v1.03 [EN]

Installation And Programming Manual of OPTIMA Eco·Tec and OPTIMA Pro·Tec OBD/CAN

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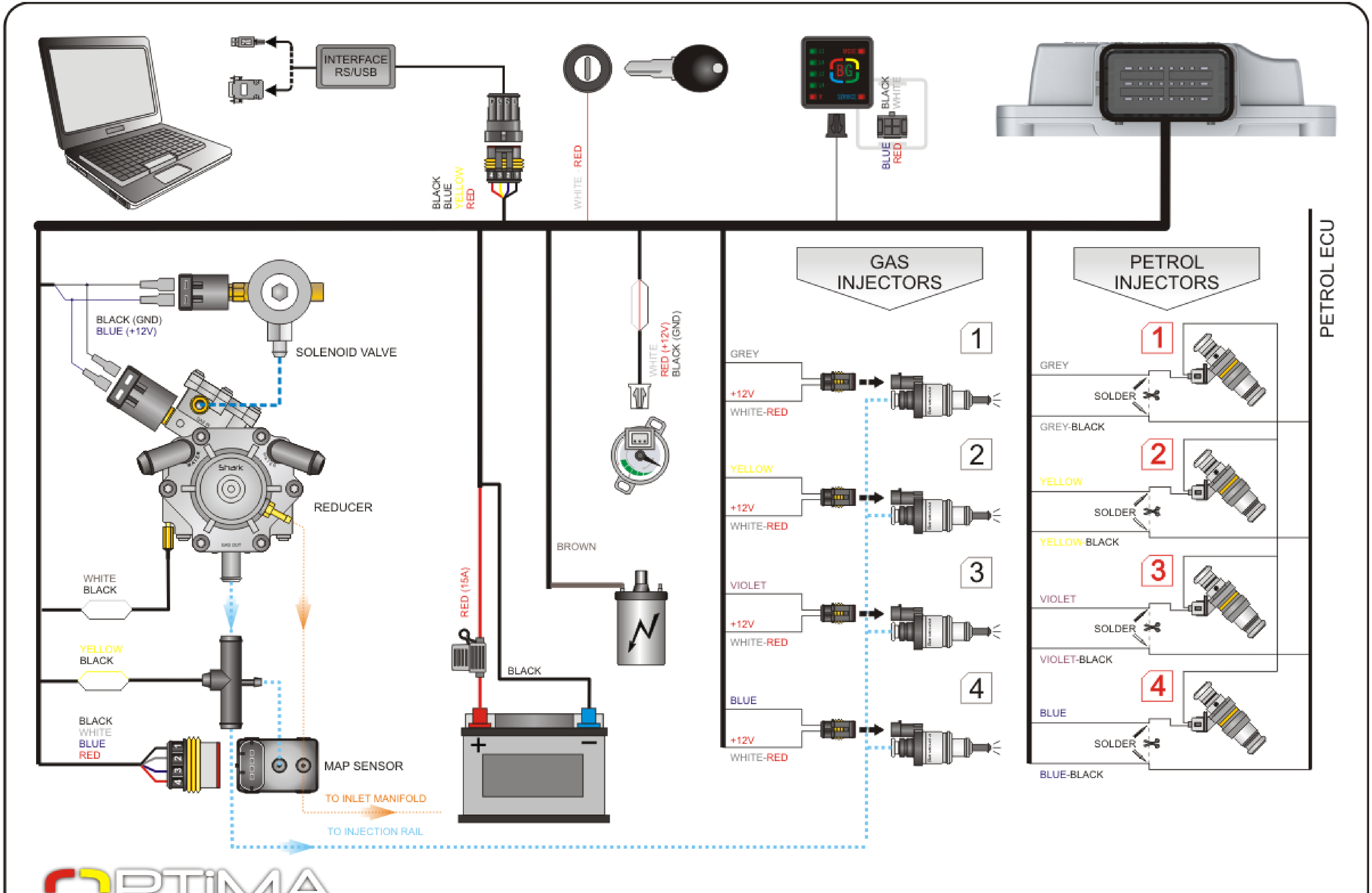
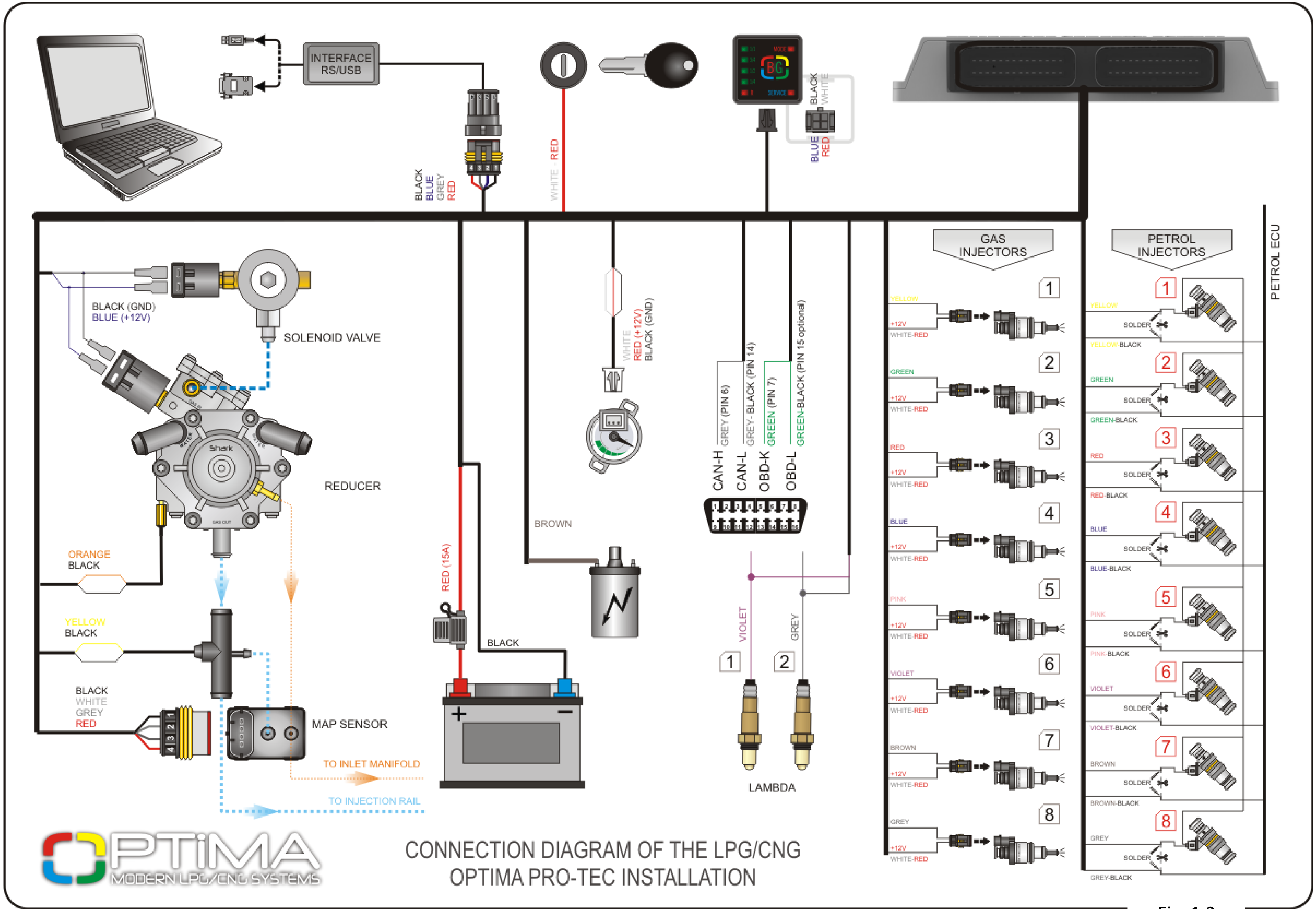


CONNECTION DIAGRAM OF THE LPG/CNG OPTIMA ECO-TEC INSTALLATION

Fig. 1.1



CONNECTION DIAGRAM OF THE LPG/CNG
OPTIMA PRO-TEC INSTALLATION

Fig. 1.2

1.3. OPTIMA Eco-Tec and Pro-Tec Controllers Installation Method

It is very important not to expose Eco-Tec and Pro-Tec controllers to high temperatures or humidity.
Installation should be carried out according to the connection diagrams (Fig.1.1 or Fig.1.2)

1.4. Selection of Pressure Regulator

When installing OPTIMA injection systems, it is very important to select the pressure regulator in relation to engine power. Improper selection of the pressure regulator in relation to engine power will cause inability of the pressure regulator to ensure nominal LPG pressure when LPG delivery is high and, as a result, pressure in the system will drop. If pressure drops below the minimal value set in the controller, the system will automatically switch to petrol.

1.5. Selection of Injector Nozzles

The size of injector nozzles should also be selected according to the engine power. The table below illustrates the example of nozzle diameter selection - engine power has to be divided by the number of cylinders.

Nozzle Diameter [mm] (Pressure 1 bar)	Engine power per one cylinders [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

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. OPTIMA Diagnostic Programme

2.1. Connecting Controller to a PC

Having successfully completed the installation, connect Eco-Tec or Pro-Tec controller to a PC with OPTIMA diagnostic programme installed, using RS-232 or USB interface from Alex Sp. z o.o.
Before launching the programme, turn the key in the ignition switch (power supply "through the ignition") and start the car (it is necessary because after disconnecting power supply "through the ignition" controller goes into sleep mode and communication is not possible, which is signalized as connection error).
If the interface is properly connected and installed, the programme will find available COM serial ports and upon discovering connected ECU, connection with diagnostic programme will start automatically.

2.2. Main Menu

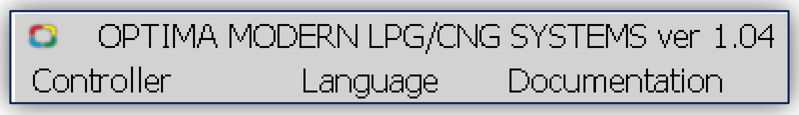


Fig. 2

Device

Connection - allows manual connection with the controller

Device info - shows information about the connected controller

Service - reminds about the installation service

Firmware update - allows software actualizations

Read settings from file - allows reading settings from the previously saved file

Save settings to file - saves current settings to file

Language - allows selecting language of the programme

Documentation - shows connection diagrams and installation manual

2.3. Main Window

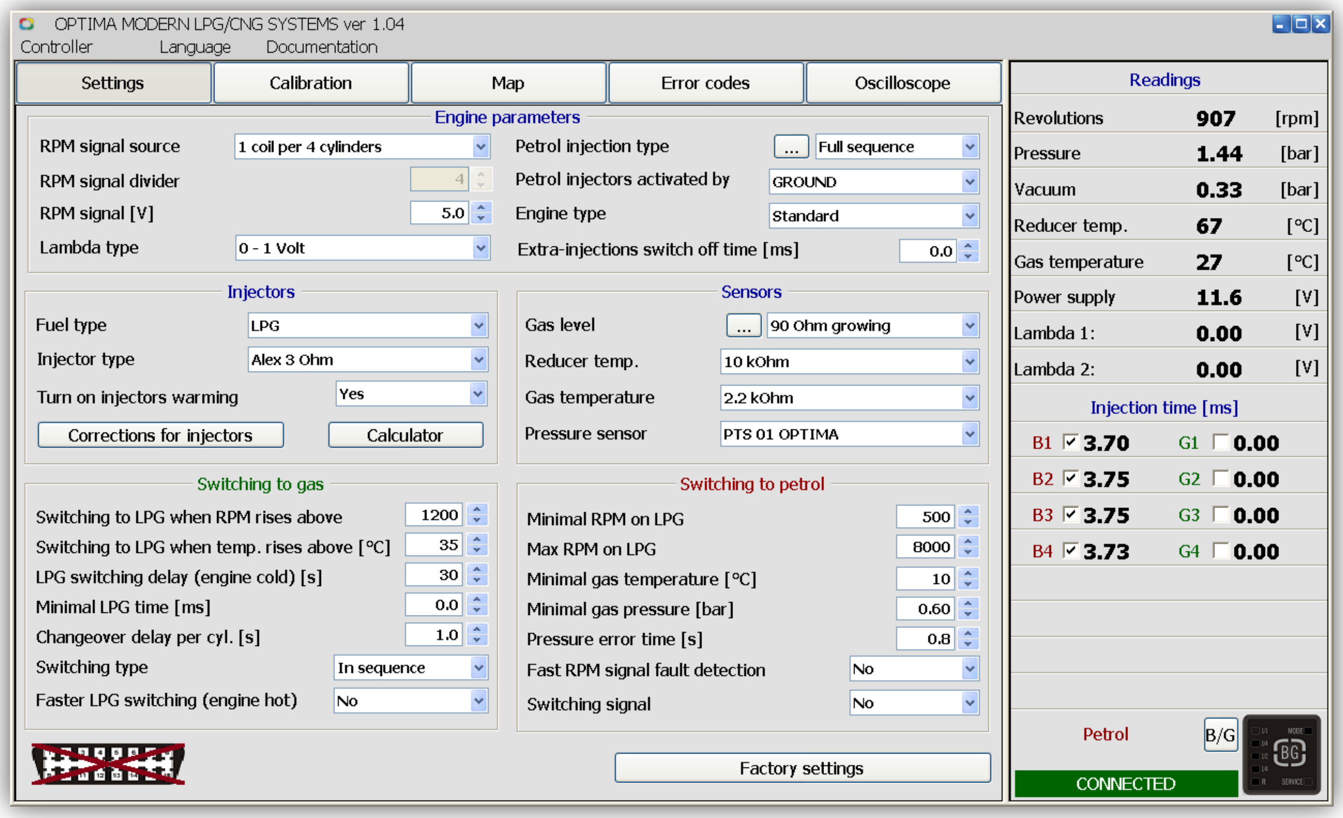


Fig. 3

2.4. Engine Settings

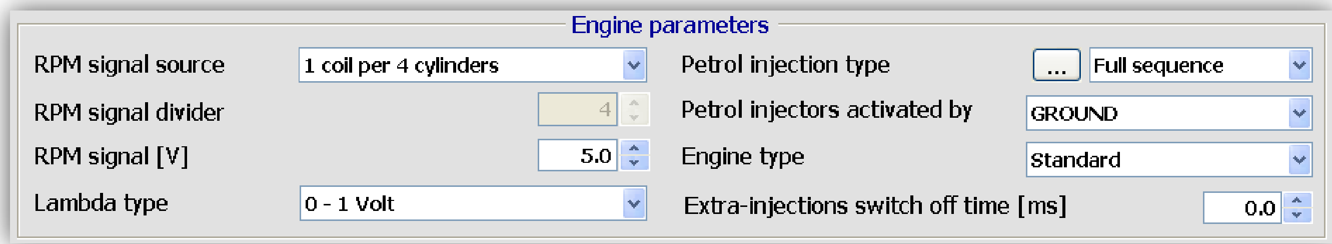


Fig. 4

RPM signal source - number of cylinders per ignition coil. Selected value should represent the adequacy between RPM signal in the programme and the vehicle's factual RPM

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 location sensors - 0-5V)

Lambda type - type of installed Lambda probe (option available in OPTIMA Pro-Tec)

Petrol injection type - type of petrol injection used in the vehicle. Selecting [...] gives the possibility of automatically detecting the type of injection

Petrol injection activated by - the type of control for petrol injectors, usually it is taken from ground

Engine type - the type of engine: standard (aspirated) or turbo (supercharged)

Extra-injections switch off time [ms] - Minimal petrol injection time transferred to gas injector. It allows to switch off extra-injections. Below the time selected controller will not register petrol injection impulses

2.5. Gas Injectors Settings

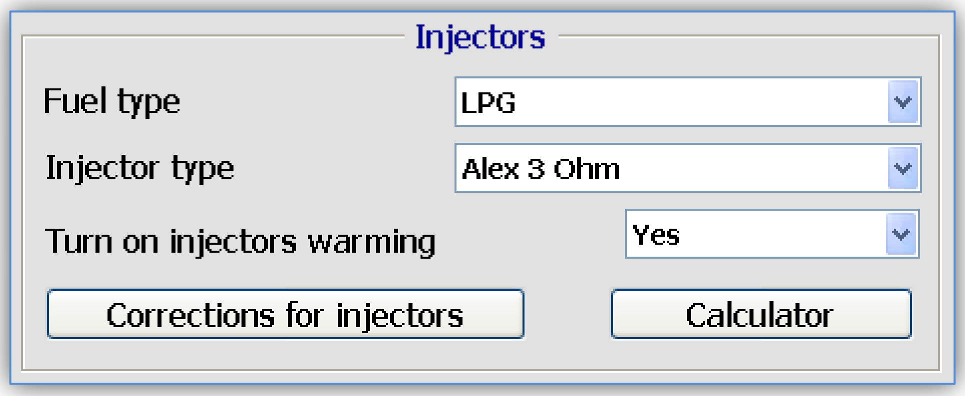


Fig. 5

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 first 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 in 'V' type engines

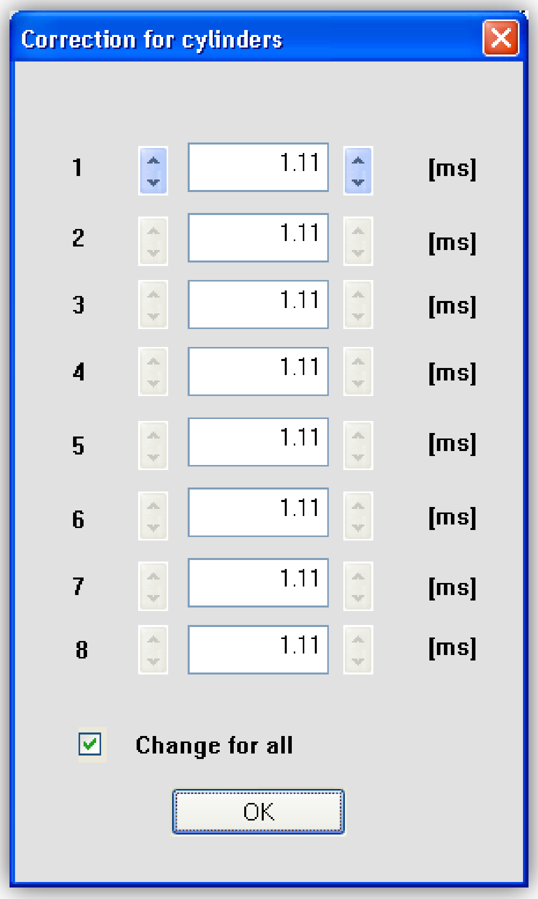


Fig.6

Such correction (if necessary) should be made in the following way:

After calibration, 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 there 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.

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

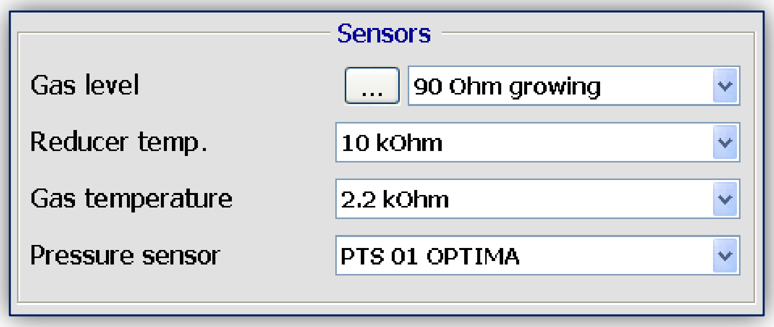


Fig. 7

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)

Pressure sensor - type of the pressure sensor (included in kit: PTS 01 OPTIMA)

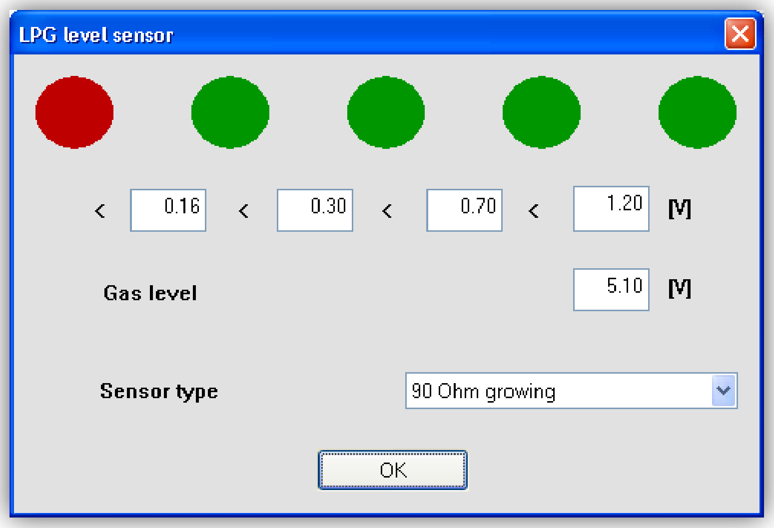


Fig. 8

Gas level - selection of the level sensor in a tank. Clicking on [...] gives the possibility of more precise adjustment of the switch by changing voltage thresholds for activating particular LEDs

Proper selection of the sensor, as well as its calibration, is crucial for the correct system performance!

2.7. Switching to Gas

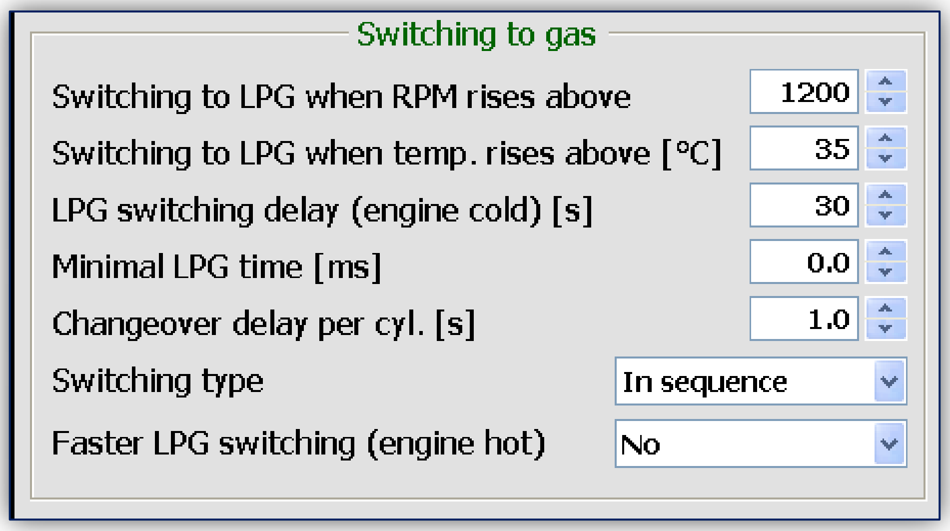


Fig. 9

Switching to LPG when RPM rises above - minimal RPM required for the engine to automatically switch over to LPG

Switching to LPG when temperature rises above - minimal temperature required for the engine to automatically switch over to LPG

LPG switching delay - with engine cold, time necessary for switching into gas at first switchover

Minimal LPG time - first switchover to gas is possible only after exceeding selected time.

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]

Switching type - type of switching between cylinders: in sequence or all cylinders at the same time

Faster LPG switching (engine hot) - if selected, warmed up engine will start directly on gas

2.8. Switching to Petrol

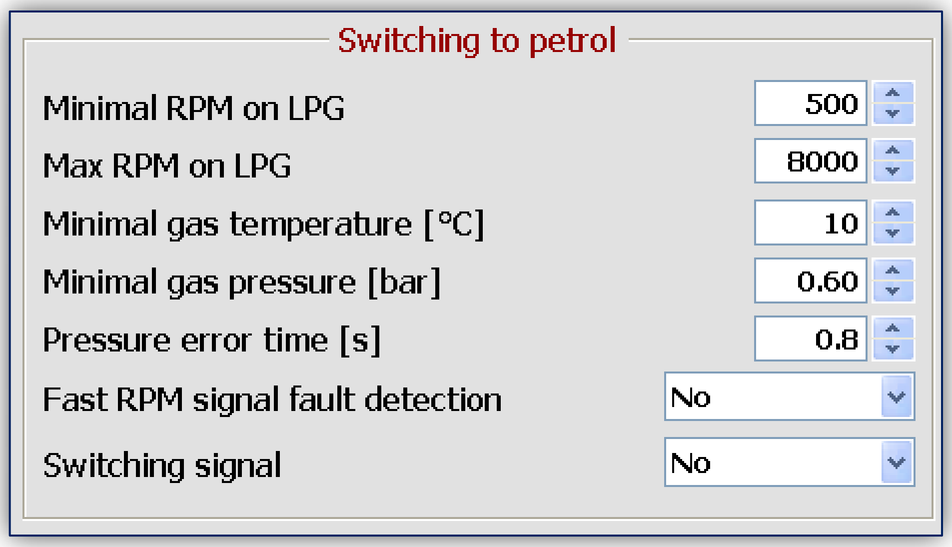


Fig.10

Minimal RPM on LPG - value of RPM below which system will switch over to petrol

Max RPM on LPG - value of RPM above which system will switch over to petrol

Minimal gas temperature - if temperature drops below the selected value, system will switch over to petrol

Minimal gas pressure [bar] - if gas pressure drops below the selected, system will switch over to petrol

Pressure error time - period of time with gas pressure lower than minimal after which system switches over to petrol

Fast RPM signal fault detection - in vehicles in which power supply "through the ignition switch" is turned on after the engine had been switched off

Switching signal - if selected, changing into gas injection will be signalized with a sound

3. Calibration

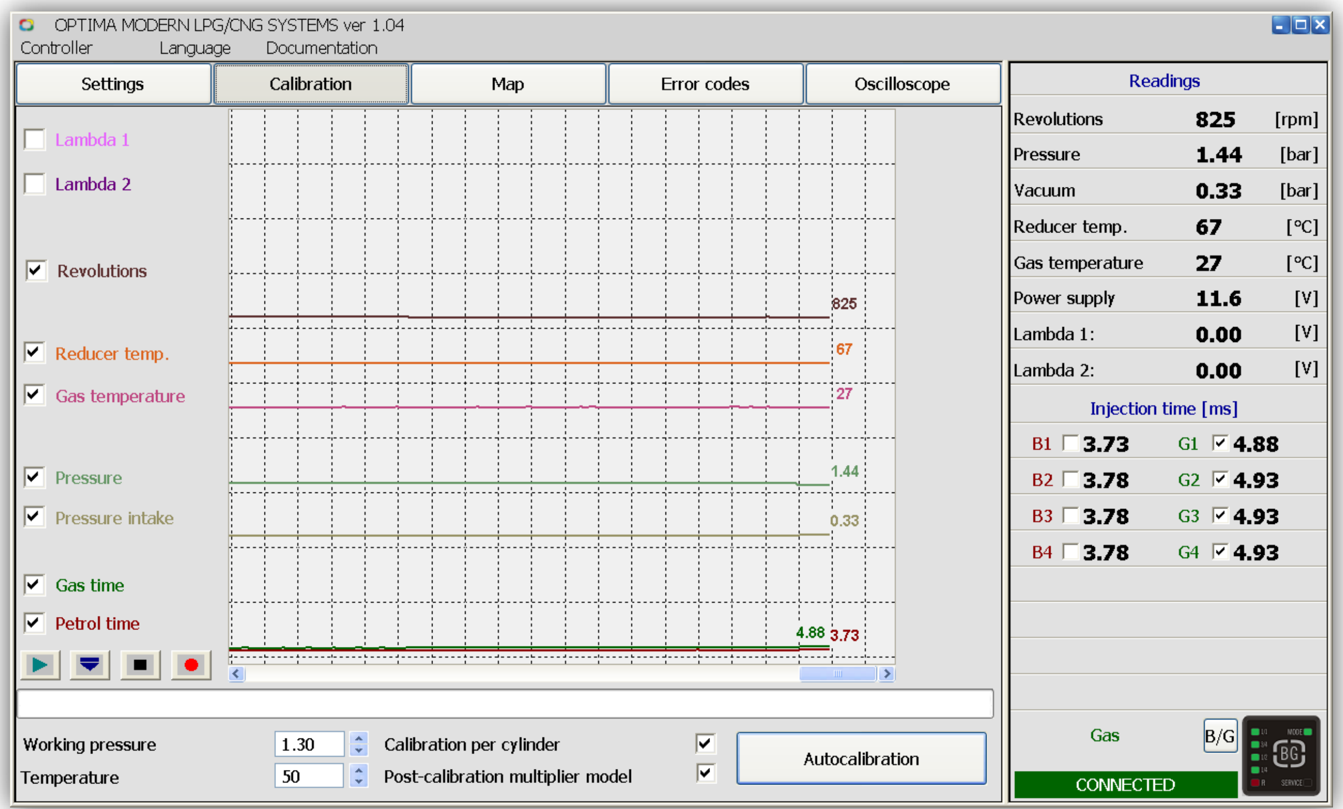


Fig.11

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)

Temperature - reducer temperature with which system can perform calibration

Calibration per cylinder - if selected, calibration will occur on individual cylinders (it is advised to select this option).

If deselected, the calibration will be performed on all cylinders at the same time (advised for full group)

Multiplier model after calibration - if selected, preliminary model of the multiplier will be created (advised). If deselected, the line of a multiplier will be at 'position 0' - straight horizontal line

Multiplier after calibration with selected multiplier model option and collected petrol map.

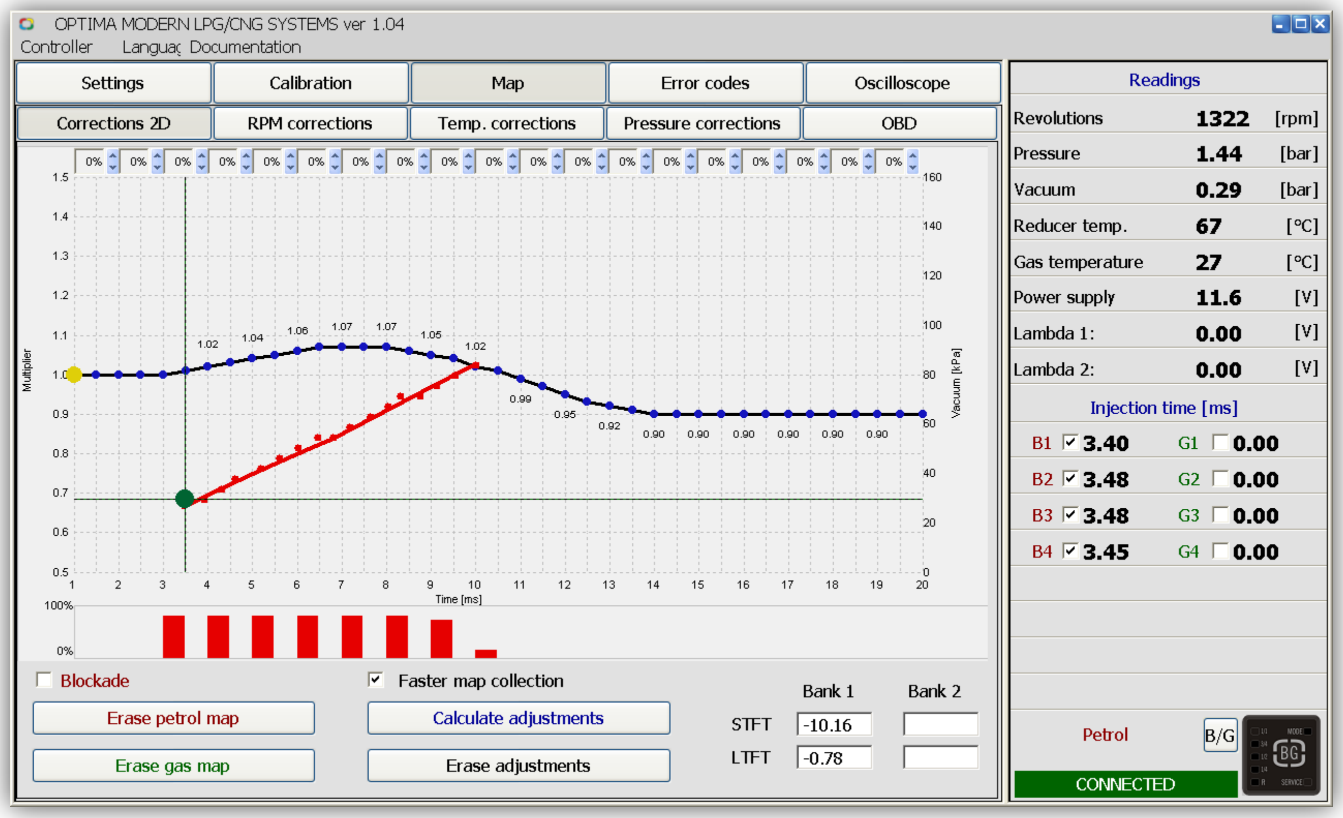


Fig.12.

3.1. Calibration Process

Having selected parameters in 'Settings', it is possible to begin calibration process.

Start the engine and heat it to the temperature of 50-60°C. Upon clicking on 'Autocalibration', the process of calibration will start and the progress will be demonstrated by moving progress bar.

During the process of calibration the vehicle must work on idle run, increasing RPM and engine load is not advisable. The vehicle will switch to gas and then to petrol to check work correctness.

With the progress of calibration, the work at the moment of switching into gas will become more stable.

Autocalibration will set corrections for gas injection time in relation to petrol injection time.

If the reducer and injector nozzles are selected properly, the correction should be placed within 0,5-2,0 ms.

If the correction after calibration is lower than 0,5 ms and 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).

When the nozzle size is improperly selected, the engine during calibration may stall. In such situation it is recommended to increase RPM to 2500. After the calibration process has finished, programme will calculate the correction and will inform whether the nozzles are too big or too small. Before the next calibration, after changing the nozzles and selecting 'Multiplier Model' option, it is advised to set corrections for injectors at 1.0 ms ['Settings' -> 'Corrections for injectors'] or to restore factory settings.

Having finished the calibration process, collect the map - it can be done in two ways: with PC disconnected or connected (connection will be visible on 2D Map).

1. Make sure that the vehicle is working on petrol (red MODE diode on the switch). Drive for approximately 5km on one gear (e.g. 4th) with different speed. Collecting petrol map will be demonstrated by the red line connecting collected points.

Red bars show the percentage of collecting particular map areas. If the points or bars are being collected too slow, it is possible to speed the process using 'Faster map collection' option (it is available only with connected PC).

2. 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.

During map collection, deviations of gas map in relation to petrol map will be visible in the windows above the map (checkbox).

With PC connected, correction of deviations can be made in two ways - with blue points on multiplier line or with arrows next to the checkbox window.

There is also a possibility of automatic Adaptation, which allows quick adjustment of multiplier correction.

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 +/- 5%.

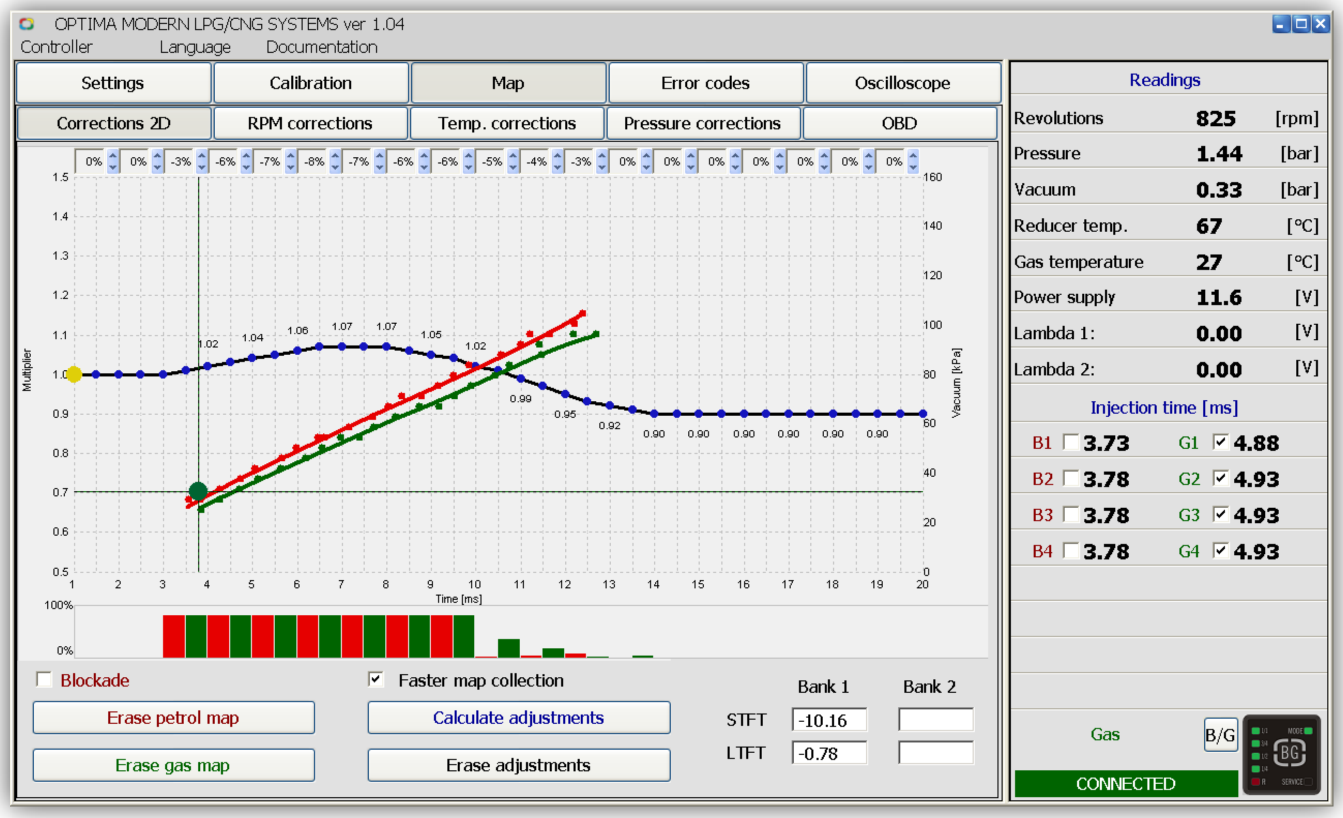


Fig.13. Partially collected map, not corrected.

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.

After pressing 'Adaptation', blue points on the multiplier correction line will be deleted. To make manual correction, after Adaptation click on one of the arrows (checkbox). Checkboxes show the state of currently collected maps.

Drawing last bars 100% filled in some cases may be very difficult or even impossible in the road conditions, that is why the bars should be treated as approximate.

The figure below demonstrates correctly conducted process of calibration, as well as maps after multiplier corrections.

Deviation in checkboxes is within +/- 5%. Red line of petrol map and green line of gas map overlap.

The correction line (black with blue points) should be placed between 1.2 and 0.7 multiplier value.

The value of correction line above 1.2 may indicate too small injector nozzles. Value below 0.7 may indicate that injector nozzles are too big.

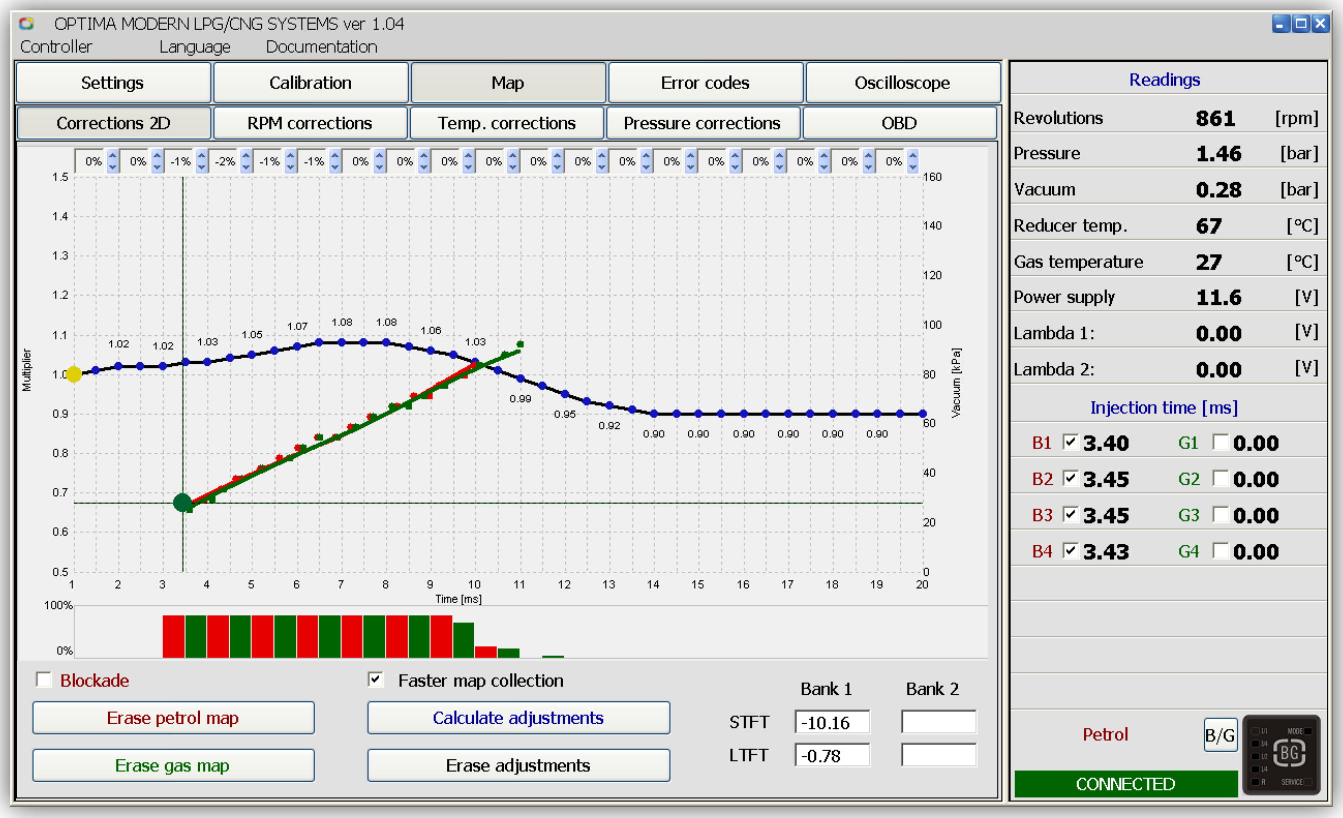


Fig.14

3.2. 2D Map

In this window 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, deviation of approximately 5% is sufficient.

The same road conditions - petrol map and gas map are collected on the same surface, with the same air temperature and humidity.

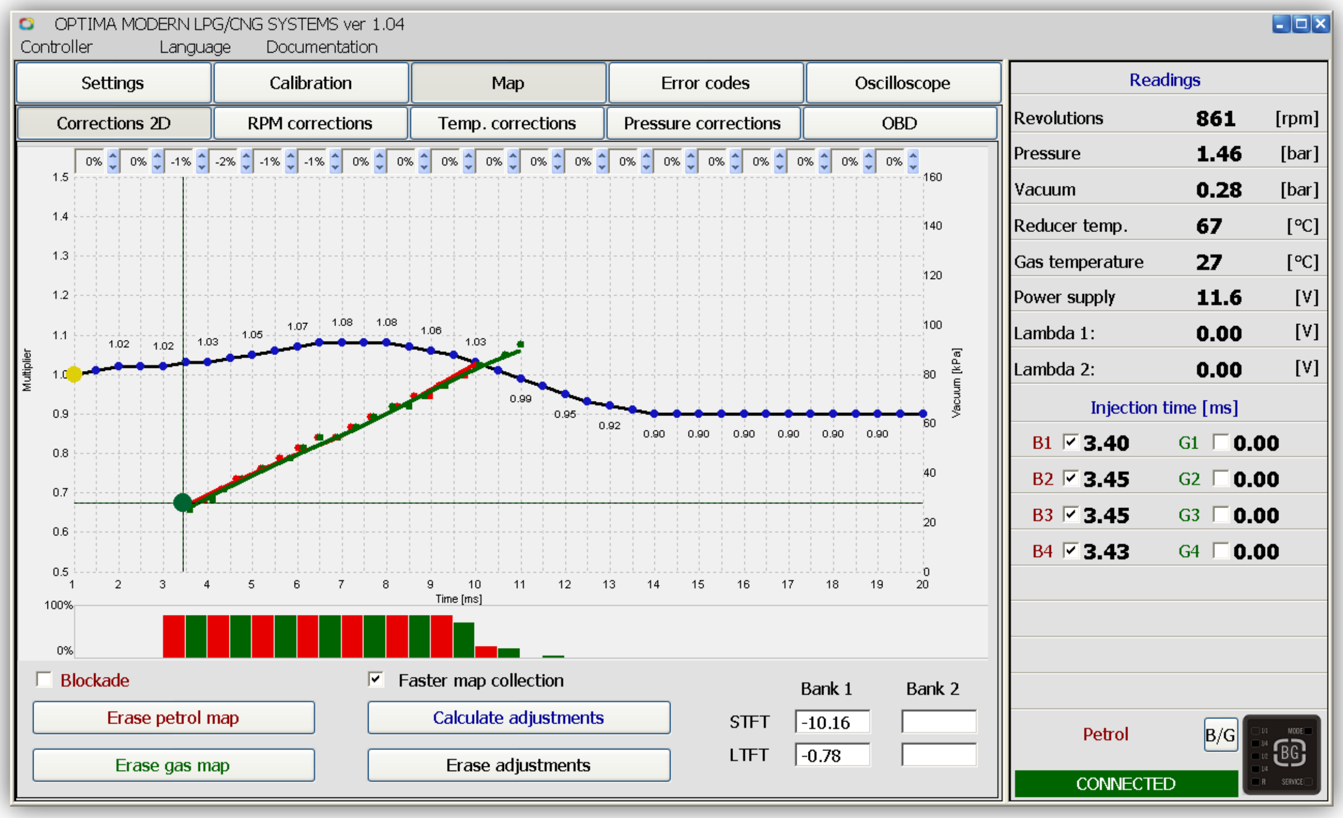


Fig.15

Red line - petrol injection time map (during work on petrol)

Green line - gas injection time map (during work on gas)

Black line with blue points - multiplier correction 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

[Enter] - adds new correction point in the selected spot

[Delete] - deletes selected correction point

Mouse:

Left button - selecting extreme left correction point

Right button - selecting and adding correction point

Bars demonstrate state of collected maps in particular injection times.

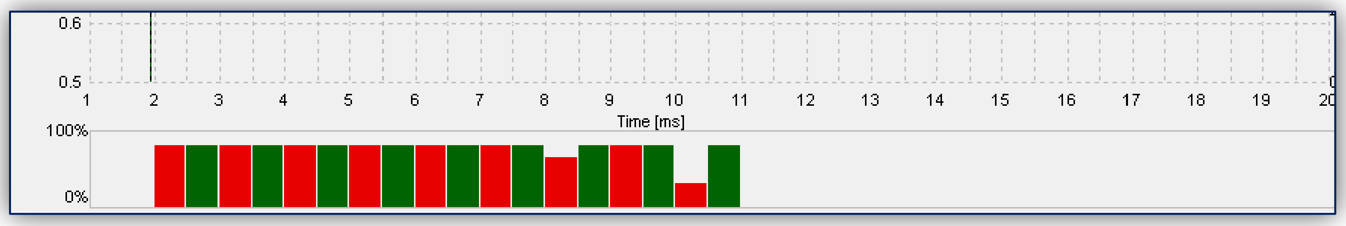


Fig.16

Red bar - demonstrates state of collecting petrol map in given injection time

Green bar - demonstrates state of collecting gas map in given injection time.

Map deviations (checkbox):

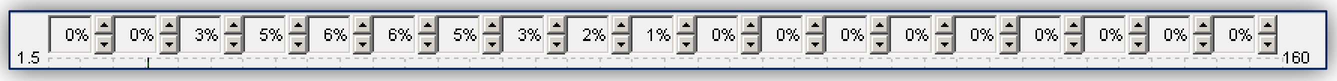


Fig.17

Boxes check multiplier compatibility, depending on deviation of gas map in regards to petrol map, arrows next to each box enable map corrections. 5% or more indicates that in given scope the multiplier should be decreased ▼. -5% and more indicates that the multiplier should be increased ▲.

OBD readings:

The window shows current OBD corrections (option available for OPTIMA Pro-Tec controller with enabled OBD function)

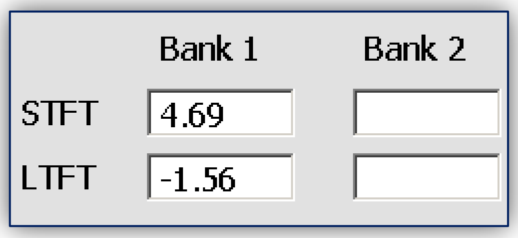


Fig.18

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

Calculate adjustments - enables automatic multiplier calibration (should be used only with properly collected maps)

Erase adjustments - deletes multiplier line to the initial state

3.3. RPM Corrections

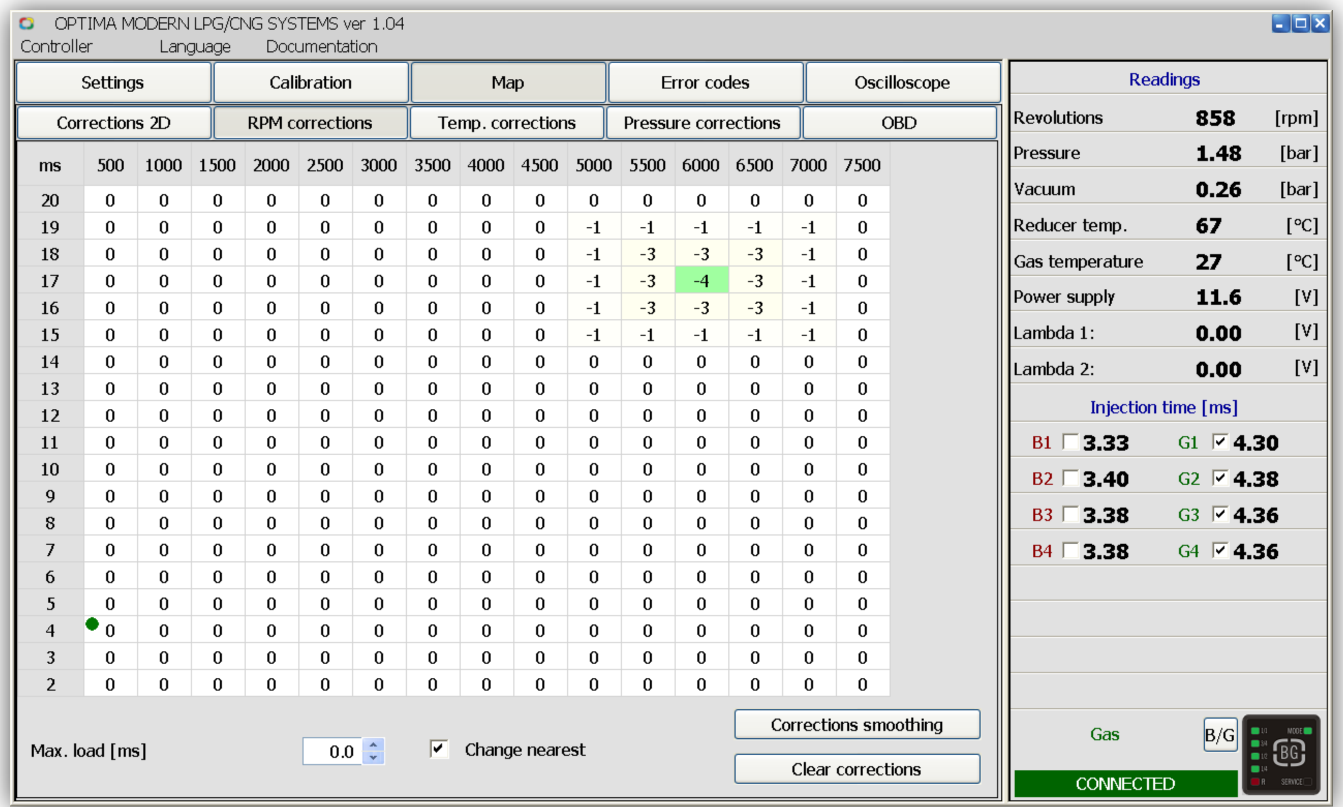


Fig. 19

OPTIMA Eco-Tec and Pro-Tec controllers allow very precise mixture adjustments in every scope of engine load.

Figure above illustrates correction map with revolutions leaning, depending on RPM value and injection time. Green 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 green 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.

'Corrections smoothing' option allows making transitions between nearest areas as smooth as possible.

'Clear corrections' enables erasing current corrections, changing them to the initial state.

3.4. Temperature Corrections

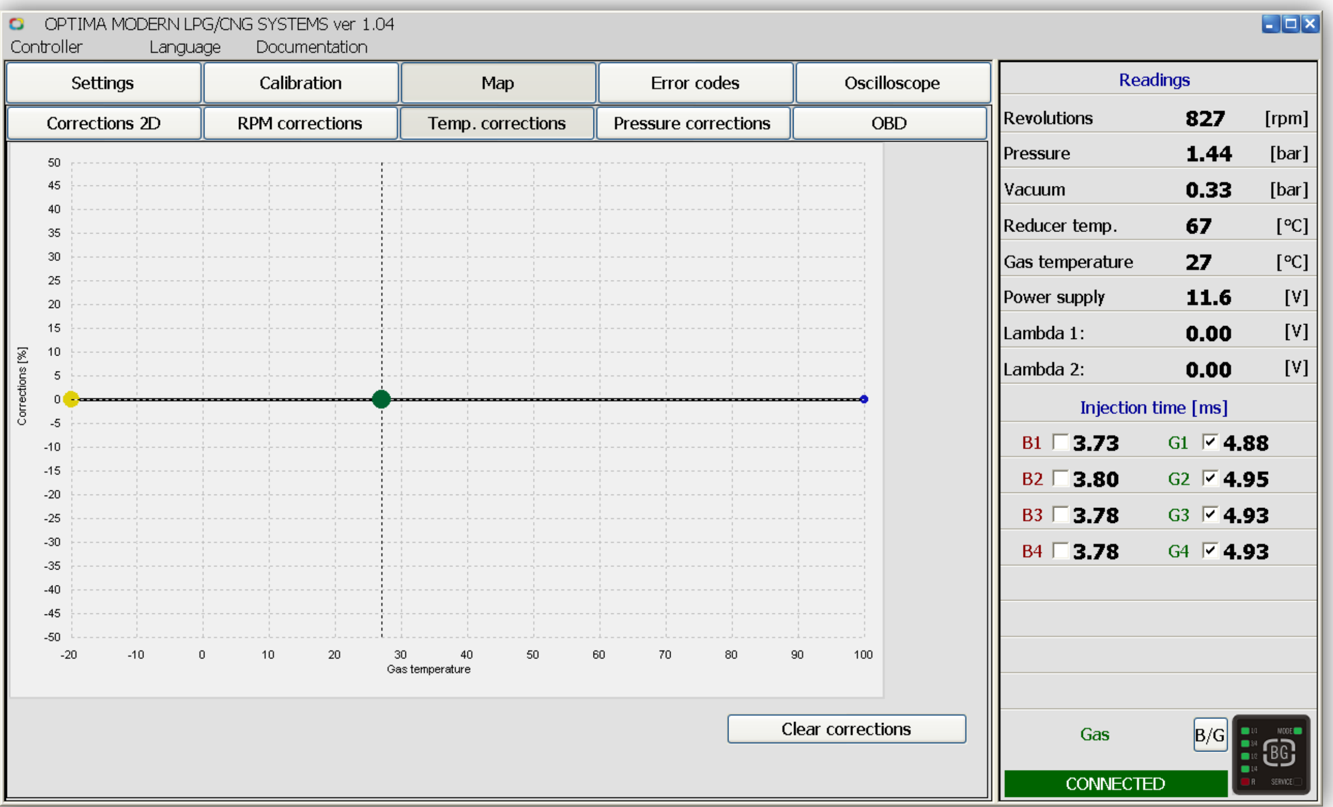


Fig. 20

OPTIMA controller is equipped with temperature correction algorithm. The map demonstrated above allows introducing corrections manually.

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.

3.5. Pressure Corrections

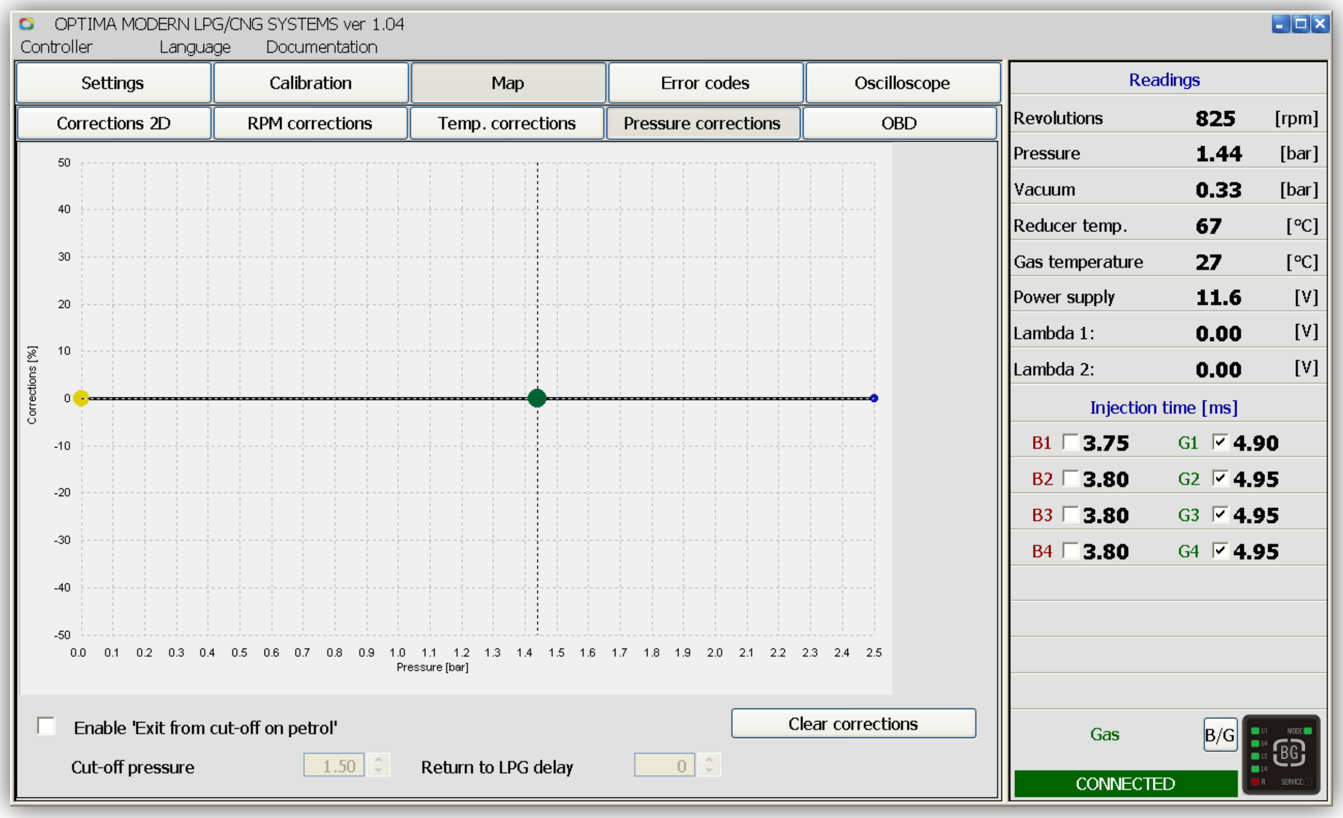


Fig.21

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 manually.

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.

Cut-off:

If during cut-off the pressure rises above value set in 'Cut-off pressure' window, the vehicle will work on petrol for the time set in 'Return to LPG delay' window.

3.6. OBD/CAN (only in OPTIMA Pro-Tec)

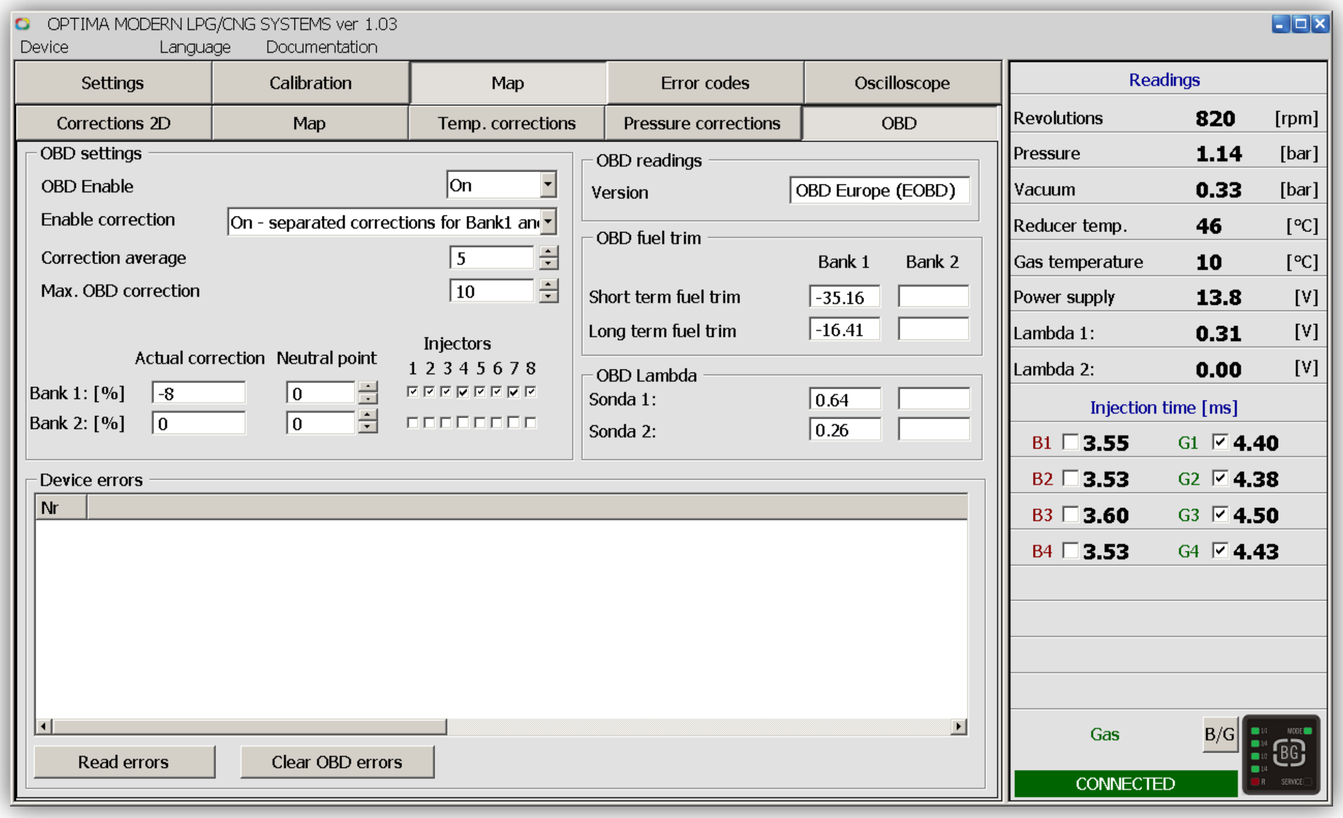


Fig.22

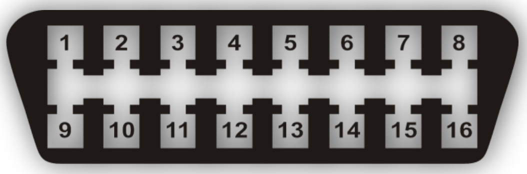


Fig.23

In vehicles fabricated after 2002, there is a possibility of connecting OPTIMA Pro-Tec controller directly to EOBD (EOBD-L pin 7 and optionally EOBD-K pin 15) or CAN (CAN-H pin 6 and CAN-L pin 14) main-line.

Take notice of the position of OBD socket in the vehicle.

Connection to OBD socket should be made according to the connection diagram, after checking communication protocol of OBD socket.

Having connected to OBD system and enabling OBD, there is a possibility of reading OBD version and observing selected parameters of short-term fuel trims (STFT) and long-term fuel trims (LTFT).

With selecting 'Enable correction: On - Average correction from Bank 1 and Bank 2' option, OPTIMA Pro-Tec controller starts automatic adjustment of LPG injection time in such a way that the corrections are on the same level as in case of work on petrol.

'Correction average' option allows setting the time after which the controller should make correction average from OBD system (in most cases the value of 2-5 s. ensures correct functioning of the system).

'Max OBD correction' option allows selecting the scope of gas injection time regulation by OBD system (in most cases it will be 15%).

OPTIMA Pro-Tec controller will control the value of OBD fuel trim and will select gas injection time, so that OBD correctors parameters (STFT and LTFT) are as close to vehicle's factory settings as possible.

'Actual corrections' option shows the percentage added to or deducted from given OBD Bank.

'Neutral Point' option allows selecting the value that will be the starting point for STFT and LTFT corrections (in most cases it will be 0). It can be done on the basis of OBD fuel trim readings during work on petrol.

Fuel trim corrections (STFT and LTFT) are the corrections made currently in the memory of original petrol controller. Their aim is to achieve stoichiometric ratio 14,7:1.

STFT is a temporary correction and shows the value of correction at the current moment of engine work. LTFT is the average of STFT corrections.

Positive values indicate that the mixture is lean and corrections system enriches it by adding petrol injection time.

Negative values indicate that the mixture is rich and corrections system leans it by shortening petrol injection time.

'Bank 1' and 'Bank 2' are applicable to V engines. In such engines it is possible to have separate corrections for one group of engine petrol injectors, e.g. for cylinders no. 1, 2, 3, 4 - Bank 1 and for cylinders no. 5, 6, 7, 8 - Bank 2.

While using OBD corrections system it is crucial to attribute proper injectors to prober Banks (especially in case of 6 or more cylinder vehicles) and to establish neutral point of long- and short-term corrections during work on petrol. OBD corrections system should be launched after setting controller maps.

3.7. Oscilloscope

Shows the signals selected on the left.

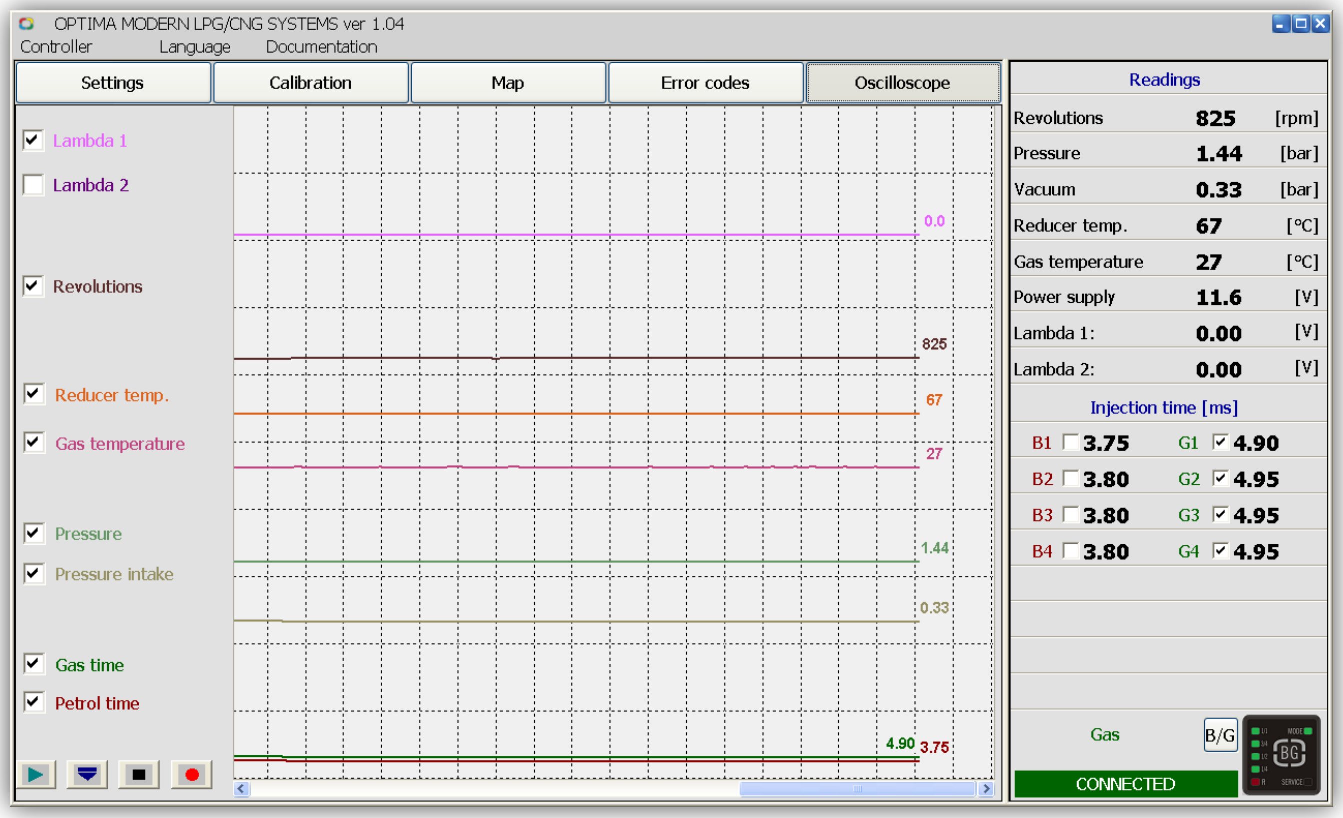


Fig.24

3.8. Errors

Shows errors that occurred during the installation work.

3.9. Readings window

Revolutions - current engine RPM

Pressure - gas pressure in injection rail

Vacuum - vacuum in the engine's intake manifold

Reducer temp. - current temperature of the reducer

Gas temperature - current gas temperature outside of the reducer

Lambda 1 - voltage shown by the first Lambda probe

Lambda - voltage shown by the second Lambda probe

Injection Time [ms]

Shows current petrol and gas injection times.

The injectors that are selected are the currently working ones (deselecting given injector results in switching it off).

It is possible to manually select working gas or petrol injectors or entirely switch off gas and petrol injector for given cylinder.

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)

[B/G] button allows quick switchover into gas.

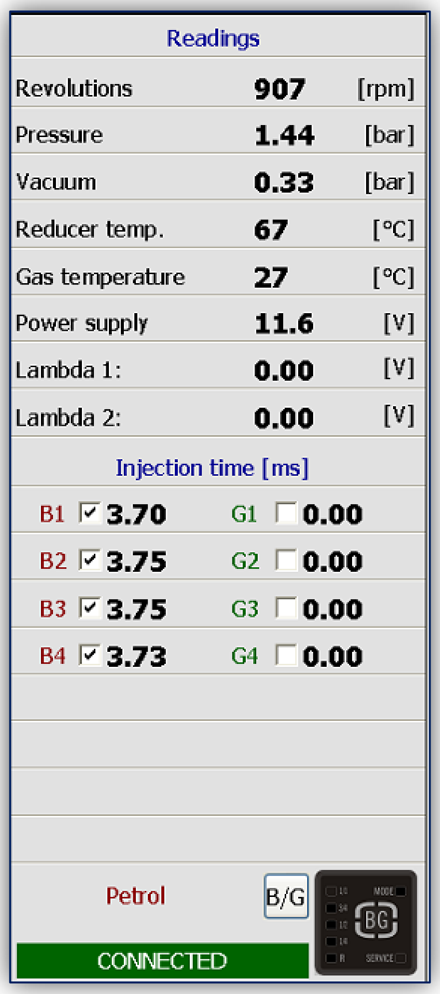


Fig.25

4. Switch

Fig.26

Diodes R, 1/4, 1/2, 3/4, 4/4 - show current gas level in a tank

MODE diode - shows the current mode of gas installation:

Red constant - engine work on petrol supply

Green constant - engine work on gas supply

Green fast flickering - the lack of gas in a tank - engine work on petrol supply

Green slow flickering - engine work on petrol supply, mode of readiness to switch on gas supply

SERVICE diode - reminds the vehicle user about periodical servicing (red constant diode).

[BG] - petrol/gas switch

Sound signals:

One short signal - signals petrol<>gas switchover (optionally)

Two short signals - indicate the shortage of gas in a tank (fast flickering MODE diode)

Three short signals - indicate the necessity of periodical checkup (SERVICE diode)