



Program and configuration manual for
sequential gas injection system

NEVO

Software version: 4.0.1.3

Full compatibility with gas controller 4.0B

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1 Introduction

Software for DiegoG3 system configuration is free and need no license key to be downloaded, installed or run.

If USB interface will be used to communicate PC with the system, the proper drivers (delivered with the software or other) should be also installed.

After installation and launching, the program should automatically connect to the controllers through COM or USB interfaces. After that it is possible to check basic parameters and configure installation.

2 Compatibility, new functions

The NEVO controllers are compatible with the software in version 4.0.x.x, where x.x stands for the release version. The most recent version of software is available on www.kme.eu. It is recommended to check availability of newest versions and to use them.

Program for communication with NEVO controller allows to communicate and is compatible with all controllers of 4.0 family. Connection with earlier controllers is not possible.

Notice: It is not possible to update firmware of any earlier controllers to version 4.0.

Program in version 4.0.1.2 will have its full functionality only with controllers with 4.0B or above firmware. In other case some functions of the program will become inactive.

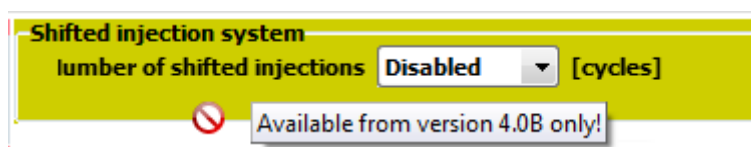


Fig. 2.1 Inactive mouse cursor.

List of changes:

Since version **4.0.1.3**:

- + Added Lithuanian and Italian language
- + Improved Auto-save mode
- + Extended information about the connected devices
- + Improved the recorder
- + Added coloring tables of corrections

Since version **4.0.1.2**:

- Full compatibility with 4.0B controller.
- Improved support for the 0-90ohm gas level sensor
- Optimized start-up and scaling program
- Added support for verifying after Autosetup
- Improved the Auto-save mode
- Introduced the manual model changes mode in Auto-save mode
- Added status of the device: GAS, PETROL, WAITING, OFF.
- Improved Recorder

Since version **4.0.1.0**:



- Full compatibility with 4.0B controller.
- Added gas injectors test.
- Added change list In Workshop info.
- Added inspections info.
- Added Turbo and Mazda options In Auto Setup window.
- Added Idle model calibration.
- Added Corrections map.
- Added stripe indicating activity of chosen functions.
- Added upgrade the Recorder (the ability to load and watch previously recorded waveforms).
- Added colour changing of red values which are beyond range for appropriate work.
- Refreshed the look of the program.

3 Program Interface

3.1 Starting view

After launching the program the starting window appears on screen (**Fig. 3.1**). After installation and launching, the program should automatically connect to the controllers through COM or USB interfaces.

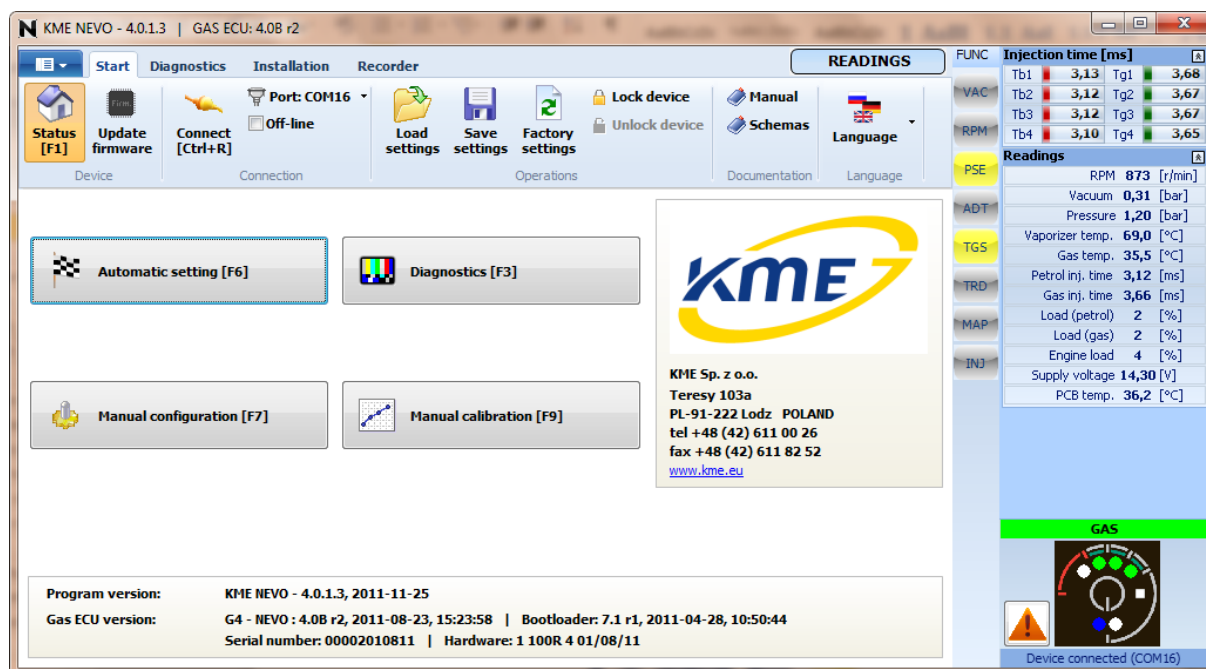


Fig. 3.1 Starting view.

Components of main window:

- Tabs – (Start, Diagnostics...) – allow to switch between different functions.
- Ribbon – field under the tabs containing functions and windows; different on each tab.
- Function window – located under the Ribbon.
- Readings stripe – located in the right side of main window. It contains current reading of the main parameters (Fig. 3.2). Values coloured in red are inappropriate for proper work of gas injection system. Vaporizer temp. is olive between the temperature of switch-over to gas and 50°C. It is blue when over 50°C, because then all of the functions and procedures work properly. Pressure is always red when running on petrol. Yellow highlighting of the Gas injection time indicates active injector correction for specific injector.

Injection time [ms]			
Tb1	6,88	Tg1	7,45
Tb2	6,87	Tg2	7,44
Tb3	6,88	Tg3	7,30
Tb4	6,88	Tg4	7,30
Readings			
RPM 903 [r/min]			
Vacuum 0,67 [bar]			
Pressure 1,13 [bar]			
Vaporizer temp. 54,26 [°C]			
Gas temp. 36,18 [°C]			
Supply voltage 12,04 [V]			
Petrol inj. time 6,87 [ms]			
Gas inj. time 7,33 [ms]			
Load on petrol 5 [%]			
Load on gas 5 [%]			
Engine load 10 [%]			
PCB temp. 40,34 [°C]			

Fig. 3.2 Readings stripe.

- „FUNC” stripe, indicating activity of chosen functions.



Fig. 3.3 Stripe indicating activity of chosen functions.

FUNC description:

- VAC – vacuum correction
- RPM – RPM correction
- PSE – gas pressure correction
- ADT – map adaptation
- TGS – gas temperature correction
- MAP – corrections map

- INJ – injectors corrections

Functions highlighted in yellow are activated.

- State of the gas ECU bar – indicates current state of the gas ECU (Fig. 3.4).
- Virtual panel – work like a real control panel: clicking on the panel image using left mouse button switches from petrol to gas and from petrol to gas, coloured diodes indicate the gas level. (Fig. 3.4).
- Program state bar – indicates the state of the program (device connected, working off-line¹, updating firmware) (Fig. 3.4).

Whole right side of main window (readings stripe, virtual panel, state bar) is visible and accessible on every tab.

If gas controller registers any errors the yellow flashing triangle appears next to the virtual panel (Fig. 3.4). Left-clicking on it opens Diagnostic errors window in Diagnostics tab.

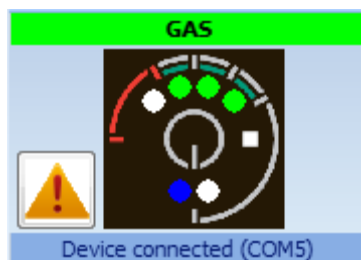


Fig. 3.4 Virtual panel with state bar and triangle informing about errors.

3.2 Menu button

Button located next to Start tab. It opens menu which contains functions from Start tab and ribbon. These functions are described in the next chapter.

¹ Off-line mode - working without communication with the gas controller.

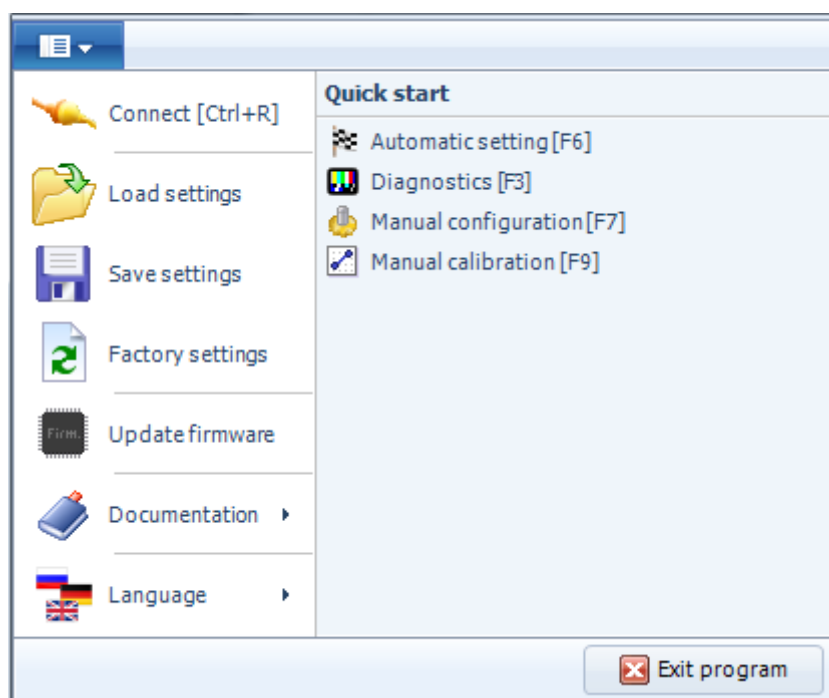


Fig. 3.5 Main menu.

3.3 Start tab

Start tab ribbon elements are split in a few groups:

- Device
 - **Status** (F1) – shown after starting the program, indicates current driver and program status: firmware and software version; it has four button(Fig. 3.1 Starting view.)
 - Automatic settings – moves to Installation → Auto Setup.
 - Diagnostics moves to Diagnostics → Installation tests.
 - Manual configuration – moves to Installation → Basic.
 - Manual calibration – moves to Installation → Model.
 - **Update firmware** (F2) -
- Connection
 - **Auto connect** (Ctrl+R) – allows to search COM port to which controller is connected and establish communication.
 - **Port: COMx** – selection of COM port.
 - **Off-line** (Ctrl+E) - enabling/disabling Off-line mode (working without communication with the gas controller)

- Operations
 - **Load settings** (Ctrl+O) - llows to load configuration that has been saved earlier.
 - **Save settings** (Ctrl+S) - allows to save controller's current configuration to a file on a PC.
 - **Factory settings** (Ctrl+D) - enables to return to factory settings of controller. After that configuration is lost.
 - **Lock/Unlock** - allows to set password preventing from changes in configuration. Password may contain digits only, its length is 4. After locking the device, no changes in its configuration are possible. Only readings are possible to be red. Unlocking require typing the password or returning to factory settings.
 - **Manual** – opens folder with manual files.
 - **Schemas** – opens new window with montage schematic.
- Program
 - **Language** – select from available program languages.

3.3.1 Firmware update

Actualization changes the firmware in connected device and saves default configuration in it. Therefore, it's recommended to save previous configuration (only if it is needed) in file before updating the controller. Actualization window is shown on Fig. 3.6. Current firmware version and available updates are visible in two frames.

Device information			
Device	Release date	Firmware	Bootloader
G4 - NEVO	2011-08-23 15:23:58	4.0B r2	7.1 r1

Available updates			
Device	Release date	Firmware	Information
G4	2011-05-16 15:20:36	4.0A r2	Bootloader: 7
G4	2011-08-23 15:23:58	4.0B r2	Bootloader: 7

Update

 Additional updates...

Fig. 3.6 Firmware update window.

Procedure of updating is as follows:

- If desired update file is not on the list of available updates press “Additional updates...” button and choose file from your PC. It will be added to the list.
- Choose update file and press “Update” button. First the window with question about saving current settings to a file will appear. After saving or choosing not to save the update confirmation window will appear (Fig. 3.8). To start actualization process press “Yes”.

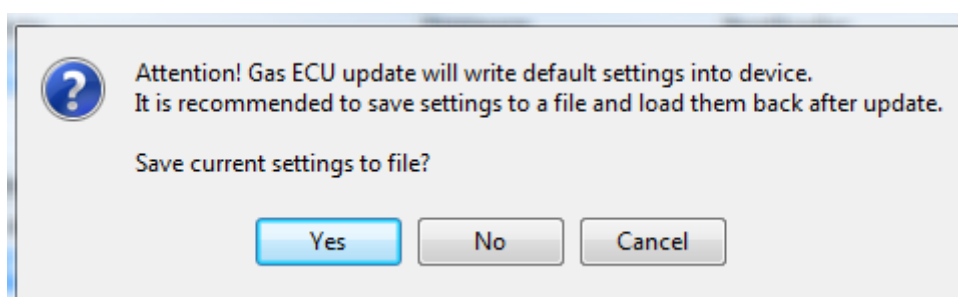


Fig. 3.7 Window with question about saving current settings to file before updating.

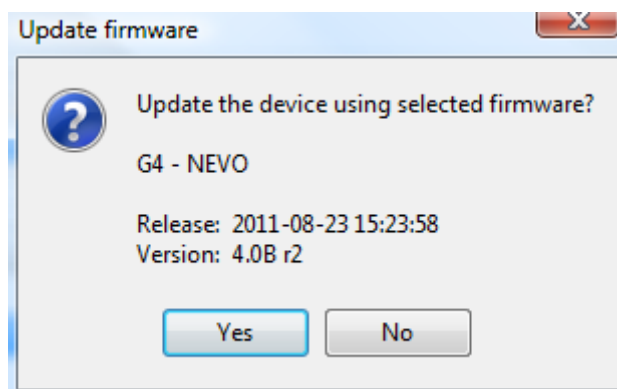


Fig. 3.8 Starting update confirmation window.

- During actualization process progress the progress bar is shown (Fig. 3.9) and diodes in drivers panel flash sequentially. Also the status bar indicates execution of actualization process (Fig. 3.10).

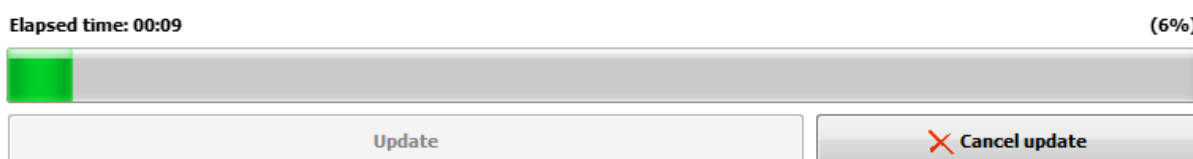


Fig. 3.9 Actualization progress bar.



Fig. 3.10 Information about running actualization.

- In case of fault in communication during actualization, (Fig. 3.11, press „OK”) press “Auto connect”

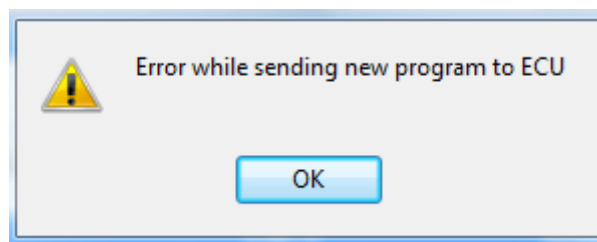


Fig. 3.11 Information about communication failure.

Window shown on Fig. 3.12 appears after retrieving lost connection. Press “Ok” to restart actualization process.

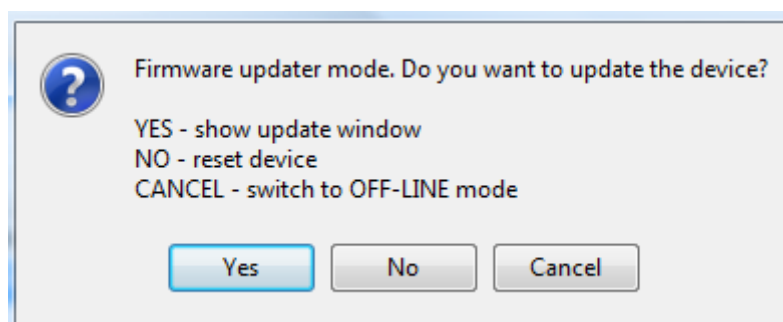


Fig. 3.12 Window shown after communication failure during the actualization process.

- After finishing update, the program informs user about it.

3.4 Diagnostics tab

Diagnostics tab contains functions that allow to check correctness of installation of sequential gas injecting system and its components. It also has functions that register errors and help to diagnose them. Diagnostics tab ribbon elements are split in a few groups:

- Settings
 - **Write** (Ctrl+K) – press this button to write current setting to gas ECU. If there are any unsaved changes made by user the button is highlighted as shown on Fig. 3.13. After pressing “Write” button the warranty invalidation warning window will appear (Fig. 3.14).



Fig. 3.13 Highlighted “Write” button.

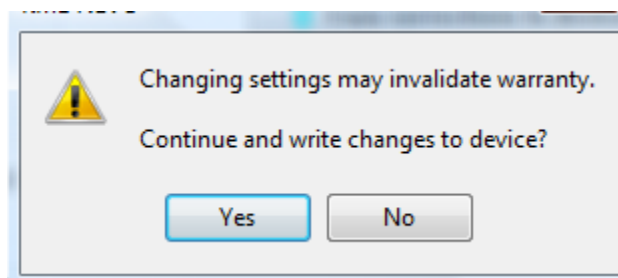


Fig. 3.14 Warranty invalidation warning window.

- **Read** (Ctrl+J) – used to read setting from gas ECU.
- **Standard** (Ctrl+L) – pushing this button overwrites current configuration in program by default settings. The “Write” button must be used for these changes to take effect.

- **AutoSave** – allows to automatically save changes in settings and adjustments without the need of using “Write” button.
- Errors
 - **Diagnostic errors** (F2) – gas ECU has self-diagnostic system allowing to detect and register errors occurred during work and determine conditions of their occurrence. Each error has its individual flash code displayed on control panel using one red and three green diodes. In the window errors are displayed with their:
 - flash code,
 - description,
 - count,
 - last time,
 - present,
 - freeze frame,
 - action.

After highlighting error its freeze frame shows in the bottom of the window. Freeze frame contains frozen parameters at which the error occurred (Fig. 3.15).

Errors codes list:

Code	Description	Red	Green	Green	Green
E001-E008	Petrol injector no signal cyl 1..8.	●	●	○	○
E009-E016	Gas injector malfunction cyl 1..8.	●	○	●	○
E017	Tred sensor short.	○	●	●	○
E018	Tred sensor open.	●	●	●	○
E019	Tgas sensor short.	○	●	○	●
E020	Tgas sensor open.	●	●	○	●
E021	Valve short.	○	○	●	●
E022	Valve open.	●	○	●	●
E023	Low gas pressure.	●	○	○	○
E024	Reducer too cold.	○	○	○	●
E025	Petrol injectors merged.	○	●	○	○
E026	Gas injectors merged.	○	○	●	○
E027	Gas temperature too high.	N/A			
E028	Control panel malfunction.	N/A			
E029	Sensor unit malfunction.	N/A			
E030	High ECU temperature.	N/A			
E031	Low ECU voltage.	N/A			

Error	Flash code	Description	Count	Last time	Present	Freeze frame	Action
E0009	  	Gas injector malfunction - cyl1	1	0 h	☒		Do not signal
E0010	  	Gas injector malfunction - cyl2	1	0 h	☒		Do not signal
E0011	  	Gas injector malfunction - cyl3	1	0 h	☒		Do not signal
E0012	  	Gas injector malfunction - cyl4	1	0 h	☒		Do not signal

 Freeze frame for selected error:

Error number	E0009	Pressure	1,10 [bar]
RPM	1000 [r/min]	Vacuum	0,90 [bar]
Petrol inj. time	3,56 [ms]	Supply voltage	12,00 [V]
Gas inj. time	0,00 [ms]	Frame occurrence count	1

Fig. 3.15 Table of error with freeze frame at the bottom.

- **Clear errors** – clears all errors registered gas ECU.
- **Read errors** – reads registered errors from gas ECU.
- **Action settings** – opens new window in which actions for all errors can be determined.
- **Tests**
 - **Installation tests** (F3) – contain channels/cylinders tests, valve test, information about gas ECU maximum working temperature , number of emergency starts and ECU resets (**Fig. 3.16**).

Channels/cylinders testing

Switch all to PETROL

1: Gas
2: Gas
3: Gas
4: Gas

Switch all to GAS

Valve testing

Valve OPEN

Emergency starts

Number of emergency starts: 0 (max.50)

Reset

ECU temperature

Max ECU temperature: 41,09 [°C]

Number of resets

Number of ECU resets: 6

Reset

Fig. 3.16 Installation tests window.

- **Injectors test** (F4) - enables to detect differences of effectiveness of used gas injectors without necessity of removing them from the system. In case of incorrectness it allows to determine the corrections, that has to be put into operation to restore proper, even work of the gas injection system.
- Workshop
 - **Workshop info** (F5) – information for workshops (change list, computer code, gas ECU working time) (Fig. 3.17).

This computer code
1284-BB88

Changes list
First settings modification
Date: 2011-07-05 09:26
Computer code: 4C83-1627
Last changes list

Date	Computer code

Inspection Info
Time/distance ratio 1h = 50 [km]
Next inspection in Disabled [km]
Distance left 0 [km]

Gas ECU working time [days:hrs:min:sec]
On petrol: 0:00:01:43 **Total: 0:00:11:50**
On gas: 0:00:10:07

Fig. 3.17 Workshop information.

It is possible to set approximate distance after which the controller will go to the inspection reminding mode. In this purpose, the Time/distance ratio has to be set (e.g. 70 kmph) and the distance between inspections. In the inspection reminding mode, each time engine starts, the controller signalize the necessity of inspection by ten long buzzer sounds.

3.4.1 Channels/cylinders testing

This function enables to check the order of channel connections, detect faulty cylinders. It also allows to check the correctness of valves operation.

Channels/Cylinders testing can be done in the following way:

1. Switch the gas system to work on gas
2. Press button "Switch all to petrol"
3. Starting from the first cylinder switch consecutive channels to gas. If the engine does not work evenly, the channel being presently checked is not working correctly (faulty cutting the petrol injector wire, faulty connection of gas injectors, or fault of gas injector operation may occur)
4. Repeat procedure to each cylinder.

3.4.2 Internal temperature of gas ECU

Current gas ECU internal temperature is shown at readings stripe. In Diagnostics tab the highest internal temperature of the controller can be checked. It allows to estimate conditions in which the controller works.

3.4.3 Number of emergency starts on gas

The controller has a procedure of emergency starting on gas.

Procedure is as follows (reducer temp. must be $> 0^{\circ}\text{C}$):

1. Turn the ignition on
2. Switch system to petrol
3. Turn the ignition off
4. Turn the ignition on
5. Press and hold button on the Control panel for about 10 seconds. State diode is blinking and buzzer is beeping. After that time the gas ECU opens the valves and the state diode on Control panel is constantly on (buzzer stops beeping).
6. Start the engine.

Maximum number of emergency starts is 50. Button "Reset" enables to set number of emergency starts back to 0.

3.4.4 Injectors test

Before doing the test the engine has to be well wormed up. It is also crucial, that gas injectors has to be installed in the proper order. It is also important, that during the whole test, the engine has to have equal load. Changing load: for example switching the air conditioning during the test may falsify the test's results.

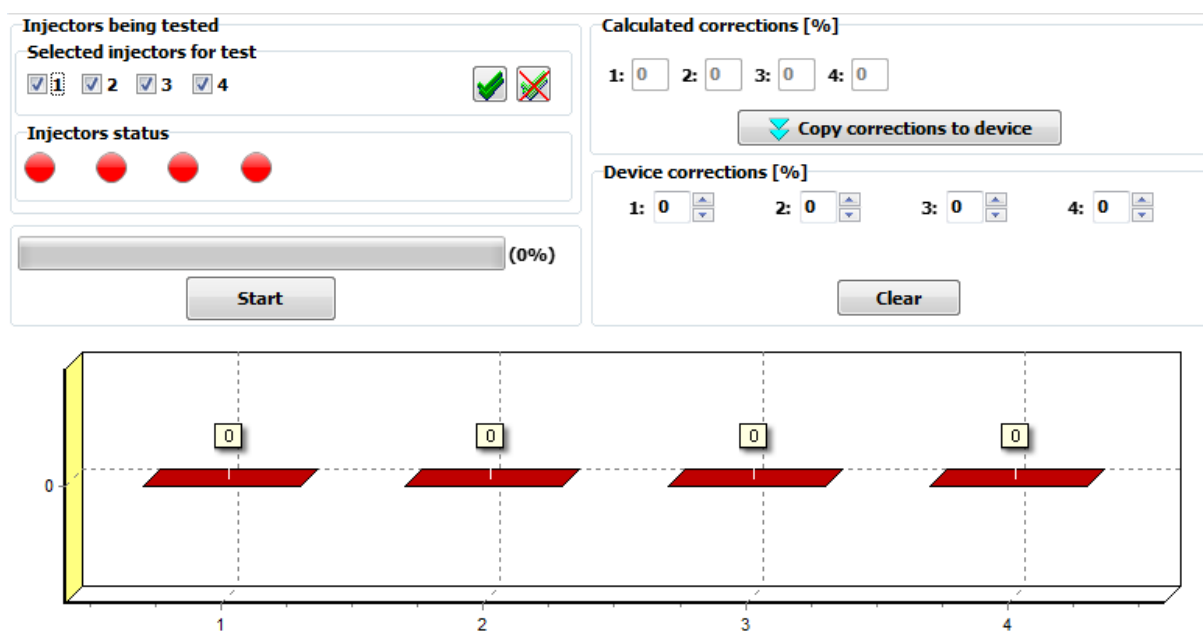


Fig. 3.18 Injectors test window.

Procedure of gas injectors testing:

1. Check, if all injectors have been properly installed in the correct order.
2. Start the engine.
3. Leave car at idle for about 5 minutes to stabilize the conditions (gas temperature, reducer temperature).
4. Open the window of the gas injectors test, choose cylinders to be tested (during the first test choose all cylinders), press Start.
5. Wait for the test to finish. During the test progress bar is visible.
6. After the test the results and corrections are shown. The result can be only used to compare effectiveness of injectors in one gas system.
7. Correction may be copied by clicking **Copy corrections to device** and then saved by clicking **Write**.

3.5 Installation

The Installation tab contains functions responsible for configuring and calibrating gas injection system. Installation tab ribbon elements are split in a few groups:

- Configuration
 - **Auto Setup** (F6) – shows Auto setup window.
 - **Basic**(F7) – shows basic configuration options.

- **Advanced** (F8) – shows advanced configuration options.
- Calibration
 - **Model** (F9) – shows editable model chart. Model is gas injection time in function of petrol injection time for no corrections.
 - **Map** (F10) – shows the window with petrol and gas maps.
 - **Corrections** (F11) – shows available corrections for the Model.
 - **Clear PETROL map** – deletes all petrol map points. Doesn't require usage of "Write" button.
 - **Clear GAS map** – deletes all gas map points. Doesn't require usage of "Write" button.
 - **Set model** – function that automatically calculates and sets model. New point will be shown on the Model chart and collected GAS map points will be deleted. Function doesn't require usage of "Write" button.

3.5.1 Auto Setup

Before you start Auto Setup, set the basic parameters required: the type of alternative fuel and gas injectors. You can choose which functions will be performed:

- **AutoConfig** – sets the basic configuration parameters required for the proper functioning of the system (number of cylinders, a source of RPM, type of injection system). Procedure can be executed when reducer temperature reaches 50°C.
- **Autocalibration** - sets the parameters of the gas installation controller on the basis of the engine behaviour at idle and prepares the car to the road test. Procedure can be executed when reducer temperature reaches 50°C:
 - **Offset** – depends on the type of gas injectors,
 - **Switch all cylinder at the same time** – perform calibration on all cylinders simultaneously.

Factory settings

Settings

Fuel type LPG

Gas injectors REG

☐ TURBO engine

☒ Auto-Config

☒ Auto-Calibration

Offset 0,9 [ms]

☐ Switch all cylinders at the same time

☐ Mazda

 **Start Auto-Setup**

 **Show map [F10]**

Fig. 3.19 Auto Setup window.

During the Auto Setup the progress window is shown.

Auto Setup
(autocalibration phase)
Calibration in progress...

Autocalibration in progress

...

Step 15 of 275

Cancel

5%

Fig. 3.20 Auto Setup progress window.

User will be informed after successful finishing the Auto Setup.

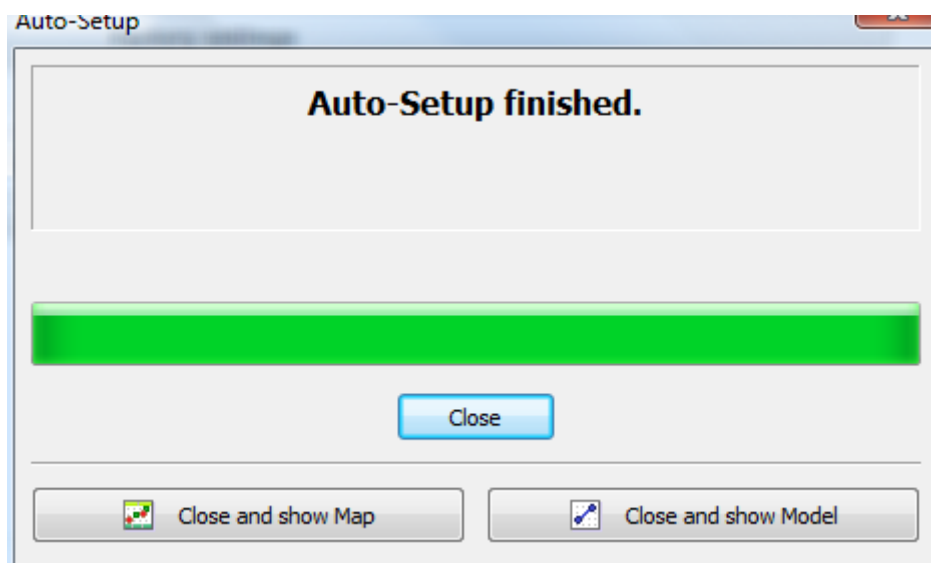


Fig. 3.21 Window with information about finishing Auto Setup.

After finishing the Autocalibration one of the messages can be shown:

- **nozzles too big** – diameter is too big in some cases. The gas controller may not be able to correct gas amount in a whole range of load. Change nozzles to smaller ones.
- **nozzles too small** – diameter is too small in some cases. The gas controller may not be able to correct gas amount in a whole range of load. Change nozzles to bigger ones. Too big nozzles, and – consequently – high tilts dangerous to the engine, because of the lack of possibility of controlling the mixture during the high load.

When Auto-Setup is successful, a message will appear in Model and Map window (Fig. 3.22). It indicates that verification process is running. To complete the verification mode, follow the instructions provided in the message. You can also manually stop the verification process by clicking the button.

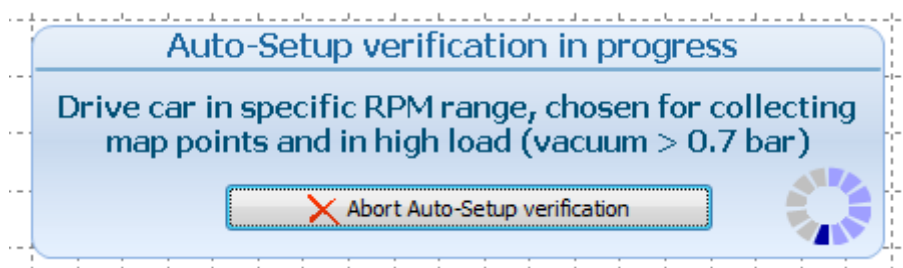
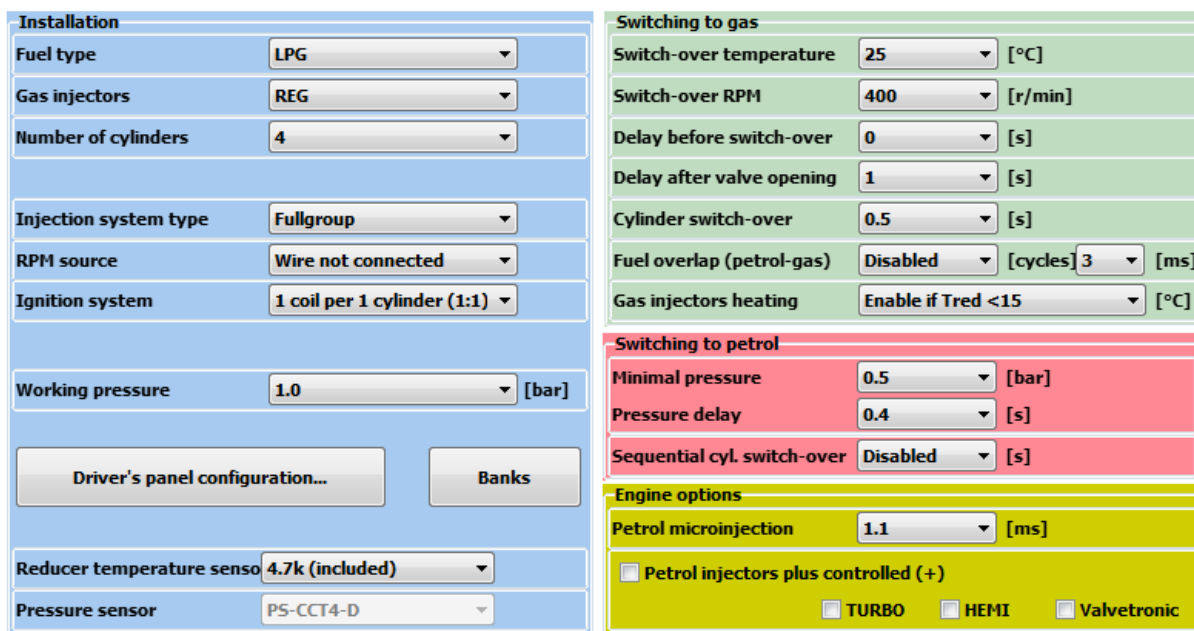


Fig. 3.22 Message indicating the ongoing process of Auto-Setup verification.

3.5.2 Basic configuration

The most important and necessary options are gathered in Basic configuration window. Each group of options has different background colour (Fig. 3.23).



Installation	
Fuel type	LPG
Gas injectors	REG
Number of cylinders	4
Injection system type	Fullgroup
RPM source	Wire not connected
Ignition system	1 coil per 1 cylinder (1:1)
Working pressure	1.0 [bar]
Driver's panel configuration... Banks	
Reducer temperature senso	4.7k (included)
Pressure sensor	PS-CCT4-D

Switching to gas	
Switch-over temperature	25 [°C]
Switch-over RPM	400 [r/min]
Delay before switch-over	0 [s]
Delay after valve opening	1 [s]
Cylinder switch-over	0.5 [s]
Fuel overlap (petrol-gas)	Disabled [cycles] 3 [ms]
Gas injectors heating	Enable if Tred <15 [°C]

Switching to petrol	
Minimal pressure	0.5 [bar]
Pressure delay	0.4 [s]
Sequential cyl. switch-over	Disabled [s]

Engine options	
Petrol microinjection	1.1 [ms]
☐ Petrol injectors plus controlled (+)	
☐ TURBO ☐ HEMI ☐ Valvetronic	

Fig. 3.23 Basic configuration window.

Description of available options:

- Installation:
 - **Fuel type** – determine the type of alternative fuel (LPG or CNG).
 - **Gas injectors** – enter installed injectors type. It is very important to choose appropriate gas injectors type. The wrong choice may cause serious problems with gas installation and Autocalibration process
 - **Number of cylinders** – enter amount of cylinders.
 - **Injection system type** – choose the car's injection system type.
 - **RPM source** – enter what is the source of the RPM signal. If RPM wire is not connected petrol injectors are the only source possible.

Wire not connected – enable this option, when the RPM wire is not connected.

IMPORTANT! When the program does not read any RPM value if this option is enabled, the RPM wire needs to be connected.

- **Ignition system** – choose the ignition system type. RPM value shown next to ignition system type allows to verify the choice. If the type is correct, shown RPM value should be the same as shown on the car tachometer.
- **Working pressure** – value of pressure for which the corrections are 0%.
- **Driver's panel configuration** – opens driver's panel configuration window shown on Fig. 3.24.

Installation	
Fuel type	LPG
Gas injectors	REG
Number of cylinders	4
Injection system type	Fullgroup
RPM source	Wire not connected
Ignition system	1 coil per 1 cylinder (1:1)
Working pressure	1.0 [bar]
Driver's panel configuration... Banks	
Reducer temperature sensor	4.7k (included)
Pressure sensor	PS-CCT4-D

Switching to gas	
Switch-over temperature	25 [°C]
Switch-over RPM	400 [r/min]
Delay before switch-over	0 [s]
Delay after valve opening	1 [s]
Cylinder switch-over	0.5 [s]
Fuel overlap (petrol-gas)	Disabled [cycles] 3 [ms]
Gas injectors heating	Enable if Tred <15 [°C]

Switching to petrol	
Minimal pressure	0.5 [bar]
Pressure delay	0.4 [s]
Sequential cyl. switch-over	Disabled [s]

Engine options	
Petrol microinjection	1.1 [ms]
☐ Petrol injectors plus controlled (+)	
☐ TURBO ☐ HEMI ☐ Valvetronic	

Fig. 3.24 Driver's panel configuration window.

Configuration window includes buttons known from the main window : Read, Write, Standard as well as many options:

- **Gas level sensor** – enter type of mounted gas level sensor.
- **LED state colour/Turn off** – choose which diode (red/blue/none) will indicate working on gas.
- **Thresholds for gas level LEDs** – sets threshold for each LED.
- **Bright/dark threshold** – Driver's panel LEDs have two levels of glowing – bright and dark. You can choose level of sunlight that makes LEDs to glow darker. Moving slider far right causes LEDs to always glow brighter.
- **Buzzer volume** – by using slider you can choose buzzer's volume level.

- *Display flash/colour codes for detected errors* – enabling this option causes that errors flash codes are displayed on the driver's panel.
 - *Display temperature for switching to gas* – when system waits for switching to gas together with increasing temperature of reducer the amount of glowing LEDs increases. Four glowing lead indicate that switching temperature has been reached.
 - *Enable additional sound for gas reserve at start* – after reaching reserve while working on gas system will generate sound informing about low gas level.
 - *Enable sounds* – when this option is disabled the buzzer is inactive.
 - *Hide switching to petrol* – when this option is active the driver's panel does not signalize switching to petrol with automatic return to gas.
 - *Signalizing driving on petrol* – when system starts in "petrol mode" and is not going to switch to gas, controller generates three short sounds.
- **Banks** - enables to use additional correction for the chosen cylinders. This option is used for equalization of work of two banks in two-banks engines. (V6 and V8).

To determine which cylinder belongs to which bank, turn the system to work on gas. Then, check any cylinder (e.g. first) as belonging to the second bank and set any correction for 2nd bank (e.g. +3ms). Then check which bank's STFT correction is changing. If STFT of first bank changed, then the chosen cylinder belongs to the first bank. If the second bank's STFT correction changed, the chosen cylinder belongs to the second bank. Every cylinder should be checked in this way.

- **Reducer temperature sensor** – choose the type of reducer temperature sensor.
 - **Pressure sensor** – choose the type of pressure sensor (at the moment only PS-CCT4-D is available).
- Switching to gas:
 - **Switch-over temperature** – reducer temperature, that has to be reached before switching to gas.
 - **Switch-over RPM** – the value of RPM that has to be reached before the controller can switch to gas.

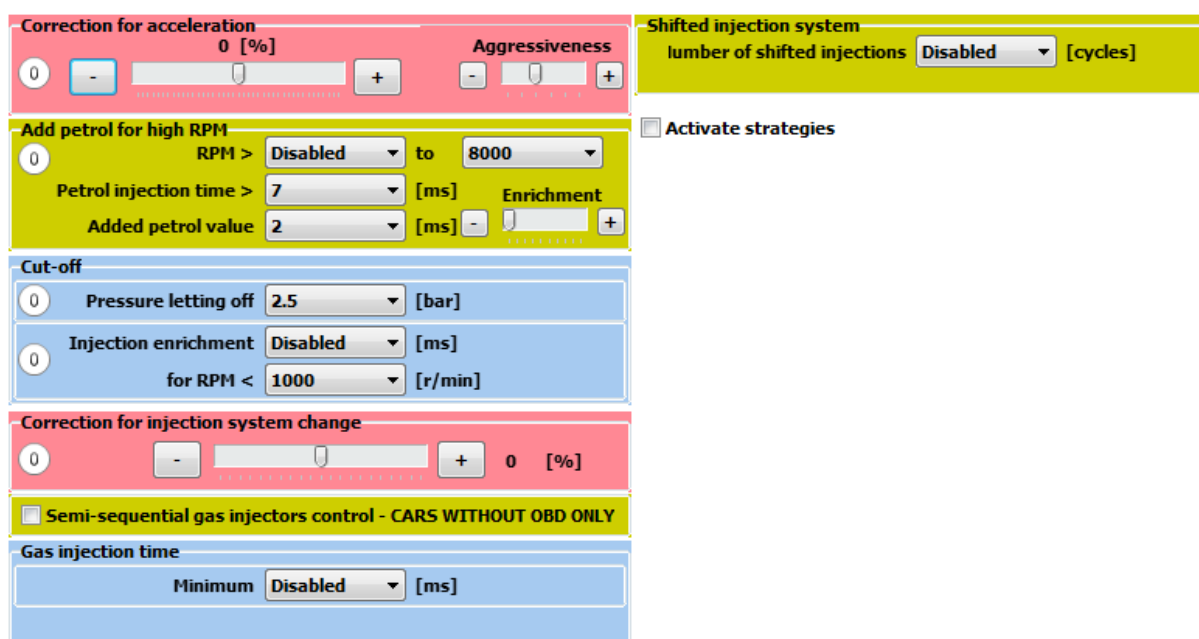
- **Delay before switch-over** – minimum time from starting the engine to switching to gas.
 - **Delay after valve opening** – time from gas valve opening to switching to gas.
 - **Cylinder switch-over** – is the period between switching on the consecutive gas injectors during switching from petrol to gas. Long period smoothes switching. The value of 0 causes all cylinders to switch on gas at one moment.
 - **Fuel overlap (petrol-gas)** – this option enables overlapping of gas and petrol during first few cycles during switching. This function is useful if there is a long distance between an inlet manifold and injectors. If so, an amount of air may gather in hoses during driving on petrol, and it is necessary to remove it and replace it with gas before switching to gas. It is done by turning the gas and petrol injectors on in the same time (overlapping). This may soften the switching process, but count of the overlapped cycles and time of each gas pulse needs to be chosen experimentally: exact values depend on pipes length and injectors. Time needs to be high enough to remove the air from pipes, but low enough not to inject too much gas and petrol at the same time. It is not advised to use more than one pulse.
 - **Gas injectors heating** – efficiency of gas injectors is lower in low temperatures. This option enables heating the gas injectors before switching to gas. This option gives more stable switching when gas injectors are dirty and cold.
- Switching to petrol:
 - **Minimal pressure / Pressure delay** – set pressure and time value after which the controller switches engine back to petrol due to the low level of gas in the tank. In cars with automatic gearbox or when strong jerk can be felt during this switching time has to be reduced by 0,1s, and when this gives no result – pressure has to be raised (e. g. to 0.8 bar)
 - **Sequential cyl. switch-over** – is the period between switching on the consecutive petrol injectors during switching from gas to petrol. Long period smoothes switching. The value of 0 causes all cylinders to switch on petrol at one moment.
- Engine options:
 - **Petrol microinjection** – enable this option if engine is microinjection-type. Engines of that type apart from a main injections in a single cycle, have also very short injections, called microinjections. If this option is not set and the engine has microinjections, petrol injection time it not stable and have small and big values by turns. In that case small values means microinjections time.

It is advised to set the microinjection time longer than values visible in Readings window.

- **Petrol injectors plus controlled (+) – external emulator required** – enable this option if petrol injectors are controlled by positive voltage signal. To this type of injectors, external emulators are required.
- **Turbo** – option used with Turbo engines.
- **HEMI** – enable this option if engine is HEMI-type. Engines of this type turn cylinders off at idle to reduce fuel consumption and emission.
- **Valvetronic** – option used with Valvetronic engines.

3.5.3 Advanced configuration

The Advanced configuration window contains the more complex options and strategies.



The screenshot displays the 'Advanced configuration' window with several sections:

- Correction for acceleration:** A slider set to 0 [%] with minus and plus buttons. An 'Aggressiveness' slider is also present.
- Shifted injection system:** A yellow bar containing a dropdown menu set to 'Disabled' and the text 'lumber of shifted injections' followed by '[cycles]'.
- Add petrol for high RPM:** A yellow bar with a white circle containing '0'. It includes a dropdown set to 'Disabled', a 'to' value of '8000', 'Petrol injection time' set to '7 [ms]', and 'Added petrol value' set to '2 [ms]'.
- Cut-off:** A blue bar with a white circle containing '0'. It includes 'Pressure letting off' set to '2.5 [bar]', 'Injection enrichment' set to 'Disabled [ms]', and 'for RPM <' set to '1000 [r/min]'.
- Correction for injection system change:** A pink bar with a white circle containing '0' and a slider set to '0 [%]'.
- Semi-sequential gas injectors control - CARS WITHOUT OBD ONLY:** A yellow bar with an unchecked checkbox.
- Gas injection time:** A blue bar with a dropdown set to 'Disabled [ms]'.

On the right side of the window, there is a checkbox labeled 'Activate strategies'.

Fig. 3.25 Advanced configuration window.

There are white circles, with "0" digit inside, located next to some of advanced options (Fig. 3.21a). White circle with "0" means, that this specific option is inactive at the moment even if its enabled. When circle turns red and the digit inside it is "1", the enabled option

becomes active (Fig 3.12b). This functionality allows to easier and quicker determine the impact of the changes made in the gas ECU configuration.



Fig. 3.26 a) inactive function indicator; b) active function indicator

Description of options:

- Correction for acceleration – correction, that is active during acceleration.
 - **Percent** – correction value.
 - **Aggressiveness** – far left position: detection of practically every acceleration, far right position: detection of only a very dynamic and rapid acceleration.
- Add petrol for high RPM – adding petrol to gas.
 - **RPM > [...] to [...]** – range of RPM, in which the mechanism is active.
 - **Petrol injection time >** – petrol injection time beyond which the addition of petrol starts.
 - **Added petrol value** – added petrol injection time.
- Cut-off
 - **Pressure letting off** – enable controlling enlarging pressure during cut-off state. This ensures proper work when cut-off passes. Pressure value, at which mechanism starts has to be chosen.
 - **Injection enrichment [...] for RPM < [...]** - enrichment option may be used when the engine does not work properly (or stops) on gas after the end of a cut-off state. When this option is switched on, during cut-off gas injectors will get opened for a given time if the RPM is less than given value. Option recommended for Renault's cars.
- **Correction for injection system change** – in some engines (often in Mazda's cars) dynamic changes of injection system type occur. Injection system type may be changed from sequential to full-group or semi sequential. In some cases during that dynamic changes inaccuracies in mixture composition may occur, and consequently, engine does not work properly. To avoid that, a new mechanism of corrections during changes of injection type may be used. If this option is active, the gas injection during detected change of injection type will be corrected by a given percentage.
- **Semi sequential gas injectors control – ONLY FOR CARS WITHOUT OBD** – option useful for fullgroup engines. It changes gas injectors control from fullgroup to semi-sequential (in this way you can use bigger nozzles size). This option can not be used if engine has OBD.

- **Minimum gas injection time** – parameter determines the minimal time of driving gas injector. Gas injection times will not be shorter than value of the parameter given here, even, if it would result from model and corrections.
- **Shifted injection system** – gas injection time and injection moment are calculated from petrol injection from other cylinder in which ignition occurs selected number of cycles before. This option helps in cars which are shaking during acceleration (for example Totyota Avensis).

Advanced configuration window also include strategies. These are the functions that cause switching system to petrol with automatic return to gas. Switching to petrol prevent the engine from working in inaccurate conditions. "Automatic return to gas" means that if the conditions that enforce switching to petrol subside, it will automatically return to work on the gas. Strategies are available after selecting "Activate strategies" (Fig. 3.27)

☒ **Activate strategies**

Switching to PETROL with automatic return to GAS when:

RPM <	Disabled	[r/min]	0
RPM >	Disabled	[r/min]	0
Petrol time >	Disabled	[ms]	0
Load (petrol) >	Disabled	[%]	0
Engine load >	Disabled	[%]	0
Vacuum <	Disabled	[bar]	0
Gas temperature <	Disabled	[°C]	0
and load (petrol) >	90	[%]	
Reducer temperature <	Disabled	[°C]	0
and load (petrol) >	90	[%]	
Long cut-off >	Disabled	[s]	0
with cylinder switch-over	0.5	[s]	

Fig. 3.27 Strategies in Advanced configuration.

- Switch to petrol with automatic return to GAS when::
 - **RPM <** – set the minimal RPM value at which the gas controller may work on gas. This option is to be used only in the last resort, when car do not work properly on gas at idle and no other methods give effect.

- **RPM >** – set the maximal RPM value at which the gas controller may work on gas.
- **Petrol time >** - petrol injection time beyond which system will switch to petrol.
- **Load (petrol) >** – set the maximal load (petrol) percentage value at which the gas controller may work on gas. **Notice:** petrol time load percentage is taken under consideration here (look at the percentage indicator Readings page). This option is to be used in the last resort in case of nor proper work under big loads. Before using it, always try to match size of nozzles to get parameter Mult of 0% (see Model)
- **Engine load >** – set the threshold load (see the sidebar readings) beyond which the system switches to petrol.
- **Vacuum <** - vacuum below which system switches to petrol. Helpful option for cars which go out when approaching the intersection.
- **Gas temperature < and load (petrol/engine) >** - set the minimal gas temperature at which controller may work on gas on high load. This function prevents engine from using not vaporized gas during long and big loads. This option is recommended for engines with power 300 PH and above.
- **Reducer temp. < and load (petrol/engine) >** - set the minimal reducer temperature at which controller may work on gas on high load. This option is recommended for engines with power 300 PH and above.
- **Cut-off longer than ...[sec] with cylinder switch-over...[sec]** – the purpose of this function is to avoid possible problems with returning from cut-off. If the option is enabled, during long cut-off (length can be set by first parameter), the system will be temporarily switched to petrol. The second parameter (time of switching a single emulator on) tells how fast will consecutive cylinders be switched back on gas.

3.5.4 Model

Model window (Fig. 3.28) allows you to manually tune the gas system. The model is a feature that converts petrol injection times (Tb) for gas injection times (Tg). On the graph the model is represented by blue points and the segments connecting them. Above each point is a number indicating the Tg of a given point in ms. It is possible to insert up to 15 points of the model, which gives a great freedom of modelling (the optimal number of points of the

model is approximately 8). Instantaneous operating point of the system is represented by a yellow diamond shaped point.

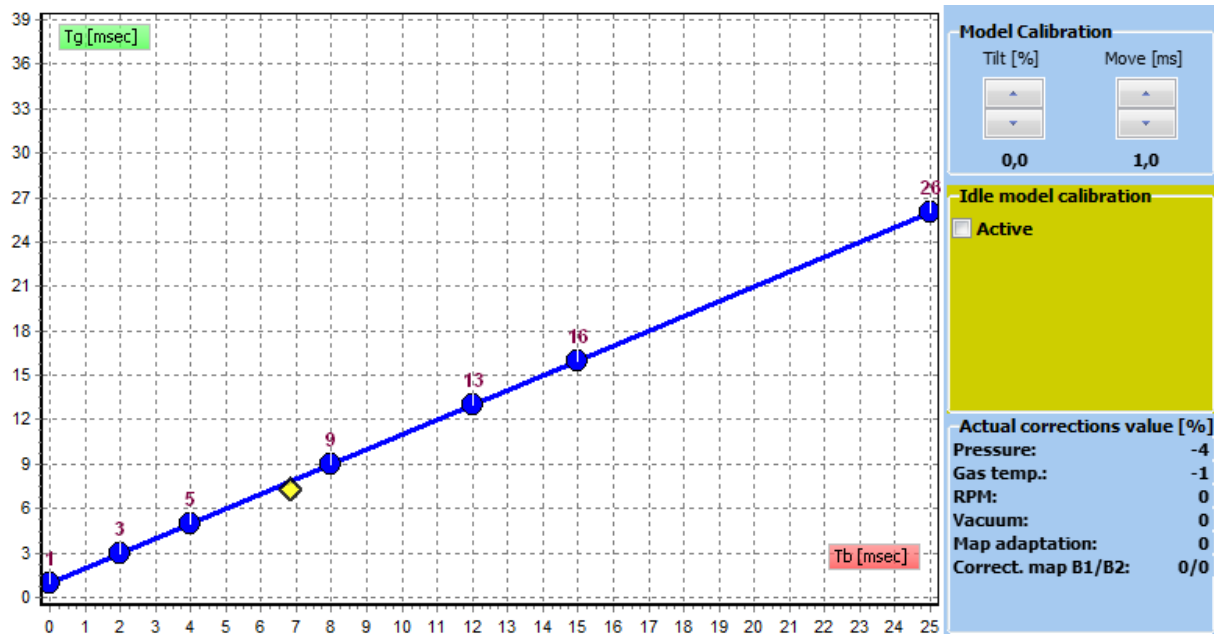


Fig. 3.28 Model window.

In Auto-Save mode manual model changes are impossible. To manually modify the model points leaving Auto-Save mode active, select the appropriate option (Fig. 3.29). Any modification made to the model must be manually saved (Auto-Save does not work on the model). After making any manual changes in the model, a message appears on outdated gas map and its automatic erasure after saving the changed settings (Fig. 3.29).

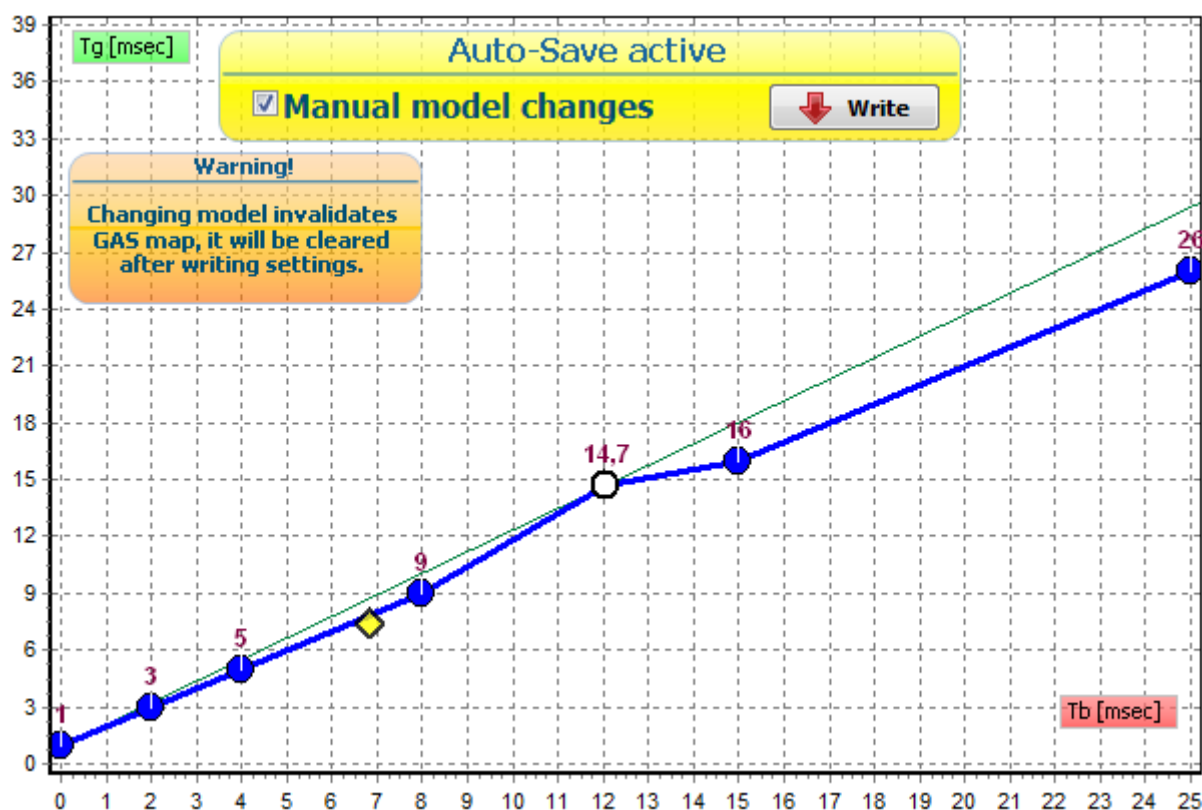


Fig. 3.29 Model window In Auto-Save mode.

Functions on Installation → Model tab:

- Click on the point to set focus on it.
- When the focus is set on the point, it is bolder and is blinking.
- Changing model points can be done with keyboard in one of the following ways:
 - Click on the point to set focus on it.
 - When the focus is set on the point, it is bolder and is blinking.
 - The position of the focused point can be changed with arrow keys.
 - To focus next or previous point Ctrl + arrow keys can be used.
 - To delete selected point Del key can be pressed.
 - To add a new point between focused and the next point, Ins key can be used.
 - To save changes in model, Enter key can be used.
 - To cancel changes – Esc key can be used.
- Changing model points can be done with mouse in one of the following ways:
 - Clicking on the model with right mouse button adds point to model.
 - Clicking on a point and dragging it changes the point coordinates. Note : you cannot change points order in this way.

- Pressing Ctrl and clicking any point deletes the point.
- Model calibration:

The model can be modified using the mouse or using the parameters in the panel model:

- **Tilt** – parameter enables to change Tg value of all model points by a given percentage. It changes the ratio of slope (gradient) of the model curve.

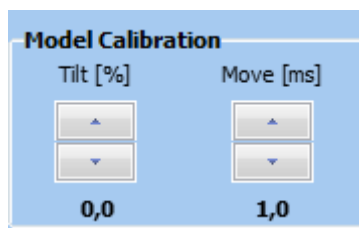


Fig. 3.30 Model calibration buttons.

Recommended tilt for groups of engine types:

Engine type	Recommended tilt
Sequential turbo	-5 – 5 %
Sequential	0 – 15%
Semi sequential	10 – 25%
Full group	15 – 30%

If on high RPM (e. g. 6000RPM) petrol injections are merged (injection times reach 20ms) nozzles need to be changed to bigger ones, and thanks to that tilt parameter can be lower and this should prevent from merging injection times.

Move - parameter enables to change Tg value of all the model points by a given value in milliseconds. Offset depends on reaction times of gas injectors.

- **Idle model calibration** - enables using additional model for the idle work. This model is represented by points P1 and P2 (**Fig. 3.31**). Thanks to that, idle work can be richer or leaner than it would be with normal model. P1 and P2 coordinates are calculated during autocalibration, but may be also set manually.

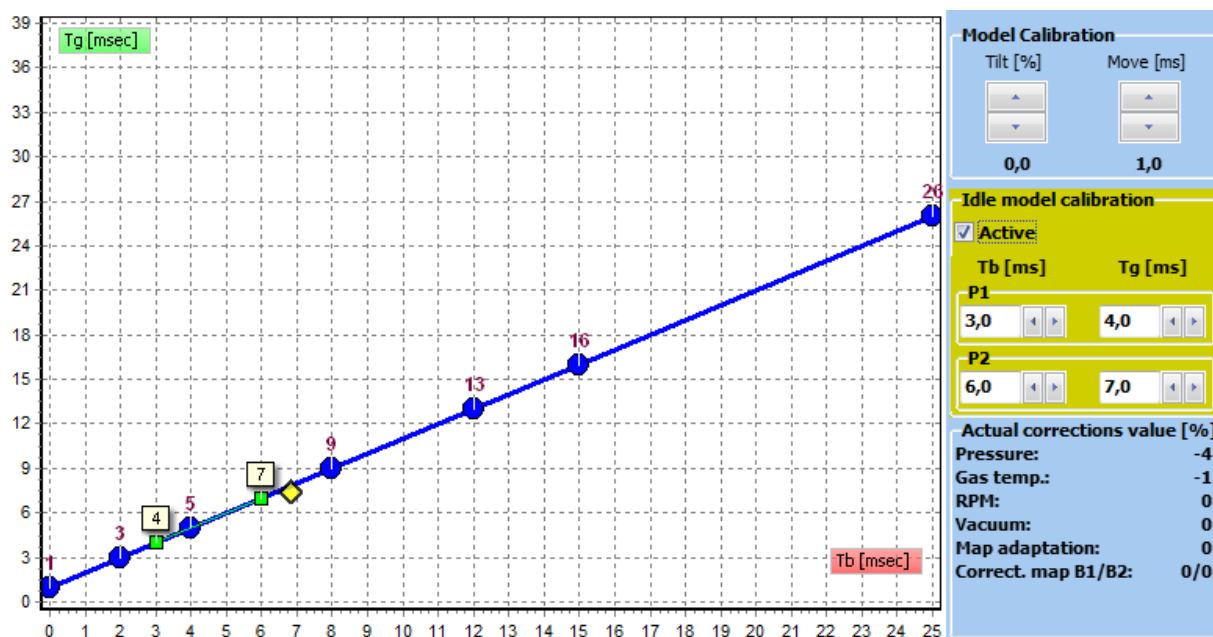


Fig. 3.31 Idle model on Model chart.

In the model window there is a frame from the current values of the corrections are shown and regularly updated in real time (Fig. 3.32):

Actual corrections value [%]	
Pressure:	-4
Gas temp.:	-1
RPM:	0
Vacuum:	0
Map adaptation:	0
Correct. map B1/B2:	0/0

Fig. 3.32 Current correction frame.

On the Model graph there is also petrol template and calculated model. First one is indicated by red dots (Fig. 3.33) while the second one by orange squares (Fig. 3.34). Number of petrol template and calculated model points depend on collected map points.

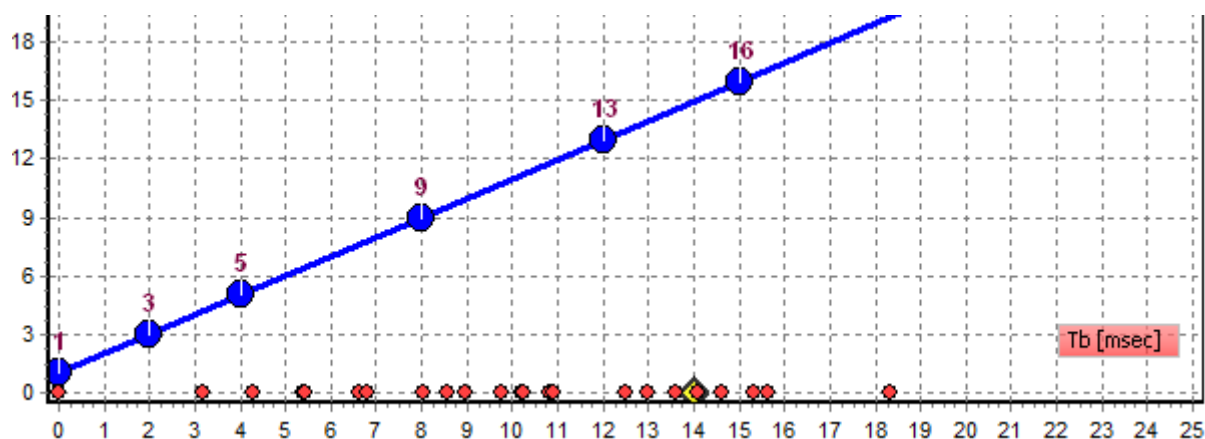


Fig. 3.33 Petrol template on the Model chart.

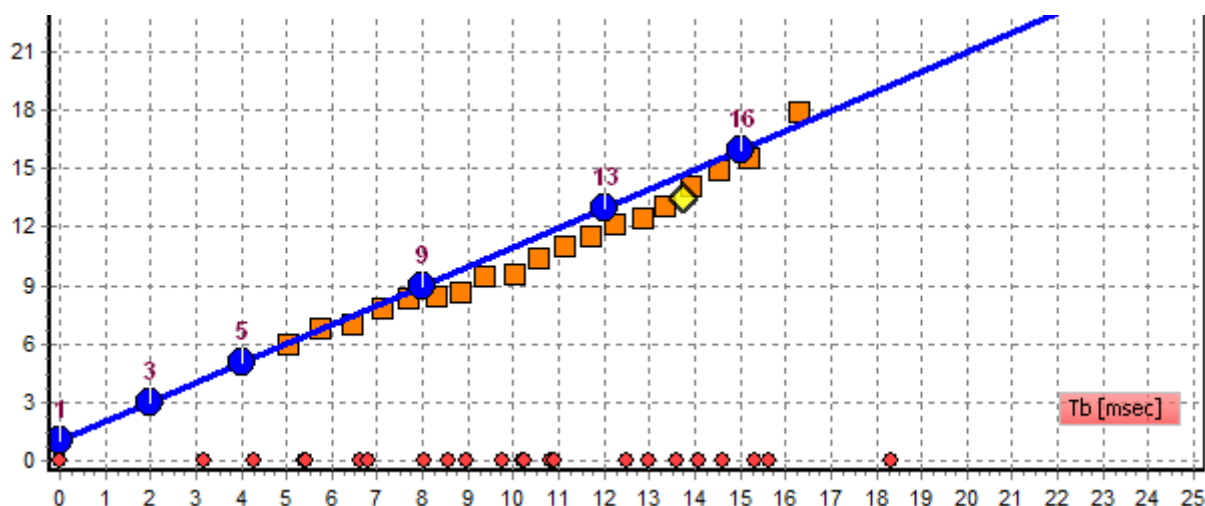


Fig. 3.34 Petrol template and calculated model points on Model chart.

With petrol template and calculated model points you can use the Set model function, which automatically moves the model to the suggested location. The exact process of calibrating the gas system, the collection of maps and setting the model is described in Chapter 3.5.7.

3.5.5 Map

During the road test controller collects points of the petrol and gas map. Points are collected only when reducer temperature is higher than 40°C, when the RPM is in a specific, chosen range. If the RPM is appropriate (RPM is in the chosen range) collected working points are saved in the controller and shown on the chart. Petrol map points are drawn in red, while gas map point in green (**Fig. 3.35**).

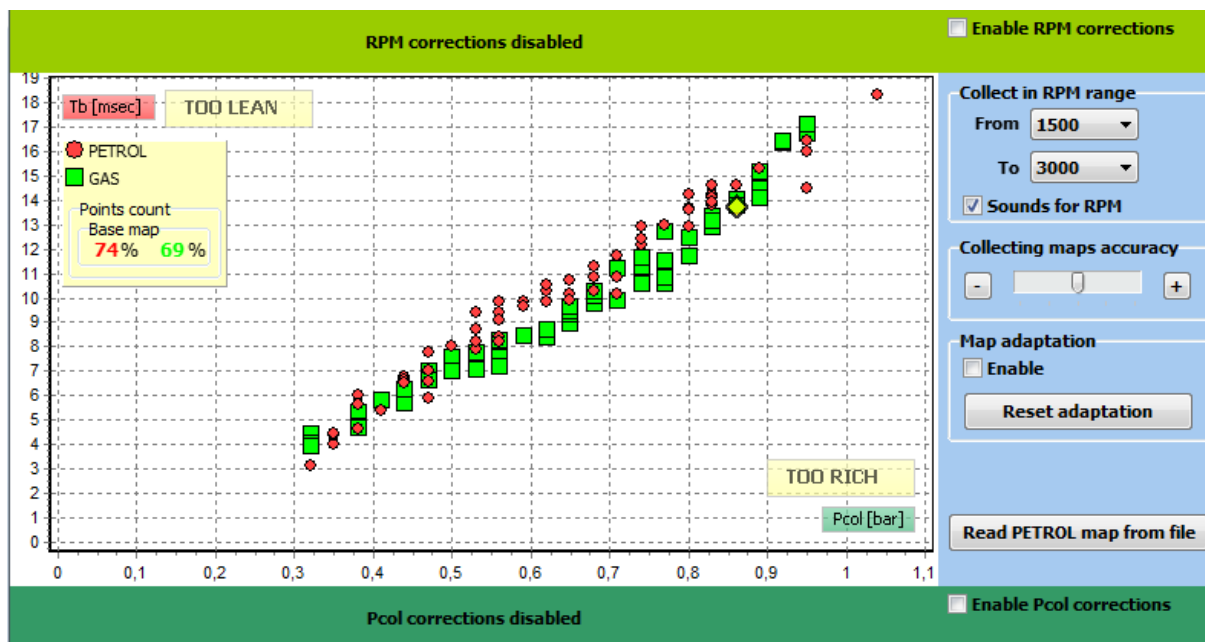


Fig. 3.35 Map window in Installation tab.

Description of options in Installation → Map:

- **Collect In RPM range from [...] to [...]** – choose range of RPM within which points are collected.
 - **Sounds for RPM** – activates the software sound signal (if the PC has a speaker) indicating that the engine is in the correct RPM range and reducer temp. > 40°C.
- **Collecting maps accuracy** – you can change the algorithm of collecting the map points. The more accurate setting the slower the map is being collected and vice versa. Collect more detailed maps for more precise calibration.
- **Map adaptation** - adaptation is an option that enables the automatic adjustment to changing engine's working conditions, as, for example, driving on low quality gas.

Turning adaptation on should be preceded by road test, because it is crucial, that the model should allow to drive in the whole range of load.

The adaptation mechanism operates during driving on gas and modifies model according to read gas injection times. Model modified by adaptation may not differ from the original model more than 20% and that is why adaptation may not be the only mechanism calibrating the controller. After turning on the adaption, frame that contains number of collected points is increased by points by points collected for the purpose of adaptation in different RPM ranges (**Fig. 3.36**).

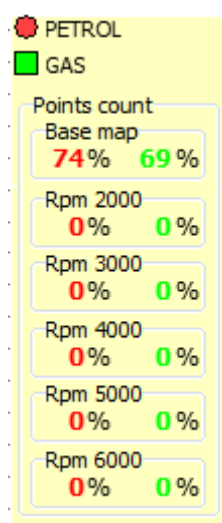


Fig. 3.36 Frame with additional ranges of RPM.

- **Reset adaptation** – erases all the information gathered so far by the adaptation.
- **Read PETROL map from file** – enables to read maps from the file on the PC hard drive.
- **Clear PETROL map** – erases petrol map from controller.
- **Clear GAS map** – erases gas map from controller.

In Map window you can also enable the RPM and vacuum (Pcol) linear corrections. After enabling the two tables will appear at the top and bottom of the Map chart (**Fig. 3.37**).

RPM [r/min]	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	☒ Enable RPM corrections
Correct [%]	0	0	0	0	0	0	1	2	3	4	5	8	10	11	12	13	14	15	

Pcol [bar]	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,1	☒ Enable Pcol corrections
Correct [%]	0	0	0	0	0	0	0	0	0	0	

Fig. 3.37 RPM (top) and Pcol corrections table (bottom).

3.5.6 Corrections

Linear corrections

Tgas

Tgas[°C]	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	>
Correct [%]	-6	-6	-5	-5	-4	-4	-3	-3	-2	-1	0	1	1	2	2	2	3	3	4	5

☒ Enable Tgas correction:

Corrections map

BANK 1 (Inj: 1, 2, 3, 4) **BANK 2 (None)** ☐ Enable corrections map

RPM		500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0
	4	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
Tb	8	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
	12	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
	16	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
	20	0	0	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	0	0	0	0	0

Buttons: +1, -1, +5, -5, =0, R

Banks...

Current correction B10

Fig. 3.38 Tgas correction table and Corrections map.

- **Tgas correction** - enables to add correction from gas temperature. It is recommended to use standard corrections. Verification of corrections may be done when engine is cool ($T_{\text{vaporizer}} < 20^{\circ}\text{C}$) by comparing petrol times on petrol and petrol time on gas. Such a correction has to be chosen, so that the difference between those times would be the smaller.
- **Corrections map** - by corrections map it is possible to set a more advanced corrections on RPM and petrol injection time (Tb). If linear corrections on RPM are not enough to regulate the system (e.g. if in some high RPMs corrections should be different for high load and different for low load) then it is possible to set RPM corrections depending on petrol injection times by corrections map. Notice: it is possible to set different corrections map on each bank. It is necessary then to select injectors belonging to second bank.

To activate correction map, select **Enable corrections map** option. To set corrections on correction map, select some area of the map by mouse and press one of the buttons on the right side of the map (+1, -1, +5, -5, =0). The value of the correction in the selected area will be changed by a value corresponding with the pressed button. Notice: corrections on the map should be as smooth as possible. Resultant correction for the current working point

is changing linearly with changes of RPMs and injection times and is visible below the correction map.

3.5.7 Road test

The road test procedure:

1. Choose RPM range to collect points in. Doing test in one RPM range is absolutely sufficient. It is recommended to choose a RPM range that will be most frequently used during further car usage.

NOTICE: Both petrol and gas map has to be collected in one RPM range. For example, if 1500 – 3000 RPM range was chosen, both petrol and gas map has to be collected in specified range. After changing RPM range maps should be cleared and collected again. When servicing it is recommended to collect a new petrol map if the old one was collected earlier than a month ago because of changes of external conditions.

After changing RPM range save the changes.

2. Clear petrol and gas map.
3. Switch the controller to work on petrol.
4. Collect petrol.

Drive on petrol, try to keep rounds per minute in the chosen range:

Example for RPM range: 2250-2750 RPM

	Parameters	Time
PETROL	2 nd gear, 2250-2750 RPM	~1-2 min
PETROL	3 rd gear, 2250-2750 RPM	~ 1-2 min
PETROL	4 th 5 th gear, 2250-2750 RPM	~ 1-2 min

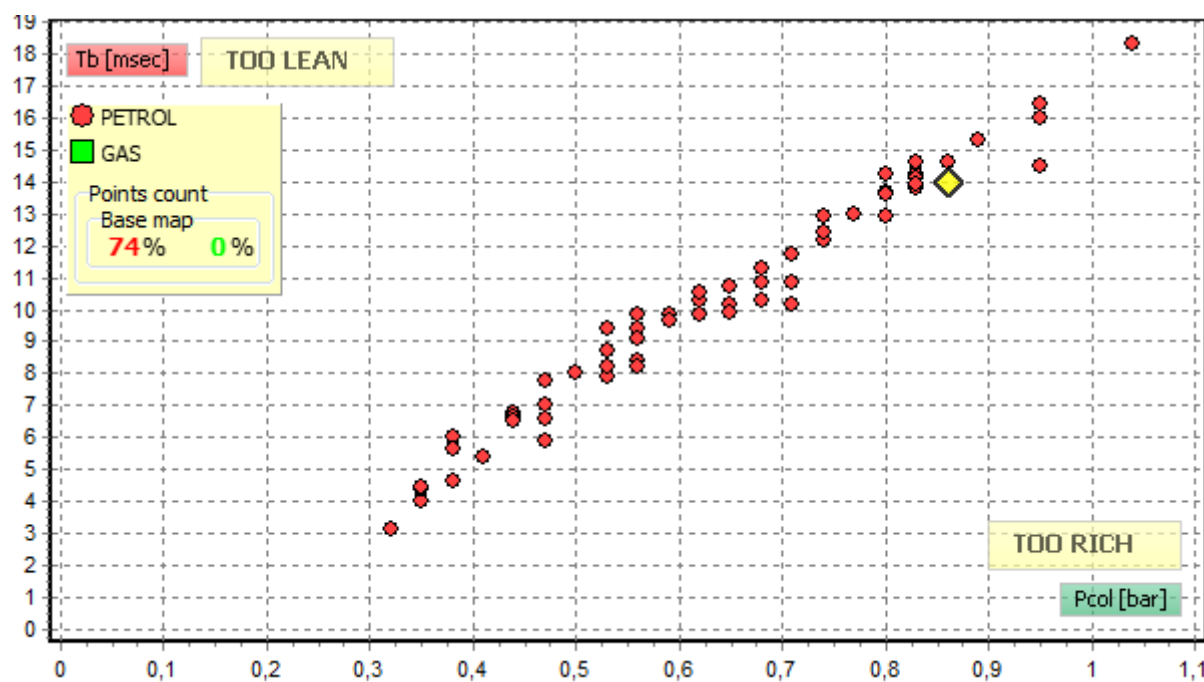


Fig. 3.39 Collected petrol map.

Time of collecting may be adjusted, take under consideration that there should be about five points collected during drive on each gear. Points should be spaced equally in the whole range of load. Collected petrol map may look like on Fig. 3.39.

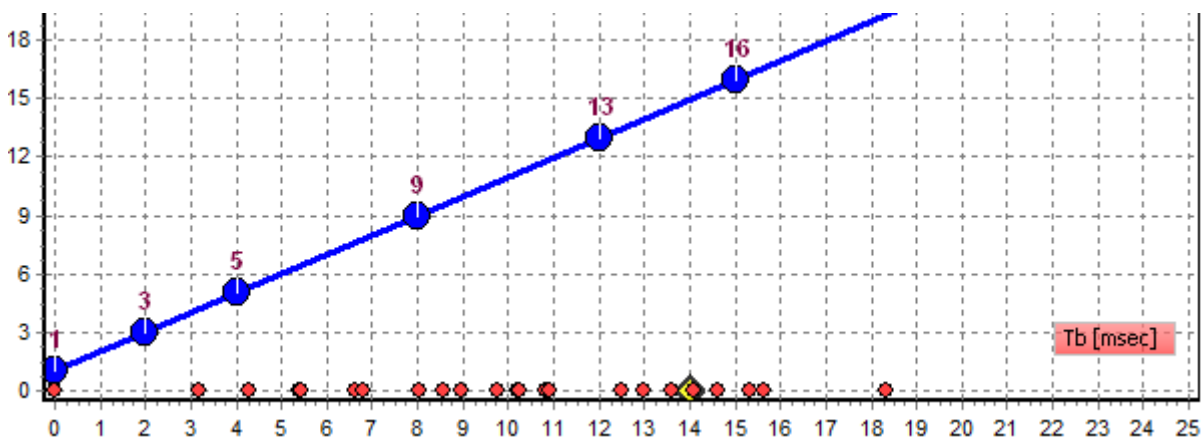


Fig. 3.40 Petrol template based on collected petrol map.

5. Switch the controller to work on gas.
6. Collect gas map.

Drive on gas, try to keep rounds per minute in a chosen range.

Example for RPM range: 2250-2750 RPM:

	Parameters	Time
GAS	2 nd gear, 2250-2750 RPM	~1-2 min
GAS	3 rd gear, 2250-2750 RPM	~ 1-2 min
GAS	4 th or 5 th gear, 2250-2750 RPM	~ 1-2 min

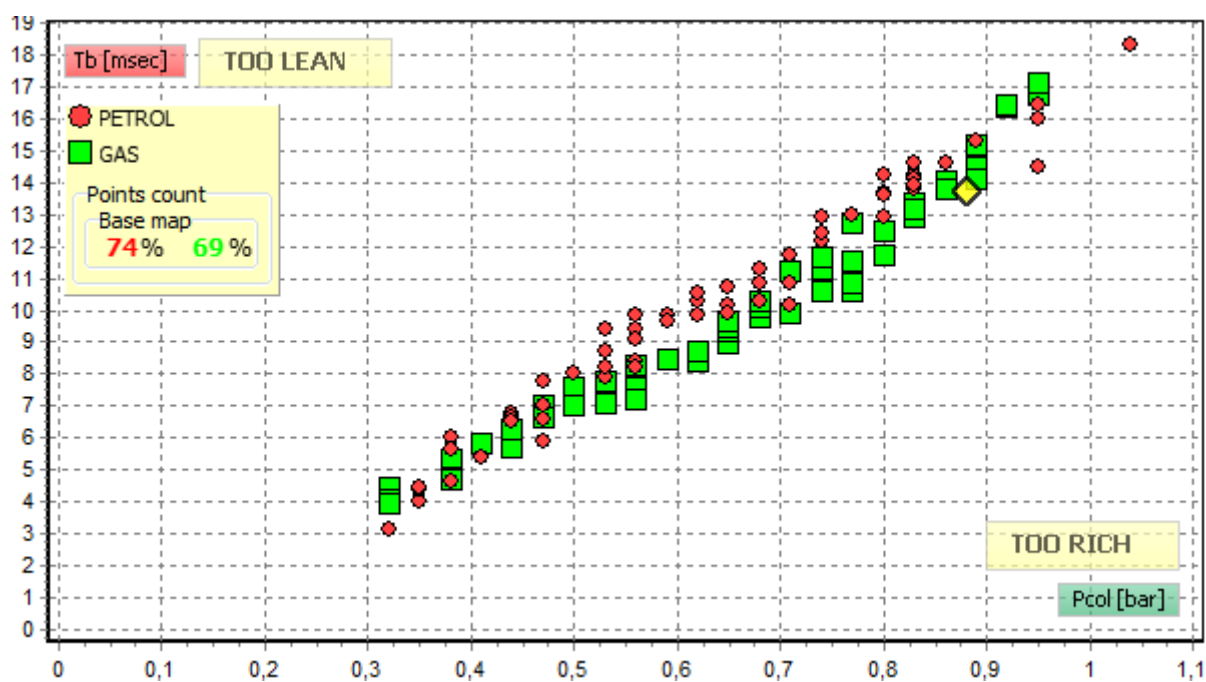


Fig. 3.41 Collected petrol and gas map.

Gas map after collecting may look like on Fig. 3.41. Calculated model based on petrol an gas map is shown on Fig. 3.42.

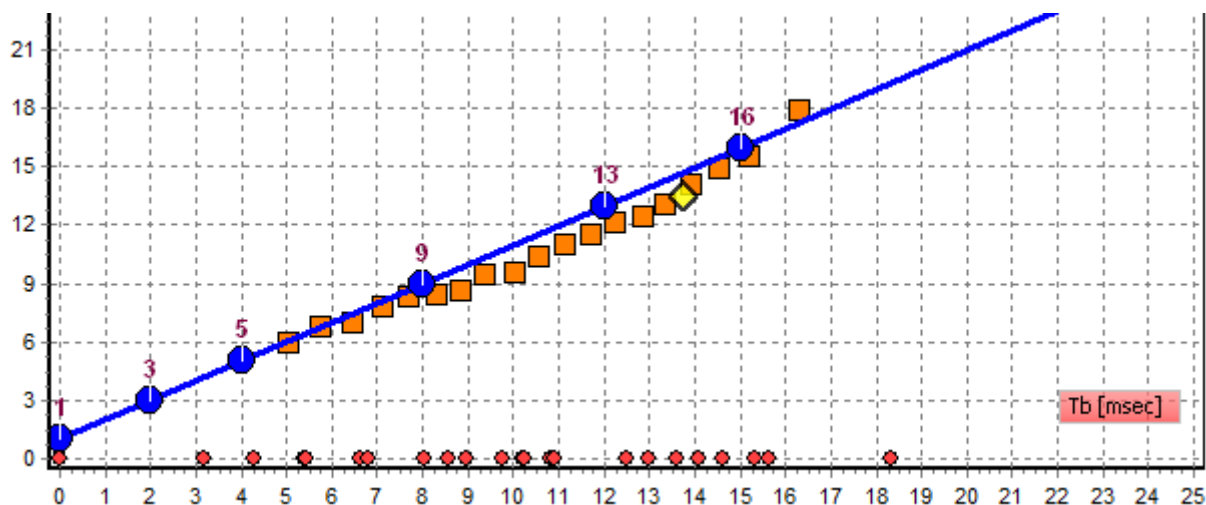


Fig. 3.42 Petrol template and calculated model points on Model chart.

7. If used gas injectors were used for the first time during autocalibration, their characteristics may change drastically during first drive on gas. Therefore first autocalibration may not give correct results. It is recommended to check if idle model is still correct after first drive on petrol by comparing petrol time at idle on gas and petrol time at idle on petrol (figures 3.40, 3.41).

Tb1	4,38	Tg1	6,52
Tb2	4,38	Tg2	6,52
Tb3	4,39	Tg3	6,53
Tb4	4,39	Tg4	6,53

Fig. 3.43 Petrol and gas times while running o gas..

Tb1	4,37	Tg1	0,00
Tb2	4,37	Tg2	0,00
Tb3	4,37	Tg3	0,00
Tb4	4,37	Tg4	0,00

Fig. 3.44 Petrol times while running on petrol.

If those time are drastically different (difference bigger than 0,2 ms) autocalibration or idle model should be set again by moving P1 and P2 points In that situation, gas map may be needed to be collected again.

8. After collecting petrol and gas maps click „Set model” button. Program will ask for confirmation of setting model and deleting gas map. (Fig. 3.45).

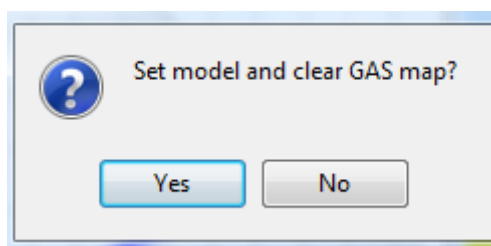


Fig. 3.45 A window confirming setting the model and deletion of the gas map.

If you click YES, the points of the map will automatically be converted to the model. The program will move the model points to cover orange settings points. At the same time gas map will be deleted so as the old calculation points. New model will be automatically written to the gas ECU.

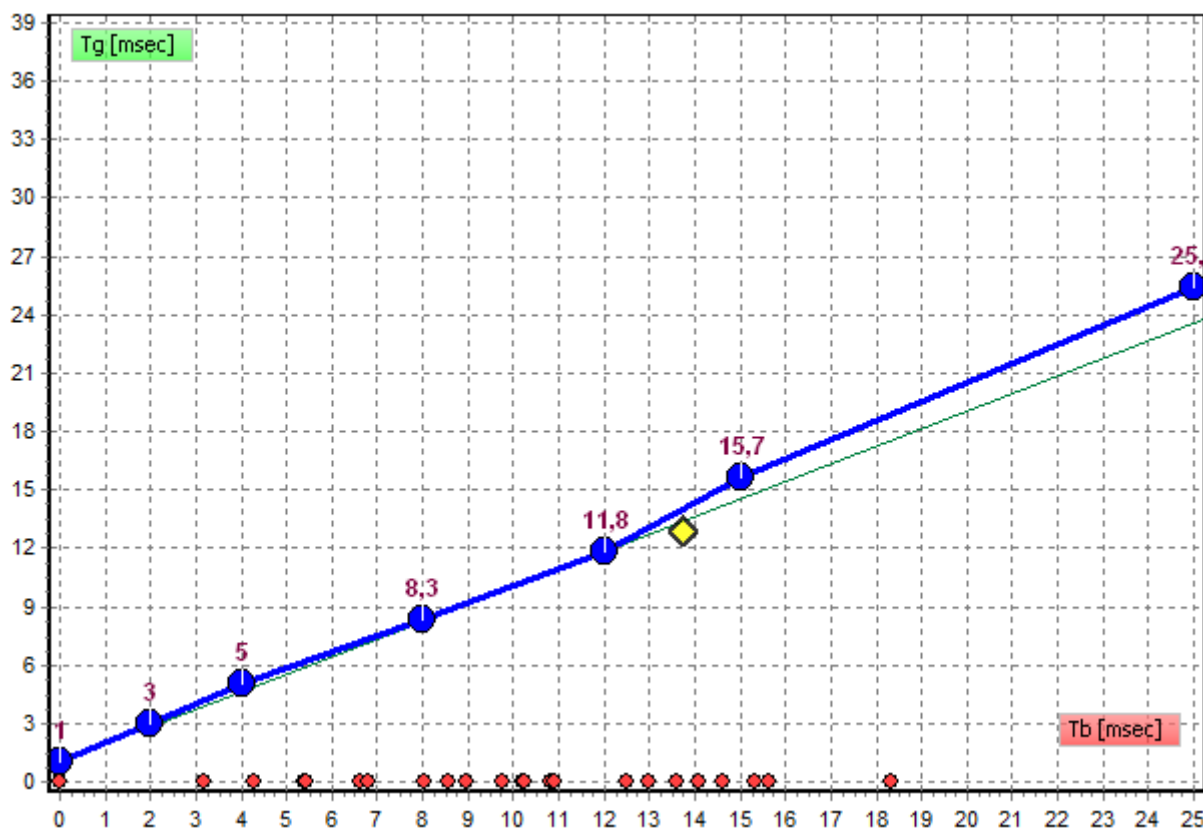


Fig. 3.46 Model changed with Set model function.

9. Then, if needed, the model can be also changed by mouse, keyboard keys or by changing tilt and move parameters. After changing the model, when it fully fit the yellow calculation points, press "Write".
10. Procedure should be repeated until petrol and gas maps covers completely (like on Fig. 3.47).

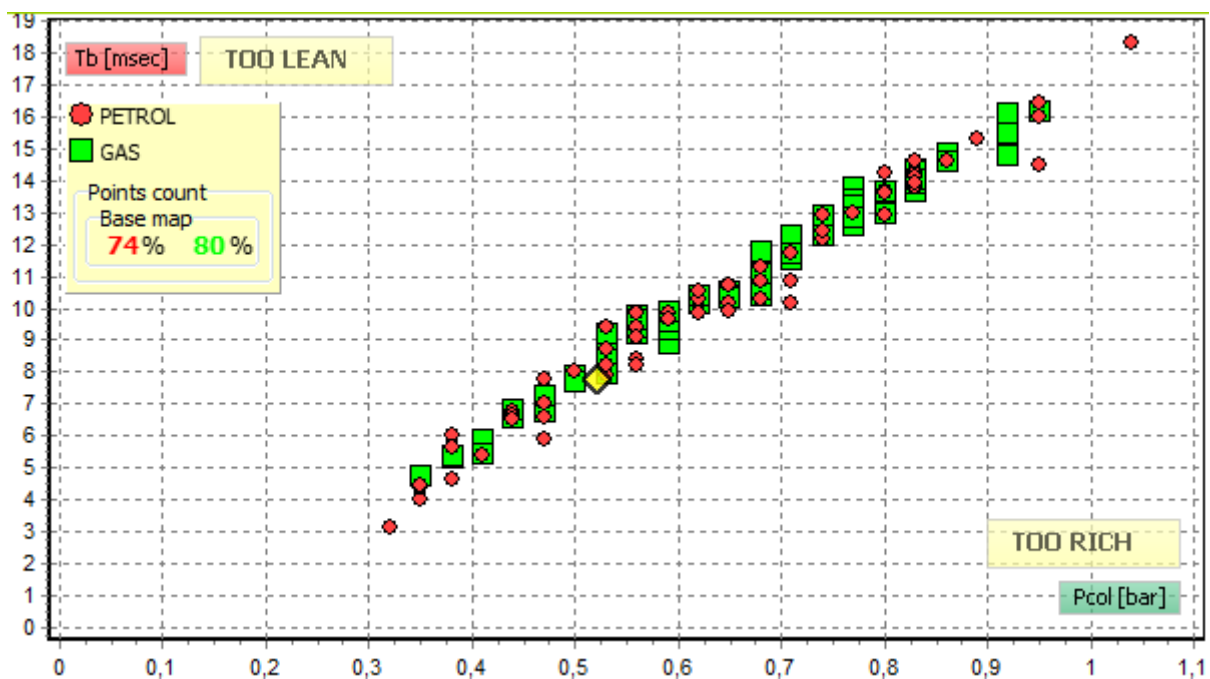


Fig. 3.47 Gas map covering petrol map.

3.6 Recorder

This function allows you to register gas system performance in time. Parameter values are presented in numerical and graph form. The blue vertical line sets the time moment for which numerical values are shown. After stopping the recorder you can set the blue line and therefore read the values in anytime moment in which the recorder has run. The "Save buffer" allows you to save recorder's data in to a file. You can load previously saved data and display in on the recorder's chart.

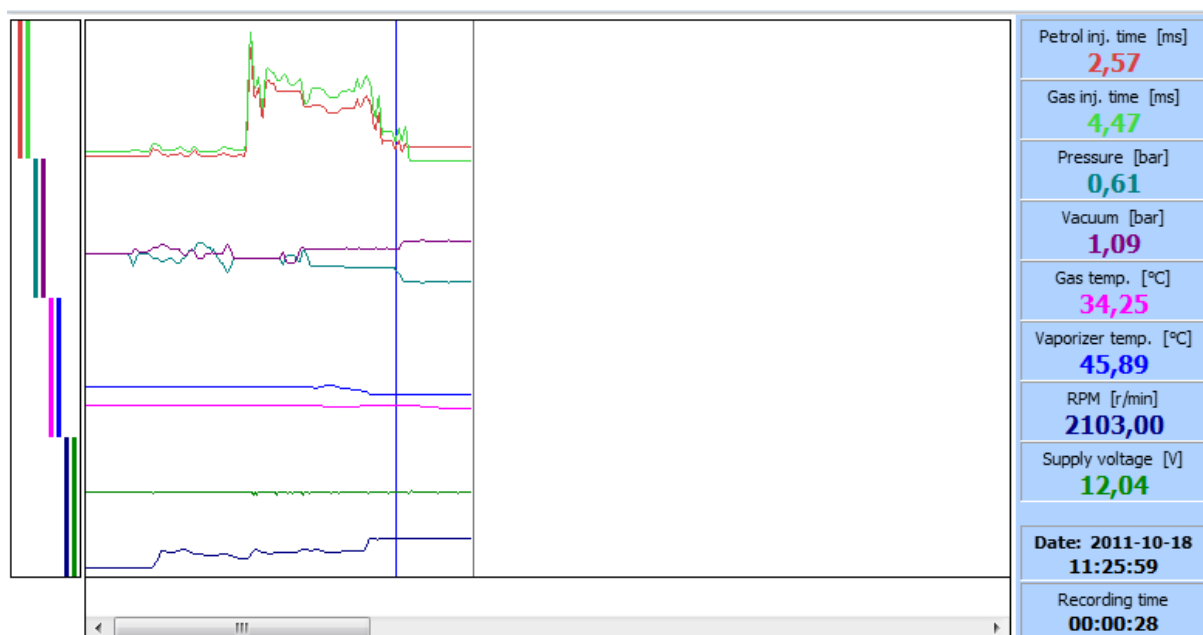


Fig. 3.48 Recorder window.

3.7 Readings window

It is window where all the important parameters of gas system are shown in a very clear way. Readings window is equivalent to readings tab from the DiegoG3 system and aims to facilitate the reading of parameters in such situations as driving the car while road test.

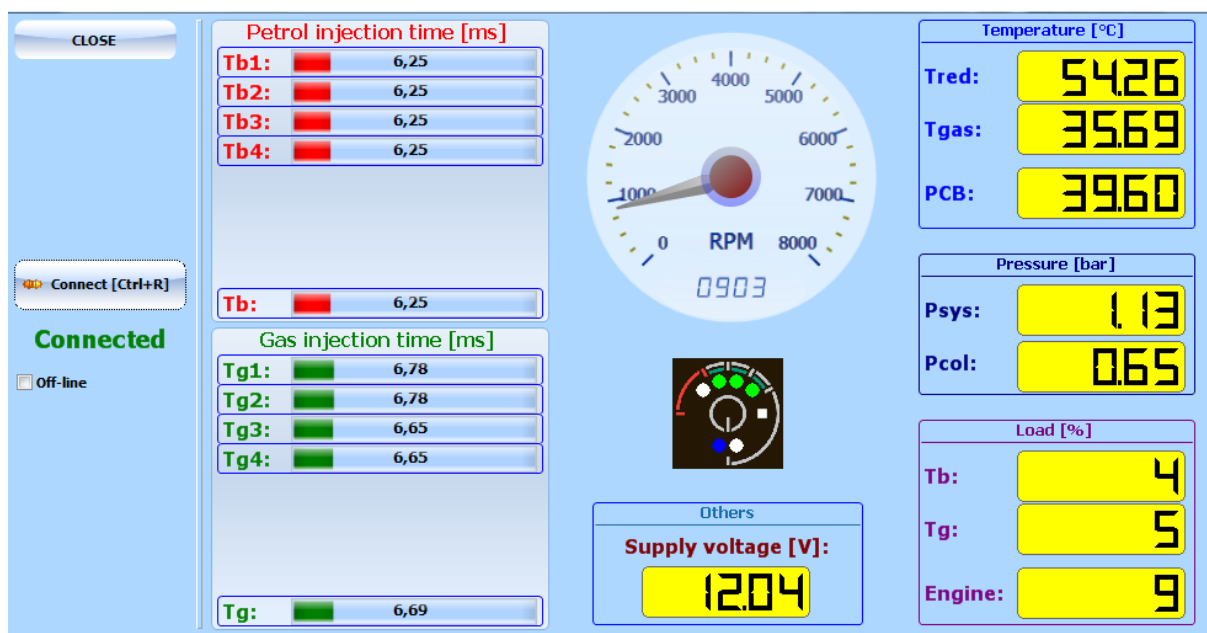


Fig. 3.49 Readings window.