

Instruction of connection and programming of the OSCAR-N controller

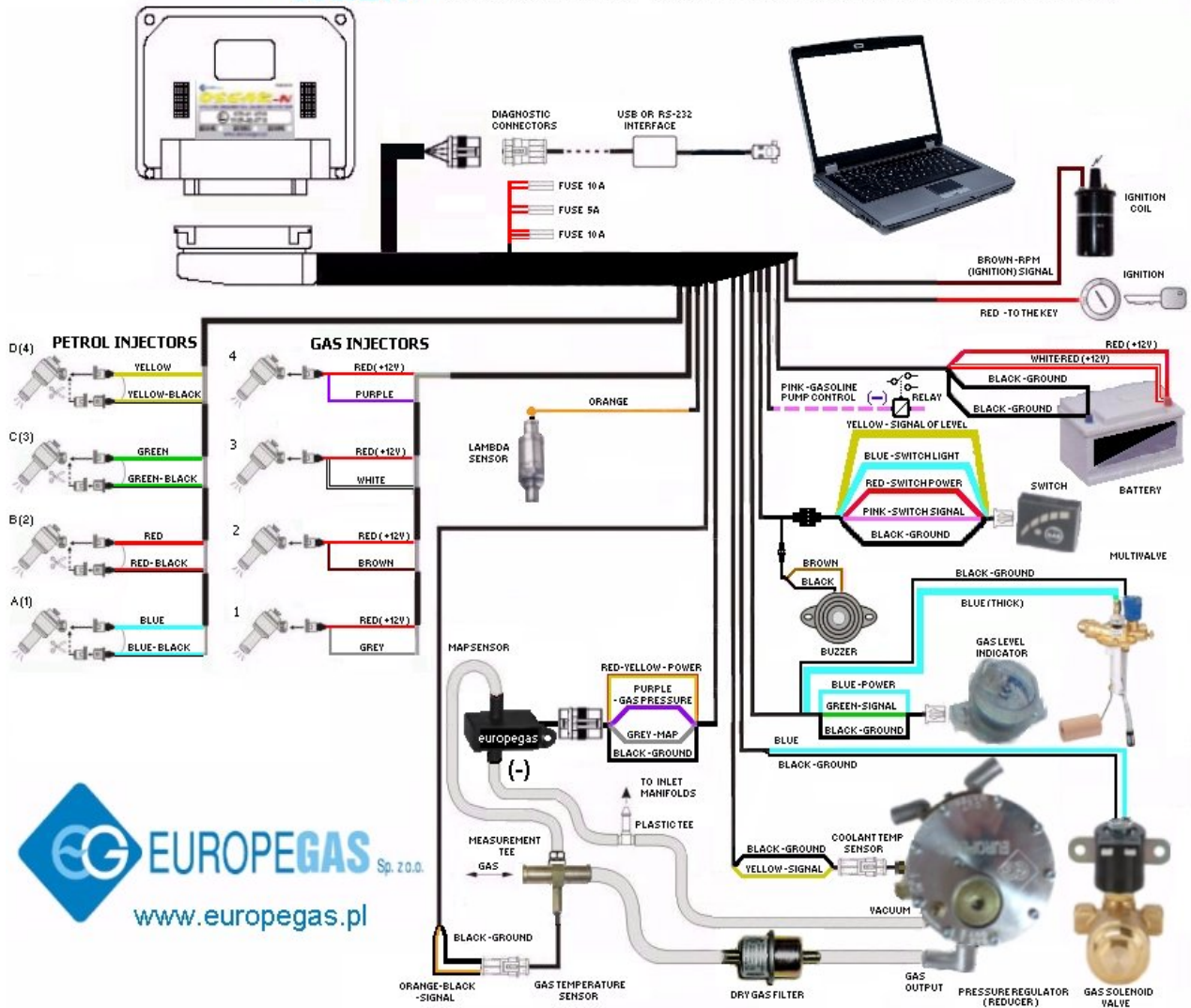
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1. Installation of OSCAR-N sequential gas injection system

1.1 OSCAR-N sequential gas injection system installation diagram

"OSCAR-N" 4 CYLINDERS VERSION CONNECTION DIAGRAM



1.2 OSCAR-N ECU installation method

During the installation of OSCAR-N sequential gas injection system it is suggested for the wire set to point downwards. It is also suggested that it should be placed in such a way to avoid the negative impact of high temperature and humidity.

1.3. Selection of pressure regulator.

Connection of wiring should be performed according to the connection diagram. During connection of the OSCAR-N sequence gas injection system pay special attention to proper selection of a pressure regulator for given engine power and injectors' nozzles. Improper selection of the pressure regulator in relation to engine power will cause that when the LPG delivery is high (i.e. the throttle fully opened) the pressure regulator will be not able to ensure nominal LPG pressure and the pressure in the system will drop. If the LPG pressure will drop below the minimum value set at the controller the system will switch over to supply with gasoline. For most of the cars the pressure regulator should be regulated close to 1 bar (You can observe the this value in OSCAR-N software).

1.4. Selection of injectors' nozzles diameter

ATTENTION!

Injection rail type RAIL, VALTEK should be calibrated with a special calibration device before installing it in the car. Calibration is needed for checking the piston stroke which must be equal for all of the cylinders. For shorter times of injection (2,0 – 2,6 ms) it is recommended setting smaller piston stroke which should be between 0,40 – 0,45 mm. For longer petrol injection timings (3,0 – 4,0 ms) the piston stroke should be between 0,45 – 0,65 mm.

Selection of injectors' nozzles diameter depends also on the engine power. The injectors' nozzles should be selected in such way so that at high engine load and high RPM the multiplier for given injection time should be close to 1. Most engines have injection times amounting to 15 [ms]. The table below contains list of nozzle diameters depending on power for 1 cylinder. To read out the nozzle diameter for given engine correctly it is necessary to divide the engine power by number of cylinders.

Nozzle diameter [mm] Reducer's pressure 1 [bar]	Power for 1 cylinder [KM]
1,8-2	12 – 17
2,1-2,3	18 – 24
2,4-2,6	25 – 32
2,7-2,9	33 – 40
3,0	41 – 48

Pay special attention that the figures in table are only rough values and in some cases may not agree with real ones.

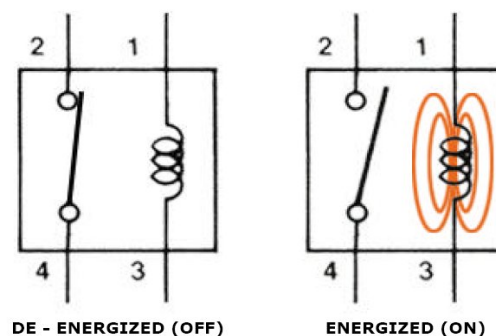
Such situation can appear in vehicles fitted with semi-sequential or full group (all injectors activated simultaneously) injection. In such vehicles nozzle diameters will be smaller than these given in the table due to the fact that in such type of LPG supply control the volume of supplied LPG is greater than for full sequence – twice for the semi-sequential and four times for full group injectors.

1.5. Connecting the fuel pump control cut-off wire

ATTENTION!!!

Remember to use relay between gasoline pump control cut-off and OSCAR-N ECU pink wire. **Connecting this wire directly to the gasoline pump control (without relay) may damage ECU.**

Normally closed relay should be used. That means that when the relay coil is NOT energized, the relay switch contacts are closed, completing the circuit through pins 2 and 4. When the control coil is energized, the relay switch contacts opens, which breaks the circuit open and no continuity exist between pins 2 and 4. Both situations are shown on the drawing given below.



The connection to the separate pins should be made in following order:

Pin 2 and 4 -gasoline pump control cut off (between positive line from the fuel pump control)

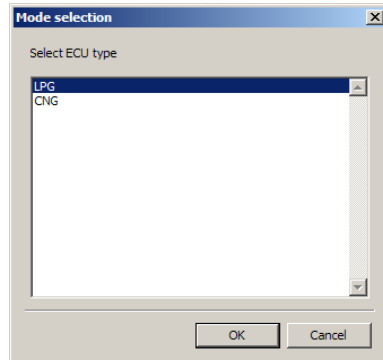
Pin 1 -pink wire from OSCAR-N ECU (negative impulse is given by this line at the moment of changeover from petrol to LPG, which is cutting-off the work of gasoline fuel pump)

Pin 3 -positive signal (12V) from the car's key (or from the battery)

2. Description of the OSCAR-N diagnostic program

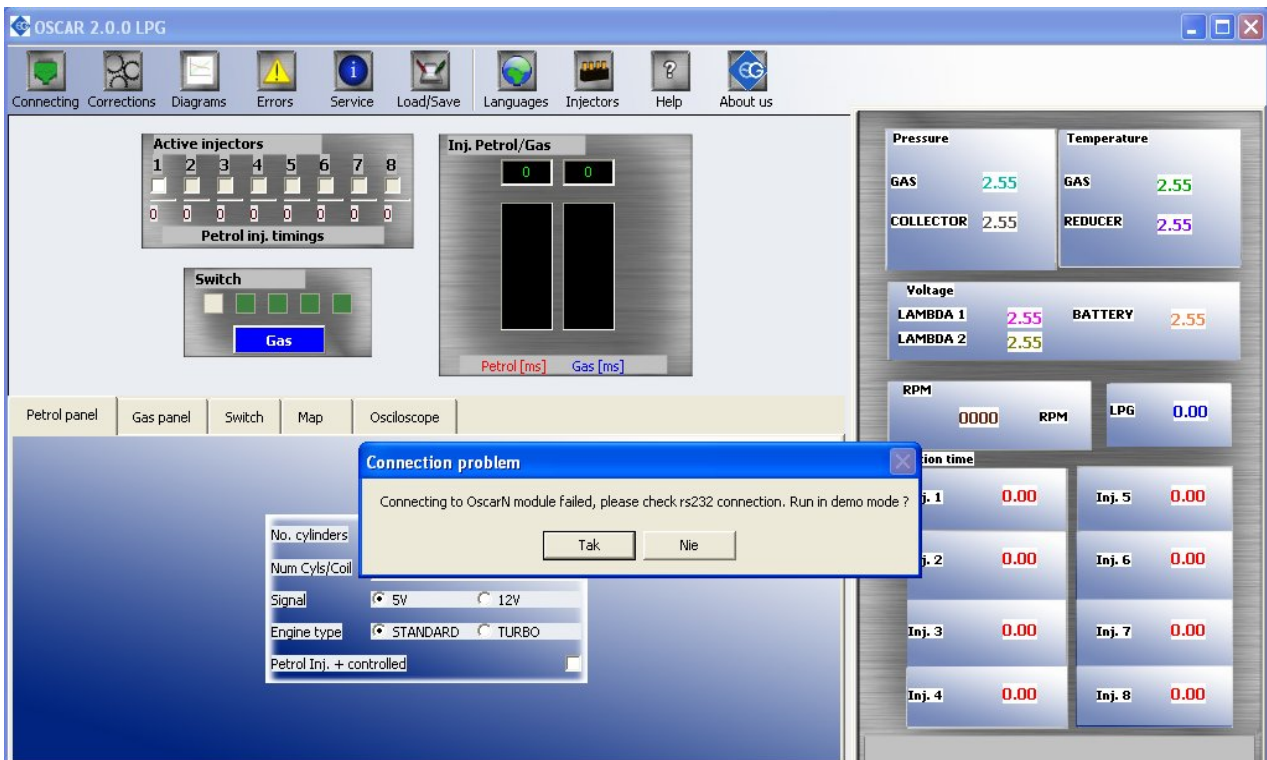
2.1.Choosing LPG or CNG work mode

At the beginning please choose the OSCAR-N ECU type **LPG** or **CNG**.

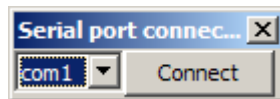


2.2. Connecting controller to the PC

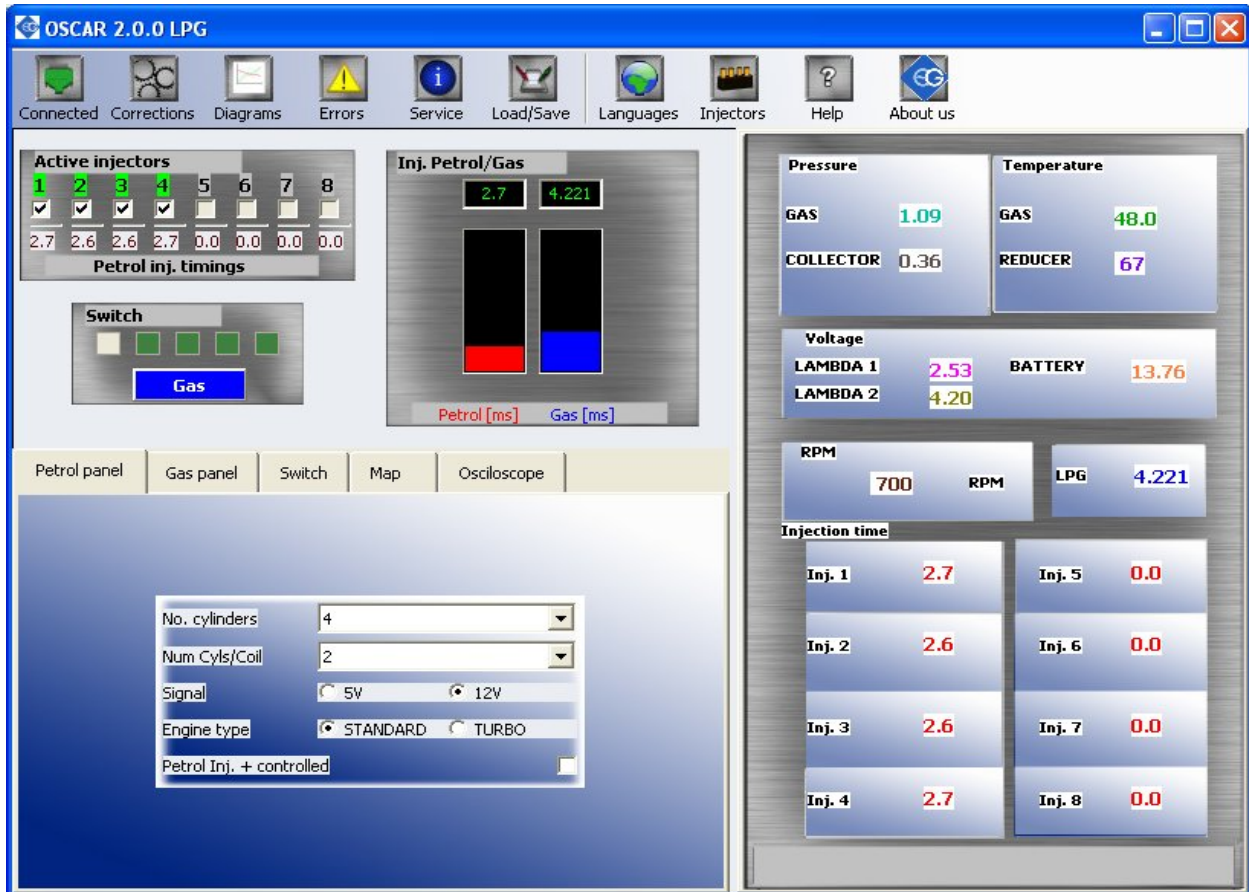
If the all the connections are made correctly, connect OSCAR-N to the PC with installed OSCAR-N diagnostic program, by using special OSCAR-N interface. **Before starting the program turn on the ignition** (supply the controller with voltage); this is necessary because after about 10 minutes without power supply from the ignition switch the controller goes to the sleep mode, where the communication is impossible. That situation will be signalled as connection error.



To make connection please click by the left mouse button first icon from the top left side of the screen. Then choose the proper port number to establish a connection by pressing „Connect” button.



After starting the program – if the the communication port is selected properly – the controller should establish connection with the diagnostic program, what is signalled with the message “Connected” in the left upper corner of the program main window.



2.3. Main window content

On the left top side of the window, above the Panels You can find following groups:

- “**Active injectors**” group - here You can turn off / on active LPG injectors which should be inactive / active during work on LPG. If You disable separate injector by clicking on the tick under the number of injector the adequate petrol injector will start working, while the rest of the cylinders will be working on LPG. This option is very useful for diagnostic purposes.

Below the ticks of the active injectors You can find the injection times of adequate **petrol injectors**.

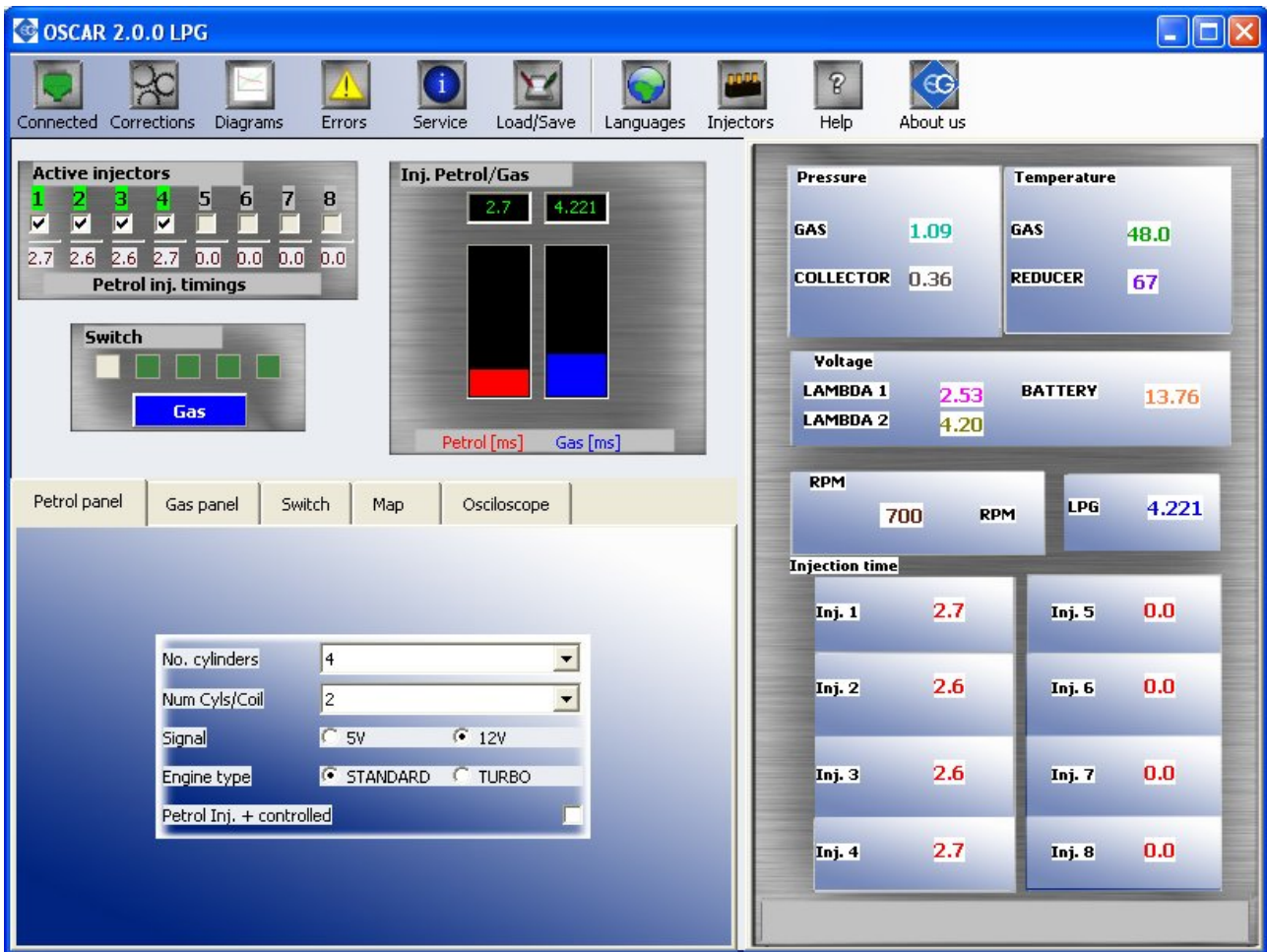
- “**Injectors Petrol / Gas**” group – here the injectors' opening times are visualised as blue and red bars. The values of the first petrol and gas injectors are shown above these bars.

- “**Switch**” group -the five squares always show the current gas indication level. The Gas / Petrol button is used for manual changeover between both fuels. This also could be done by pressing SPACE button on the keyboard.

On the right side of the OSCAR-N program window You can find actual indication of most important system parameters.

2.4 Setting the basic parameters

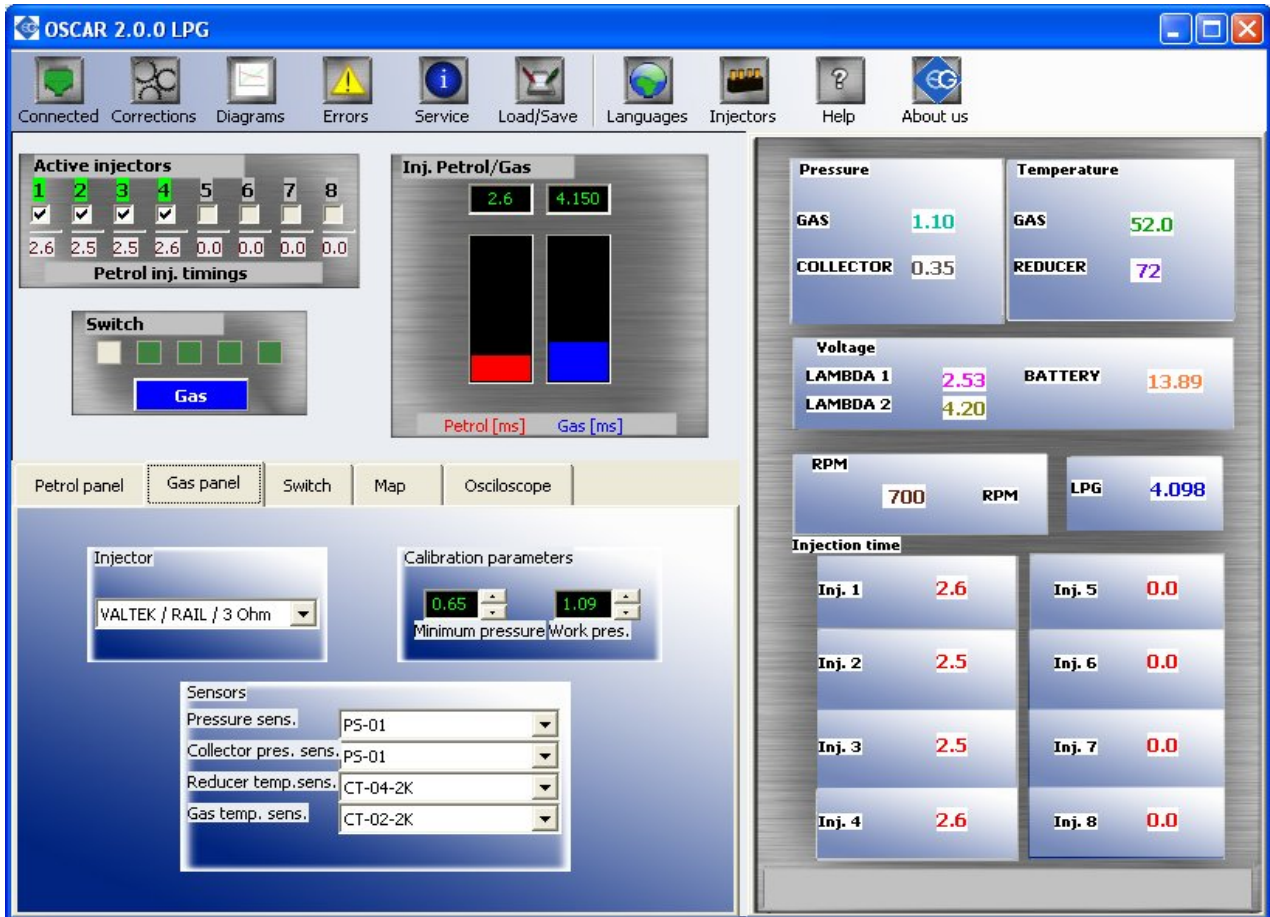
2.4.1. Petrol Panel



First step after connecting the interface from the computer to OSCAR-N ECU and turning on the program is to set the parameters from the Petrol Panel properly.

- *Number of cylinders* – number of engine cylinders
- *No. of cylinders for one ignition coil* – number of cylinders for one ignition coil (wrong selection will cause improper indication of RPM signal)
- *Revolutions signal* – revolutions signal source, 12 V – signal from the ignition coil, 5V – signal from the vehicle's computer
- *Engine type* – engine type, Standard – standard engine without supercharger, Turbo – supercharged engine
- *Petrol Injection controlled with „+”* - injection signals reading in systems where signals are “positive”, i.e. grounding is the common signal for all injectors and the controlling signals are up to 12 [V].

2.4.2. Gas Panel



Second step will be selecting the the proper injector rail type (for RAILGAS 3 Ohm injectors please select VALTEK/RAIL/H2000 3 Ohm), and type of sensors from Gas Panel. Selection of wrong sensor will cause improper sensor indication (i.e. wrong selection of gas temp. sensor may cause showing very low reducer temperature on the screen after the start of warm engine)

Usually in OSCAR-N there are following sensors attached (They will be selected automatically after first controller connection with the PC) :

- pressure sensor – PS-01
- collector pressure sensor -PS-01
- reducer temperature sensor – CT-04-2K
- gas temperature sensor -CT-02-2K

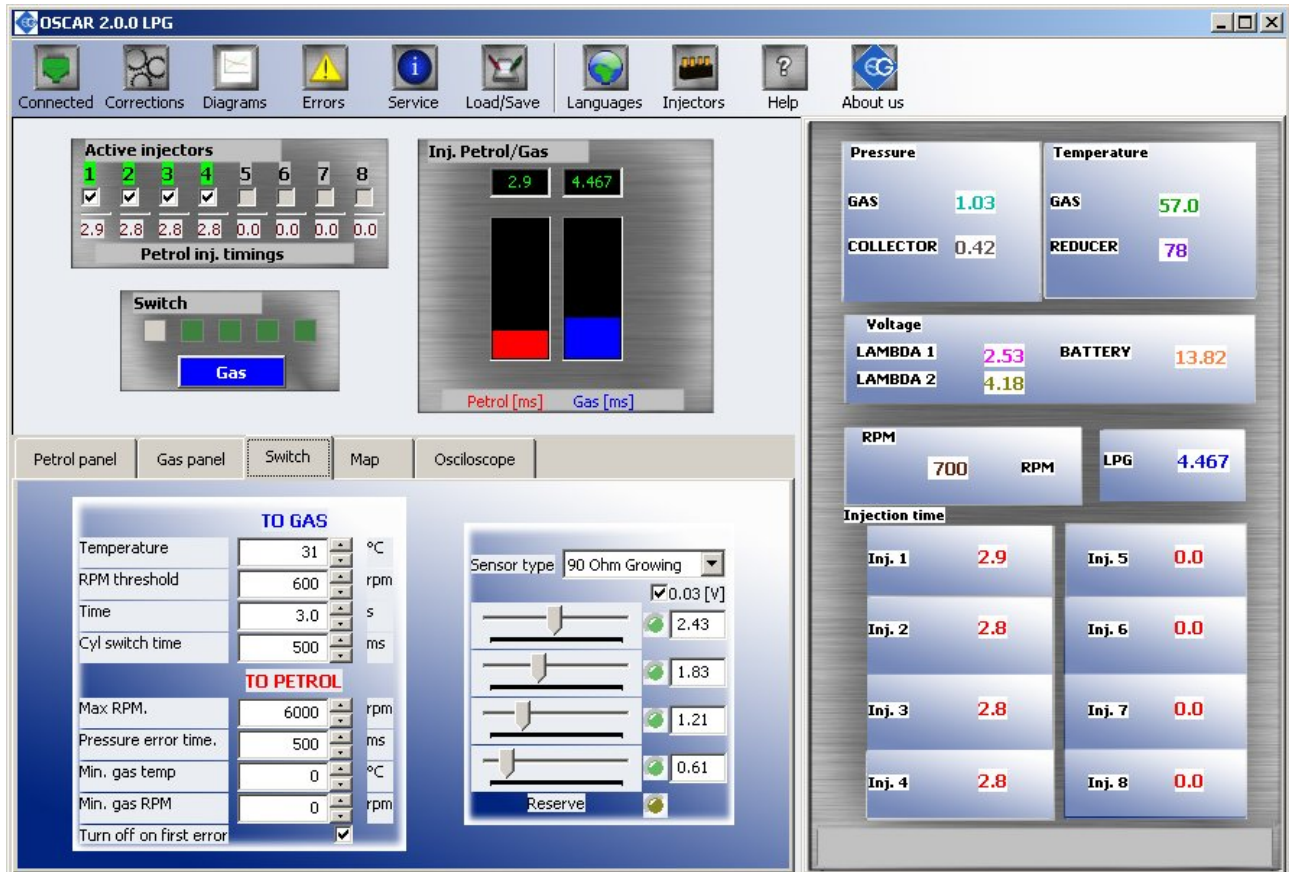
Calibration parameters:

“*Minimum pressure*” is the lowest border pressure value. If the gas pressure will fall below this value, for time longer than value set in „Pressure error time” controller will signalise „gas pressure is too low” error and it will automatically changeover to petrol.

“*Working pressure*” is the value of gas pressure during last auto-calibration process. In case of any modification of this values requires performing another auto-calibration. If the gas pressure will be bigger than two times of this value the ECU will changeover to petrol signalling error „Gas pressure too high”.

Both these values are automatically set after the auto-calibration.

2.4.3. Switch Panel



Next stage is the the **Switch** settings group which contains the following parameters:

TO GAS -parameters related with changeover from petrol to gas

- **Temperature** – the LPG pressure regulator minimum temperature required for controller’s changeover to LPG. Controller will be waiting with changeover to LPG until the gas temperature will reach this level
- **RPM threshold** -engine RPM required for the controller to changeover to LPG. For the RPM threshold <700 changeover occurs at idle run
- **Time** – time period from the time of starting the engine, after which controller can changeover to LPG
- **Cyl. switch time**– time between changeover between subsequent cylinders; when the setting is i.e. 200[ms] the change over of a 4-cylinder engine from gasoline to LPG or from LPG to gasoline will last 4*200[ms]. This option works regardless of the fact that the gasoline injection system is the so-called full sequence or not.

TO PETROL -parameters related with changeover from gas to petrol

- **Max RPM** – maximum level of engine's RPM at which car can run on LPG. Exceeding this level will cause changeover to gasoline.
- **Pressure error time** – time period (in ms) while the LPG pressure could be lower than the “minimum pressure” value. If the pressure error will last longer than this time period the car

will change over to gasoline, and the pressure error will be signalled.

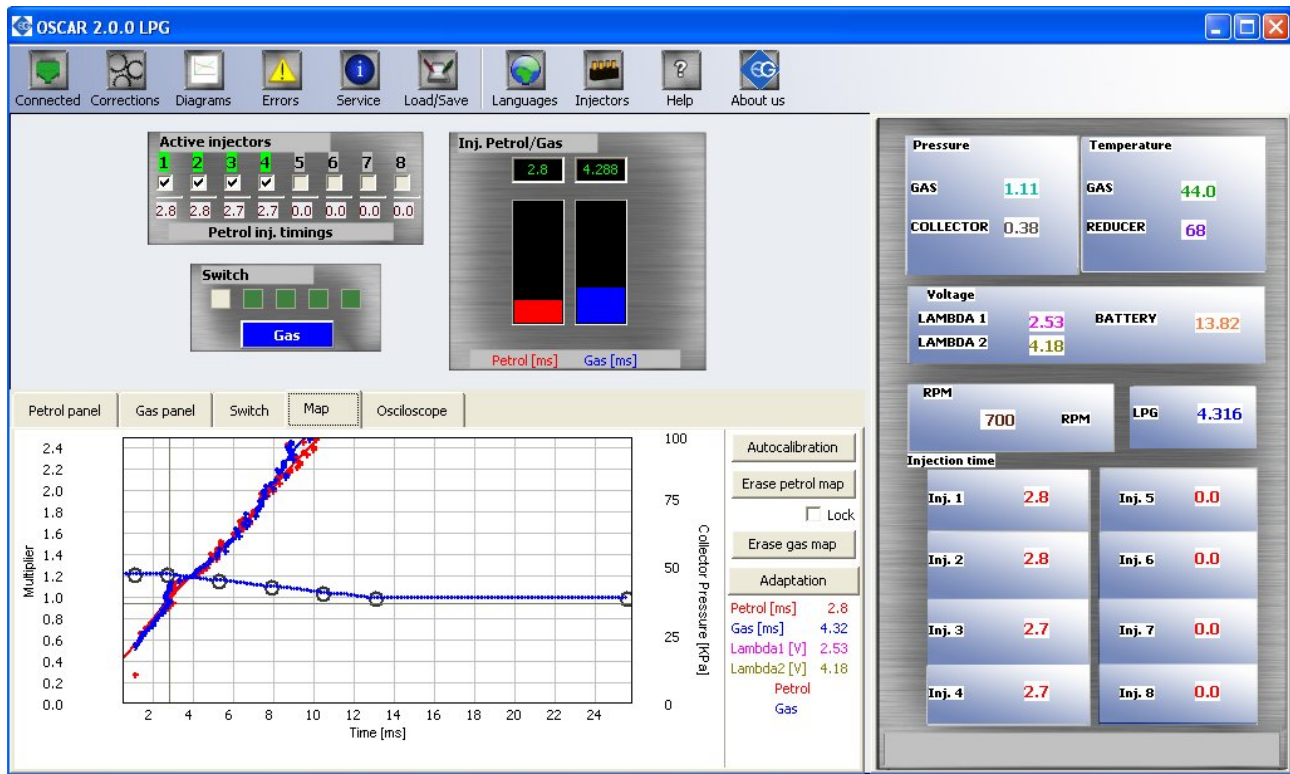
- **Min. gas temperature** – lowest border of LPG temperature. If gas temperature will fall down below this value the car will change over to gasoline
- **Min. gas RPM** -lowest border of engine's RPM at which the car could run on LPG. If the RPM will fall below this level the car will change over to gasoline.

Sensor type -characteristics of level indication sensor installed on the tank's multivalve.

Here You can also set the levels at which the particular level diodes on the switch will turn on and off, depending on the electrical signal (in Volts) read from the level indication sensor. That value is always shown in the OSCAR-N program, below the sensor type selection field.

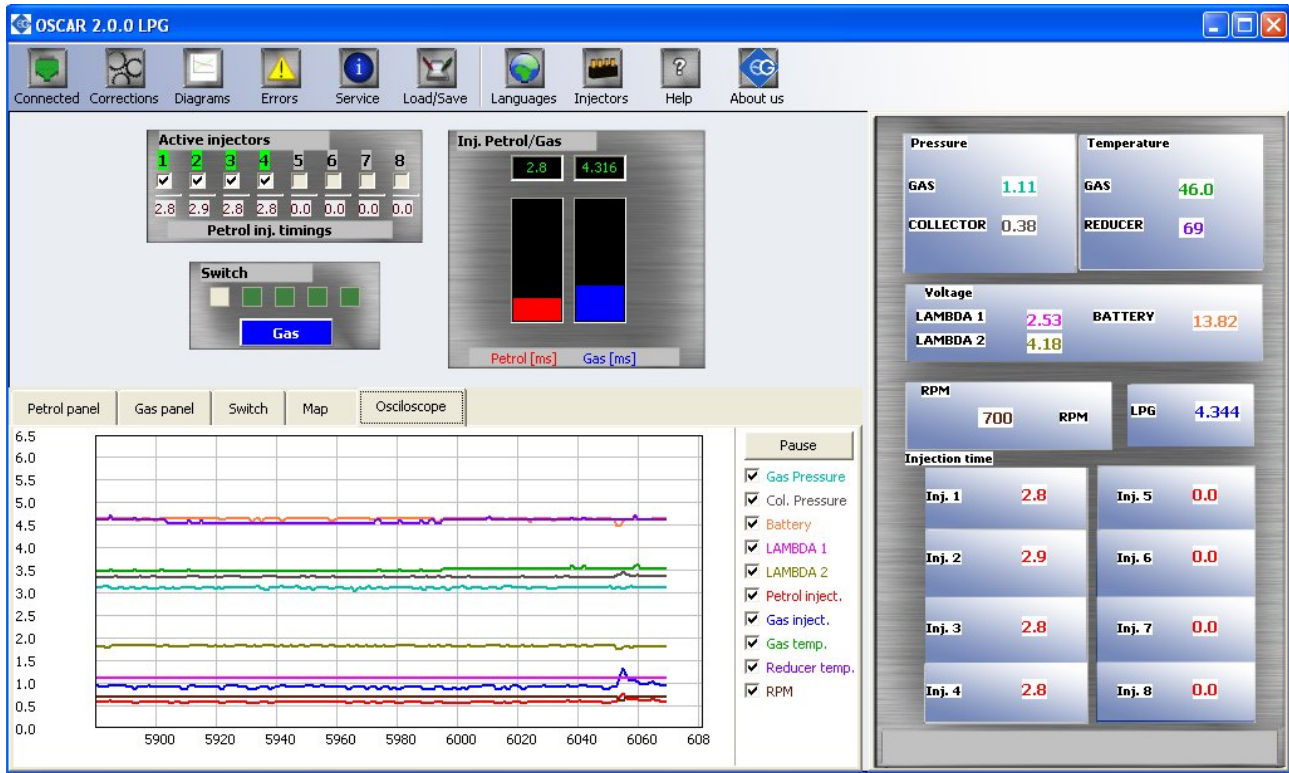
Before changing sensor type check the box with actual voltage indication. Uncheck it when you changed sensor type. This function enables turning on or off inertia of gas level indication in the controller. Leaving this field checked in could cause rapid changes of level indication during the drive (especially when taking sharp curves).

2.4.4. Map Panel



In the **Map** bookmark You can find **Auto-calibration** button which starts the auto-calibration. You can also **erase gas** and **petrol map** from the memory of the OSCAR-N ECU, and **lock** the petrol map (no more points will be collected from the moment of ticking on the “**Lock**”). Auto-calibration process is described more precisely in point **3.1.** of this manual.

2.4.5. Oscilloscope Panel

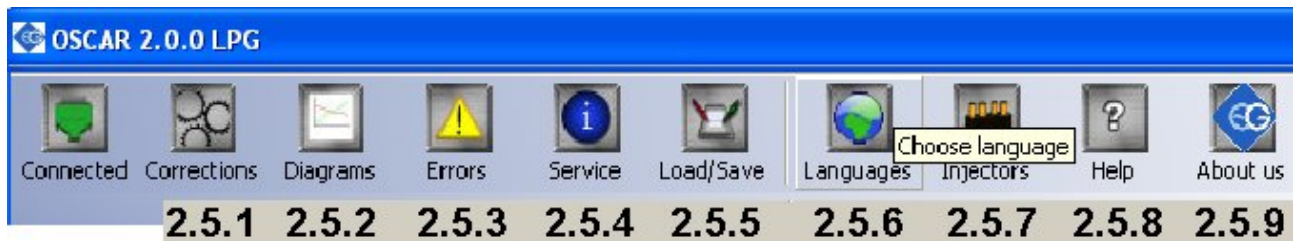


On the right side of the main window there is the a window named *Injection time* which shows us the petrol injection times on each car's cylinder and the times of injection of first gas injector. Above it You can find other windows which contain following signals measured by the controller:

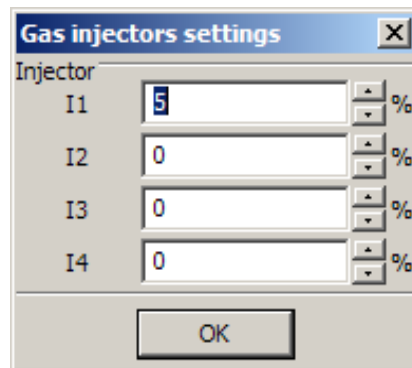
- *Gas pressure [bar]* – LPG pressure value (pressure difference between the pressure regulator and the suction collector)
- *Collector pressure [bar]* – *MAP* -pressure value within the suction collector (the absolute pressure value)
- *Gas temperature [°C]* – LPG temperature at the pressure regulator outlet
- *Reducer temperature [°C]* – temperature of the liquid gas within the pressure regulator
- *Power supply voltage [V]* – voltage at the controller's power supply
- *Lambda 1 voltage [V]* – voltage at the lambda 1 probe
- *Lambda 2 voltage [V]* – voltage at the lambda 2 probe
- *RPM [rev/min]* – engine revolutions per 1 minute

All signals described above are visible on the oscilloscope and can be turned on and off anytime. After pressing "Pause" button the lines stop being drawn. This option can be used for checking what were earlier indications of signal.

2.5. Other functions available in the main window



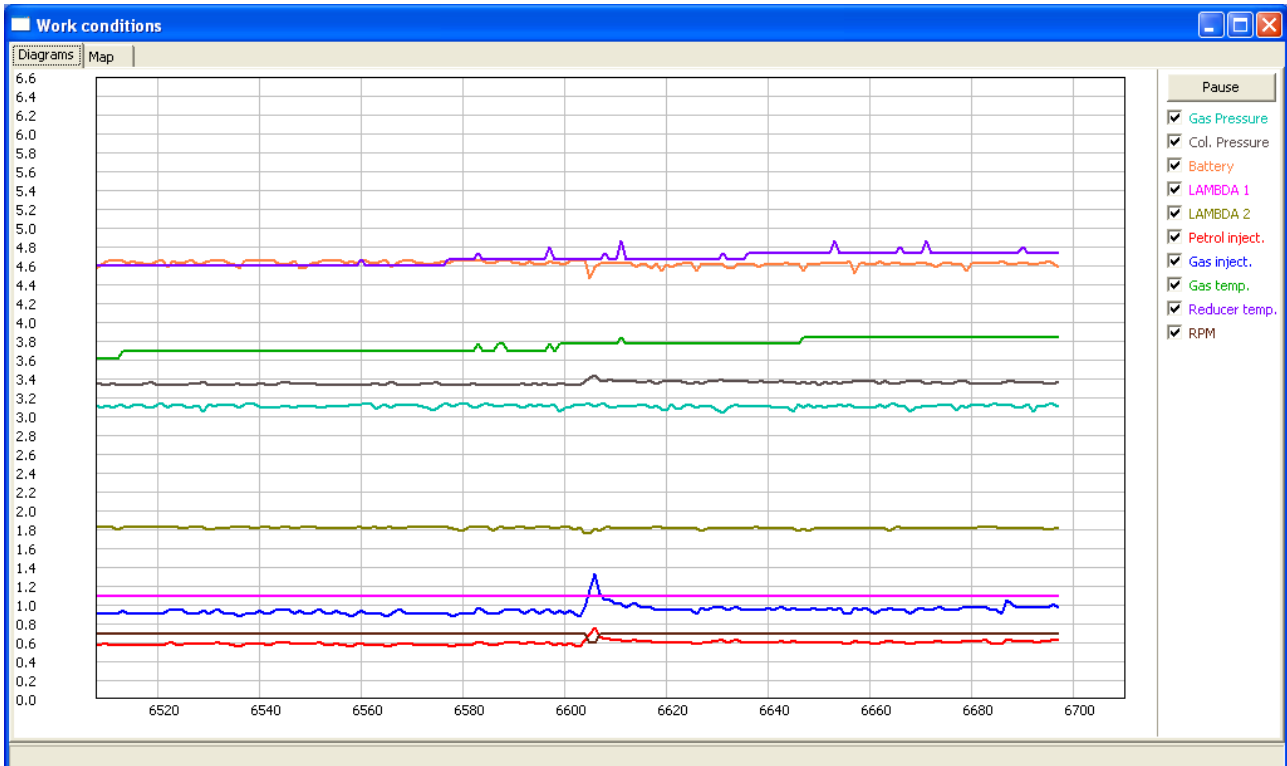
2.5.1. Gas injectors corrections



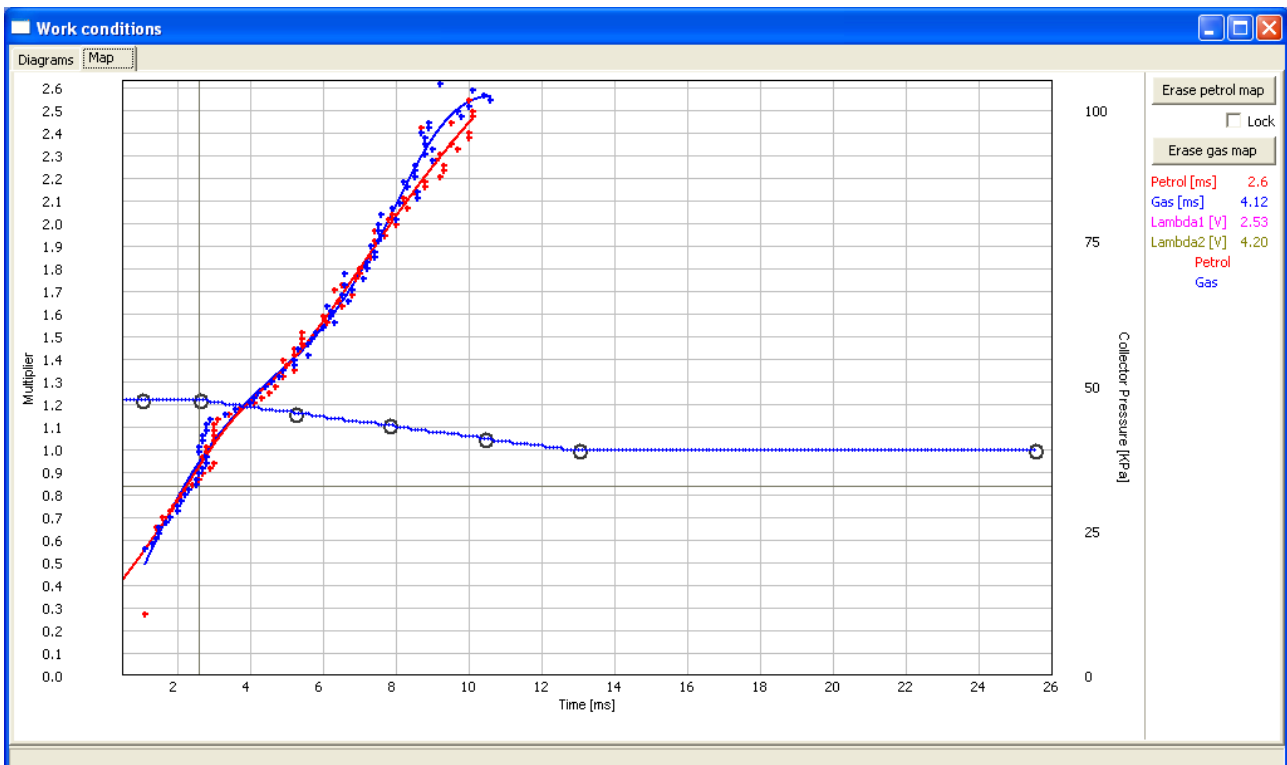
Use this window to calibrate (in %) the LPG injectors. These settings enable a correction of the fuel mixture for each cylinder. This is used i.e. to correct the injection time variations present in a “V” type engine cylinders. To calibrate the injectors, use the following procedure: Upon auto-calibration, check the **gasoline injection times** for each cylinder when using gasoline. Turn the LPG injectors on, one at a time, and observe if there are any differences in the injection times after switching from gasoline to LPG. Adjust the % settings (**only when necessary!**) for each injector so that switching to LPG one injector at a time will not result in changing the **gasoline injection times**.

WARNING!!! Use this option as a last resort, i.e. when sure that the installation was performed properly, all mechanical issues have been eliminated and injection times variations for given injectors are still present when using LPG. Do not ever use injection strip-collector pipes of different lengths and then the injectors’ calibration to accommodate this difference!!! Also never use this option when the system is not in a perfect working condition or when some of its elements have worn out. Using this option in a manner not consistent with the above instructions may result in damage to the car!!!

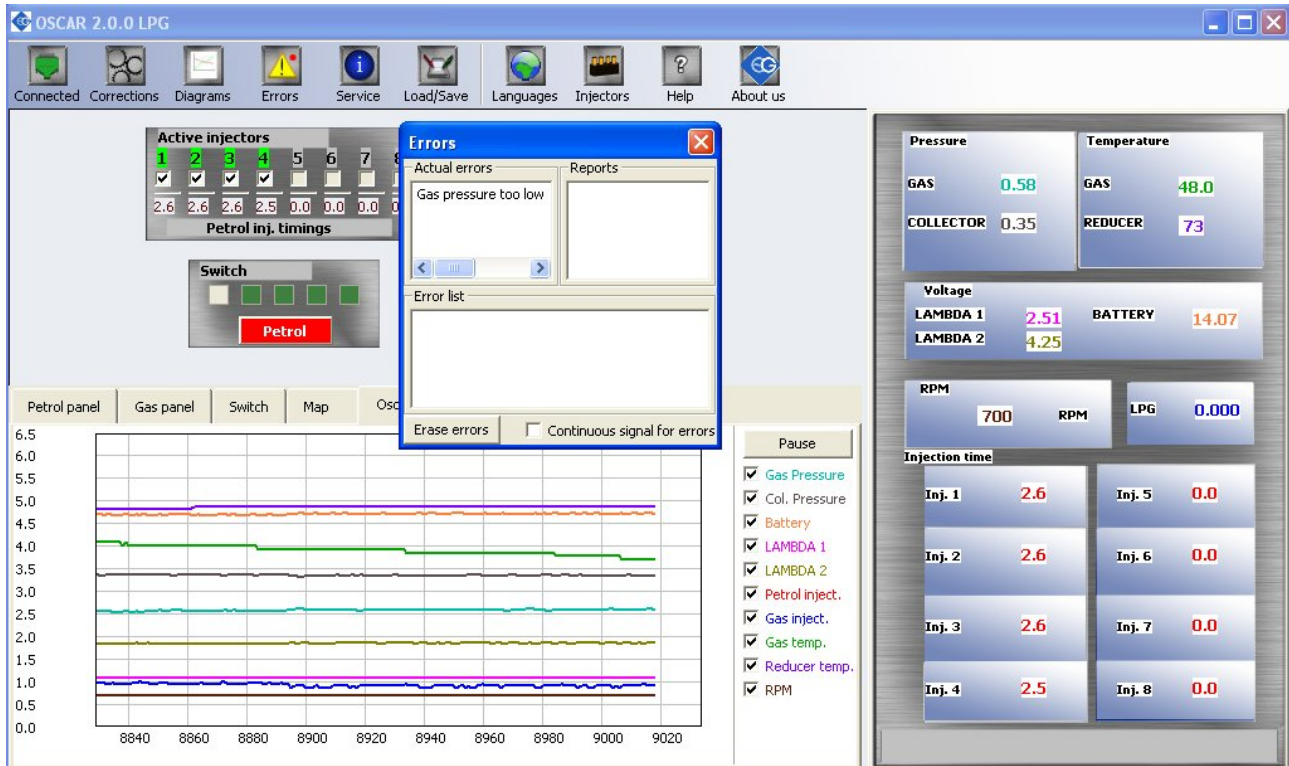
2.5.2. Diagrams



This function makes available to work with **Map** and **Oscilloscope** windows independent from the main window. The window can be moved across the screen and it is fully resizable.



2.5.3. Errors



Error appearance is signalled by beeping from a buzzer (if connected) and changeover back to petrol. The diode on the switch will start blinking. In the software window the red dot will appear on the “Errors” icon. When You click it You will the “Errors” window will appear.

The Error window shows the following fields:

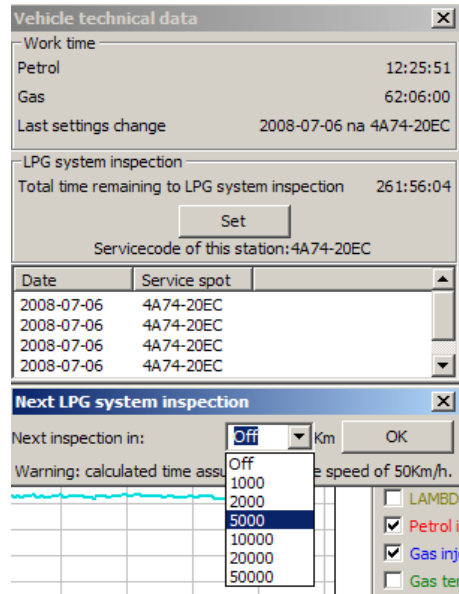
Erase Errors -this option makes available to erase errors which have occurred

Continuous signal for errors – if selected, acoustic signals will inform of an error until manually turned off by the user. If unselected, the acoustic signals will remain on only for a set amount of time.

List of errors which may occur:

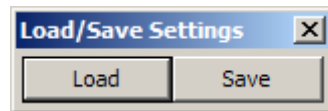
- **Injector No. [...] Error** – no LPG injector No. [...] or injector damage
- **Voltage Error** – voltage at the controller’s power supply lower than 9 [V]
- **LPG pressure too high**– the LPG pressure has been two times higher than operational pressure for 60 seconds (a reducer problem)
- **LPG pressure too low** – the LPG pressure has dropped under the min. pressure value for a set amount of time.
- **No gasoline injection** – the controller has detected a lack of gasoline injector signal for one or more gasoline injectors.
- **Data error, check settings!** – the controller has detected a settings error, check all controller settings.
- **Power supply voltage too low for LPG!** – the controller power supply is too low to work with LPG.

2.5.4. Service



Makes possible to set time remaining to the next system inspection. It will be signalised by beeping of the buzzer and switch LED's blinking after each turning off of the ignition until next system inspection will be set by the installer. All service numbers of the PCs connected to the ECU will be written in its memory.

2.5.5. Load /Save



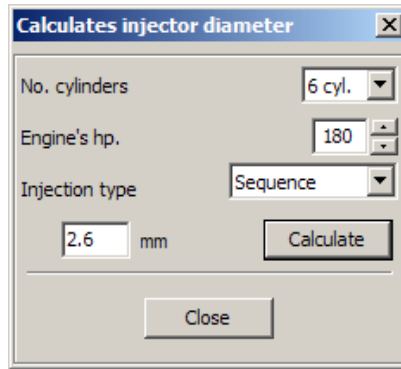
Makes possible to “Save” current program settings in a *.xse file. All the settings like the multiplier values, sensor types etc. can be saved on disk and easily restored in any moment by pressing the “Load” button.

2.5.6. Languages

There are following program interface languages available to choose from:

- Polish
- English
- Russian
- German
- Turkish
- Czech
- Slovakian

2.5.7. Injectors diameter



This function makes possible to calculate injection nozzle's diameter according to amount of HP to one cylinder.

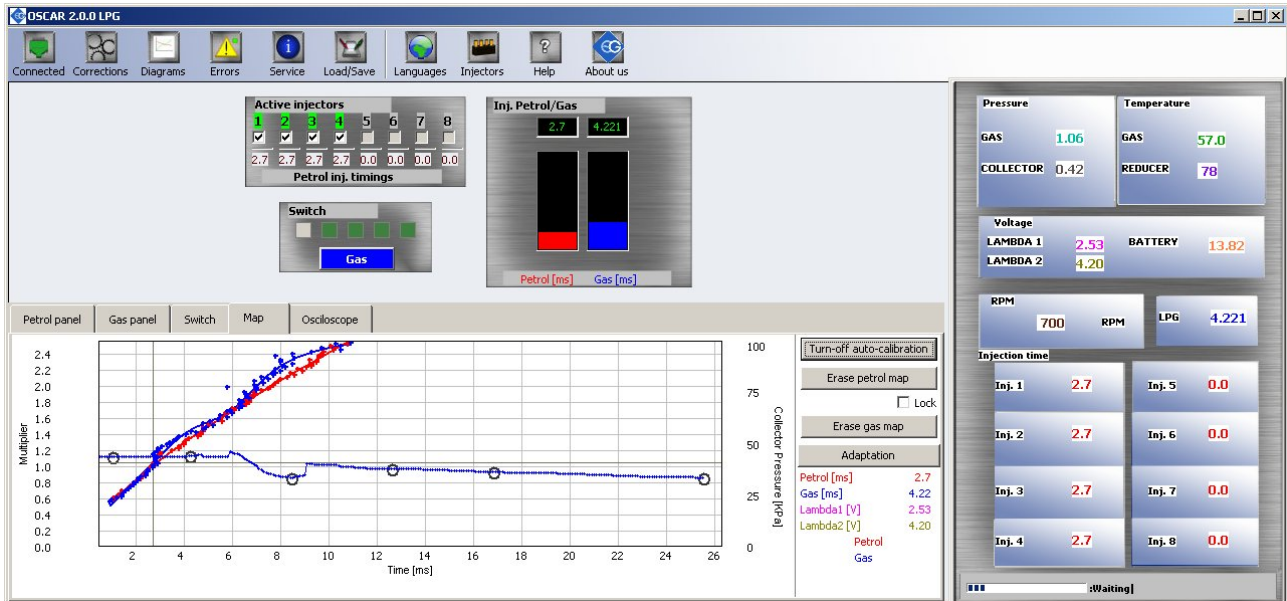
2.5.8. Help

Opens directory including this manual and wiring diagrams.

2.5.9. About us

Some information about "Europegas" Sp. z o.o. Company divisions in Poland with all addresses, e-mails and other information.

3. Auto-calibration



In the „**Map**” bookmark You can find „**Auto-calibration**” button which You should press now to start the auto-calibration. On the right side of the window You should see progress bar with information about calibration process.

Prior to starting the auto-calibration start the engine and wait until the lambda probe starts to work. During auto-calibration the engine should work at idle run. Do not increase RMP, switch off air-conditioning and lights, do not turn the steering wheel, because this may cause erroneous action of the auto-calibration. Please notice that during the auto-calibration all other functions remain inactive (You can only “**Turn-off auto-calibration**” in case of any problems with the work of the engine).

During auto-calibration watch carefully gasoline and LPG injection times. If LPG injection times are shorter than gasoline injection times, the injector nozzles may be too big and should be replaced with smaller ones. When the auto-calibration is finished 2 points should appear on the left and right side of the map and 4 points between them. The second left point is the point of engine operation at idle run i.e. the point of operation during auto-calibration. The multiplier’s value for this point should be between 1.2 and 1.6. If the value is greater than 1.6 then longer times of gasoline injection (i.e. greater load and high RPM) may cause overlapping of injection times i.e. during one LPG injection comes another one (loop of injection times). In such case the controller sends the error message „injection time too long”. **However, in such case it is necessary to check operation of the lambda probe; if it is in the “rich” mode and the vehicle drives without problems, the error can be ignored.**

3.1. Collection of the gasoline injection map with gasoline (gasoline map)

Having made the auto-calibration switch over the vehicle to gasoline and drive about 4 km to collect the gasoline map. During collection of the map try to drive without changing gears i.e. at the 4th gear and in such way so that the lambda probe “works” (changes its mode from weak to rich) During collection of the map should appear blue points. To collect the map quicker select vehicle load in such way so that collect points in places, which are empty until now. **Collection of maps is performed without participation of the diagnostic program, thus can be done without PC connected.** However, while performing this action with connected computer and diagnostic program we can do it much quicker and we see accurately, what happens to the vehicle. When the controller recognises that the number of collected red points is sufficient, the map will be drawn with a continuous line. The accuracy of drawn line depends on the density of points collected in given area. The more points will be collected in given area, the more accurate the petrol map line will be.

3.2. Collection of the gasoline injection map with LPG (LPG map)

Having collected the gasoline map we switch the vehicle to LPG and start to collect the LPG map i the same way as for the gasoline map. The LPG map should be collected in the same road conditions and with similar loads as the gasoline map. The LPG map is drawn with blue points. Having collected sufficient number of points the map will be drawn with a continuous line. The accuracy of drawn line depends on the density of points collected in given area. The more points will be collected in given area, the more accurate the gas map line will be.

If the controller is properly set (multiplier characteristic is selected properly) the gasoline and the LPG maps should agree. If the maps do not agree, the multiplier characteristic should be corrected in the areas, where the maps do not agree (the lower axis represents co-ordinates for injection times). During collection of the LPG map, if the computer is connected and the diagnostic program started, we can immediately correct the multiplier characteristic when we see that collected blue points do not agree with the gasoline map. It is even strongly recommended, because if the multiplier characteristic differs strongly from the required one, the controller may start to switch over and – in the extreme case – can activate the signalling lamp “check engine”. During current correction of the multiplier characteristic the points of the LPG map should agree with the gasoline map. If we manage to agree both maps, we can affirm that the characteristic is properly selected.

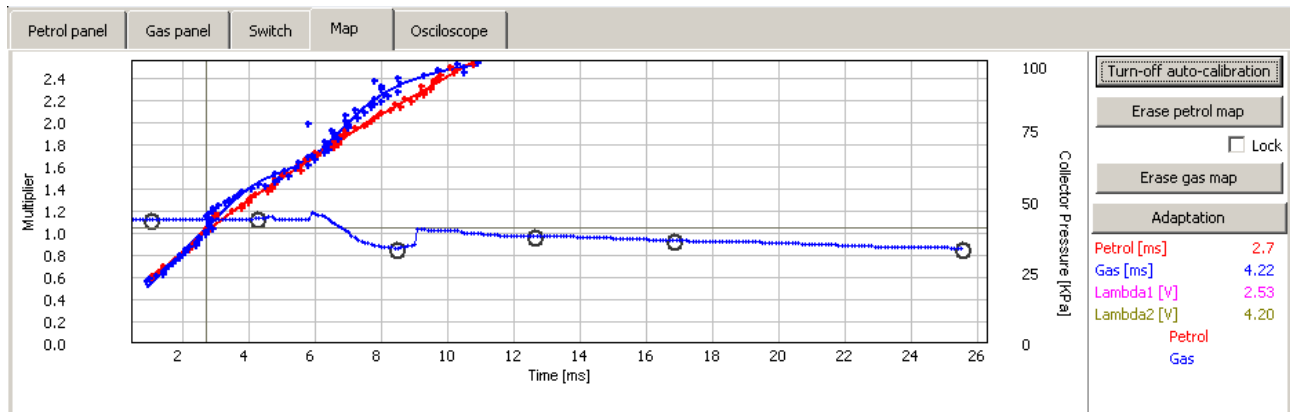
3.3. Manual setting of the controller.

The controller can be also set manually; this type setting – if performed with proper skill – can last shorter than the method described above. We start the setting of the controller – as for the previous method – with auto-calibration (it is indispensable for correct operation of the controller, see 3.1). Then, if the auto-calibration has been finished successfully and multiplier values for the calibration point are correct, we switch over the vehicle to gasoline and drive it for the test. The setting of the multiplier characteristic should be performed as follows:

We drive the vehicle using gasoline, we make efforts to keep the constant engine load i.e. gasoline injection times should be stable. We match the load so that the gasoline injection time was i.e. about 5 [ms]. Evaluation of gasoline injection times will be easier with help of the blue marker, which vertical position at the horizontal axis depends on injection time. Now we switch over the vehicle to LPG and watch, if the blue marker will not change its position at the injection time axis i.e. the gasoline injection time has not changed. If the gasoline injection time became shorter (the marker has shifted to the left), this means that for given gasoline injection times the multiplier is too high (the mixture is too rich). In such case correct the multiplier – in our case for the time 5 [ms] - downwards. If after changeover from gasoline to LPG the marker goes to the right, this means that

the mixture is too weak and the multiplier map should be shifted upwards for given injection times. The procedure described above should be performed for a few injection times beginning from the calibration point as far as to injection times for great load. We can check the multiplier map e.g. every 2 [ms] beginning from the calibration point. If necessary, we can add a point at the multiplier map to set it more precisely.

After execution of described manual setting both maps – gasoline and LPG – should agree.



- Multiplier map – blue
- Gasoline injection time map (with gasoline) – red
- Gasoline injection time map (with LPG) - blue

The multiplier map is coloured green. The left axis of co-ordinates (i.e. Multiplier) and the lower axis of co-ordinates (i.e. injection time in [ms]) is subordinated to this map. The multiplier map is designed for setting of the multiplier for given gasoline injection time. Points situated at the map (yellow) are used for setting of the multiplier. After auto-calibration 2 extreme points and additionally 4 points appears in the centre of the map. To shift a point, first mark it by a click. The value of marked point is displayed in the lower right corner of the map. Points can be shifted on the map with following keys:

- “Arrow left” – shifts the point left (change of injection time for given point)
- “Arrow right” - shifts the point right (change of injection time for given point)
- “Arrow down” – decrease of the multiplier for given injection times
- “Arrow up” - increase of the multiplier for given injection times
- „Left mouse button double click – adds new point
- „Delete” – deletes a point from the map
- „Page Up” – shifts the map upwards
- „Page Down” – shifts the map downwards

Besides of the multiplier map, the window contains two other maps. The red map is the map of gasoline injection times (with gasoline). The right (Collector pressure [KPa]) and the lower (injection time [ms]) axes are subordinated to this map. The map consists of red points. After collection of data the controller draws the map with a continuous line. The same procedure concerns the so-called LPG map i.e. the map of gasoline injection times (with LPG), which is in blue colour.

Depicted map window shows also the marker created by two crossed grey lines, which position

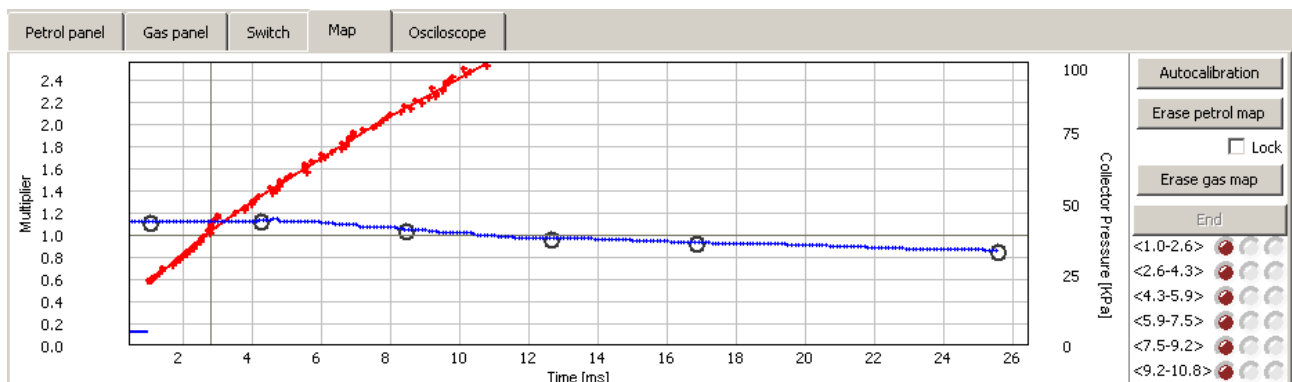
changes depending on the collector pressure and gasoline injection times. It is very useful during collection of the map because it shows at which load and injection time works the engine. At the map there are also the buttons “Erase” used for erasing of gasoline and LPG maps. Nearby the buttons is situated the selection field “Lock”, which is designed for locking the gasoline map after its collection i.e. the controller having collected the gasoline map (when the map is drawn with a continuous line) will not modify it after checking that field.

3.4. Self-Adaptation of the red and blue maps during the test drive.

„*Adaptation*” function from the Map bookmark is used for automatical adjustment of the multiplier so the gasoline injection time map (with gasoline) – red, and gasoline injection time map (with LPG) will get closed to each other in the places where they are not close enough. This function should be used **only** after using the auto-calibration function only to adjust the multiplier.

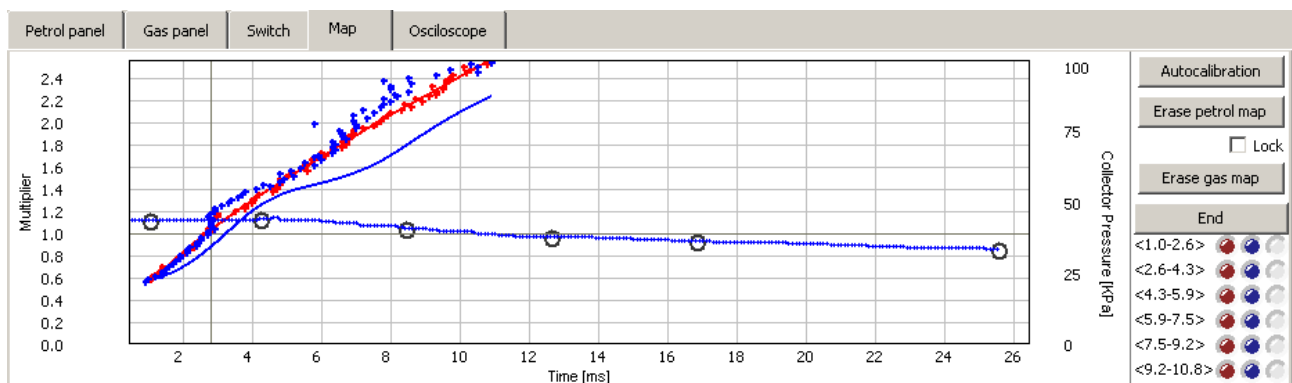
First step after performing the autocalibration should be switching to petrol mode and collection of the red points (gasoline map) during the test drive. Points should be collected from the minimal to the maximal range of the injection opening time according to the engine minimum and maximum load. When we collect enough of red points we can press the „*Adaptation*” button. The question for erasing the gas map should appear. It is recommended to press „*Yes*” so we can see where the gas points are missing. Otherwise they only will be updated in the particular places.

Now the program will divide the collected points into 6 equal intervals which length will depend on minimal and maximal injection times.



In case if we haven't collected enough points not all of the red diodes will be turned on. If that situation happens we should continue the driving on petrol until enough red points will be collected . You can see the intervals in where they are missing from the red diodes (they will be turned off in those moments). In the picture above we see the situation that we have collected enough points.

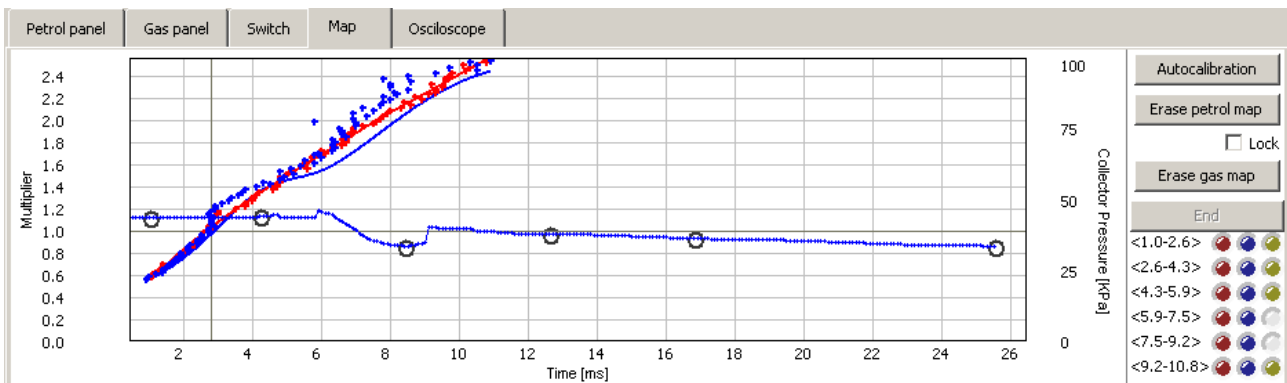
After we collect enough red points the communicate will appear that we should changeover to gas and continue the driving. We should continue the driving on gas on all ranges of injection time according to the collector pressure so the all blue diodes will be turned on.



In the picture above we can see that not all of the blue points were collected. From the blue lights indication we can see that the last two intervals is missing (from 7,5ms to 9,2ms and 9,2 ms to 10,8 ms). That means that we should continue the driving on gas on high injection opening time according to the collector pressure.

It is possible to end collecting the points by pressing „End” button, but it is not recommended because the program will only update the multiplier where enough of points were collected.

After enough of blue points will be collected the communicate will show that the adjustments has been automatically made to the multiplier and we should continue running on gas. The gas map will be erased automatically so during the driving on gas and collecting the blue points again we can see what changes to the blue line has been caused by the modification of the multiplier. The yellow diodes turned on shows us where the lines are close enough to each other. In the ranges that we find too big differences we always can make modification by moving the points manually.



4. LED switchboard operation and acoustic signals

4.1. LED switchboard

The LED switchboard consists of:

- LED line indicating LPG level
- the LED indicating type of fuel
- button

LED line– shows current LPG level in the tank. 4 green LEDs indicate a full tank; a red LED indicates “reserve”.

The LED – shows current operating status:

- off – the engine runs on gasoline
- slow blinking (once per second) – awaiting engine temperature reading
- normal blinking (twice per second) – the controller is in the auto-mode (waiting for required rpm before switching to LPG)
- fast blinking (4 times per second) – controller error (no LPG in the tank)
- on – the engine runs on LPG

Push button – for switching from one fuel type to another

The controller “remembers” the last fuel type setting before switching the ignition switch off.

In order to start the engine on LPG (e.g. when the gasoline pump is damaged), press in and hold the button on the LED switchboard while turning the ignition on. The LED should come on. When the engine revolutions are detected, the controller turns the solenoid valves on and the engine starts on LPG. In this mode, it is not possible to turn back to gasoline. Turn the ignition off to turn this special mode off.

4.2. Acoustic signals

The controller generates the following acoustic signals:

- Three acoustic signals – when switching from LPG to gasoline because of low LPG level in the tank
- Three short acoustic signals followed by a long one – when a controller error occurs
- **When switching the ignition off** – two short signals followed by a long one indicate a scheduled service visit. Visit a service station to have your system checked.