



*SEQUENTIAL INJECTION
INSTALLING AND TUNING MANUAL*

Version 08.07

VSC Adjusting

I. Before installing, really useful to follow:

1. All of connections should be made with unplugged fuses.
2. All of the connections should be solder and isolated
3. Always remember to choose right nozzle diameter to each engine
4. Always pressure should be set on the level 1,3-1,6 Bar

II. Main information

Equipment needed for proper VSC installation

- PC or notebook
- VSC software
- Interface
- Solder, workshop equipment.

System VSC automatically set all of the needed corrections.

WARNING!!

Manual is an integrated part of the system.

It is prohibited to make any 'improvement' in VSC system, in an order fo losing warranty wrights.
Opening ECU cover gives You approximately 100% chances of loosing warranty rights.

III. Converting with VSC system.

First step: disconnecting the battery

Before starting the conversion it is NECESSARY to disconnect the battery.

Second step: reducer montage

Reducer should be installed according to its instruction, in a place where can be easily controlled, fixed, replaced.

All of the rubber hoses should be installed at least 10cm from exhaust.

Reducers temperature signal, is used for setting the moment of changing over from patrol to gas supply. Reducer's temperature sensor has to be connected in to the ECU harness.

Third step: Injectors montage

Injectors rail should be placed near the manifold and a far as it is possible from high voltage wires. On the end of manifold, really close to the petrol injectors, you have to drill the holes and screw the cooper nozzles in it. The nozzles in manifold have to be connected with injectors rail nozzles by high-pressure rubber pipes. Lengths of those rubber pipes have to be equal. Connect to the rail, wire bunch from gas ECU

INJECTORS RAIL CAN'T BE FITTED UPSIDE-DOWN

Fourth step: Gas filter montage

This filter should be fitted between reducer and injectors rail. Connect BOSCH map sensor. Gas filter should be placed in the place that allows replacing it in the future.

Fifth step: VSC ECU montage

ECU should be placed far from electromagnetic interferences, and far from any possible water leakage.

Sixth step: Connecting the level sensor and buzzer.

You can destroy switch, if you push it too hard.

Buzzer should be put in a place, from where it can be easily heard.

Seventh step: connecting the electrical wiring

1. Montage of fuses cover has to be made according to wiring scheme. WITHOUT FUSES INSIDE
2. Connecting the wires in to the battery:
Red wire (+) gas install. Direct to the battery (+). Red/black wire connect to the electrical installation of the car, in a place where, voltage is turned on after turning on the key.
3. Connect the RPM signal to the coil.
4. Connecting the lambda probe: find the LP signal, isolate it and solder it to ECU wire
5. Connecting the gas EV: Electro Valve installed on Multi Valve on the tank, and the one close to the reducer, connect to the ECU wiring (blue)

Eight step: Electrical connection of the injectors

You should connect the injectors, with the plugs from the ECU, according to the wiring instruction.

Ninth step: Battery supply connection

After checking all of electrical connections, you can connect the battery.

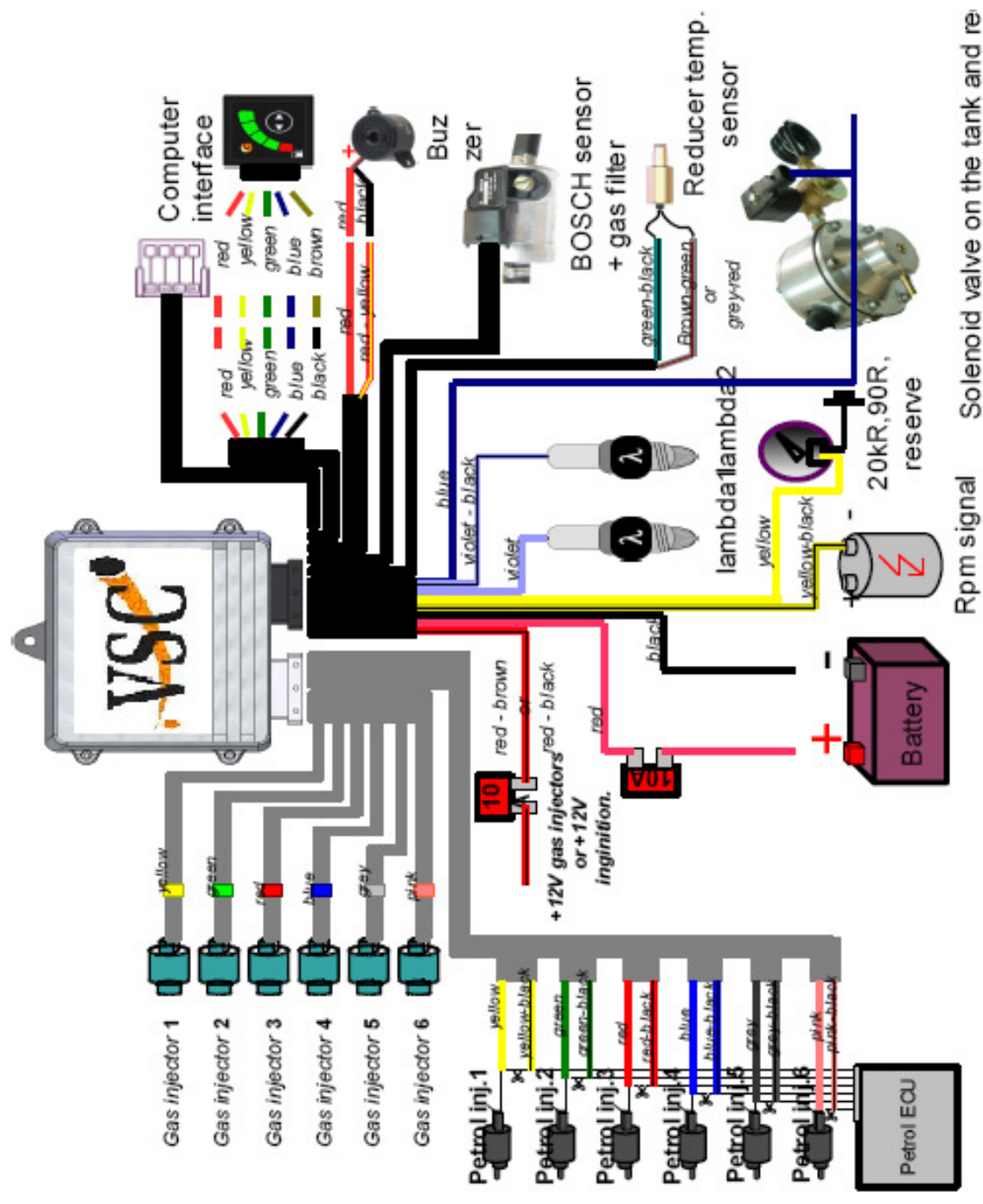
Tenth step: VSC Tuning

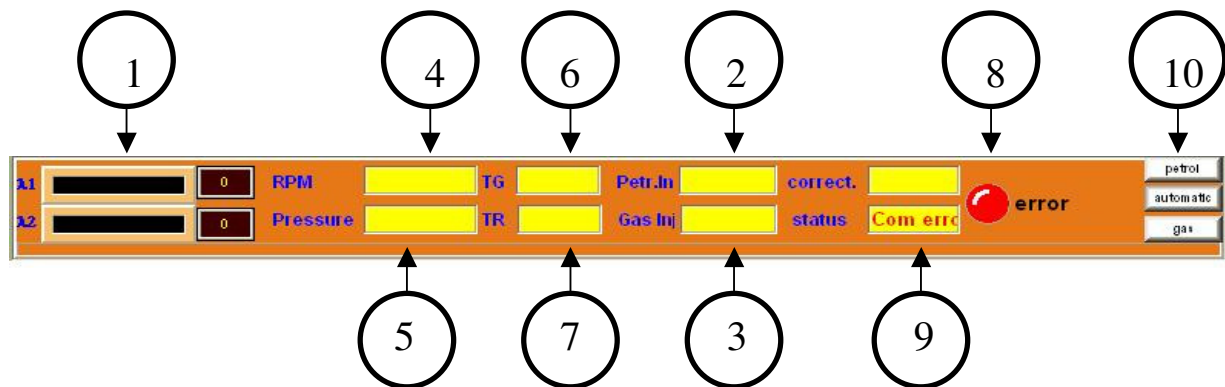
After making all connection, connecting the battery, but before putting all of the fuses on its place, you can start the engine on the petrol. Then fill the tank with gas - LPG

Start the engine, wait till it turns over to LPG, and then check all installation searching for leakage. After that you can start tuning process according to manual.

Technical data:

<i>Operating temperature range</i>	<i>-40°C +125°C</i>
<i>Supply voltage range</i>	<i>9 – 20 VDC</i>
<i>Gas injector's minimum resistance</i>	<i>0,6 Ω</i>
<i>Maximum current In</i>	<i>1 to 8A (depending on the injectors used)</i>
<i>Gas pressure readout</i>	<i>BOSCH Sensor – absolute, filtered FIR readout</i>
<i>Gas temperature readout</i>	<i>BOSCH Sensor 0,5 %</i>
<i>Regulator temperature readout</i>	<i>Mitsubishi 0,5 % temp. sensor</i>
<i>Lambda probes voltage readout (2 channels)</i>	<i>0 to +5 V DC</i>
<i>Communication</i>	<i>Diagnostic interface</i>
<i>Computer's processor</i>	<i>DSP – 130 MHz</i>
<i>Analog Channels</i>	<i>12bit 100kHz</i>
<i>Petrol injectors readout</i>	<i>Basic version operates with injectors controlled by „ground””. A version reading out injectors controlled by „plus” is available.</i>
<i>Inner emulator resistance</i>	<i>100 Ω +/- 10% - It's possible to order a version with different resistance.</i>





1. Lambda probes:

- after selecting a proper lambda probe type one can observe it's changes in the panel. L1 – first probe, L2 – second probe. Connecting the probes is not necessary.

2. Petrol injection time:

- petrol injection time displayed in [ms]

3. Gas injection time:

- Gas injection time displayed in [ms]

4. Engine revolutions:

- engine revolutions/minute [rpm]

5. Gas pressure on the injectors strip:

- It is the absolute pressure of expanded gas from BOSCH sensor

- 1.00 Bar stands for atmospheric pressure

- Recommended pressure by weight is 1.80 – 2.10 Bar, whereas by idle gear 1.2 – 1.6 Bar.

6. Gas temperature:

- temperature measured by BOSCH sensor

7. Regulator temperature:

- regulator current temperature

8. Controller's errors status:

- if during the system operation an error occurs, it will be indicated by the red dot flashing and an „error” inscription. After clicking the dot the error code will appear. .

- the error can be deleted in the program menu (it also deletes old errors)

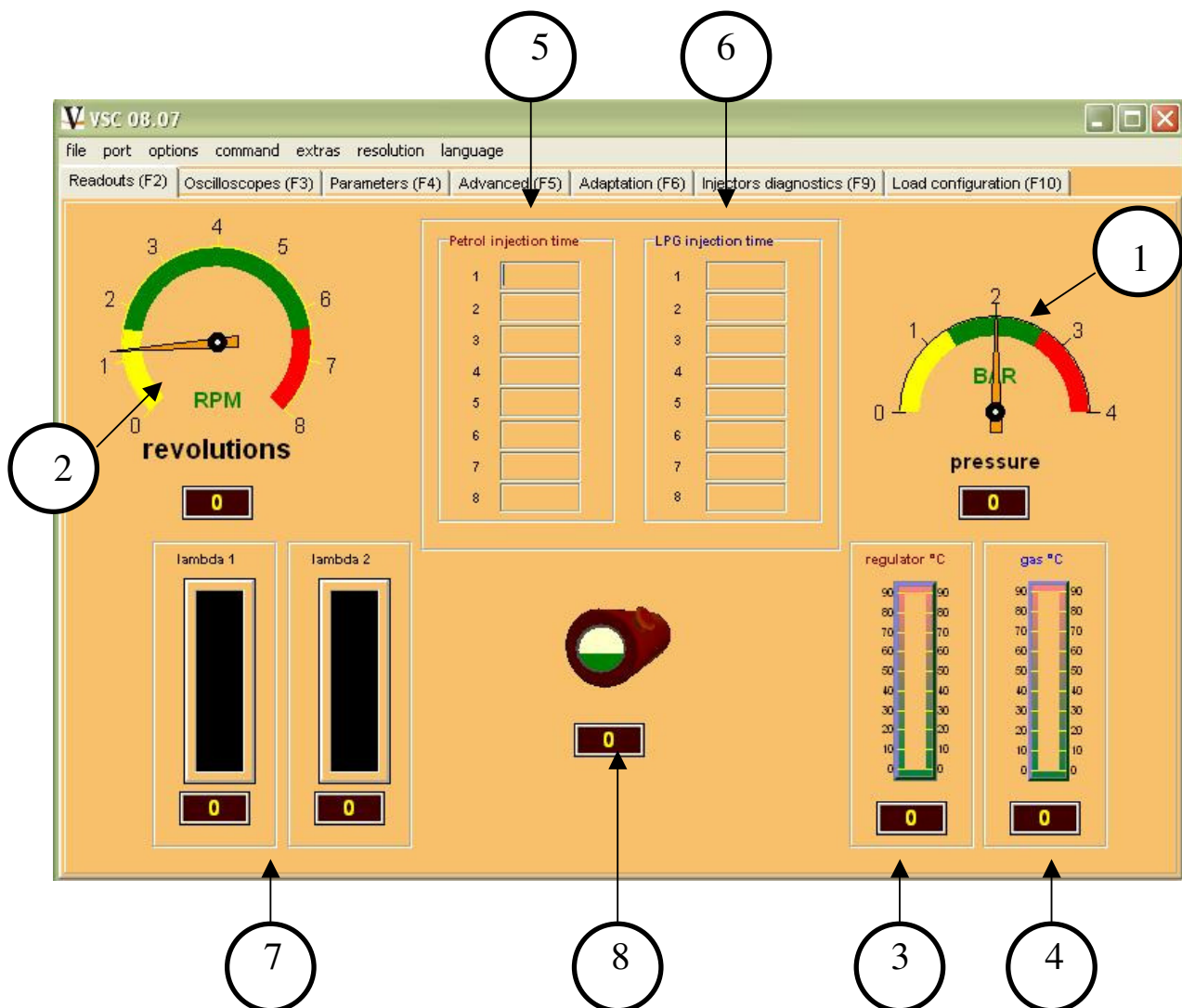
9. System Status:

- informs whether the controller is connected to a PC computer and indicates the current feed status (Petrol / GAS)

10. Feed change buttons:

- by means of the buttons the feed can be changed at any moment to petrol, gas or automatic operation

- feed change works even if switching conditions hadn't been achieved



All values are displayed live !!!

1. Gas Pressure:

- a manometer indicating current gas pressure in the BOSCH sensor
- 1.00 Bar stands for atmospheric pressure
- Recommended pressure by weight is 1.80 – 2.10 Bar, whereas by idle gear 1.2 – 1.6 Bar

2. Engine rpm:

- indicates current engine rpm

3. Regulator temperature:

- a thermometer indicates the regulator temperature graphically and digitally

4. Gas temperature:

- a thermometer indicates gas temperature graphically and digitally

5. Petrol Injection Time:

- petrol injection time in [ms]

6. Gas Injection Time:

- gas injection time in [ms]

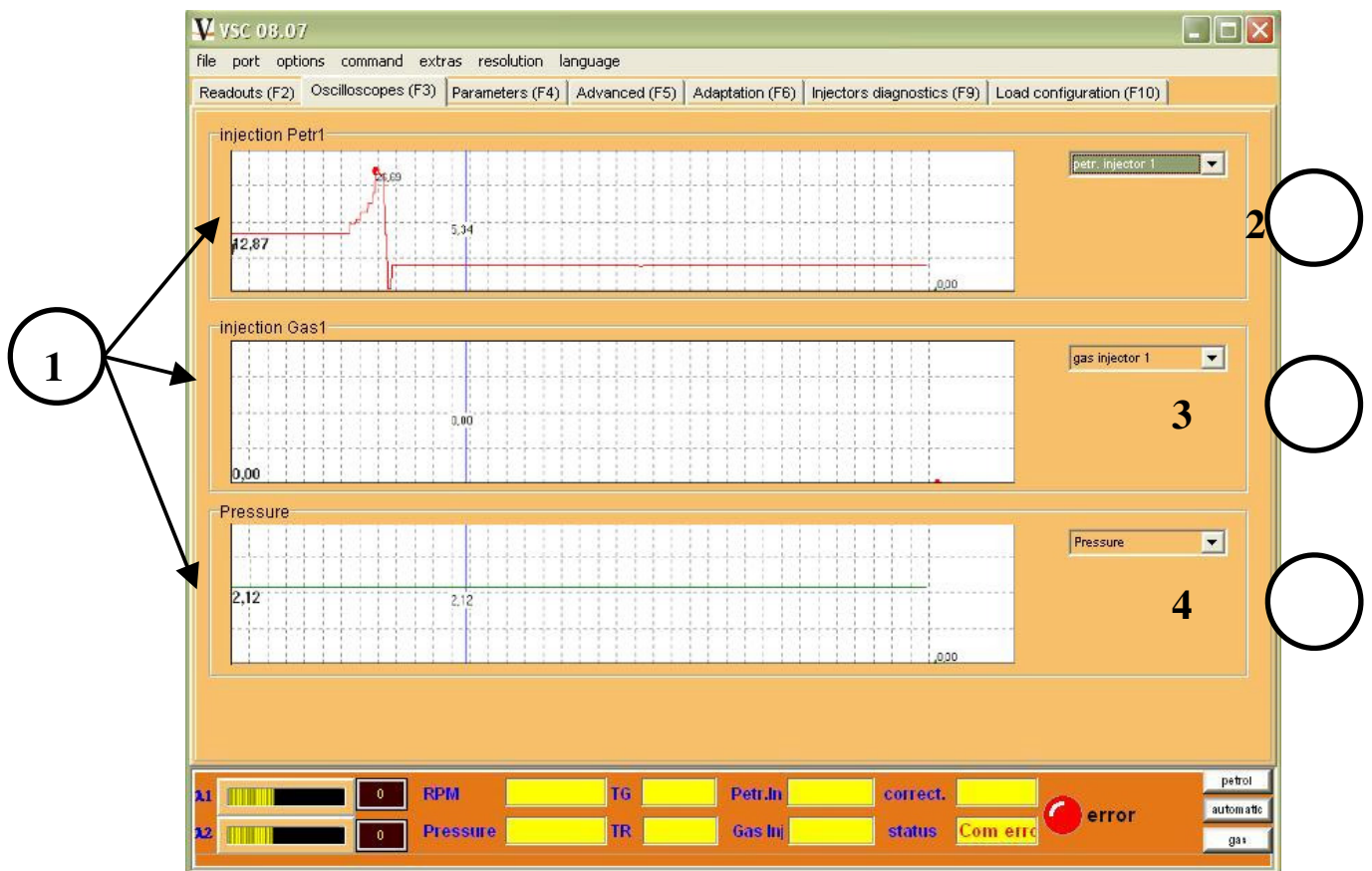
7. Lambda probes readouts:

- allows to observe graphically and digitally voltage from the probes

8. Tank gas level, according to the sensor indication:

- indicates the gas level in the gas tank. Level is the unit – a value variable from 0 to 4096

Oscilloscopes description



1. Oscilloscopes:

- very fast, displaying values live.
- time constant of displaying is 0,015 second
- **green dot** on the oscilloscope's run indicates the minimum recorded value
- **red dot** on the oscilloscope's run indicates the maximum recorded value
- 2. - middle, **blue strip** indicates a value in the middle of the oscilloscope's run
- **current value** is displayed on the oscilloscope's left side

3. Petrol injector display selection:

- petrol injectors times from Inj P1 to Inj P8 can be observed on the first oscilloscope. Each injector is displayed separately.

4. Gas injector display selection:

- gas injectors times from Inj G1 to Inj G8 can be observed on the first oscilloscope. Each injector is displayed separately.

5. Additional parameter display selection:

- The last oscilloscope can display: gas pressure, lambda probes voltage, gas temperature, regulator temperature, rpm, and corrections

Parameters

1	Injector type	Valtek red	Engine maximum rpm	6500	6
2	ignition system type	4 cyl.	Reserve glass refreshing	10,0	10
14	petrol injection type	Half-sequential	Reserve glass type	Own definition	9
3	Switching to gas temperature	30	Lambda Probe 1	off	11
4	Petrol/Gas switch over mode	Ascending rpm	Lambda Probe 2	off	12
4	Switching to gas rpm	1500	Switching engine maximum rpm on/off for gas feed. After exceeding the set rpm threshold engine will be switched to petrol feed and after rpm drop, the engine will be switched back to gas feed.		
5	Fuels overlap - nr of common cycles	0			
7	Gas mixture enrichment	+15			
8	Idle gear injection time correction	0,05			
15	Engine maximum rpm	On			
16	Turbo	No turbine			
13					

11	0	RPM	TG	Petr.Ju	correct.	petrol
12	0	Pressure	TR	Gas Inj	status	automatic
						gas

Manually entered parameters are saved to the controller after exiting the parameter or after pressing the [Enter] key.

- Parameters selected with a mouse (e.g. Injector Type) are saved to the controller after selecting the parameter.

1. Injector type:

- it is the field of selecting the injector type used
- select the injector used from the list
- Injector change modifies **Injector Parameters** in *advanced settings*
- alternatively select an available injector from the list and then select injector's **Own Definition**, what allows to modify **Injector Parameters** in *advanced settings*
- **Attention !!!! If the injector is available on the list, do not modify it's settings, because it may cause the system's incorrect operation!!!!!!**

2. Ignition System Type:

- select the ignition system type in such a way, so that the displayed engine rpm are equal to actual ones

3. Switching to gas temperature:

- regulator temperature, at which switching to gas feed is possible.
- the temperature should not be set below 30 °C

4. Switching to gas revolutions:

- rpm, at which switching to gas feed takes place
- Switching may take place at ascending or descending revolutions

5. Fuels overlap – number of common cycles:

- it represents fuels overlap in cycles, that is common injections of gas and petrol
- it's the number of petrol and gas common injections until the injectors emulator switches on, usually it shouldn't exceed 12 common cycles
- usual settings: 4cyl. – 4 cycles, 6cyl. - 6 cycles

6. Engine Maximum Rpm:

- a very rarely used option, it allows to switch to petrol feed after reaching maximum rpm

7. LPG mixture enrichment:

- gas mixture enrichment at weight is the main parameter allowing to regulate gas dosage to cylinders
- enrichment is automatically selected during **autoadaptation**
- the parameter's value may be negative, however if it is too low, e.g. below **-10 %** it means that **the injectors nozzles have been selected incorrectly**, and they should be changed to **smaller ones**
- whereas if the parameter exceeds **+40 %**, **the injectors nozzles should be changed to bigger ones**, because the car may have too little **power**.
- the easiest way, without autoadaptation, is to select the enrichment in the experimental way: check how the car rpm climb up at various settings and choose the best one.
- if the „**check engine**” lights because of the mixture (e.g. too lean or too rich), adjust it with this particular parameter – if the map is not used
- after changing **the Enrichment** check if the displacement is set correctly !!!!!!!

8. Enriching/straitening the mixture on idle gear (displacement):

- displacement means **enriching/straitening** the mixture **on idle gear** (without weight)
- displacement is selected automatically during **autoadaptation**
- it is the second main controller's parameter. The rule for setting this parameter: make the petrol injection time during gas feed very similar to the petrol injection time during petrol feed . It will prevent the on-board computer from displaying errors on idle gear.
- before setting the displacement, the previous parameter - **7. - LPG mixture enrichment** must be set correctly first.
- manual setting:

Switch to petrol feed, wait a while, then write down petrol injection time **Tp1**, then switch to gas feed and write down petrol injection time **Tp2**.

$Displacement = Tp2 - Tp1$.

This is the equation for calculating the displacement

- always try to select *the injectors nozzles* and *pressure on idle gear* in such a way, so that the displacement is a positive value

9. Reserve Glass Type:

- gas level indicator type selection. Own definition is possible, as well as changing the thresholds values of selected glass

10. Reserve refreshing:

- this parameter indicates how often (in seconds) the reserve glass level is being refreshed
- the bigger the inertness of the multivalve is, the higher value this parameter should have

11. Lambda Probe 1:

- lambda probe selection
- in case of lack of probe select: *Off*

12. Lambda Probe 2:

- lambda probe selection
- in case of lack of probe select: *Off*

13. Handy parameter description

- displays a short description of each parameter in the program after selecting a specific parameter

14. Petrol injection system type.

- select a proper one, although it is not necessary

15. Engine maximum rpm

- switching engine maximum rpm on/off for gas feed. After exceeding the set rpm threshold engine will be switched to petrol feed and after rpm drop, the engine will be switched back to gas feed.

16. Turbo

- turn it on when the car has a turbine

Advanced Parameters Description:

1	Regulator underpressure	Disconnected	rpm delta	No descend. rev.	11
3	Pressure of switching back to petrol	1,40	Rpm signal power	2	12
4	Delay of switching back to petrol	0,25	INJ signal power	2	13
5	Injector pre-heating	Off	Advanced corrections		2
5	Pre-heating type	Average Pre-hea	Correction on injector		14
6	Switching off due to low gas temp.	No	The delay of switching back to petrol feed after gas pressure drop [sec]		
7	Switching off due to low regulator temp.	No			
8	Delay of switching to gas	2,5			
9	Pressure filtering	Normal			
10	Switching over sound	On			

X1 0 RPM TG Petr.In correct.

X2 0 Pressure TR Gas Inj status Com err

petrol

automatic

gas

1. Regulator Underpressure:

- the system may operate either with the underpressure connected or disconnected
- it is recommended always to connect the underpressure to the regulator !! It allows to achieve lower gas pressure in the injectors' strip on idle gear.
- this parameter is set during autoadaptation

2. Advanced corrections.

- switching on a map which allows to enrich the mixture at various engine's run ranges.

3. Pressure of Switching Back to Pertol:

- pressure, below which the controller will switch back from gas feed to petrol feed
- this parameter should be kept above the atmospheric pressure, which is 1 Bar
- do not wxceed 1,5 Bar
- this parameter is set during autoadaptation

4. Delay of Switching Back to Pertol:

- time, after which the contoller will switch back from gas feed to petrol feed after detecting too low pressure on the injectors strip
- this parameter is important by cars with a turbine, where it should be extended
- 1 second is a standard

5. Injector pre-heating:

- this option allows to pre-heat gas injectors before switching to gas feed
- works if the regulator temperature is below 5°C
- the pre-heating is done by short impulses of gas injectors opening and lasts for several dozen seconds or until the regulator reaches 5°C
- this option is initially off

6. Switching off due to low gas temperature:

- if this option is set, car feed will be switched back from gas to petrol when the gas temperature drops below the pre-set one.
- it prevents gas in the regulator from not vaporizing

7. Switching off due to low regulator temperature

- if this option is set, car feed will be switched back from gas to petrol feed when the regulator temperature drops below the pre-set one.
- it prevents the regulator from freezing

8. Delay of switching to gas:

- time from switching on coils on the tank and regulator to switching on gas injectors. It may be used as delay of switching to gas feed
- it is the time from switching on the tank's multivalve and the regulator's solenoid valve to switching on the injectors emulation and starting the run of gas injectors

9. Pressure filtering:

- sensitivity of BOSCH sensor filtering
- initially the filtering is set to Normal
- if the underpressure is on this parameter may be set to faster filtering

10. Switching the sound signal on/off:

- the buzzer is active or mute.

11. Rpm Delta.

- if the rpm descends by the set number, car feed will be switched to gas (with the option descending rpm selected)

12. Rpm Signal Power:

- if there are interferences on the engine rpm signal, this function allows to eliminate them
- the higher the parameter value, the stronger the filtering
- the filtering is internally limited to 500 units, still it is not recommended to exceed 100
- the parameter is initially set on 2

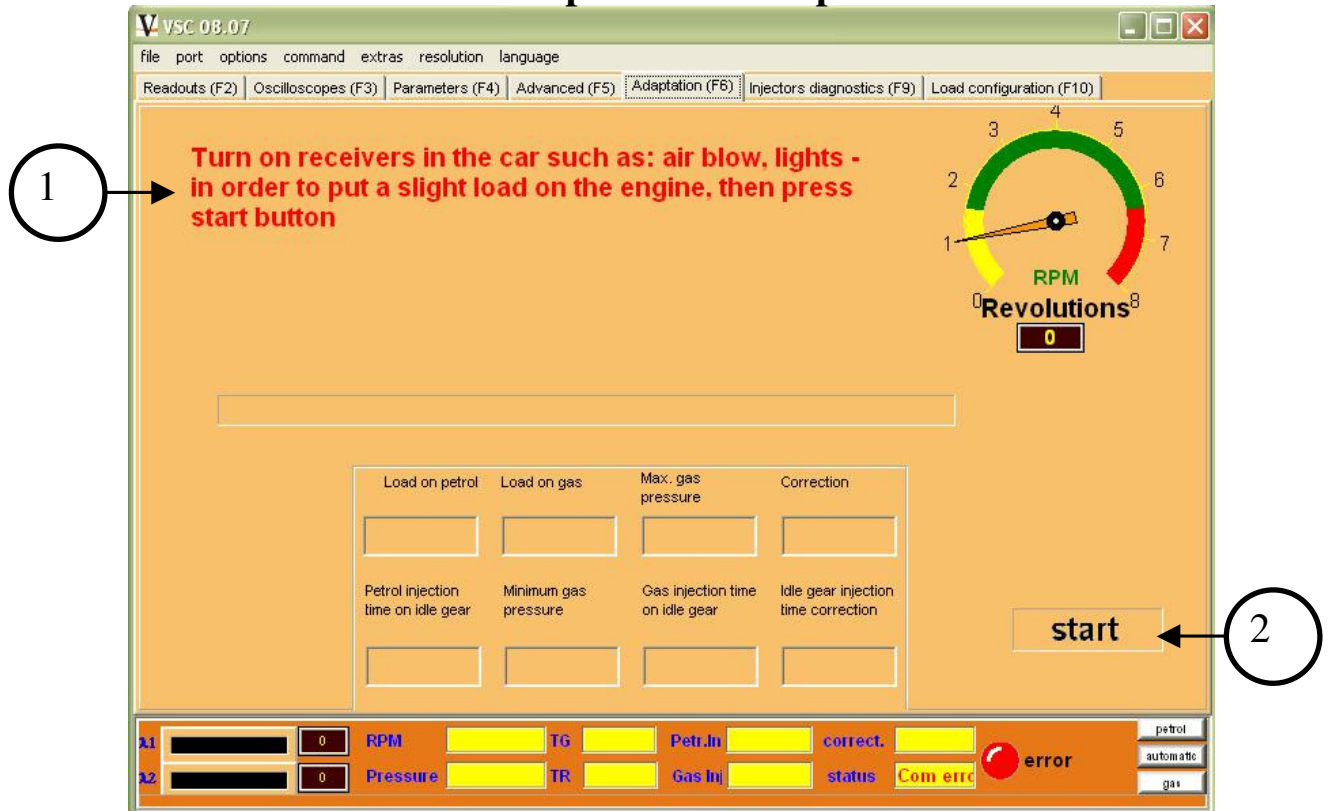
13. INJ Signal Power:

- if there are interferences on the injections time signal, this function allows to eliminate them
- the higher the parameter value, the stronger the filtering
- the filtering is internally limited to 500 units, still it is not recommended to exceed 100
- the parameter is initially set on 50

14. Corrections on the injector:

- this parameter works identically as **Displacement** except that it can be applied to each cylinder separately
- the parameter applies to engine idle gear
- the parameter is useful by V – engines

Autoadaptation Description:



1. Commands field:

- on this field the commands for autoadaptation will be displayed
- follow the commands !!!!

2. Autoadaptation Start Button:

- clicking the button starts the autoadaptation process. Once started, the autoadaptation should not be aborted until it's finished !!!!

Injector's Parameters Description after chosing injector's own definition

1
2
3
4
5

Injectors setting

-
□
✕

Gas injection's maximum time	35
Gas injection's minimum opening	1,30
Injection's full opening	4,00
Percentage sustain	35
Gas inj. switching on delay to petrol	2,00

OK

Cancel

1. Gas Injection Maximum Time:

- Maximum time that a gas injector is able to generate
- initially set on 30 [ms]

2. Gas Injection Minimum Opening:

- minimum time, during which a gas injector opens , if a petrol injection opening is detected
- this parameter depends on the injector's speed and is modified by injector selection field

3. Injection full opening:

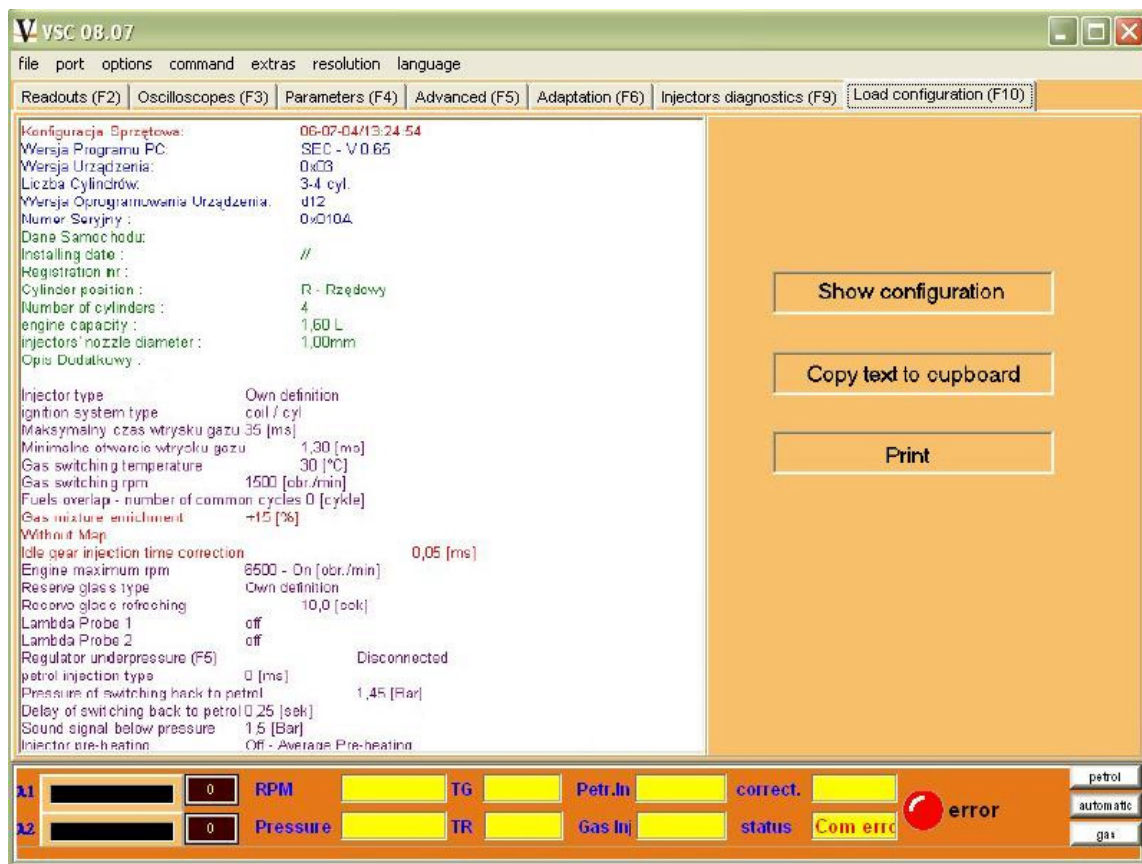
- the time of full current impulse which opens the gas injector.
- do not exceed the range from 2 to 8 [ms], because it may lead to injectors' coils damage or free injection opening !!!!!!!!!!!!!!!!!!!!!!!

4. Percentage sustain:

- percentage current of injector's sustain
- this parameter depends on the injector's resistance and is modified by injector selection field
- keep this parameter within the range from 30 % with low resistances (e.g. 1.2Ω) to 60 % with high resistances (np. 10Ω)

5. Delay of Switching On LPG injection to Petrol:

- it is the time in [ms] by which switching on gas injection will be delayed comparing to petrol injection
- 2 [ms] is a standard value
- this parameter is modified by injector selection field



1

2

3

1. Show Configuration:

- clicking the button once will display the configuration in the main field

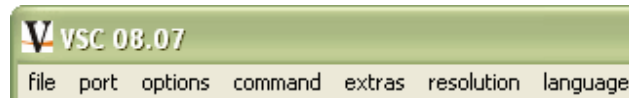
2. Copy Text to Cupboard:

- clicking the button will copy the configuration in a text form to the system's cupboard, so that it can be pasted to a text editor or another program later

3. PRINT:

- prints the configuration

Program Menu Description



FILE

1. **Load Parameters** – loads previously saved parameters from a file.
2. **Save Parameters** – saves parameters to a file.

PORT

1. **Autodetection** – automatically detects the computer port, to which the interface has been connected
2. **Number** of the port, in which the controller's presence has been detected.

OPTIONS

1. **Readouts** – displaying the readouts tab in the program
2. **Oscilloscopes** – displaying the oscilloscopes tab in the program
3. **Parameters** – displaying the parameters tab in the program
4. **Advanced** – displaying the advanced parameters tab in the program
5. **Autoadaptation** – displaying the autoadaptation tab in the program
6. **Map 1** – map enabling advanced functions of enriching/straitening the mixture.
7. **Map Inj** – weight map enabling to enrich/straiten the mixture.
8. **Injectors diagnosis** – tab enabling to switch off gas injectors in order to check their operating
9. **Configuration readout** – notepad tab.

COMMAND

1. Feed change after choosing petrol/automatic/gas option.
2. Controller errors readout.
3. Controller errors erasure.

EXTRAS

1. Controller's operating time readout.
2. Car's data from the controller readout
3. Saving car's data to the controller (for example when You change the nozzles).
4. Reset the controller to initial settings

Installing directions:

1. All the connections should be made with fuses taken out.
2. All the connections must be properly soldered and sealed !!
3. Crew members responsible for installing and tuning should be trained for the job.
4. The injectors' nozzles should always be chosen properly, according to the car's power!!
 1. In case of too large nozzles, the car's consumption may be too high, and the mixture may be too rich
 2. In case of too small nozzles, the car's power may be too low and the mixture may be not rich enough
5. Pressure should always be chosen properly on low revolutions, with underpressure connected to the regulator – recommended pressure is 1,4 Bar.