advanced settings button. It displays **Sampling Configuration** window, where we can **lock the petrol and gas map** refresh, as well as to choose a **Sampling algorithm**. The default is the optimal algorithm, which allows you to collect maps with decent speed and good accuracy.



In the lower part there is a readout panel, which displays the current injection time for petrol (**Petrol Inj. Time**) and gas (**Gas Inj. Time**) the vacuum / pressure value in inlet manifold (**MAP [bar]**), the current pressure (**P [bar]**) and the option of setting the working pressure (**Working pressure [bar]**). By double-clicking the selected parameter, its readouts can be viewed in the additional window that can be seen in the foreground of all tabs. By increasing this window's size, font size will be enlarged.

Caution! The correct working pressure setting is required for proper operation of the gas pressure compensation. It is automatically set during autotuning process. For any future pressure changes autotuning must be performed or to manually adjust the pressure so that when working on gas at idle with fully warmed engine, its value equals pressure in the system.

Installation adjustment

The next step after autotuning, leading to properly adjusted installation, is to collect map of petrol injectors' opening time under different loads during operation on petrol and gas. Gathering these maps and their interpretation will allow a fairly easy way to check whether the mixture is correct throughout the load range and whether driving on gas will not 're-tune' the petrol controller. In addition, the Zenit Blue Box software is able to suggest changes to the model or to modify the model to achieve the best tuned up system.

After successful autotuning, perform a test drive to create **Petrol** and **Gas** maps. Petrol and gas map is automatically created in controller's memory regardless of the connection to the computer and diagnostic software. But in order to accelerate the process, we recommend a test drive with connected PC. Then you will be able to keep an eye on creating a map and generate loads to create complete characteristics of the engine.

Collecting both maps should be done with warm engine, the same gear and on the same stretch of the road.

Map points are "collected" under different loads but only if:

- reducer temp. > 50 oC
- rpm >500 and <4000
- MAP <0,95 bar for standard engine and <1,85 bar for turbo charged
- time after ignition >60 sec.

Readiness to collect map indicates green color of map plotting ball. If even one of the above conditions is not met the ball will be black and the map will not be collected.

Collection of maps we start driving on petrol. To map points visible **View sampling** option should be selected.

If the points are visible within the whole range of engine load and a continuous Averaging line appears you may move to perform the gas map.

When installation is in use the map refreshes automatically. To disable the petrol map refresh, use **Lock petrol** option.



After the petrol map is collected, switch- over the system to gas mode and create a **gas map** in exactly the same way as petrol.



If the lines do not overlap map means that the dose of gas is not optimal and model requires adjustment. You can do this in two ways. The first is the manual adjustment. If the blue points (gas) are below the gasoline (red) it means that the dose of the gas is too small and the model should be moved up or increase your multiplier. If the blue points are above petrol it means that the dose of gas is too high and the model should be moved down or reduce the multiplier.

The second way is to use the function **Suggested tuning**. After its activation green line appears on the graph indicating suggested how the model should look like for both petrol and gas maps to be aligned. At this point, the model must be adjusted. You can do this in two ways: using the automatic **Auto alignment** function or manually. Manual adjustment is done by "pulling" individual points of the model run model curve close to the Green Line, making it smooth, without cusp points. In **Auto alignment** option, program itself will correct the model.



After "Auto alignment" function was activated, the gas map will be automatically erased and only the petrol map will remain on the screen. To check the results you have to collect the gas map again. A new map of the gas is made in the same way as the previous one.

If the adjusted model line maps still do not match, you should make the next adjustment in the same way as the first time. Select the function **Suggested tuning**, press the button **Auto alignment** or carry out a manual adjustment of the model curve. We create a new gas map. Typically adjusting ones or twice is sufficient for proper installation settings. For large map disparity using those features may be required a greater number of times.

Calibration is complete when the gas map line overlaps with the petrol map line.



CAUTION! For newer cars with more advanced engines map overlapping does not have to be synonymous with the correct and optimal setting of the gas system. In such cases, we suggest that you verify the adjustment using OBD scanner, comparing the fuel trims when working on gas and petrol.

At the end, we suggest to check the engine idling. To do this, leave the car idling, running **on petrol** and observe **petrol injection time**. Next, change the power supply to **gas** and again observe **petrol injection time**. After switching fuel supply the timing should remain unchanged or should not significantly change. Permissible difference is about 3%. If the difference is greater, adjust the setting using following tab Tuning ->Map

Tuning - Map

Map tab includes a table that allows you to further adjust the gas dose depending on the RPM and the gasoline injection times.

Tuning														
Settings	Fuel strategies	OBD	Logger	Diagnostics	Sundries	News from AGC								
Line	Map	Compensations	Autotuning	Autoadaptation										
<input checked="" type="checkbox"/> Active														
[ms]/RPM	0	600	800	1100	1500	2000	2500	3000	3500	4000	4500	5000	6000	
0,0	-6	-6	-6	-2	0	0	0	0	0	0	0	0	0	
1,5	-11	-11	-8	-4	0	0	0	0	0	0	0	0	0	
2,5	-11	-11	-8	-4	0	0	0	5	7	7	7	7	7	
3,5	-6	-6	-6	-2	0	0	0	5	8	12	12	12	12	
4,5	0	0	0	0	0	0	0	5	8	15	15	15	15	
6,0	0	0	0	0	0	0	0	5	8	15	15	15	15	
8,0	0	0	0	0	0	0	0	5	8	15	18	18	18	
10,0	0	0	0	0	0	0	0	5	8	15	16	16	16	
12,0	0	0	0	0	0	0	0	5	8	13	13	13	13	
14,0	0	0	0	0	0	0	0	5	8	13	13	13	13	
16,0	0	0	0	0	0	0	0	5	8	13	13	13	13	
18,0	0	0	0	0	0	0	0	5	8	13	13	13	13	
20,0	0	0	0	0	0	0	0	5	8	13	13	13	13	
Petrol Inj. Time [ms]	3,02			Pressure [bar]	1,05				MAP [bar]	0,27				
Gas Inj. Time [ms]	3,73			Working pressure[bar]	<<	1,01		>>	OBD	---				

Map function enables very precise tuning of gas dosing in a broad range of speeds and engine loads. It can also be used to fine tune the time of gas injection at idle and low load (with the air conditioner or the gear engaged in a car with automatic transmission).

Active option allows one-click activation or deactivation of this function

Green cursor moving across the fields of the table shows the current engine parameters (RPM and petrol injections time).

If you want to change the dose of the gas in a particular field simply select it by clicking the **left mouse button**. **To select an area** - click and **hold left mouse button** and drag cursor around the area.

To make a correction after selecting the appropriate field or area: press **ENTER**.

Dialog box pops up :

Modify value

Value

Absolute(=)
 Linear(+/-)
 Percentage(%)

Adjustments can be changed in three ways

Absolute (=) - correction takes set value regardless of the previous value. In this given example adjustment will change the selected field or area to -8

Linear (+/-)- correction increases or decreases (depending on the sign) by a specified numerical value. In the given example, correction will decrease by 8 compared to the values contained in the selected window or area.

Percentage (%) - correction increases or decreases (depending on the sign) by a specified percentage. In the given example, correction will decrease by 8% compared to the values contained in the selected window or area.

Tuning - Compestiation

The **Compensation** tab contains charts with which it is possible to reduce the impact of changes in temperature and pressure on the mixture.

Tuning Settings Fuel strategies OBD Logger Diagnostics Sundries News from AGC

Line Map **Compensations** Autotuning Autoadaptation

Reducer temperature compensation
 Active

°C	10	15	20	25	30	35	40	45	50	55	60	70	80	90	100
%	-8	-7	-6	-5	-4	-3	-2	-2	-1	-1	0	0	1	2	3

Gas temperature compensation
 Active

°C	10	15	20	25	30	35	40	45	50	55	60	65	70	80	90
%	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	6	8

Gas pressure compensation
 Active

Acceleration compensation
 Enabled Disable over temp.[°C] **60** Return speed **5**

Δt	2	3	3	4	5	5	6	6	7	8	8	9	9	10	11
%	0	0	-1	-2	-2	-3	-4	-5	-5	-6	-7	-7	-8	-9	-10

Petrol Inj. Time [ms] **2,79** Pressure [bar] **1,15** MAP [bar] **0,35**

Gas Inj. Time [ms] **4,69** Working pressure [bar] **1,11** OBD 3,12 % 0 %

Compensations for the **reducer temperature** and the **gas temperature** help maintain optimal mixture when the engine is warming up or when the gas temperature rises above the standard:

- immediately after the switch after a long standstill when the engine is still not warmed up and the gas has low temperature and high density - enabled compensation prevents too rich mixture - gas injectors opening times are shortened, e.g.: at Tred = 30 at 4%

- when gas temperature increases, gas density decreases and it may lead to serious impoverishment of the mixture, when you turn the corrections on, in case of high gas temperatures the ECU enriches the mixture, for example.: At T of gas = 90 at 8%.

Compensation for **gas pressure** prevents changes in the mixture at pressure fluctuations.

In Zenit Blue Box entire algorithm has been "stitched into" the program. For proper compensation the operating pressure has to be set correctly. This can be done under the tab **Tuning-> Line** (more information on this subject can be found in chapter: Tuning-> Line).

For proper system operation, we recommend leaving temperature and pressure compensations on and to checking the correctness of the working pressure setting.

Factory setting - **recommended** - correction values can be changed. To do this, check the box using the mouse and use the **ENTER** key. A window will appear where you can enter a new correction value. The second way is to select the fields you want to change and use the '+' and '-' on the keyboard. This way both the correction value and temperature value can be changed.

Switch - system status indicator

The switch in the Zenit Blue Box system indicates various operating states helping with the initial diagnosis of the gas installation:

- **LEDs "ribbon"** - no communication with the ECU
- **gas level LED flashing** - waiting for the right conditions to switch
- **"check" LED flashes + 3 x beep sound** - an error in diagnostics, driving on gas possible
- **"check" LED permanently lit + 2 x beep sound** - service reminder, driving on gas possible
- **gas level LED "line decreasing" + 1 x long beep sound** - gas pressure too low - switching to petrol
- **gas level LED "line growing" + 1 x long beep sound** - an error in diagnostics causes switching to petrol

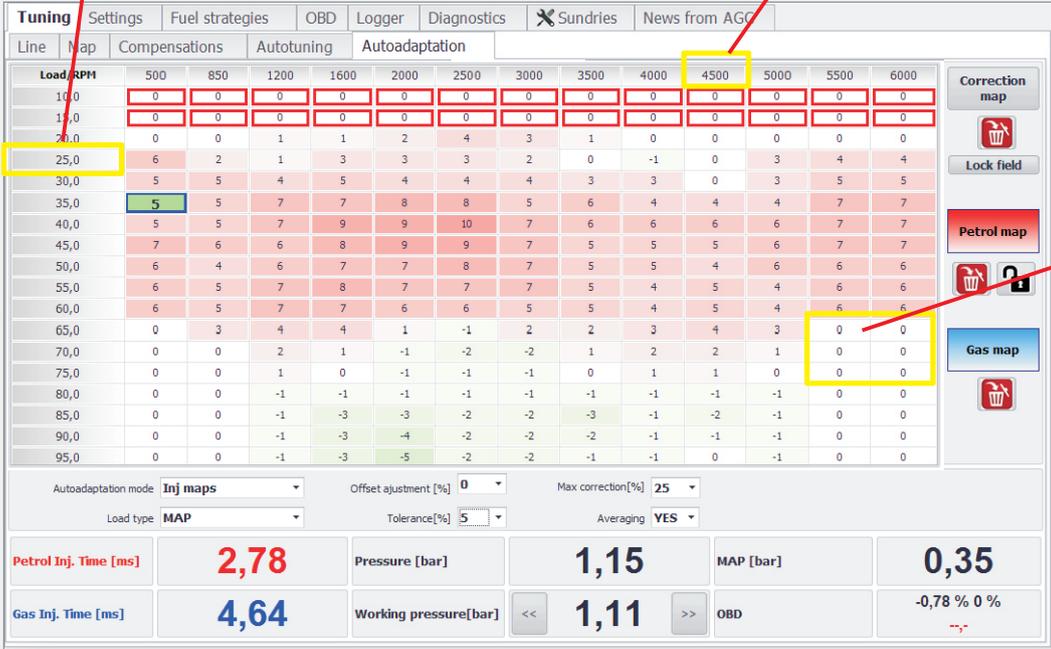
Tuning: Autoadaptation (for ECUs in the OBD version only)

The Zenit Blue Box controller in the OBD version is equipped with the Autoadaptation system. It is an automatic "learning" function, which, on a regular basis, over the entire period of driving on gas, makes sure that the fuel mixture is optimal. Autoadaptation in the Zenit Blue Box controller can be operated in one of the following two modes: 1. Inj Maps 2. OBD

No matter which mode has been selected, the operating algorithm is similar. While driving on gas, the Autoadaptation Correction Map is additionally taken into account in gas dosage calculations. Based upon the collected data, the ECU verifies on a regular basis if the gas fuel mixture is within its pre-set tolerance. If not, then it corrects the adjustments map and gas dosage at the same time, on a regular basis. The following parameters are used to configure this function:

Change the value using keyboard keys  or  by 1 each time the key is pressed

Change the value using keyboard keys  or  by 50 each time the key is pressed



The screenshot shows the 'Autoadaptation' tab in the software. It features a grid of values for different RPM ranges (500 to 6000) and load types (10.0 to 95.0). The '4500' RPM column is highlighted in yellow. A red box highlights the '5' value in the 35.0 RPM row. A 'Modify value' dialog box is open, showing the 'Value' field set to '0' and the 'Absolute(=)' radio button selected. The 'Enter' button is highlighted in red. Below the grid, there are settings for 'Autoadaptation mode' (Inj maps), 'Offset adjustment [%]' (0), 'Max correction [%]' (25), 'Load type' (MAP), and 'Tolerance [%]' (5). The 'Petrol Inj. Time [ms]' is 2,78, 'Gas Inj. Time [ms]' is 4,64, 'Pressure [bar]' is 1,15, and 'Working pressure [bar]' is 1,11. The 'MAP [bar]' is 0,35 and the 'OBD' status is -0,78 % 0 %.

Manual change of the value:
 - select the field or area with the left button of the mouse,
 - press 
 - enter the value and confirm

Autodaptation mode -

OBD: Short- and long-term fuel trims read directly from the car's OBD will be the autoadaptation base.

Inj Maps: Autoadaptation will be based upon maps of petrol injector opening times collected while driving on petrol and while driving on gas. No connection with OBD will be required.

Static: Autoadaptation jest inactive, but the Correction Map being collected will be taken into account while calculating gas dosage.

Disabled: Autoadaptation is inactive, Correction Map will not be taken into account while calculating gas dosage.

Load type: MAP - The load on the engine will be calculated based upon pressure in inlet manifold the more open the throttle, the higher pressure in the manifold, and the higher the load on the engine.

OBD - Information on engine load will be collected directly from the vehicle's OBD (recommended for Valvetronic engine types, where there is no vacuum in inlet manifold).

Offset adjustment: The basic fuel mixture correction value (i.e. the one that will be aimed at, the ideal one). Usually, it should be equal to zero, i.e. the system will aim for the fuel mixture to be the same both on gas and on petrol. In case of cars with high mileage, it is sometimes advisable to check STFT and LTFT values on petrol. If these values are different from zero on the average, then the Offset should be set in a similar manner as well.

Tolerance: The maximum difference between the currently calculated correction and the **Offset adjustment** value. If the actual calculated correction is within tolerance, then Autoadaptation will not introduce any additional gas dosage adjustments. As an example, in case the Offset is 0 and Tolerance is 5, then Autoadaptation will only start to work when the current correction is lower than -5% or higher than +5%. Due to the natural tendency of the petrol controller to make instantaneous changes in injectors' opening times and to make short-term adjustments, the minimum tolerance that can be set is 3%, and the recommended one is 5%.

Max correction [%]: The maximum limit value of gas dosage adjustment, which can be imposed by Autoadaptation. By default, it is 25%.

Autoadaptation mode - Inj Maps

In this mode, Autoadaptation is based upon maps of petrol injector opening times. Therefore, the first and the most important step is to create a map of petrol injector opening times while driving on petrol. Such map will serve as a model that the system will aim at while driving on gas. Values are collected over the full range of the engine's loads and its RPM. Conditions required to start collecting samples are the same as for standard maps that can be seen in the Model tab (see: page 20). The sample collecting status can be viewed upon clicking the Petrol Map button. It is the quality of the petrol map that decides about how accurate Autoadaptation can be in this mode! The more petrol samples, the more accurate the Autoadaptation process will be.

The map development status, which you can see on the right side of the screen, will inform you on map development progress on the percentage basis. The minimum rate that provides for safe and precise operation of this function is 65%.

Petrol samples are collected regardless of whether the controller is connected to a PC computer or not. However, in order to create the petrol map faster and make it more accurate, we recommend to drive with the computer connected (to view progress in the map development process).

Fields excluded from Autoadaptation

Toggle between the particular maps:
Grey - Correction Map
Red - Petrol Map
Blue - Gas Map

Upon having collected the appropriate number of fields, the system can be switched over to gas supply. As you drive on gas, the blue map of petrol injector opening times will be created automatically, as well as the adjustments map.

Erase the map

Lock the petrol map

Each map can be erased by pressing the red button with a waste bin icon on it. In order to exclude some area from the Autoadaptation process, e.g. an area of very low loads which the controller enters while cut-off, as in the example enclosed, or the low RPM area (idle), select it with the left button of the mouse, and press the **Lock field** button

Autoadaptation mode - OBD

The OBD mode has one significant advantage over the 'Inj Maps' mode. It does not require collecting of the basic petrol map. When all the pre-settings are completed and Autoadaptation is activated in the OBD mode, you can start to drive on gas practically right away. Also, there is no danger that, while driving, you will start to use the engine in those working areas (e.g. very high RPM), where the basic petrol map is missing. Everything this mode needs is connection with the OBD system. The Zenit Blue Box system takes regular readings of the engine's performance parameters, such as status of the fuel system or STFT and LTFT, records them, and builds the correction map on the basis of these readings.

Tuning														Settings	Fuel strategies	OBD	Logger	Diagnostics	Sundries	News from AGC
Line	Map	Compensations			Autotuning			Autoadaptation							Correction map					
Load/RPM		500	850	1200	1600	2000	2500	3000	3500	4000	4500	5000	5500	6000						
10,0		0	0	0	0	0	0	0	0	0	0	0	0	0	Lock field					
15,0		0	0	0	0	0	0	0	0	0	0	0	0	0						
20,0		0	0	-3	-3	-4	3	3	3	0	0	0	0	0	Petrol map					
25,0		4	4	0	2	3	4	4	3	0	0	0	0	0						
30,0		6	4	4	6	6	5	5	6	4	0	0	0	0	Gas map					
35,0		5	4	4	7	7	6	6	7	4	0	0	0	0						
40,0		2	2	4	6	6	6	6	6	4	0	0	0	0	Correction map					
45,0		0	0	2	5	5	5	5	4	3	0	0	0	0						
50,0		0	0	0	2	1	2	2	2	-1	0	0	0	0	Lock field					
55,0		0	0	0	0	1	0	0	-1	-1	0	0	0	0						
60,0		0	0	1	0	0	0	1	0	-1	0	0	0	0	Petrol map					
65,0		0	0	2	1	1	0	0	1	0	0	0	0	0						
70,0		0	0	2	3	2	0	0	-1	0	0	0	0	0	Gas map					
75,0		0	0	1	1	1	0	0	0	0	0	0	0	0						
80,0		0	0	0	-1	-1	-1	0	0	0	0	0	0	0	Correction map					
85,0		0	0	0	-1	-2	-1	0	0	0	0	0	0	0						
90,0		0	0	0	-1	-1	-1	0	0	0	0	0	0	0	Lock field					
95,0		0	0	0	-1	0	-1	0	0	0	0	0	0	0						

Autoadaptation mode	OBD	Offset adjustment [%]	0	Max correction[%]	25
Load type	MAP	Tolerance[%]	3	Averaging	YES

Petrol Inj. Time [ms]	2,83	Pressure [bar]	1,15	MAP [bar]	0,34
Gas Inj. Time [ms]	4,73	Working pressure[bar]	<< 1,11 >>	OBD	2,34 % 0 %

In the OBD mode, when you switch over to the petrol map, you will see a map of averaged fuel trims recorded while driving on petrol, while the gas map will be a map of averaged fuel trims recorded while driving on gas. Such information can be used for diagnostic purposes.

Tuning														Settings	Fuel strategies	OBD	Logger	Diagnostics	Sundries	News from AGC
Line	Map	Compensations			Autotuning			Autoadaptation							Correction map					
Load/RPM		500	850	1200	1600	2000	2500	3000	3500	4000	4500	5000	5500	6000						
10,0		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	Lock field					
15,0		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						
20,0		0,0	0,0	-2,0	-2,0	1,0	1,0	2,0	1,0	0,0	0,0	0,0	0,0	0,0	Petrol map					
25,0		0,0	0,0	-3,0	-4,0	-1,0	1,0	1,0	-2,0	0,0	0,0	0,0	0,0	0,0						
30,0		1,0	-1,0	-1,0	-1,0	-1,0	-1,0	-4,0	-2,0	0,0	0,0	0,0	0,0	0,0	Gas map					
35,0		-2,0	-2,0	-1,0	-1,0	-1,0	-2,0	-3,0	0,0	0,0	0,0	0,0	0,0	0,0						
40,0		-1,0	-1,0	-1,0	1,0	-1,0	-2,0	-2,0	0,0	0,0	0,0	0,0	0,0	0,0	Correction map					
45,0		0,0	0,0	-1,0	-1,0	-1,0	-3,0	-3,0	-1,0	1,0	0,0	0,0	0,0	0,0						
50,0		0,0	0,0	0,0	1,0	-2,0	1,0	-3,0	-1,0	1,0	0,0	0,0	0,0	0,0	Lock field					
55,0		0,0	0,0	1,0	1,0	1,0	1,0	-3,0	-1,0	0,0	0,0	0,0	0,0	0,0						
60,0		0,0	0,0	-2,0	-2,0	1,0	1,0	-2,0	1,0	0,0	0,0	0,0	0,0	0,0	Petrol map					
65,0		0,0	0,0	0,0	-1,0	-2,0	0,0	1,0	2,0	0,0	0,0	0,0	0,0	0,0						
70,0		0,0	0,0	0,0	0,0	2,0	-2,0	0,0	2,0	0,0	0,0	0,0	0,0	0,0	Gas map					
75,0		0,0	0,0	1,0	1,0	1,0	1,0	-1,0	3,0	0,0	0,0	0,0	0,0	0,0						
80,0		0,0	0,0	0,0	0,0	1,0	1,0	1,0	3,0	0,0	0,0	0,0	0,0	0,0	Correction map					
85,0		0,0	0,0	-1,0	0,0	1,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0						
90,0		0,0	0,0	1,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	Lock field					
95,0		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						

Autoadaptation mode	OBD	Offset adjustment [%]	0	Max correction[%]	25
Load type	MAP	Tolerance[%]	3	Averaging	YES

Petrol Inj. Time [ms]	2,83	Pressure [bar]	1,15	MAP [bar]	0,34
Gas Inj. Time [ms]	4,73	Working pressure[bar]	<< 1,11 >>	OBD	2,34 % 0 %

Electrical wiring diagram

It is also available from the program level in the tab **Sundries -> Documentation**

