OPTIMA

MODERN LPG & CNG SYSTEMS

OPTIMA Nano/Expert
controller manual

www.optimagas.com
www.autogas-alex.com

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1.1. OPTIMA Nano connection diagram

PETROL ECU

PETROL INJECTORS

1	SOLDER	GREY
		GREY-BLACK
2	SOLDER	YELLOW
		YELLOW-BLACK
3	SOLDER	VIOLET
		VIOLET-BLACK
4	SOLDER	BLUE
		BLUE-BLACK

GAS INJECTORS

1 2 3 4

GREY +12V WHITE-RED
YELLOW +12V WHITE-RED
VIOLET +12V WHITE-RED
BLUE +12V WHITE-RED

WHITE
RED (+12V)
BLACK (GND)

BROWN

BROWN RPM WIRE COULD BE CONNECTED DEPENDING ON A CHOSEN PROGRAMME OPTION:
RPM - IGNITION COIL, CRANKSHAFT, CAMSHAFT
MAP - FLOW SIGNAL FOR MAP DRAWING IN A VELVETRONIC ENGINES
LAMBDA - LAMBDA PROBE SIGNAL
AFR - ANALOG SIGNAL FROM THE SET FOR MEASURING THE EXCESS OF OXYGEN IN THE EXHAUST GAS

AFTER CHOOSING THE CORRECT OPTION IN A PROGRAMME THE WIRE TO IGNITION SWITCH COULD BE DISCONNECTED

BLACK - RED
RED

RED
YELLOW
BLUE
BLACK

BLACK

RED (15A)

MAP SENSOR

TO INLET MANIFOLD
TO INJECTION RAIL

INTERFACE RS/USB

SOLENOID VALVE

BLACK (GND)
BLUE (+12V)

REDUCER

ORANGE
BLACK

YELLOW
BLACK

BLACK
WHITE
BLUE
RED

WHITE
BLUE
RED
BLACK

MODE
SERVICE
R

Fig. 1 (OPTIMA Nano Connection Diagram)

3

1.1. OPTIMA Expert connection diagram

PETROL ECU

PETROL INJECTORS

#	Color	Solder color
1	YELLOW	YELLOW-BLACK
2	GREEN	GREEN-BLACK
3	RED	RED-BLACK
4	BLUE	BLUE-BLACK
5	PINK	PINK-BLACK
6	VIOLET	VIOLET-BLACK
7	BROWN	BROWN-BLACK
8	GREY	GREY-BLACK

(SOLDER at each injector)

GAS INJECTORS

#	Color	+12V	WHITE-RED
1	YELLOW	+12V	WHITE-RED
2	GREEN	+12V	WHITE-RED
3	RED	+12V	WHITE-RED
4	BLUE	+12V	WHITE-RED
5	PINK	+12V	WHITE-RED
6	VIOLET	+12V	WHITE-RED
7	BROWN	+12V	WHITE-RED
8	GREY	+12V	WHITE-RED

WHITE
BLUE RED
BLACK

MODE
SERVICE
R

ISO 14230(KWP)
ISO 9141-2
GREEN-BLACK (Pin 15 optional)
GREEN (Pin 7)
GREY (Pin 6)

ISO 15765-4(CAN)
GREY-BLACK (Pin 14)

LAMBDA
GREY 2
VIOLET 1

WHITE
RED (+12V)
BLACK (GND)

BLACK - RED

RED
YELLOW
BLUE
BLACK

INTERFACE
RS/USB

SOLENOID VALVE

REDUCER

Shark

BLACK (GND)
BLUE (+12V)

MAP SENSOR

TO INLET MANIFOLD
TO INJECTION RAIL

BROWN

BLACK
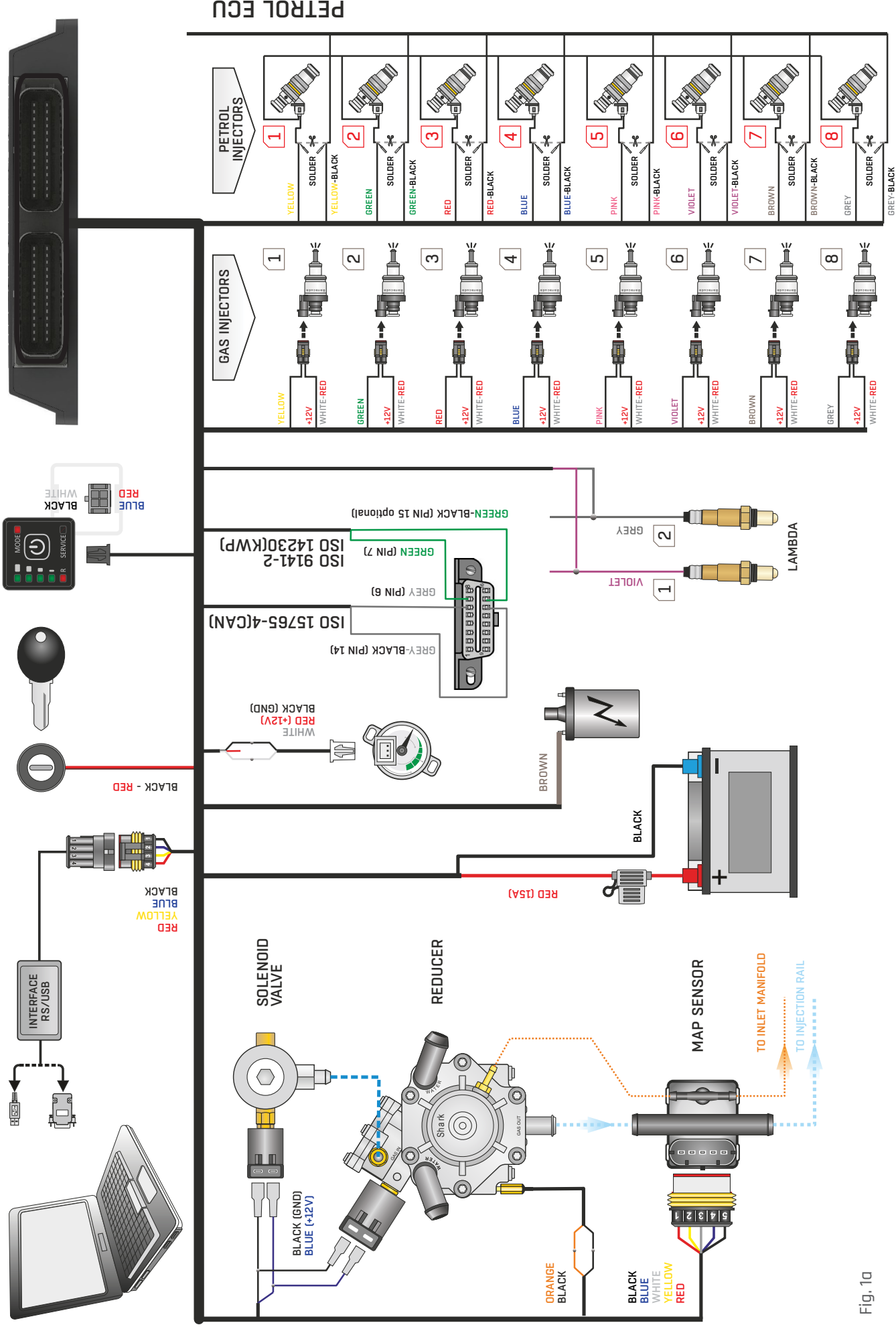
RED (15A)

ORANGE
BLACK

BLACK
BLUE
WHITE
YELLOW
RED

Fig. 1a

1.2. Method of installing the OPTIMA Nano/Expert controller

The controller OPTIMA Nano/Expert is being installed with the connector downwords in a way that prevents its direct exposure to water and high temperatures.

Installation should be conducted according to the connection diagram of a particular controller.

1.3. Reducer selection

When installing OPTIMA Nano/Expert sequential injection systems – it is very important to select the reducer in relation to the engine power. Improper selection of the reducer in relation to the engine power will cause that when the LPG delivery is high the – reducer wil not be able to ensure nominal LPG pressure and the pressure in the system will drop. If the LPG pressure drops below the minimum value set in the controller – the system will automatically switch to petrol.

1.4. Selection of injector nozzles

The size of injector nozzles should also be selected according to the engine power. The table below illustrates

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

the example of nozzle selection- engine power has to be devided by the number of cylinders.
The values presented in the table should be treated as approximate as they may differ depending on the type of gas injector and the type of injection (full group, - semi-sequential, sequential). It is advised to use the calculator built in the diagnostic programme.

2. Description of the diagnostic programme OPTIMA 2.0x

2.1. Connecting the controller to a PC

Having succesfully completed the installation, – connect – the Nano/Expert controller to a PC with OPTIMA diagnostic program, using the RS-232 interface or USB. Before launching – the programme, – turn the key in the ignition switch (power supply "through the ignition") and start the car. Without having power supply the controller goes into sleep mode and the communication is impossible. That situation will be signalized as a connection error when opening diagnostic program OPTIMA. If the interface was connected and installed properly the program serches all the available COM serial ports.The number of port should be chosen with the first connection. Each following connection will be established automatically.

2.2. Main menu

Fig. 1a

DEVICE
   » Device info – shows information about the connected controller
   » Service – reminds about the installation service
   » Firmware update – allows to update the software
   » Read settings from file – allows reading settings from the previously saved file
   » Save settings to file – saves current settings to file

CONNECTION
   » Connect/Disconnect – enables/disables connection with the controller
   » COM(x) – x stands for the number of – ports available on a PC

ELM
   » Connect/Disconnect – enables/disables connection with the additional OBD2 ELM327 interface
   » COM(x) – x stands for the number of – ports available on a PC

LANGUAGE – selection of the programme language

VIEW – three view options depending on the advancement level

COLOR – colour options depending on a PC screen readability.

DOCUMENTATION – mounting diagram and programme manual. pinout
   » Service

CONTACT
   » Technical Support – remote desktop (via TeamViewer programme)
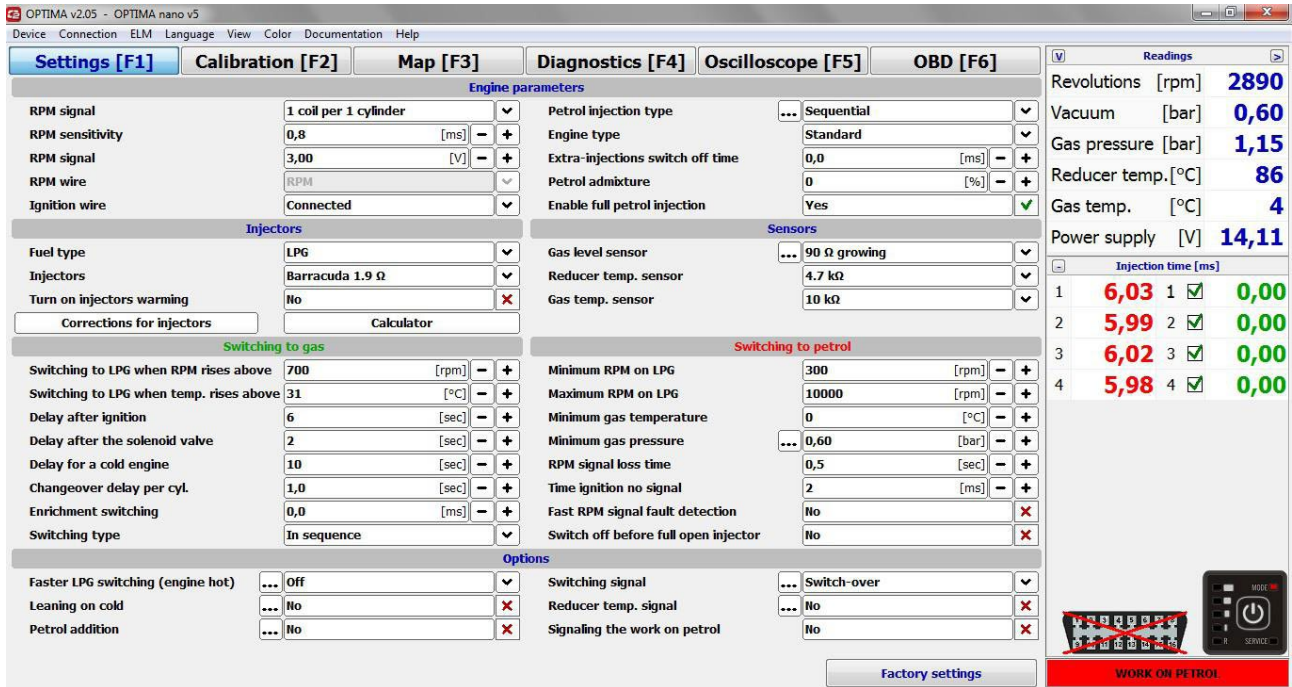
2.3. Patrameters window OPTIMA 2 (Nano version)

Fig. 2

PLEASE NOTE
AVAILABLE VIEW OPTION WHICH ALLOWS THE ACCESS TO ADVANCED FUNCTIONS OF THE CONTROLLER.

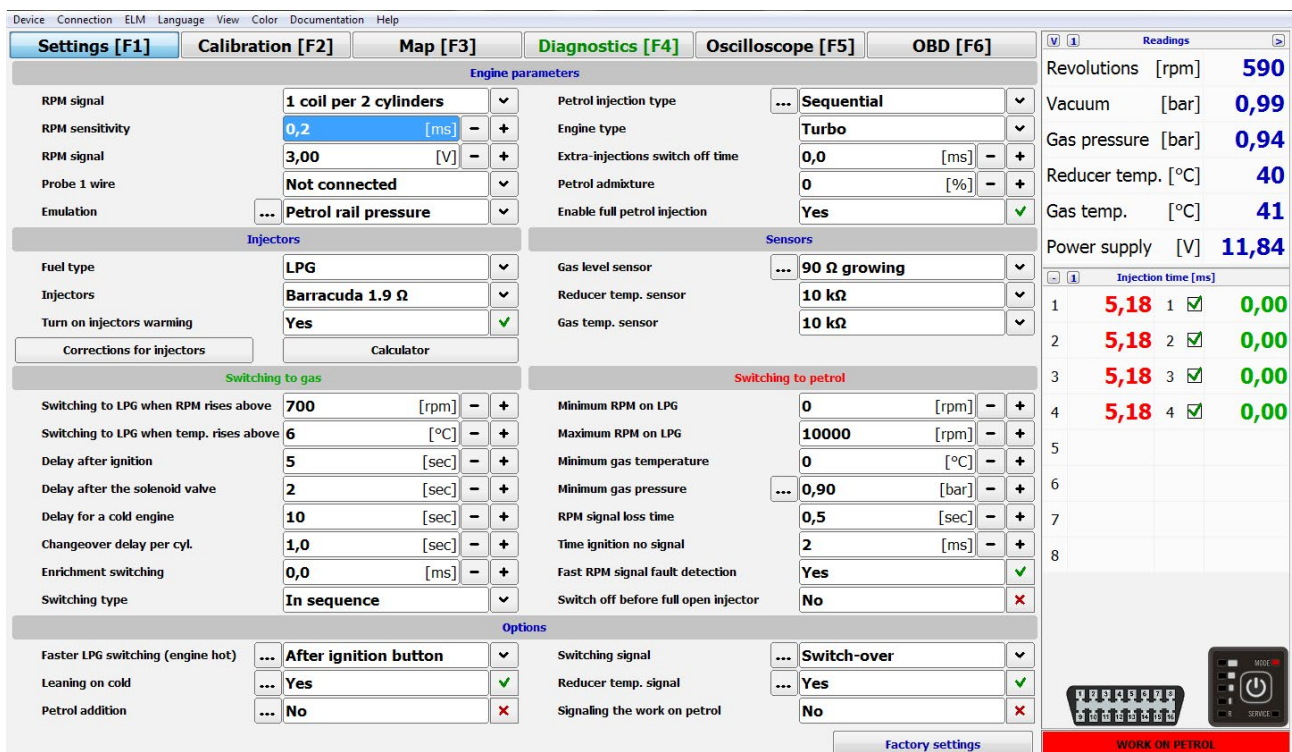## 2.3. Patrameters window OPTIMA 2 (Expert version)

Fig. 2a

2.4. Engine settings

Engine parameters					
RPM signal	1 coil per 1 cylinder	∨	Petrol injection type	... Sequential	∨
RPM sensitivity	0,8 [ms] − +		Engine type	Standard	∨
RPM signal	3,00 [V] − +		Extra-injections switch off time	0,0 [ms] − +	
RPM wire	RPM	∨	Petrol admixture	0 [%] − +	
Ignition wire	Connected	∨	Enable full petrol injection	Yes	✓

Fig. 3 (engine parameters)

» **RPM SIGNAL SOURCE** – number of cylinders per ignition coil. Selected value should represent the adequacy between the RPM signal in the programme and the vehicle's actual RPM.

» **RPM SENSITIVITY** – in case of a problem with reading the turnovers we can increase the sensitivity of a controller to the particular rotation impulses through decreasing this parameter's sensitivity

» **RPM SIGNAL DIVIDER** – divider available if the selected source of RPM signal is from injectors or from crankshaft.

» **RPM SIGNAL [V]** – value of power supply with which RPM – perform without disturbance (standard value for ignition coil is 12V, – for crankshaft sensor – 0-5V)

» **RPM WIRE** – with the Nano controller it is possible to use rpm wire to read the signals such us:

» **LAMBDA** – we are able to read the work of Lambda probe.

» **MAF** – the brown wire is connected to the air flow meter in a vehicle when we need the map for engines without the vacuum in the collector e.g Valvetronic.

» **AFR** – the brown wire is connected to the analog output of the Air Fuel Ratio set in order to more precise adjustment of λ (lambda) coefficient – especially useful in the case of tuned up vehicles to increase their power.

» **IGNITION WIRE –** when sellecting „off" the controller determines the ignition state basing on the petrol injectors signals. The option available only with 5 pin Mapsenor and could be used after improper connection + after ignition. With option „not connected" the safety valve could be removed from + after ignition and other installation elements will be powered by the gas controller (having problems with starting the engine fro longer period, we choose – the option „on" and necessaraliy connect + after ignition with + of petrol injectors)

» **PETROL INJECTION TYPE** – type of petrol injection used in the vehicle.Selecting [....] gives the possibility to detect automatically the type of injections and leads to the window with possibilities to sequence configuration – assigning to banks – permanently disabling gas injectors.

» **ENGINE TYPE** – the type of engine:standard(aspirated) or turbo (supercharged)
» **EXTRA-INJECTIONS SWITCH OFF TIME [MS]** – Minimal petrol injection time transferred to gas injectors. It allows to switch off extra-injections in cars e.g Mazda, Opel Antara, Chevrolet Captiva.

1	2,15	1 ☑	0,00	
2	0,60	2 ☑	0,00	
3	2,13	3 ☑	0,00	
4	0,60	4 ☑	0,00	

EXAMPLE:

In this situation, the value of extra-injection swich off should be set above the value of extra-injection. In this case 0, 6 or higher e.g. 1, 2 if such injection times occur.

Fig. 4

» **PETROL ADMIXTURE** – Cyclical petrol injection while working on gas for cooling and lubricating the inlet valves.
» **ENABLE FULL PETROL INJECTION** – should be switched on at the moment of non-impulse injectors opening*
» *** NON-IMPULSE INJECTORS OPENING** – the situation takes place when a singular cycle of an engine work is shorter than estimated time of petrol injection. e.g. If we have 5000 rmp, – one cycle of the engine work in a sequential control system is 24ms. When the controller calculates the time above 24 ms e.g 26ms, – the injector opens but has no time for closing as it receives another impulse to open. The situation repeats so quickly that there is a continuous pass of pulse from the controller to the injector, – thus the time of injection lenght becomes uncountable. Most of the gas contollers recognize 0.00 ms as the time of injection and switch into petrol. With the controller Nano we are able to continue the ride on LPG and the injectors are driven to the maximum allowable injection timing.

Formula for the maximum lenght of the injection time:
$$T_{injection} \text{ in ms} = [60/(0, 5 * rmp)]*1000$$

2.5. Gas injectors settings

Fig. 5 (injectors setting)

» **FUEL TYPE** – type of fuel LPG or CNG
» **INJECTOR TYPE** – type of injector installed in the vehicle.
» **TURN ON INJECTOR WARMING** – allows warming gas injectors before the switch-over to gas and before reaching the switch-over temperature
» **CALCULATOR** – helps to select the right size of injector nozzles
» **CORRECTIONS FOR INJECTORS** – After deselecting „Change for all" option it allows to correct injection time variations ina "V" type engine . Such correction (if necessary) should be made in the following way:After callibration, – check what are the petrol injection times on particular cylinders – during work on petrol.
» Turning on particular gas injectors one at a time, – check – in which cylinders are differences of petrol injection time after switching to gas.
» Corrections should be set in such a way that petrol injection time does not change while switching on particular gas injectors.
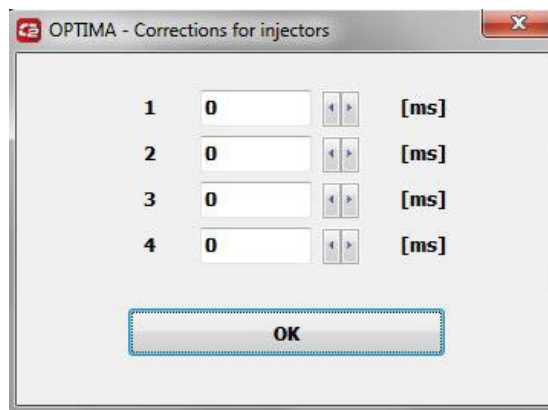
Fig. 6

DO NOT USE THIS OPTION WHEN SYSTEM IS NOT IN A PERFECT WORKING CONDITION OR WHEN SOME OF ITS ELEMENTS HAVE WORN OUT.

2.6. Sensors settings
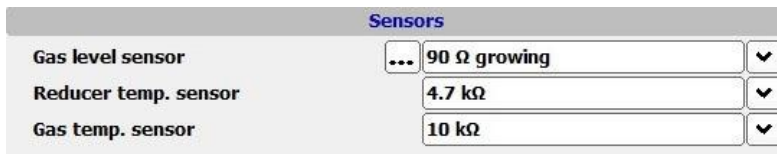
Fig. 7 (sensors settings)

» **REDUCER TEMPERATURE** – type of sensor used for measuring reducer temperature (included in kit: 10kohm)
» **GAS TEMPERATURE** – type of sensor used for measuring gas temperature (included in kit: 10kohm)
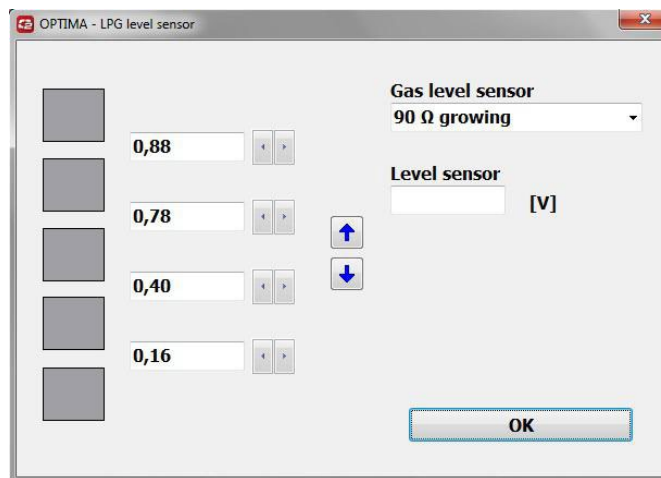
Fig. 8 (regulation of gas level indication)

» **GAS LEVEL** – selection of the level sensor in a tank. Selecting [...] gives the possibility of more precise adjustment of the switch by changing voltage thresholds for activating particular LEDs

NOTE !!!
PROPER SELECTION OF THE SENSOR, - AS WELL AS ITS CALIBRATION, - IS CRUCIAL FOR THE CORRECT SYSTEM PERFORMANCE!

2.7. Switching to gas
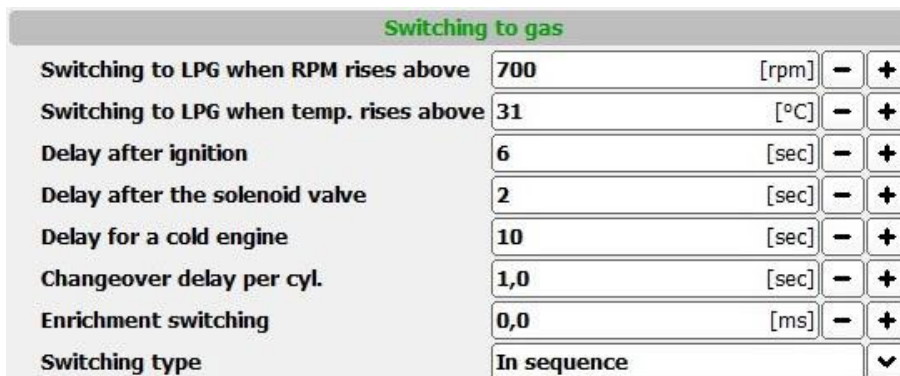
Fig. 9 (view of parameters when switching to gas)

» **SWITCHING TO LPG WHEN RPM RISES ABOVE** – minimal RPM required for the engine to switch over to LPG

» **SWITCHING TO LPG WHEN TEMPERATURE RISES ABOVE** – minimal temperature required for the engine to switch over to LPG

» **DELAY AFTER IGNITION** – time necessary for switching into gas after engine ignition.

» **SOLENOID VALVE SWITCHING DELAY** – regulated solenoid activation time preceding switching into gas.

» **LPG SWITCHING DELAY WITH COLD ENGINE** – time necessary for switching into gas at first switchover

» **CHANGEOVER DELAY PER CYL [S]** – time between switching of subsequent cylinders – e.g. when this parameter is set at 1.0 [s] for 6 cylinders engine – switching from petrol to gas or from gas to petrol will last 6*1.0 [s]

» **ENRICHMENT SWITCHING** – the possibility of momentary overlap when switching fuels – useful in the case of „ unsatisfactory" change from petrol to gas supply.

» **SWITCHING TYPE** – type of switching between cylinders:
  • In sequence – one after another
  • All cylinders at the same time

2.8. Switching to petrol

Fig.10 (conditions of switching to petrol)

» **MINIMUM RPM ON LPG** – value of RPM below which system will switch over to petrol Minimal RPM on LPG - value of RPM below which system will switch over to petrol

» **MAXIMUM RPM ON LPG** – value of RPM above which system will switch over to petrol

» **MINIMUM GAS TEMPERATURE** – temperature below which system will switch over to petrol

» **MINIMUM GAS PRESSURE [BAR]** – f gas pressure drops below the selected value, – the system will switch over to petrol. Additional options [...]

» **PRESSURE ERROR TIME** – period of time with gas pressure lower than minimal after which the system switches over to petrol.

Fig.11

» **SWITCH OFF WITH THE FIRST PRESSURE DROP.**
- **YES** – when the pressure drops below the minimum and the pressure error time is over the system will switch into petrol with a sound signal.
- **NO** – when the pressure drops below the minimum and the pressure error time is over the system at first switches only one cylinder into gas to reduce the gas consumption. If the decline remains the controller will swicht the next cylinder up the full petrol work. This mode will be recorded as work on both fuels i.e „MIX"

» **RPM SIGNAL LOSS TIME** – adjustment of a closure time of the solenoid valve and injectors following the RPM disappearance. **FOR THE CHOSEN OPTION OF RPM READING FROM THE INJECTORS THE TIME SHOULD BE SET TO 5S**

» **TIME IGNITION NO SIGNAL** – possibility of adjusting the time at which the gas solenoid valves and injectors will be closed after the ignition disappearance.

» **FAST RPM SIGNAL FAULT DETECTION** – in vehicles in which power supply "through the ignition switch" is turned on after the engine was switched off

» **SWITCH OFF BEFORE FULL OPEN INJECTOR** – if selected [YES] when there is a full opening of a gas injector (e.g. As a result of too small nozzles or too great pressure drop)the injector will not be able to deliver a larger amount of gas, – the system will automatically switch the cylinder to petrol. If selected [NO], – the car will continue to run on gas even after full gas injector openning.

2.9. Options

Additional abilities of the controller.

» **FAST LPG SWITCHING / ENGINE HOT** – if sellected the heated engine starts direclty on gas.There are two options available:

Options			
Faster LPG switching (engine hot)	... Off ⌄	Switching signal	... Switch-over ⌄
Leaning on cold	... No ✗	Reducer temp. signal	... No ✗
Petrol addition	... No ✗	Signaling the work on petrol	No ✗

Fig.12

» **AFTER IGNITION BUTTON** – the controller begins the gas injection directly after receiving the injection signal. It's important to start the enging directly after the ignition and actication of solenoid valves (if there is a problem with starting the option „after RPM" should be chosen.

» **AFTER RPM** – The controller starts the gas injection and opens the solenoid valves after detecting RPM.

» **LEANING ON COLD** – the option is used when there is flooding on a cold engine, – the parametres are chosen in a way that prevents the jerks while acceleration. It mainly applies to the VAG group cars to a temperature up to 40 degrees.

» **PETROL ADDITION** – The option enables enriching the mixture by additional portion of petrol in an exactly indicated engine work – scope. The option should be used wisely and it should not exceed the petrol addition value above 2ms as well as on low engine rotations.
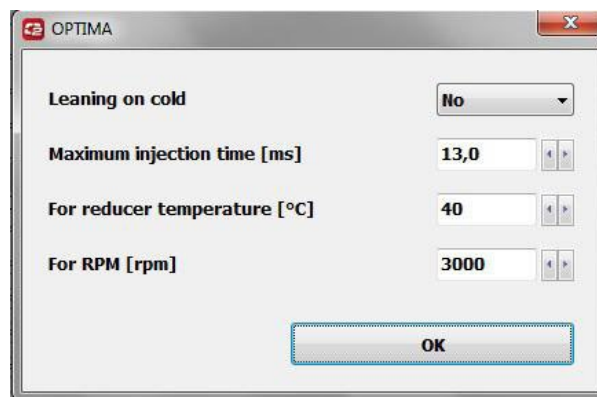
Fig.12a

- » **SWITCHING SIGNAL** – after sellecting […] there are 4 sygnal options available:
  - **OFF** – Only the moment of running out of gas is being signalled.
  - **SWITCH BUTTON** – The moment of pressing the switch button is being signalled quietly.
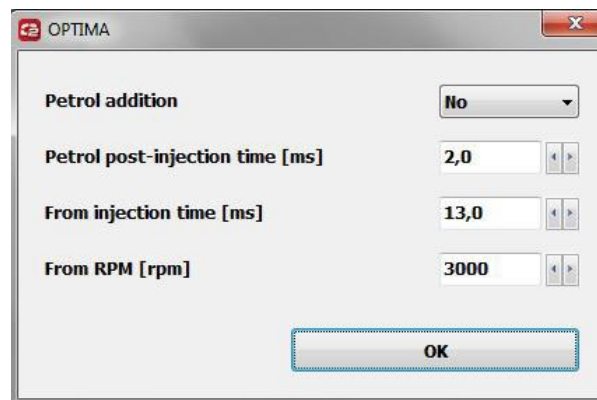

Fig.12b

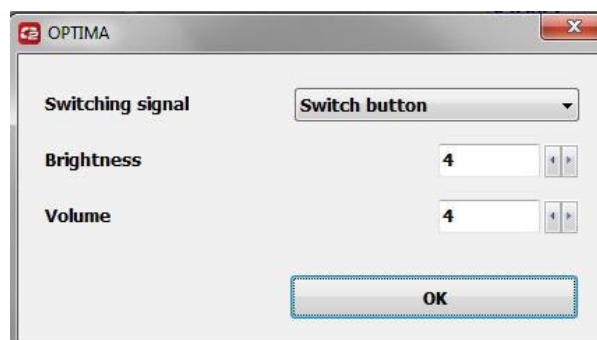- **END SWITCH** – the switch makes a quiet sound when pressing the switch button and a loud sound

Fig.12c

  after the system has been switched.
  - **SWITCH OVER** – the switch makes a quiet sound when pressing the switch button and a loud sound after the switching of each cylinder.
- » **BRIGHTNESS** – Possibility to regulate the LED brigtness of a switch.
- » **VOLUME** – Possibility to regulate the volume of a switch.

» **REDUCER TEMPERATURE SIGNAL** – The option enables to set the alarm for indicated reducer temperature. When the option is on after reaching the switching temperature it switches to gas. Diode on the switch MODE green blinks .Upon reaching the designed temperature the dide stops blinking and the switch signals that the reducer reached the indicated temperature. Example of use: The option is useful when the reducer is not heated enough to use the full engine power without the consequences of – a gas system freezing (reducer temp. lower than 25) but enough to enable the car to ride properly at low loads. After reaching the indicated signalling temperature (for example 40 degrees) it is clear that the system is heated enough for the engine to work properly in all load scapes. The reasonable use of the option enables us – to reduce the time of working on petrol

» **SIGNALLING THE WORK ON PETROL** – When the option is on it activates the signal 10 seconds after the engine starts – to remind that the switch is set to work only on petrol dide MODE: red.

3. Calibration
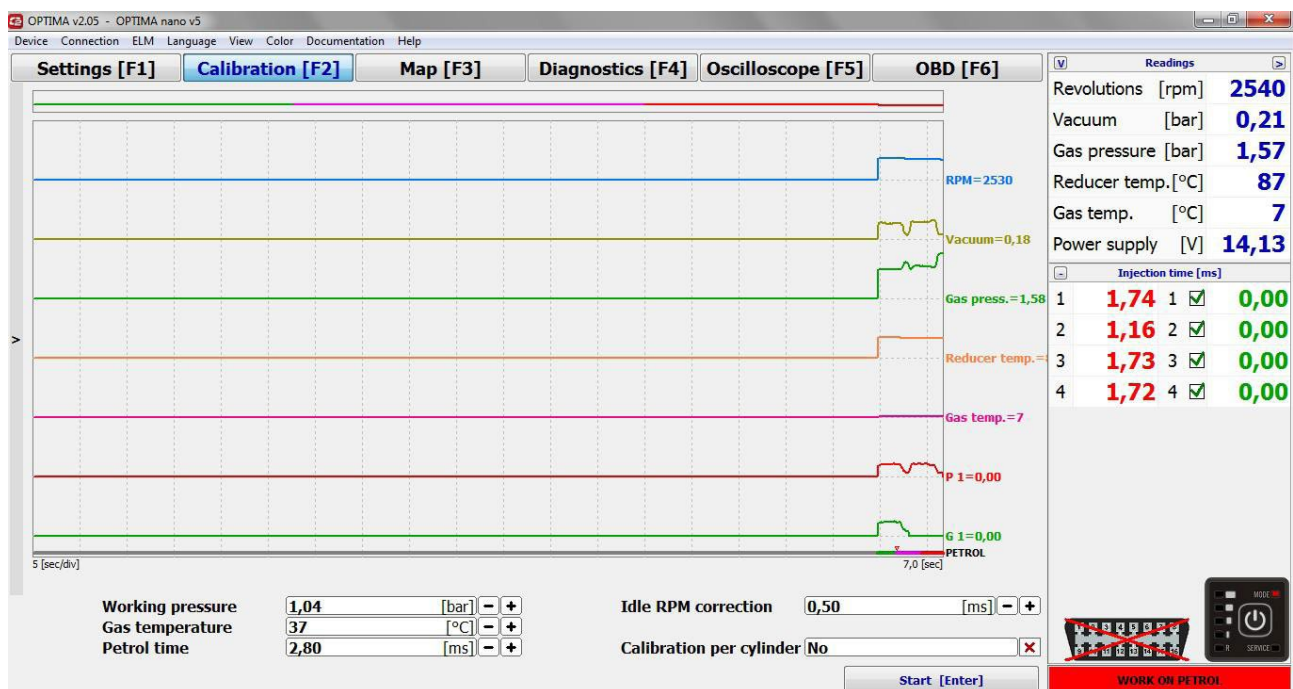
Fig. 13

Before starting the calibration process, – its method and parameters can be selected:

» **WORKING PRESSURE [BAR]** – gas pressure during calibration (will be set automatically by the system)

» **GAS TEMPERATURE** – gas temperature with which system can perform calibration (will be set automatically by the system)

» **PETROL TIME** – the value of petrol injection time – while working on idle run (will be set automatically by the system)

» **IDLE RPM CORRECTION** – Time corrections for an idle gear(the system sets automatically during calibration)

» **CALIBRATION PER CYLINDER** – (It is advised to select [NO]) selecting YES, – calibration will occur on individual cylinders thus the calibration time will be greatly extended. If deselected, – the calibration will be performed – on all cylinders at the same time.

3.1. Calibration process

During the process of calibration the vehicle must work on idle run. If during the calibration gas injection time is shorter than petrol injection time – it may indicate the necessity of changing the size of injector nozzles (it will be signalized by the programme after calibration).

In most cases – the idle gear correction after the first calibration should be within 0, 8ms - 1, 2ms. If the correction is below 0, 8ms it means that the nozzels are too large whereas the correction above 1, 2ms indicates too small nozzles.

Having finished the calibration process – collect the map – it can be done in two ways: with PC disconnected or connected (connected PC allows to observe which areas on the map have not been collected yet).
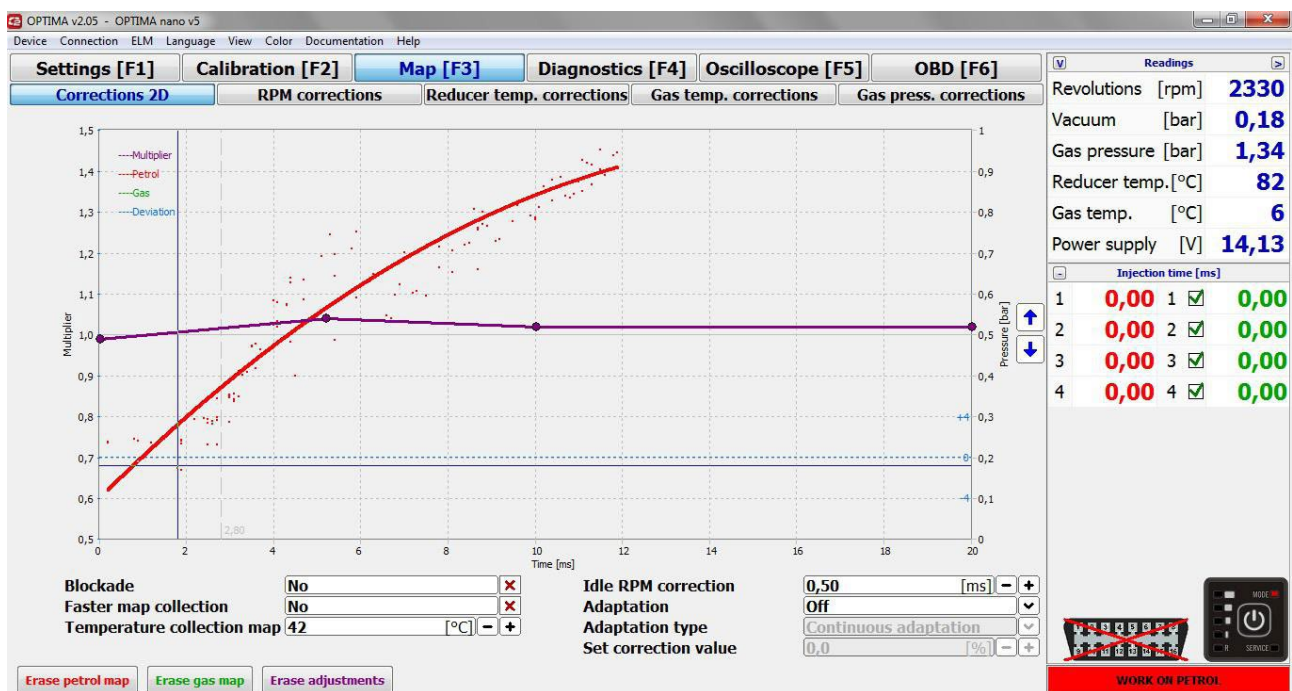
Fig. 14

Make sure that the vehicle is working on petrol (red MODE diode on the switch). Drive for approximately 5km on one gear with different speed, – tying to speed up rapidly few times. Collecting petrol map will be demonstrated by the red line connecting collected points (opion available when the PC is connected).

Switch to gas (green MODE diode on the switch) and drive for approximately 5 km in a way as close to the previous drive on petrol as possible. Collecting gas map will be illustrated by the green line.
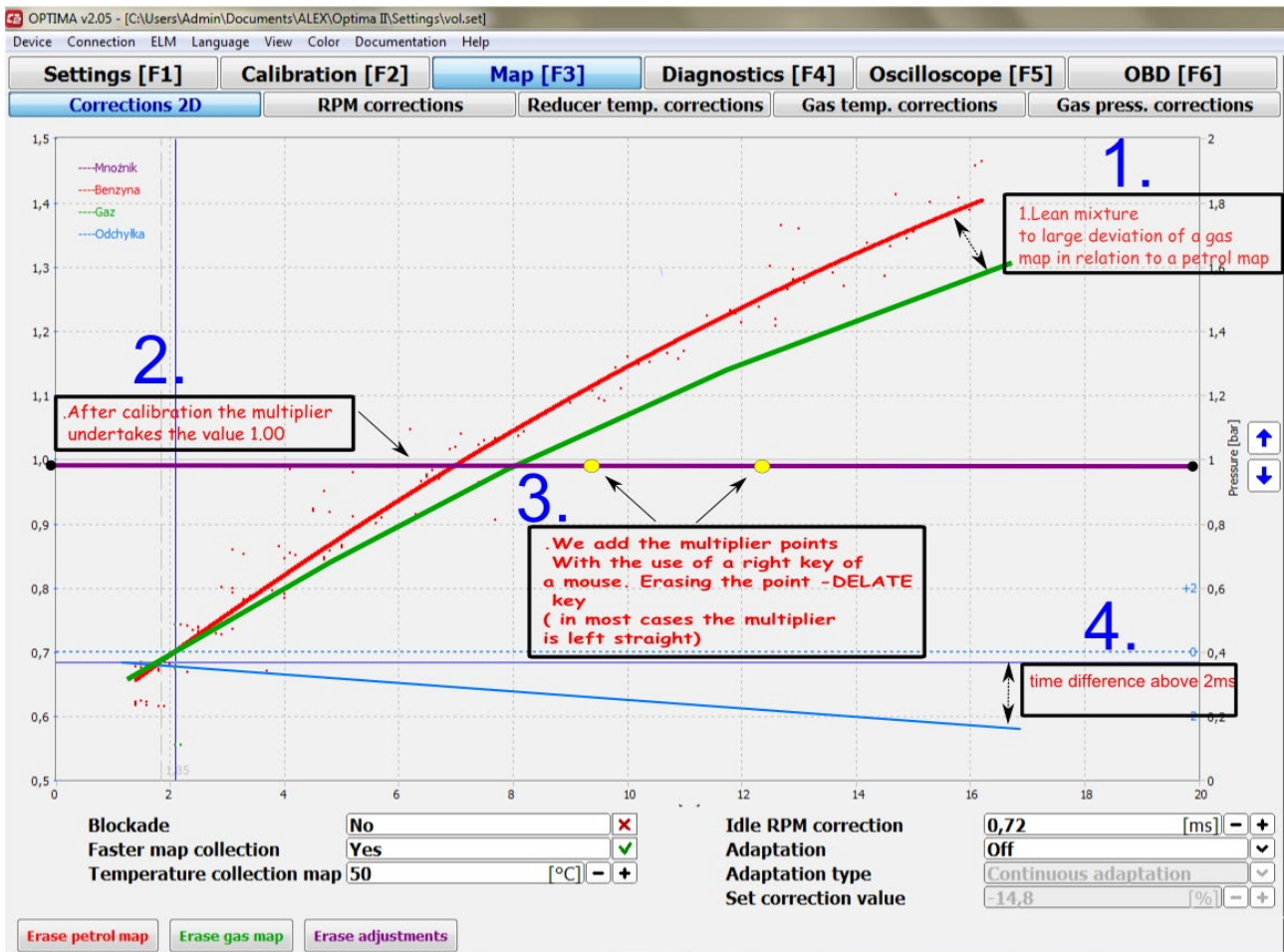
Fig. 15

After map collection, deviations of gas map in relation to petrol map will be visible. In the above example both gas map green line and deviation blue line suggest that the mixture is lean. In such case, – the multiplier should be raised and another ride on gas should be made.
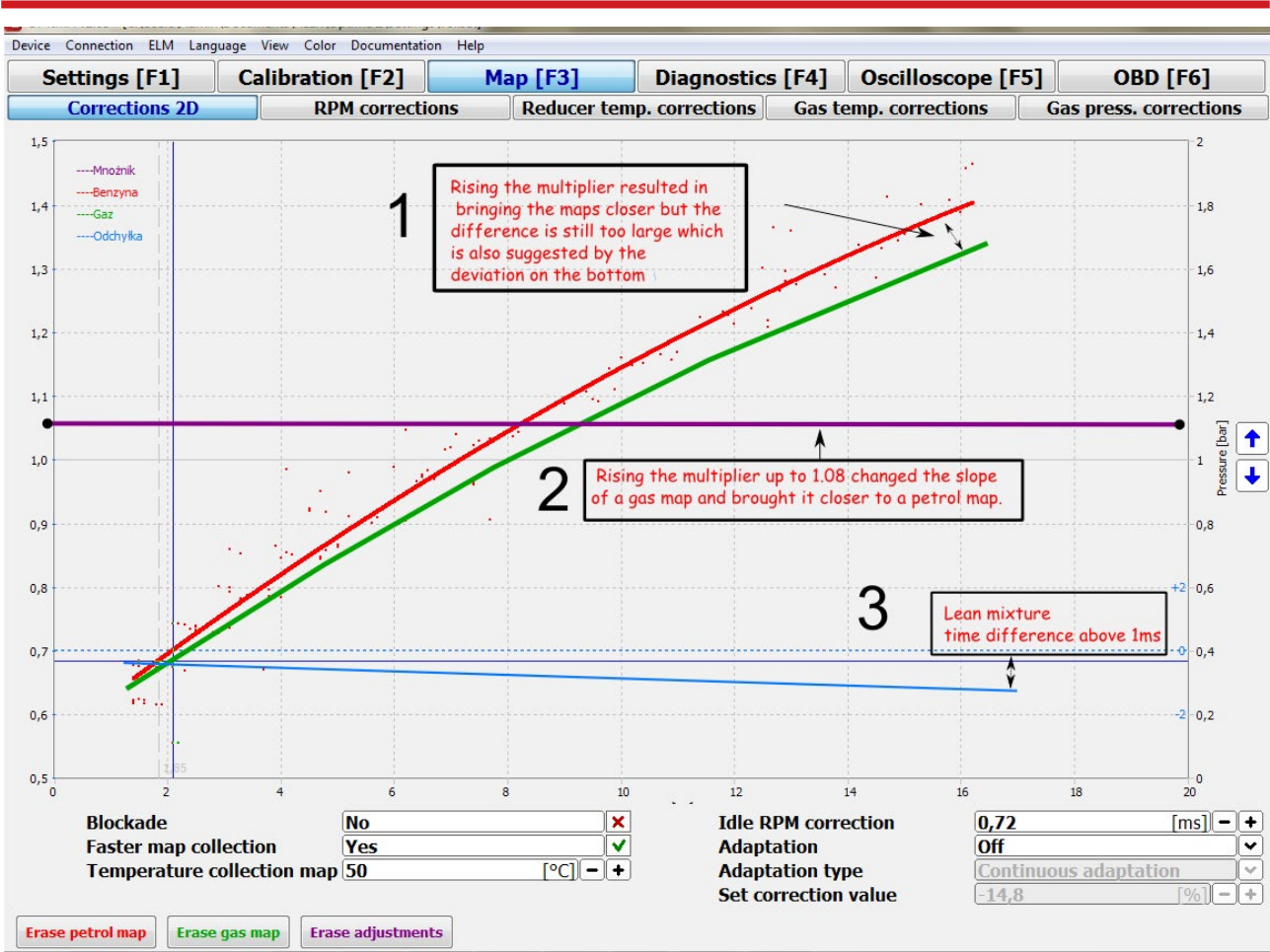
Fig. 16

After the multiplier has been raised (lean mixture) and the test ride has beed done, the gas map moved closer to petrol map, though the mixture still remains lean.
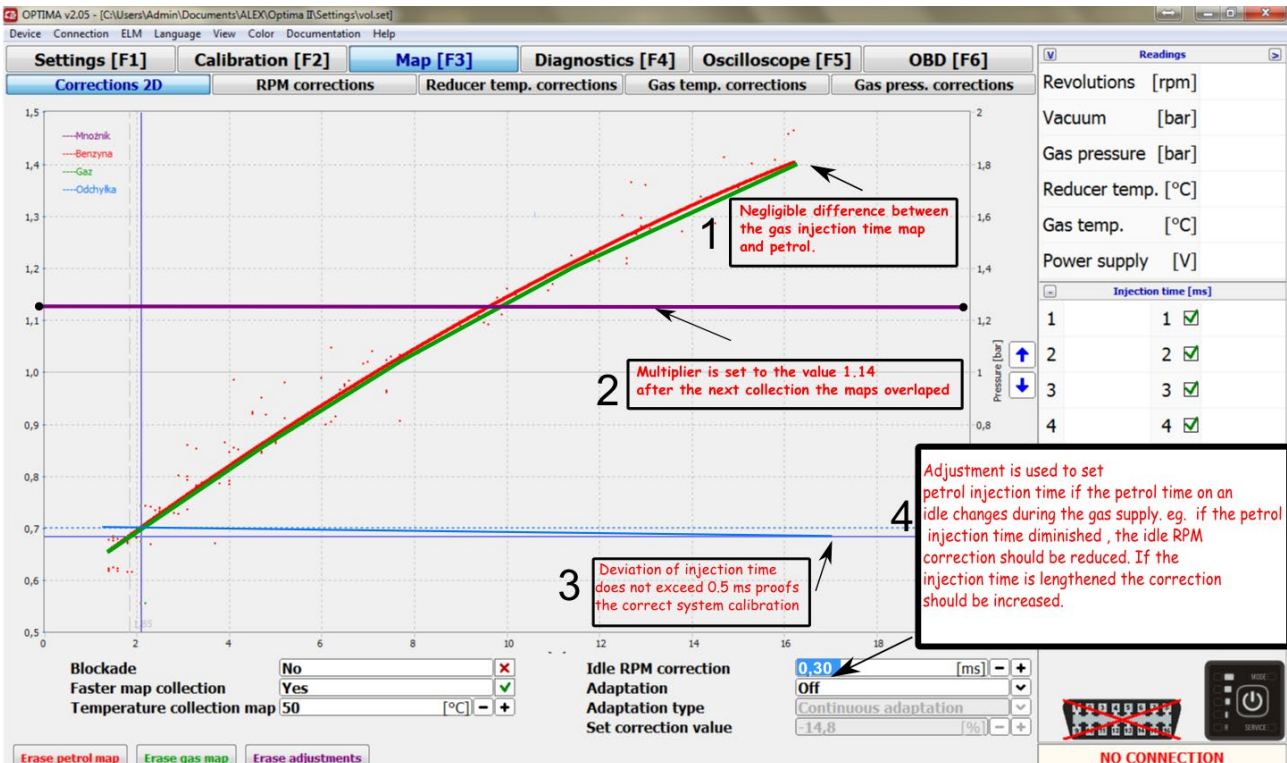

Fig. 17

Having raised the multiplier correctly the gas map and petrol map moved closer, – the straight – deviation blue line suggests that – the mixture is OPTIMAL.

EVERY CORRECTION ON THE MULTIPLIER LINE WILL BE INCLUDED ON GAS MAP ONLY AFTER NEXT MAP COLLECTION IN GIVEN PERIOD OF INJECTION TIME.

The system is well calibrated if the difference between gas map and petrol map is not bigger than +/-0,5ms

Additionally, – the accuracy of collected gas and petrol maps could be checked in the RPM correction file. **Map [F3] > RMP correction > Injection time deviation (view changes when pressing the key F8) or the switch Petrol and switch GAS.**

In this window, – the range of engine work included for – 2D map drawing is visible. Red bars illustrate the range of petrol map collection wheras the green bars the range of gas map collection. White bars with the values of injection time differences while working on petrol and on gas.
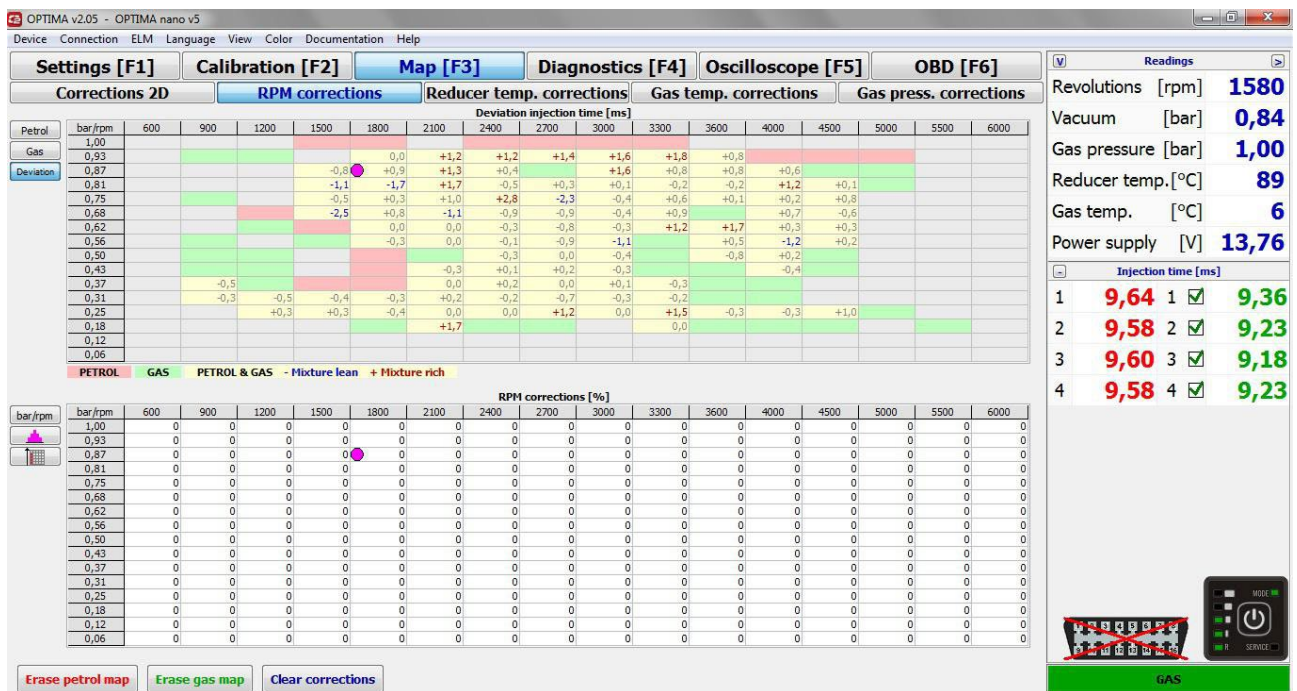
Fig. 18

Collecting both petrol and gas map can be done with disconnected PC. However, – collecting map with diagnostic programme connected allows monitoring and corrections of the map charts.

3.2. Adaptation function

Besides the standard calibration there is an option of adaptation choice and the time when it will be made.

Adaptation
» **TO INJECTION TIME MAP** – adaptation based on recorded – times of petrol and gas injections visible in the RPM correction.
» **TO OBD PETROL MAP** - adaptation based on the map of short and long term corrections which could be found in OBD> RMP Corrections
» **TO INDICATED OBD VALUE** – the option allows to set own OBD correction value persued by the gas controller.

- Indicated correction value – we should give the resultant of two adjustments STFT and LTFT. Most often the value is the same as on petrol, for example with the value STFT= -5 and LTFT =5 the resultant is 0 and such value should be put in. The option should be used for setting the car directly on gas without the need of driving on petrol.

Callibration without the need of driving on petrol (OBD connection necessary):
If we determine the value that must be reached by the petrol controller adjustments (resultant STFT, LTFT) we are able to set the system through the OBD callibration.
After autocallibration at stand choose: **2D Diagram > Adaptation > For indicated OBD corrections value**
Adaptation type > constant adaptation
Indicated correction value: for exapmle 0,0 (value for most cars)

After driving approximately 20km only on gas, – the system automatically sets the multiplier and IDLE RPM corrections so the resultant – of OBD correction for STFT and – LTFT equals the indicated value. The corrections values could be checked on OBD map selecting RPM corrections (green map)
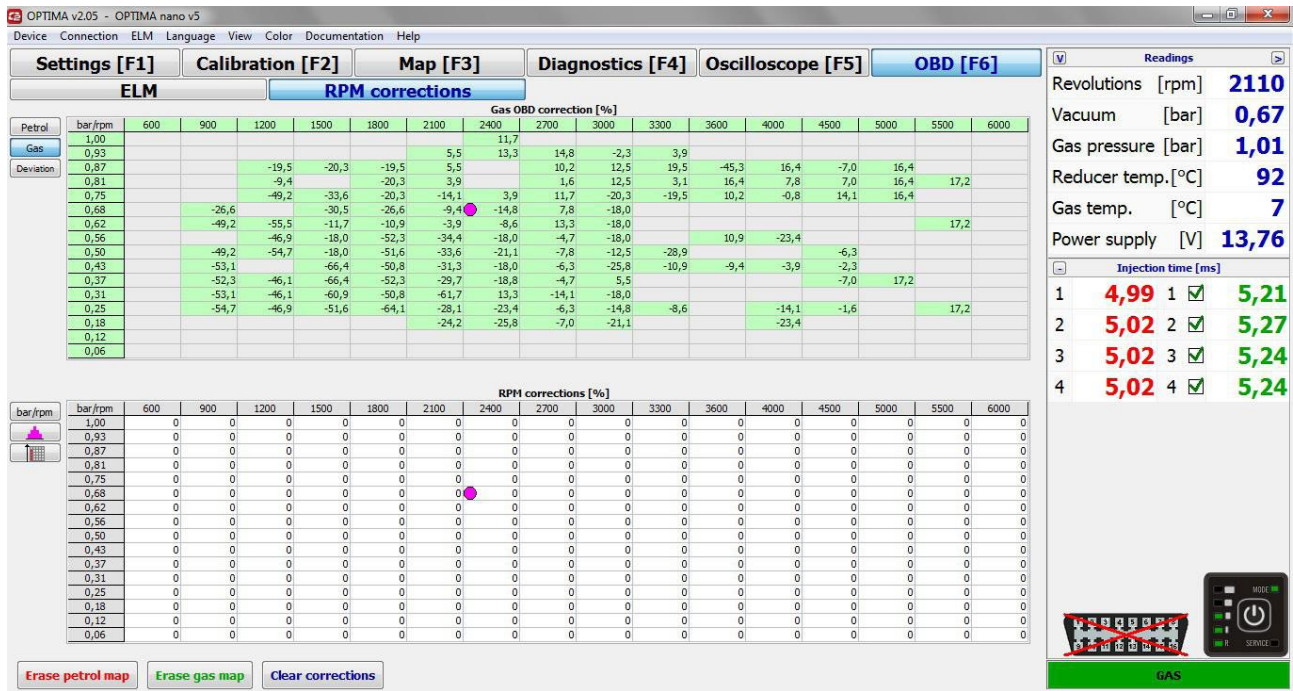
Fig. 18a

ADAPTATION TYPE:
» **THROUGH THE IGNITION** – adaptation of the parametres is applied at the moment of turning the car on and off .
» **CONSTANT ADAPTATION** – is working while driving the car and currently adjusts the settings of multipier and idle gear.
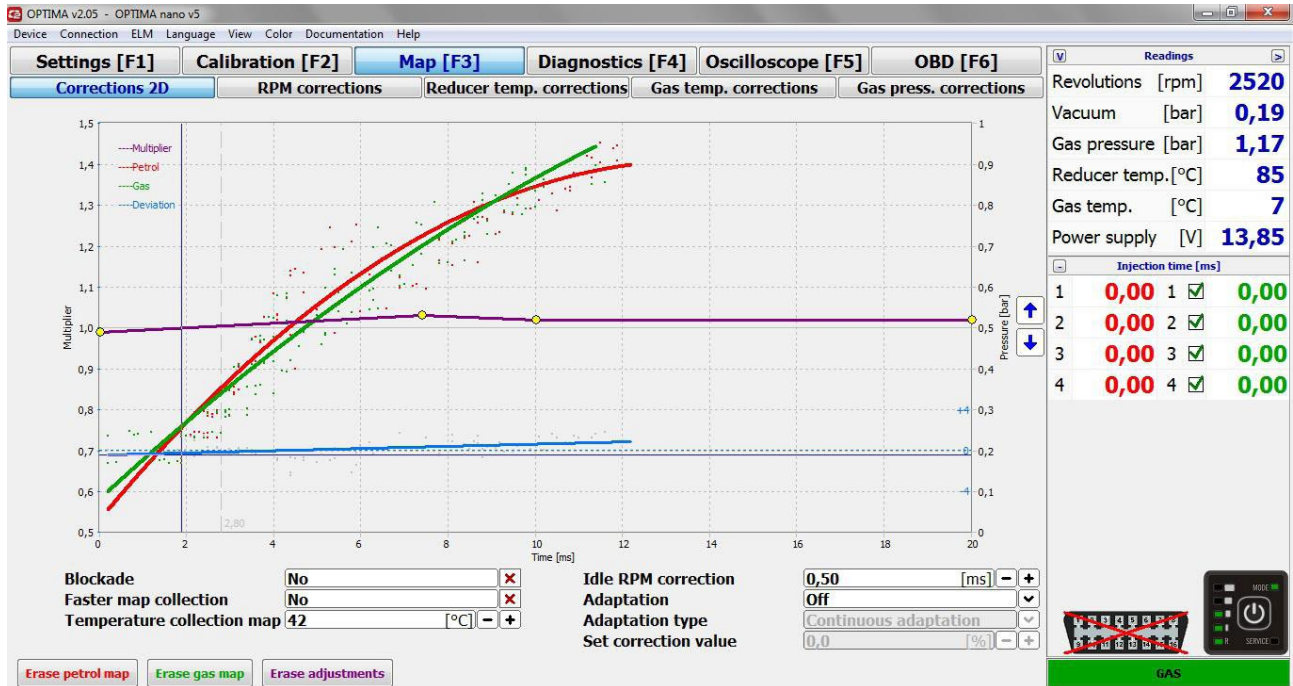
3.3. Corrections 2D

Fig. 19

In the window MAP/Corrections 2D the charts of controller maps are visible. Charts indicate petrol map of petrol ECU. The ideal situation is when the lines after calibration during driving overlap (in the same road conditions), – however, – in practice it is sufficient when the deviation blue line in nearly horizontal and is overlaping the dotted line 0.

<u>* The same road conditions – petrol map and gas map are collected on the same surface, – with the same air temperature and humidity.</u>

Fig. 20

RED LINE – petrol injection time (during work on petrol)

GREEN LINE – gas injection time (during work on gas)

VIOLET LINE – multiplier correction line

BLUE LINE – deviation line

Multiplier correction is possible through the blue points, – in the following way:

KEYBOARD:
→ Right arrow – moving right on the multiplier correction line
← Left arrow – moving left on the multiplier correction line
↑ Up arrow – increasing selected point
↓ Down arrow – decreasing selected point
- Delete – deletes selected correction point

MOUSE:
» left button – selecting left correction point
» right button – selecting and adding correction point

RPM CORRECTIONS:

Bars demonstrate state of collected maps in particular injection times:

RED BAR – demonstrates the state of collecting petrol map in given injection time

GREEN BAR – demonstrates the state of collecting gas map in given injection time.

YELLOW BAR – demonstrates the state of overlaping petrol map and gas map. The number gives us the deviation of injection times.
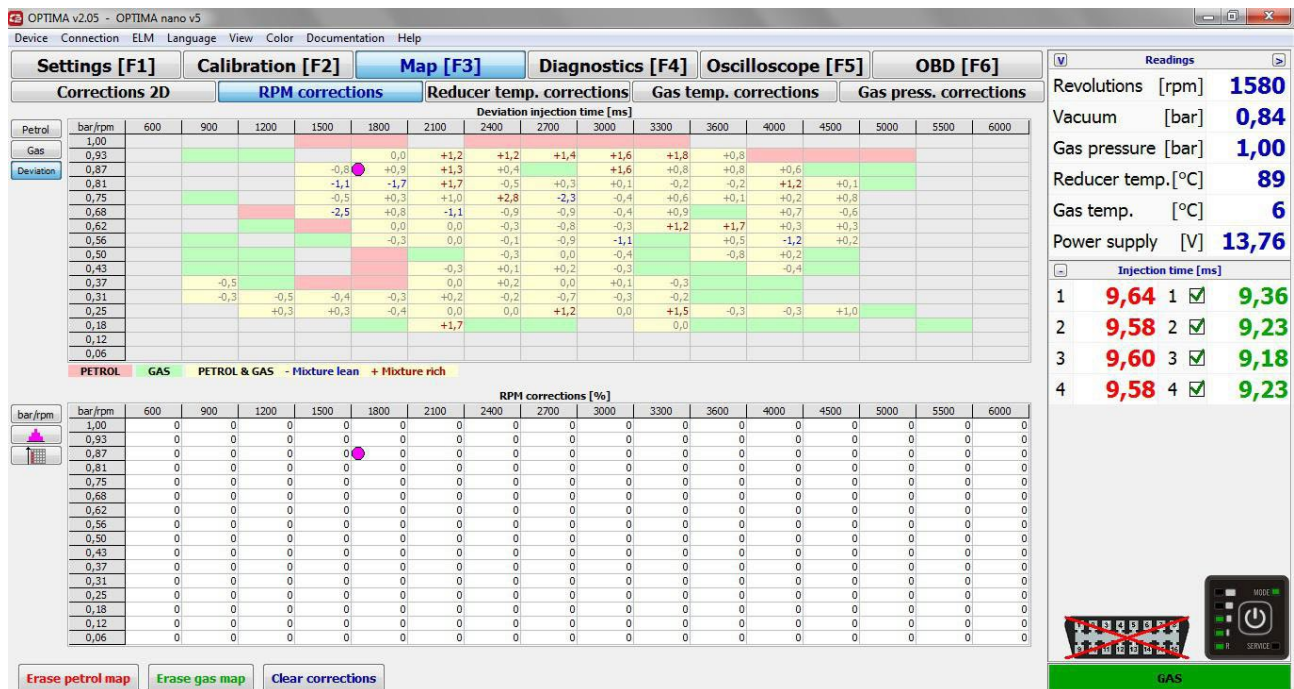
Fig. 21

YELLOW BARS DEVIATION MAPS:

Boxes check multiplier compatibility, – depending on deviation of gas map in relation to petrol map. If there are many bars above -1.0, – it means that the mixture is lean in given scope The petrol time while working on gas is longer than the petrol time while working on petrol – in the same scope of engine work. – Analogously in case when the value is above +1.0

OPTIONS:
- » **BLOCKADE** – if selected, – current map chart will be saved in the memory of controller
- » **[ERASE PETROL MAP]** – deletes petrol map chart
- » **[ERASE GAS MAP]** – deletes gas map chart
- » **FASTER MAP COLLECTION** – enables faster collection of chart points
- » **[ERASE ADJUSTMENTS]** – deletes multiplier line to the initial state

Parameters window could be customised.
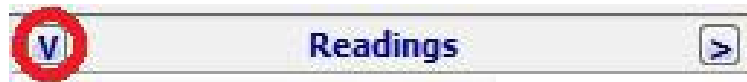
Fig. 22
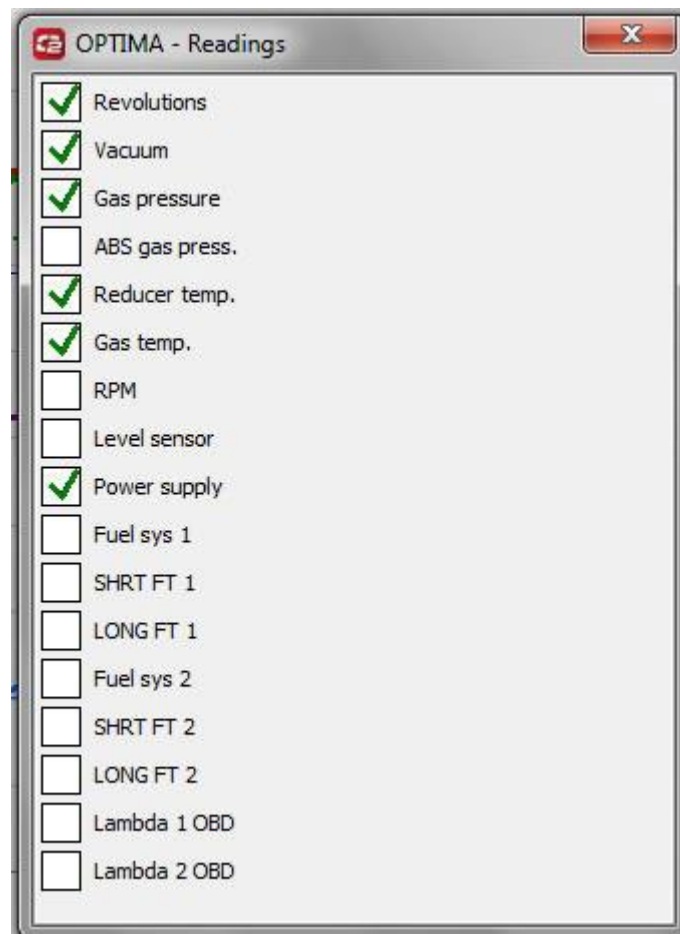
Fig. 23

3.4. RPM corrections
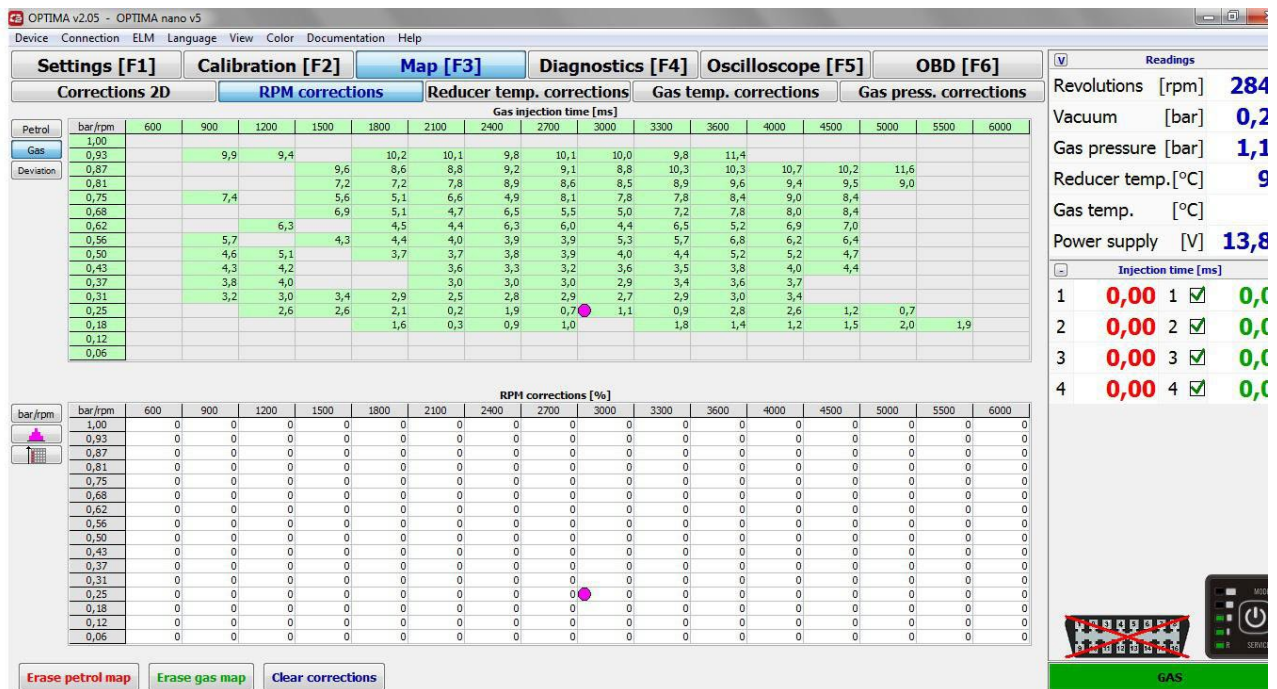
Fig.24 (RPM correction map)

OPTIMA Nano controller allows very precise mixture adjustments in every scope of engine load. Figure above illustrates the correction map. The purple dot indicates current engine work (scope of RPM and injection time).

Gas injection may be corrected in given RPM scope, – by clicking on the area for which we want to change the gas injection parameter and selecting it with purple – square.

By holding **CTRL + UP ARROW ↑**, – it is possible to enrich given area – and by holding **CTRL + DOWN ARROW ↓** – to lean it.

When 'change nearest' option is selected – the system will enrich nearest areas. When this option is not selected – change of only one area of RPM correction will be possible.

We can additionally change the values of the current scope by clicking + and – on the keyboard
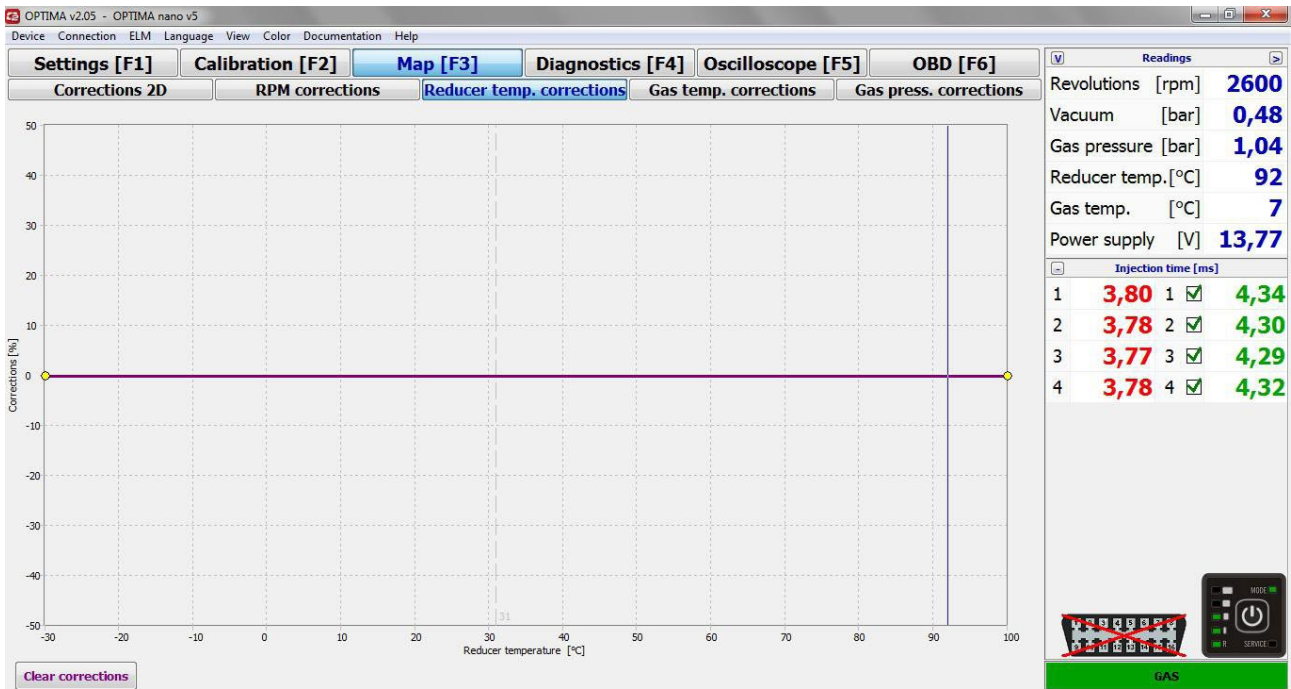
3.5. Gas temperature corrections (for advanced)
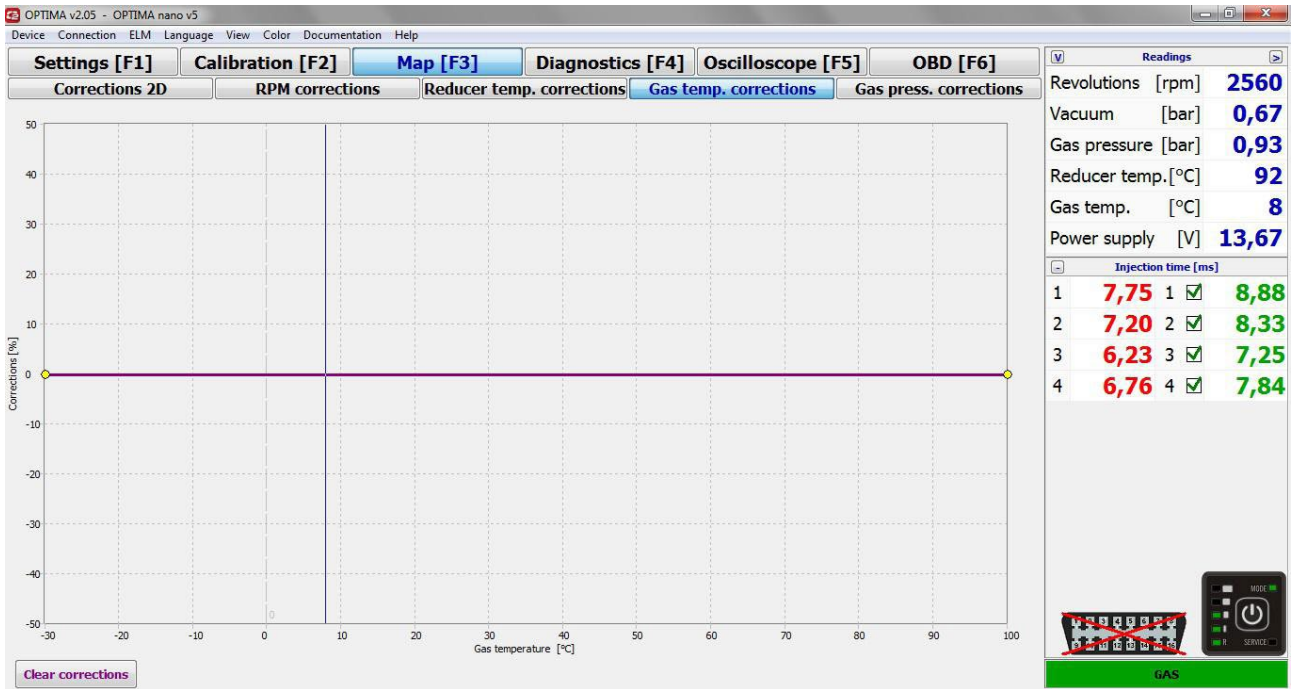
Fig. 25 (temperature correction map)

OPTIMA controller is equipped with temperature correction algorithm, however the map demonstrated above allows introducing corrections.

Corrections should be conducted in the same way as these of 2D map multiplier – there is a possibility of introducing up to 20 points of temperature corrections.

In most cases changing the parameters of temperature corrections map is not necessary.

3.6. Reducer's temperature correction (for advanced)

Fig. 26 (reducer's temperature correction)

OPTIMA controller is equipped with temperature correction algorithm, – however, – the map demonstrated above allows introducing corrections.

Corrections should be conducted in the same way as these of 2D map multiplier, – there is a possibility – of introducing up to 20 points of temperature corrections.

IN MOST CASES CHANGING THE PARAMETERS OF TEMPERATURE CORRECTIONS MAP IS NOT NECESSARY.

3.7. Pressure corrections (for advanced)
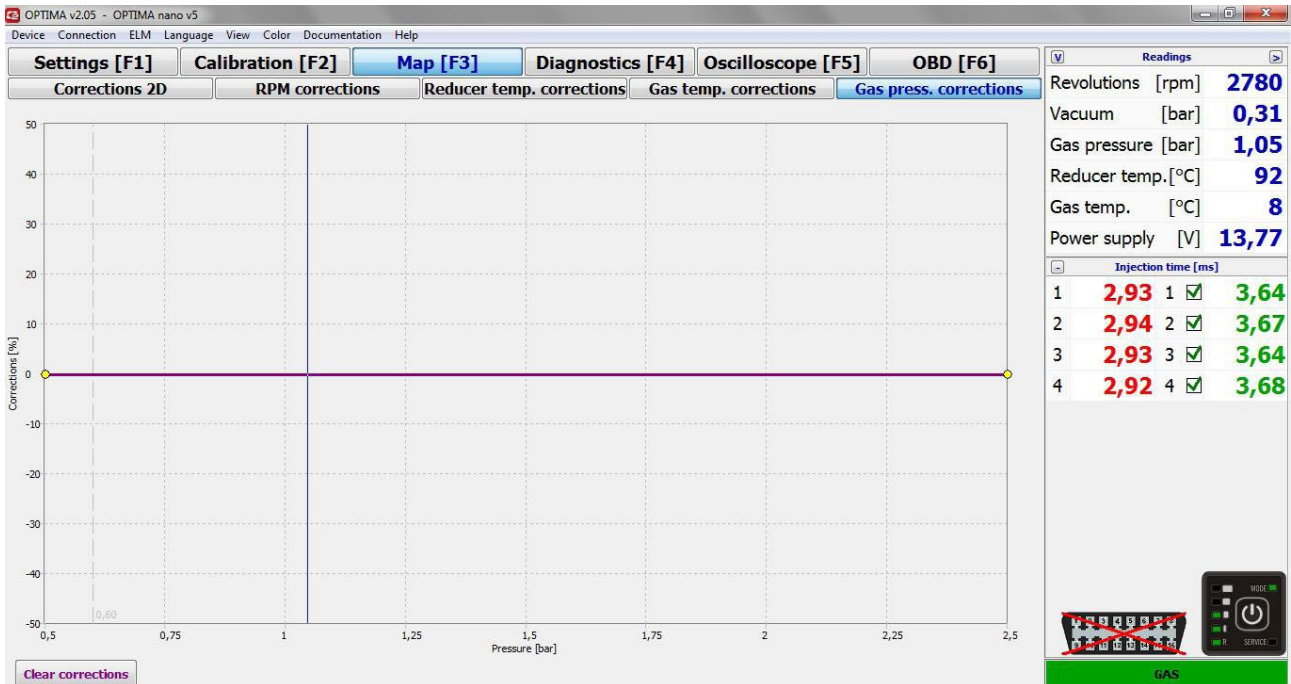
Fig. 27 (gas pressure correction map)

The same as in case of temperature corrections – OPTIMA controller is equipped with pressure corrections algorithm – with the possibility of introducing corrections on the pressure corrections map.
Corrections are introduced in the same way as the ones of multiplier and temperature.

DO NOT USE THIS OPTION IF THE REDUCER IS NOT PROPERLY SELECTED IN RELATION TO ENGINE POWER.

3.8. Fuel pressure emulator (only Optima Expert controller)
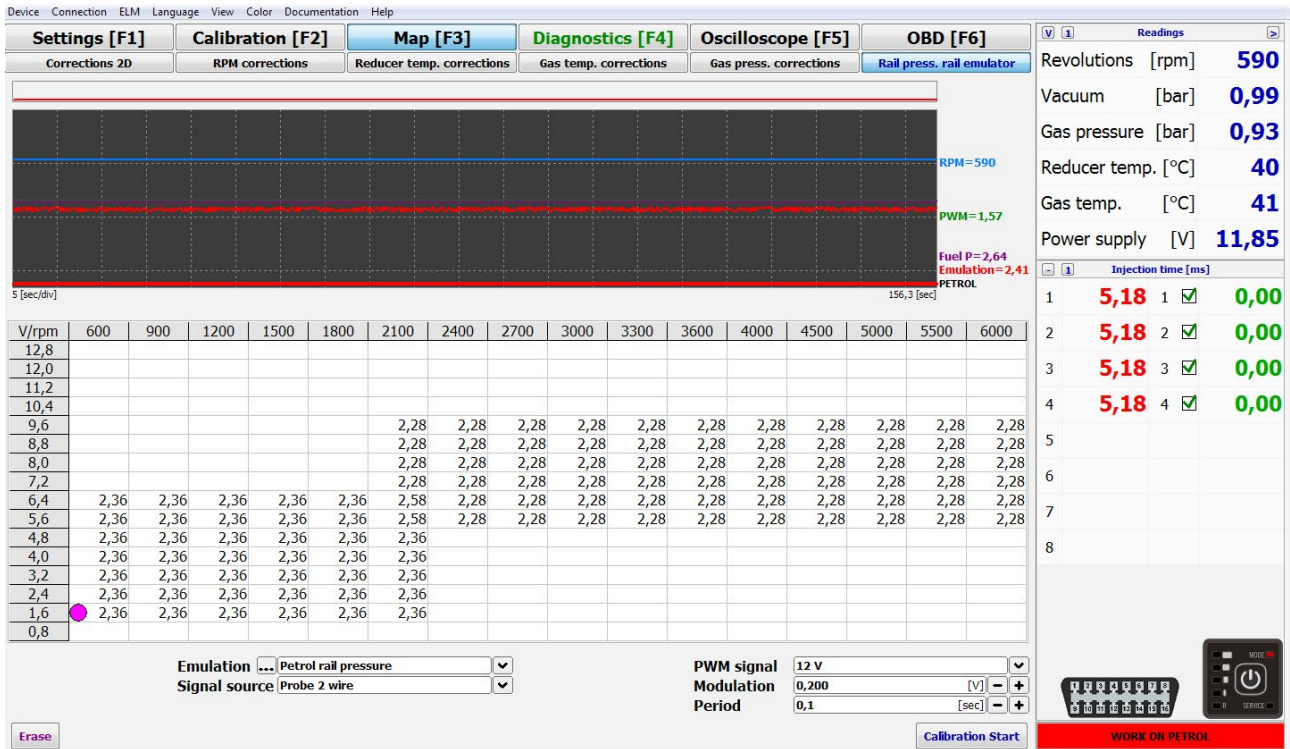
Fig. 27a

Thanks to built-in emulation system we can emulate some of the electronic components of the engine, such as:

» **PROBE BEFORE THE CATALYST:**

We can adjust the parametres of a probe with the use of a driver by moving the Lambda coeficient. It is not advisable to use this option without the view of AFR coeficient with the help of the external broadband probe.

» **PROBE AFTER THE CATALYST :**

in case you want to emulate the lambda probe after catalytic converter ,connect the probe signal before the catalytic converter and the emulation probe cable after the catalytic converter. The controller, based on the first probe signal, will set the right course on a probe wire after the catalyst.

» **FUEL RAIL PRESSURE:**

Due to the fact that while working on gas the petrol injectors remain closed, with some kind of cars there is the increase of fuel pressure and the voltage of a sensor measuring the pressure. It is being signalled by the shining lamp of engine failure and OBD error.

Thanks to built-in emulator we can collect the voltage map for a fuel pressure sensor and read it while the car is working on gas. By doing so, the car will not see the difference in a fuel pressure when working on gas and on petrol. To make the use of an emulator's abilities, the controller must be installed according to the diagram,switch the car to petrol and press Start Calibration in a Rail Press. Emulator tab.

At this point , the controller will start mapping the fuel pressure sensor while driving on petrol. Standard driving should be performed in the same way as when collecting the injection times on petrol. Try to fill the largest possible range of a table.If we are not able to gather a wider range ,we can switch the car to gas. While driving , check if the violet working point works in the same range as listed in a table. If the violet dot tents to „escape" from the range
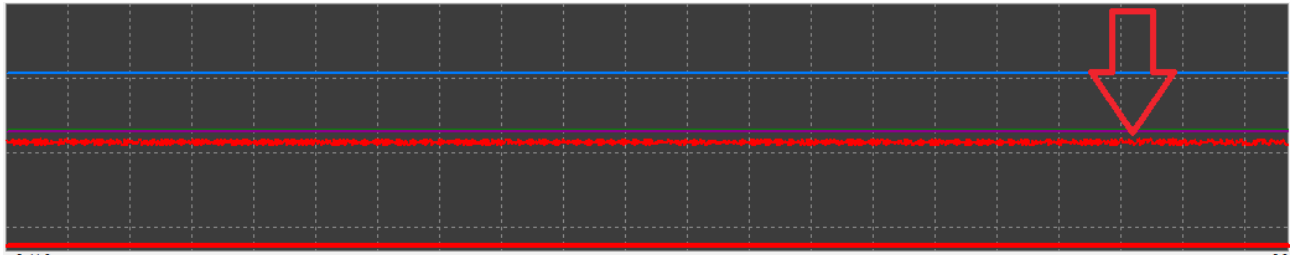
Fig. 27b

we can use the Modulation option (the option simulates the voltage changes of a sensor at the determined value) Additionaly, when choosing Period (the option determines the frequency of simulated voltage rise by the value set in the modulation). The signal change is visible on the diagram.

It enables the simulation of indicator's operation and constant voltage change. Thus, the sensor will never achieve a constant value and the petrol controller will not report its damage.
 Recommended initial values:
Period - 0,200
Modulation - 0,1

4. OBD/CAN

In vehicles fabricated after 2002, – there is a possibility of connecting OPTIMA Nano controller to EOBD.

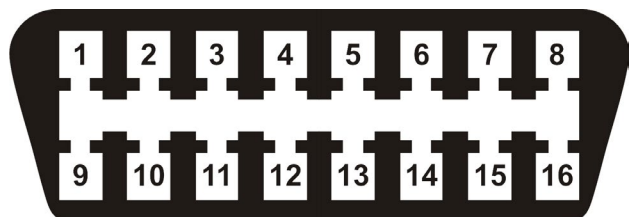Connection to CAN or – OBD is possible in two ways.

Fig. 28

4.1. Connecting OBD/CAN – via – the ELM327 interface

ELM327 interface – models

Fig. 29

Fig.30

We are connecting the OPTIMA ECO+ interface to the PC. Then we are also connecting – the ELM327 interface to the car OBD2 socket and to the USB port in the PC.

Having connected to the Nano controller with the software OPTIMA 2.XX and after choosing an option of connecting with ELM327 we are able to collect and compare the injection correction maps of STFT, – LTFT both on petrol and on gas and then we could correct them in a suitable way.
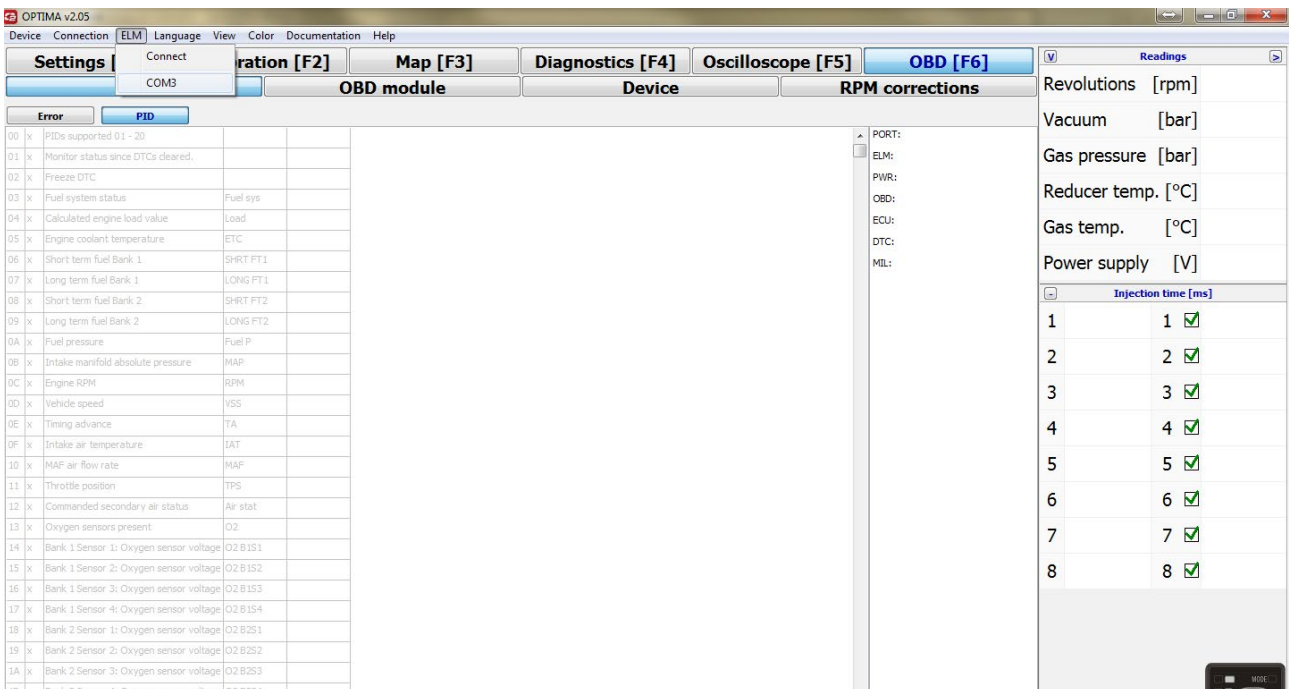
Fig. 31

4.2. Maps collecting procedure

Sellect the "OBD" and then the "RPM corrections".
Drive a car on petrol with different speeds on different gears. When noticing that table bars don't change and the new bars don't appear, – switch into gas and fill the table – exactly in the same way during driving on gas.

VIEW OF OBD CORRECTIONS COLLECTED ON PETROL
View of corrections on petrol after the test drive with connected OBD Adapter or with – the ELM327 interface.
Red table – view changed with **[F8]** key or – by Petrol, Gas, – Deviation switches.
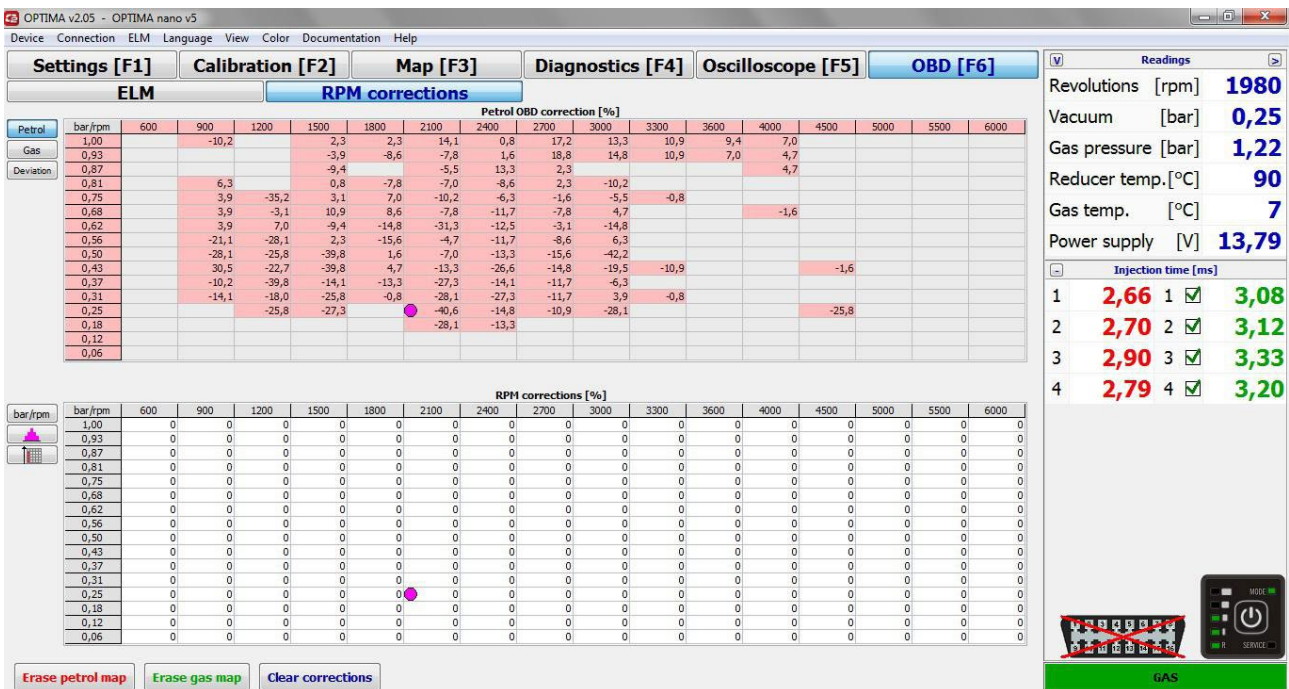
Fig. 32

The controller creates the map by recording each correction value .Red bars represent – scopes collected on petrol. Grey bars mean that the vehicle has not worked in such scope yet or went to the Open Loop (Open Loop – the car do not use – STFT or LTFT)

VIEW OF OBD CORRECTIONS COLLECTED ON GAS

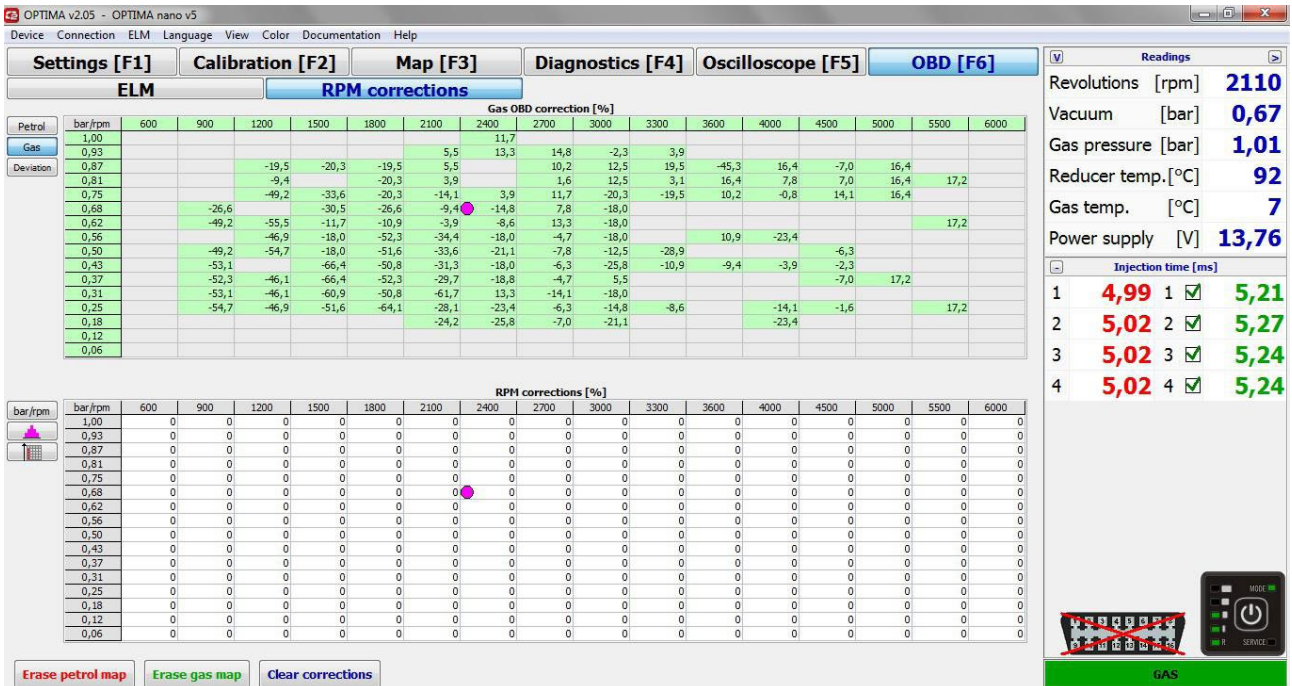View changed by clicking the gas switch or **[F8]** on a keyboard.

Fig. 33

NOTE:

WHILE MAP COLLECTING IN THE GAS AND PETROL CORRECTIONS VIEW – THE CONTROLLER OFTEN SHOWS – THE CORRECTION WITH NEGATIVE VALUE E.G. -15% – WHICH MEANS THAT THE MIXTURE IS ENRICHED BY 15 % . HOWEVER SWITCHING TO THE DEVIATION VIEW – THE SITUATION IS REVISED AND THE CONTROLLER SHOWS THE DIFFERENCE BETWEEN THE CORRECTIONS.

DEVIATION OF OBD CORRECTION ON GAS AND PETROL

GREEN BARS – OBD corrections collected on gas

RED BARS – OBD corrections collected on petrol.

YELLOW BARS – difference between gas and petrol corrections

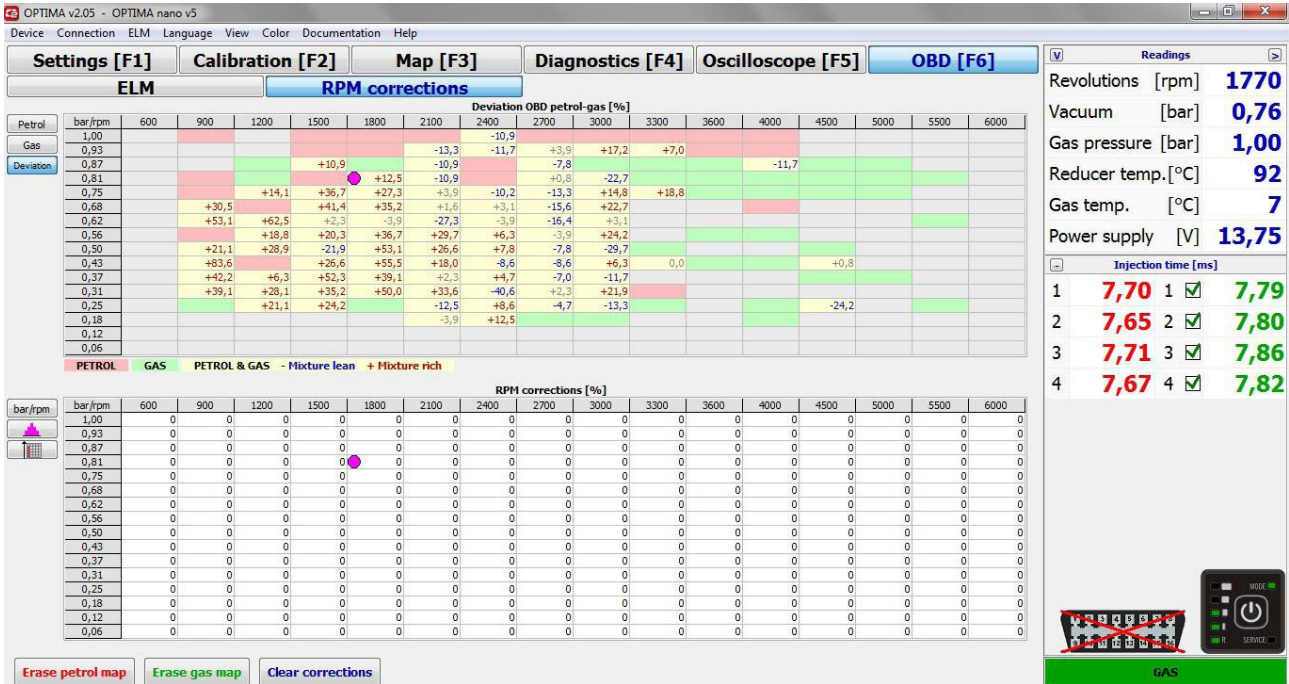**GREY BARS** – no values collected

Fig. 34

Positive value **(+ PLUS)** – **A DEVIATION TABLE** indicates that the fuel mixture in given scopes is – rich. Negative value **(- MINUS)** indicates that the fuel mixture in given scopes is lean. The correction could be done by the deviation table or with the use of multiplier. – In such case the multiplier should be reduced down.

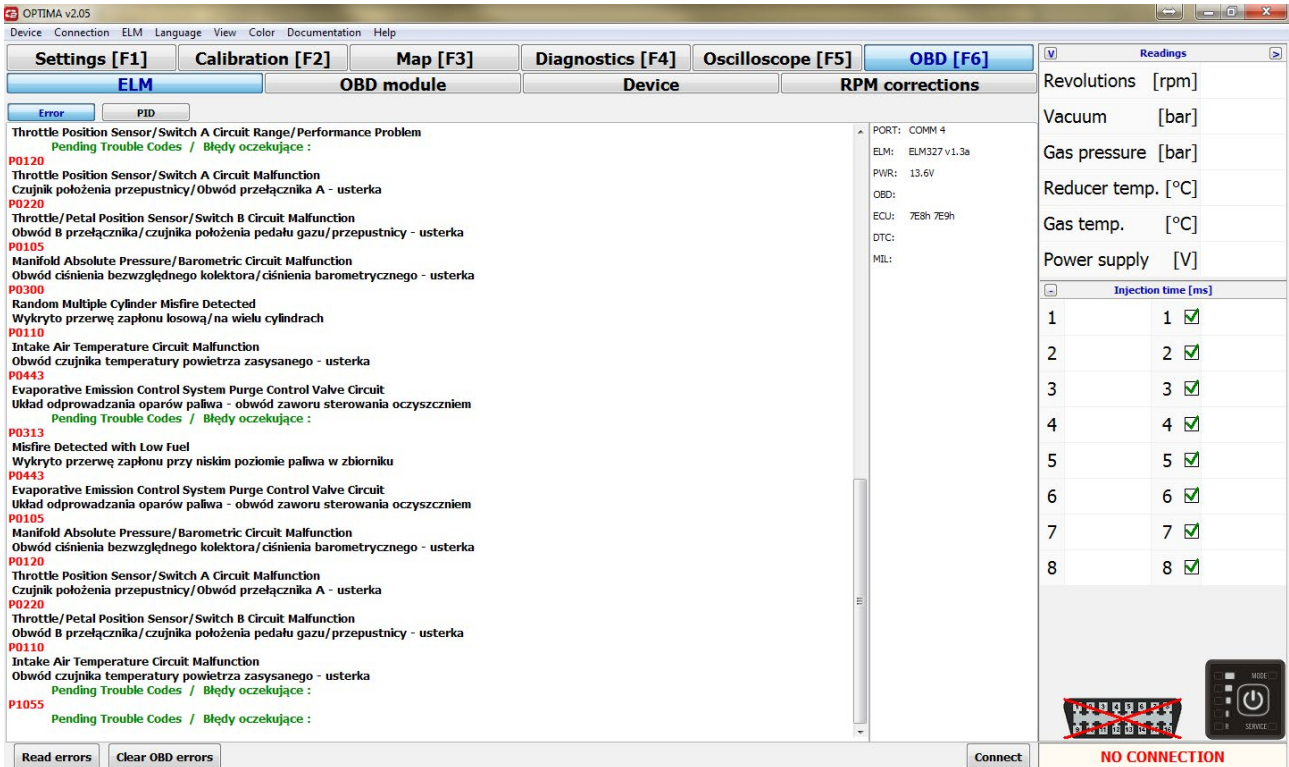# 4.3. Error reading with the ELM327 interface

OBD > ELM > ERROR

Fig. 35

4.4. Advantages of using ELM327 interface with the controller OPTIMA nano

» General access of the interface through out – the world.

» Possibility to set every car basing on the – corrections of petrol controller and – thus avoiding the occurence – of lean mixture errors (the table shows the real state of OBD petrol controller corrections – while – working on gas and petrol).

» Interface is also used for diagnostics and overview of any parameter in every car with the OPTIMA ECO + contoller – with the ability to read and erase OBD errors.

» Possibility to control the corrections on petrol and gas without the need of using a second OBD scanner (no need for a manual calibration with a scanner)

» **In many cases it eliminates the need of a permanent installation of OBD Adapter.**

4.5. OBD2 adapter

Having correctly installed – OBD2 adapter in a car, – there is a possibility to use the same options as with the ELM327. Additionally, – there is a possibility of – constant setting adaptation as regards STFT corrections and LTFT petrol controller.

4.5.1. Built-in OBD (only Optima Expert controller

Imagen. 35a

Optima Expert controller allows a constant communication with the car's OBD. It enables us to programme the petrol controller to adjust the installation automatically during driving

OBD PROTOCOL - choose the type of OBD connection protocol.If it is unknown, we could choos the option Automatically. When we connect to OBD correctly, on the bottom right hand side we will see on which OBD connection pins the protocol has been gathered. The current errors will be displayed together with the name of communication protocol. Based on this, we can choose the permanent OBD protocol's name.

LTFT CORRECTIONS INVERTED - it allows to invert long-term OBD corrections when the car has inverted OBD corrections. In 99% of cars we leave the NO option.

(Usually, if the OBD corrections are positive it indicates too lean mixture whereas if the corrections are heading the negative direction it indicates that the mixture is too rich)

STFT CORRECTIONS INVERTED - it allows to invert short-term OBD corrections when the car has inverted OBD corrections. In 99% of cars we leave the NO option.

(Usually, if the OBD corrections are positive it indicates too lean mixture whereas if the corrections are heading the negative direction it indicates that the mixture is too rich)

ADAPTATION

» **TO INJECTION TIME MAP –** It is an adaptation based on saved injection times of petrol and gas

» **TO OBD TO PETROL MAP –** it is an adaptation based on short and long-term correction map on petrol which could be found in a tab OBD> RPM corrections .

» **OBD TO SET VALUE –** the option allows to enter your own OBD correction value to which the gas cotroller will be aiming to.

- **SET CORRECTION VALUE** –here we should give the result of two adjustments of STFT and LTFT. Usually it is the same value as on petrol, for example, for the value STFT= -5 i LTFT= 5 the result is 0 so this value should be entered. The option could be used for setting the car directly on gas without the need of driving on petrol.

OWN PID / USER PID – we can define any PID (OBD parameter) we would like to see in parametres reading and save to the oscilloscope file.Keep in mind that large number of parametres slower down the transmission between the car's OBD controller and the gas driver.

CLEAR ALL OBD ERRORS – it erases all the petrol controller errors. The option is to be used as a last resort, when everything is set properly and the controller still reports the errors

CLEAR FUEL TRIM ERRORS – it erases all the petrol controller errors conected with the fuel trim. The option is to be used as a last resort, when everything is set properly and the controller still reports the errors.

CLEAR SELECTED ERRORS - here we can define an error code to be deleted.

DTC READING SCOPE - the option for setting the period of time when the gas controller is being checked automatically by the petrol controller for the presence of errors.

5. Diagnosis

The controller stores the errors occured during installation work and records their frequency for faster diagnosis. Additionally, – it creates the history of events.

5.1. Possible errors

» **MANIFOLD – PRESSURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO LOW.**
Improper voltage value in a manifold pressure sensor, – check the wires and connectors

» **MANIFOLD – PRESSURE SENSOR ERROR – – THE VALUE OF VOLTAGE IS TOO HIGH.**
Improper voltage value in a manifold pressure sensor, – check the wires and connectors

» **GAS PRESSURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO LOW.**
Improper voltage value in a gas pressure sensor, – check the wires and connectors

» **GAS PRESSURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO HIGH.**
Improper voltage value in a gas pressure sensor, – check the wires and connectors

» **REDUCER TEMPERATURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO HIGH.**
Improper voltage value in a reducer sensor, – check the sensor wires and the connection. If the switch button was repeatedly held, – the error could be ignored.

» **REDUCER TEMPERATURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO LOW.**
Improper voltage value in a reducer sensor, – check the sensor wires and the connection.

» **GAS TEMPERATURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO HIGH.**
Improper voltage value in a gas sensor, – check the sensor wires and the connection

» **GAS TEMPERATURE SENSOR ERROR – THE VALUE OF VOLTAGE IS TOO LOW.**
Improper voltage value in a gas sensor, – check the sensor wires and the connection

» **TOO LOW POWER SUPPLY.**
Voltage dropped below 9V, – it may indicate the problem with battery or charging system.

» **TOO HIGH POWER SUPPLY.**
Voltage rises above – 16V, – check the battery charging system

» **NO POWER SUPPLY ON LPG VALVE**
Absence of a power supply in a solenoid valve.

» **NO POWER SUPPLY ON LPG INJECTORS**
Absence of a power supply in injectors

» **NO POWER SUPPLY ON PTS**
Absence of a power supply in PTS

» **TOO LOW GAS PRESSURE BEFORE SOLENOID-VALVES SWITCHING**
Absence or very low gas pressure pressure before solenoid-valves switching

» **TOO HIGH GAS PRESSURE BEFORE SOLENOID-VALVES SWITCHING**
Very high gas pressure before solenoid valves switching.

» **MINIMUM RPM ON GAS**

Switching to petrol at minimum rotation

» **LOSS OF RPM WHILE THE IGNITION IS ON**
Rotations declined while the ignition is on or there is an improper connection of plus after the key.

» **MINIMUM REDUCER TEMPERATURE ON THE LPG**
Switching to petrol at the minimum reducer temperature

» **MAXIMUM GAS PRESSURE**
Switching to petrol after reaching the gas pressure above 4bar

» **WORK ON BOTH LPG AND PETROL DUE TO THE MINIMAL GAS TEMPERATURE**
Partial switching to petrol at the minimum gas temperature.

» **WORK ON BOTH LPG AND PETROL DUE TO THE MINIMUM GAS PRESSURE**
Partial switching to petrol at the minimum gas pressure. It may accure at the gas exhaustion or a drastic pressure drop.

» **WORK ON BOTH LPG AND PETROL AFTER THE PETROL INJECTORS LOOPING.**
Partial switching to petrol after the full opening of petrol injectors (impulse injection control changes into constant injection control after injection impulses overlaping).

» **WORK ON BOTH LPG AND PETROL AFTER THE GAS INJECTORS LOOPING.**
Partial switching to petrol after the full opening of gas injectors (impulse injection control changes into constant injection control after injection impulses overlaping).

» **FAULT ON GAS INJECTOR NUMBER**
Signalling the lack of injector or damaged – injector wire

» **SHORT CIRCUIT OF GAS INJECTOR NUMBER**
Signalling the circuit of a gas injector or damaged injector wire.

5.2. Readings

» **REVOLUTIONS** – current engine RPM
» **PRESSURE** – gas pressure in injection rail
» **VACUUM** – vacuum in the engine's intake manifold
» **REDUCER TEMPERATURE** – current temperature of the – reducer
» **GAS TEMPERATURE** – current gas temperature outside of the reducer
» **POWER** – napięcie zasilania sterownika (napięcie instalacji samochodowej)
» **LAMBDA 1** – Voltage shown by the first Lambda probe
» **LAMBDA 2** – Voltage shown by the second Lambda probe

Fig. 36

5.3. Injection Time [ms]

Shows current petrol and gas injection times. The injector that is selected is the currently working one (deselecting given injector results in switching it into petrol).
At the bottom of readings window information about the connection with the controller is visible.
Through the switch symbol it is possible to change the type of injection (petrol/gas)

5.4. Oscilloscope

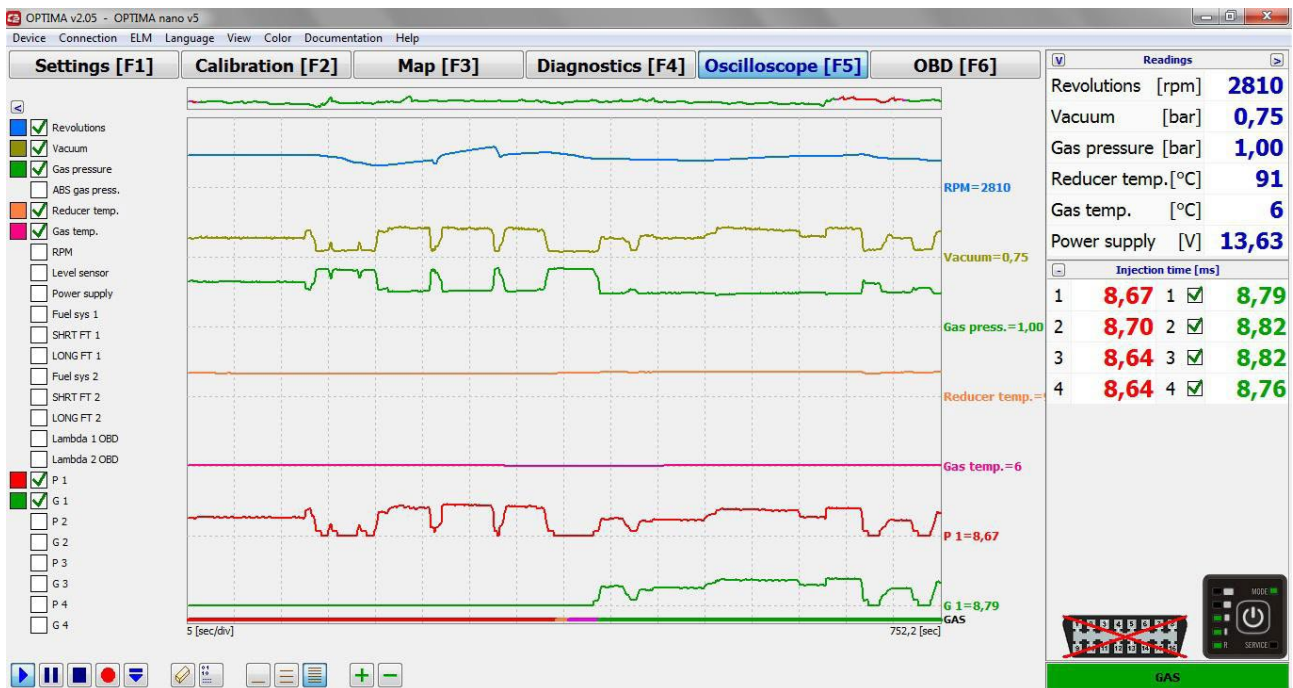Shows the signals selected on the left side.
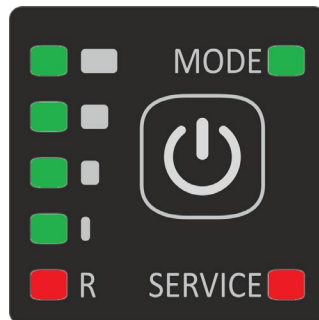

Fig. 37 (oscilloscope)

6. Switch

Fig. 38

- » **DIODES R** – indicate current gas level in a tank
- » **RED MODE DIODE** – engine work on petrol supply
- » **GREEN FLICKERING MODE DIODE** – system is working on automatic mode, – waiting for reaching selected temperature and RPM parameters
- » **GREEN** – fast flickering - System on automatic mode e.g after gas pressure drop
- » **SERVICE DIODE** - signalizes the necessity of the installation service

7. Technical Support – remote desktop (via TeamViewer programme)

Through the internet connection. Previously contacted, – the technical support can connect romotely directly with – the OPTIMA user's computer in order to help with the system operating. The only conditions that must be met are the controller connection via interface and the internet access.

Fig. 39

www.optimagas.com
www.autogas-alex.com