

# Software Documentation for the Autotronics Gas Injection Controller



## Introduction

We are pleased to present our new product – Autotronics Sequential Gas Injection Controller.

It has been generally designed for application in cars with modern OBD2 systems for fuel delivery diagnosis. However, it may be also installed in older car models.

Due to its modern construction and efficient processor, it gives the possibility to meet strict standards concerning exhaust fumes emission while maintaining the drive dynamics similar to that when petrol is used.

Autotronics is a new concept and unique in the market sequential Gas Injection Controller with communication mode through digital controller area network CAN. The new Autotronics controller has therefore a possibility of petrol computer OBD ECU diagnostics from the gas controller software level. The advantage of this controller is the ability of an ideal gas calibration for petrol, continuous OBD setting monitoring and its automatic correction to the level specified by EURO exhaust fumes emission standards.

## **New Controller Abilities:**

- Can be connected to the controller area network CAN (in cars manufactured after the year 2003.)
- Single emulators with a function for testing gas injectors
- Lambda probe emulator
- Fast signal processor 120MHz.
- Automatic detection of petrol injection type and its optional configuration
- Compatible with various resistance temperature sensors /2.2, 4,7, 6.8, 10 kOhm/
- Connection and read out for two lambda probes separately
- Maximum revolution function for gas
- Continuous buzzer signal function with new programmable changeover switch
- Possible setting of cut off exit for petrol
- Enlarged scale of entering the corrections on the correction map up to +/- 50%
- Correction charts separate for two parts of V motors
- Two scales for correction map for work of petrol injectors, fully changed scale /ms/RPM/
- Automatic corrections using original OBD trims from petrol ECU

## **New Software Abilities:**

- Reading apparatus of the OBD system performing on the CAN, with the function of checking basic diagnostic data, settings, loading in and deleting OBD errors.
- Automatic OBD corrections separate for each data Banks. / BANK 1, BANK 2 /
- Advanced digital filtration of all input signals.
- Ability for data collection for mapping during driving without PC requirement.
- Mapping using original OBD trims
- Automatic detection of petrol injectors controlling type (sequence / semi sequence / non-sequence)
- Three types of controller calibration
- New algorithms of calibration (separate calibration for each cylinder)
- New algorithms for gas injectors warm-up
- New algorithms for all level sensor type
- New algorithms protecting from engine stalling at CUT-OFF exit for cars with supercharging.
- New algorithms allowing servicing vehicles with a problem of permanent petrol injection at high engine speed.
- Intuitive graphic interface, indicating interchangeably the state of each emulator and gas injectors for various control types.
- Tools enabling testing during performance of each emulator and gas injector, separately for each cylinder.
- Adjustable cut-off parameters on petrol transferred to gas (full and not full cut off)
- Automatic selection of temperature sensor depending of injector type

# FIRST STEPS

## ACTIONS SHOULD BE MADE DURING THE FIRST SYSTEM CALIBRATION

During the installation of Autotronics Sequential Gas Injection System it is suggested for the wire set to point downwards. It is also suggested that it should be placed in such a way to avoid the negative impact of high temperature and humidity please check all the connections are proper and correct.

\* **check and drill nozzles for correct size**, initial selection of nozzle size is in Settings window, pay attention that initial nozzle size selection is made for working gas pressure for about 100kPa. In any case, higher pressure set on the reducer determines smaller nozzle size. Some type of gas injectors like VALTEK, RAIL and similar, before installing in car, require plunger settings with special rail calibrator. Standard plunger way should be set for about 0,55 mm. Calibration is needed for checking the piston stroke which must be equal for all of the cylinders.

For shorter times of injection below 2,5 ms it is recommended to use faster injectors.

\* **start application** Autotronics

\* **select RPM source**: injectors source may no need to connect brown wire as RPM signal

\* **choose correct injector type** from the list, temperature sensor will be chosen automatically

\* **select correct level sensor type** you have installed from the level sensor list

\* **check correctness of all readings**: RPM signal, working pressure, temperatures etc. When needed make changes.

We recommend setting working pressure of reducer at 1.0-1.2 bar for LPG fuel and 1.5-2.0 bar for CNG

\* After setting basic parameters you can start autocalibration on idle

### There are three types of autocalibration on idle:

\* **autocalibration**: in one time all the cylinders are switch off and on, this autocalibration is available for all the petrol injection system (full group, semi seq., full seq.) During time when calibration happens, system communicates and shows recommendations after finishing calibration on idle. We recommend creating map during the driving. Procedure how to make it you can find in below text.

\* **creating map** should be started from driving on petrol, so long so that all the points for petrol are collected. Then switch to gas and repeat process while driving on gas. When it's also finished, then press STOP button and CALCULATE CORRECTIONS button. Both maps are collecting on same diagram so all the time you can see the progress of this functions. When small corrections are needed, there is possibility to make them manually. Procedure, how, to make it, is in text below.

For creating MAP, it is recommended to use rather low traveling speed than top speed but using whole range of vacuum.

**It is also possible to create MAP using original OBD trims from petrol ECU. In this case MAP is collected in MAP window as a percentage map. Period of collecting MAP in this way is to drive till the time small cells are marked in red or close to the red colour. It means that system makes no changes and values are stable with changes.**

In cars with CAN BUS line we recommend switching on automatic corrections from OBD trims. In V type engines separately for both part of engines. For more details see chapter OBD.

This function should be switched on the end of all settings in application. For V type engines with two banks data is obviously needed to evaluate which gas cylinders are on which data Bank.

# Readings

After starting, the software shows the motor working parameters in real time, registered by the gas ECU. In Figures as well as in the form of Bar Graphs.

These are the following parameters:

- Motor Revolutions,
- Injection times both petrol and gas
- Temperature of the reducer,
- Temperature of the gas stream,
- Gas Pressure, MAP Pressure
- Signal of Lambda probe,

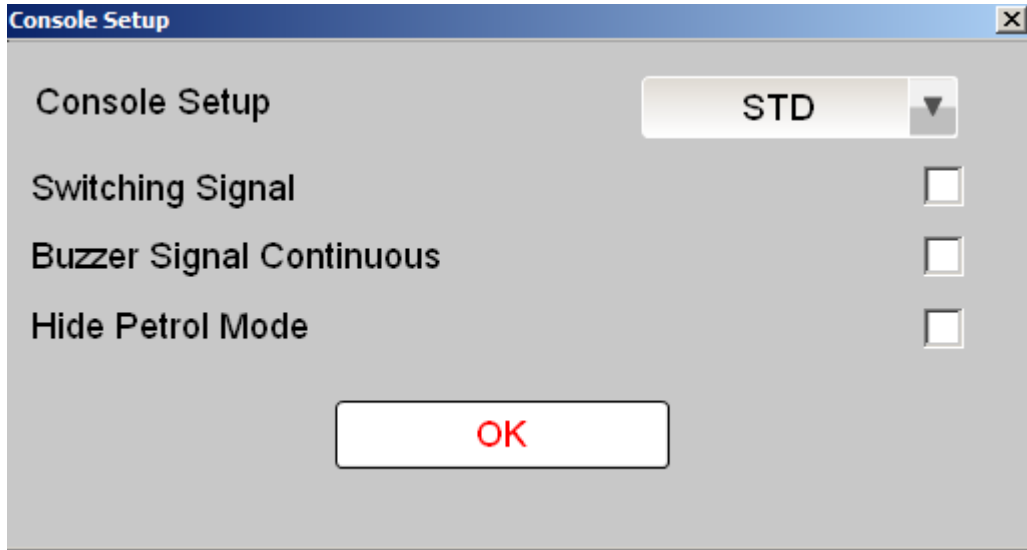
In the left bottom corner there is bitmap of switch for turning the controller into petrol, gas and setting for AUTO mode, meaning automatic switching into gas upon fulfilling relevant conditions (temperature and revolutions).

The screenshot displays the Autotronics software interface with the following sections:

- Base Settings:** Includes fields for RPM, Select, Ratio, Fuel Type, Engine Type, and Injector Type. On the right, there are dropdown menus for Coil (x 1), CNG, Standard, and Valtek 3 Ohm.
- Fuel Change Setup:** Includes fields for Fuel Change Wait Time (5 [sec]), Fuel Change Temp (35 [°C]), Fuel Change RPM (1200 [rpm]), and Sequential Switching Delay (1.0 [sec]).
- Fuel Meter Setup:** Includes a Fuel Meter Value field (0.08V [V]) and a table for fuel levels.
- Real-time Readings:** A table at the bottom shows live data for MAP (0.43 [bar]), RPM (1001 [rpm]), GAS Press (0.55 [bar]), Water Temp (41 [°C]), GAS Temp (24 [°C]), PET Time (2.98 [ms]), GAS Time (0.00 [ms]), Oxy sensor (0.69 [V]), and Fuel Trim (0.00 [ms]).

Level	1	2	3	4	5	Direction
Value[V]	Empty	4.00V	3.18V	2.18V	1.00V	Full

Double click on Switch Icon shows us some settings related to Switch behaviour:



- **Console setup** gives us choice of switch type: STD is default, but ECU is ready to use extended switch with OLED display and touch sense buttons.
- **Switching signal** – if enabled every switch between fuel will be confirmed with buzzer beep. From petrol to gas – one beep, from gas to petrol – two beeps.
- **Buzzer signal continuous** – when switching to petrol due end of tank we can setup running buzzer signal till pressing switch button
- **Hide petrol mode** – if enabled will show gas mode on switch even if gas ECU is working on petrol due to active some algorithms (e.g. Change higher RPM mode)

**Note that when PC software is connected buzzer is inactive. Buzzer works only when PC software is off.**

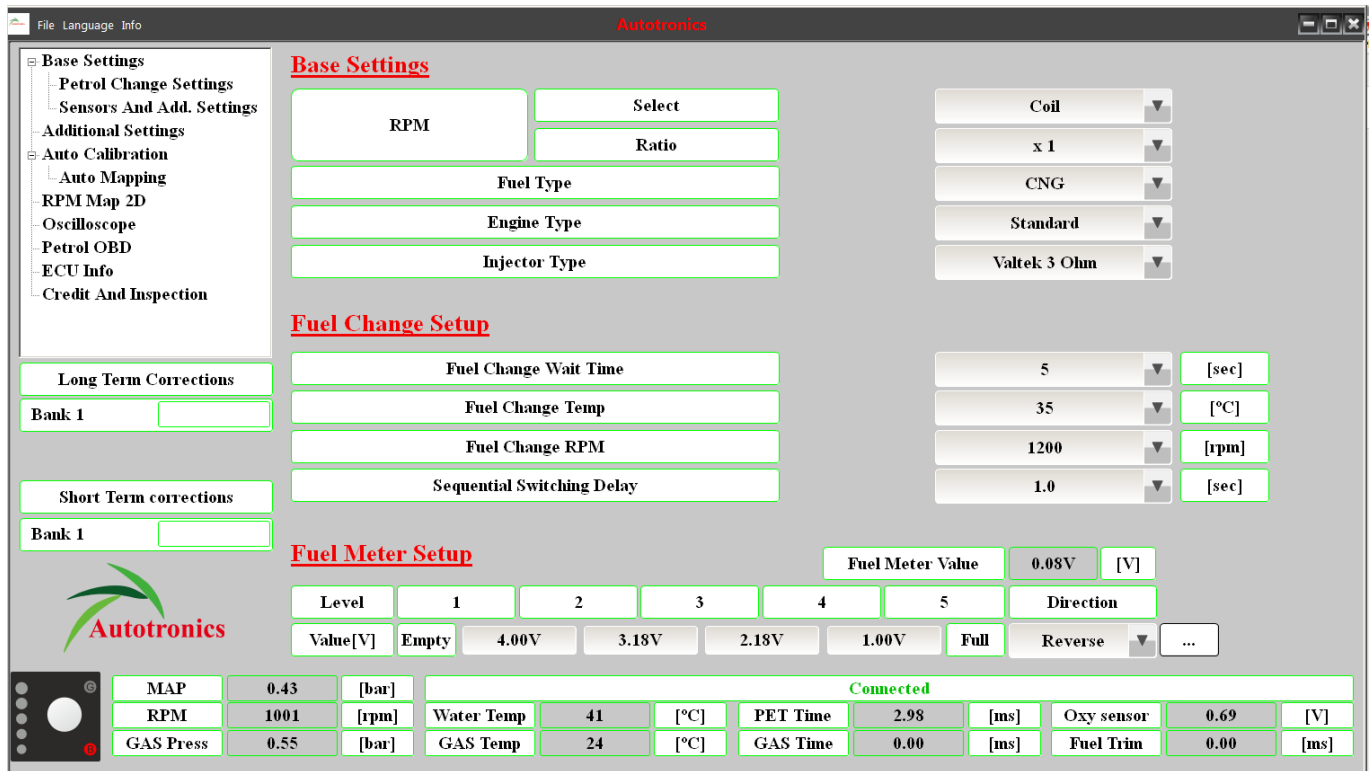
#### **NOTE:**

Before installing injector rails type VALTEK, RAIL or similar type, a pre-calibration should be made for checking piston movement.

Piston movement on the rail should be the same for each cylinder. For shorter petrol injection times (2-2,6 ms), it is recommended to set smaller movements, between 0,40-0,45 mm, for petrol longer injection times (3,0-4,0ms), 0,45-0,65 mm.

# Controller Configuration – Step-by-Step.

The first action upon the controller installation is the configuration of the basic parameters which are shown on the tab 'Base Settings'.



This is the place to set the parameters for automatic switching into gas, the source of RPM signal (single coil, double coil, petrol injectors etc.)

In this step most of parameters are set automatically as a factory setting. What is needed to set, or check is: SOURCE OF RPM SIGNAL, SWITCHING PARAMETERS IF NEEDED, type of fuel (LPG or CNG), Gas Injectors Type and Fuel Level Sensor setup.

Pressure parameters are set automatically during autocalibration process. Additional settings are described in next part of manual.

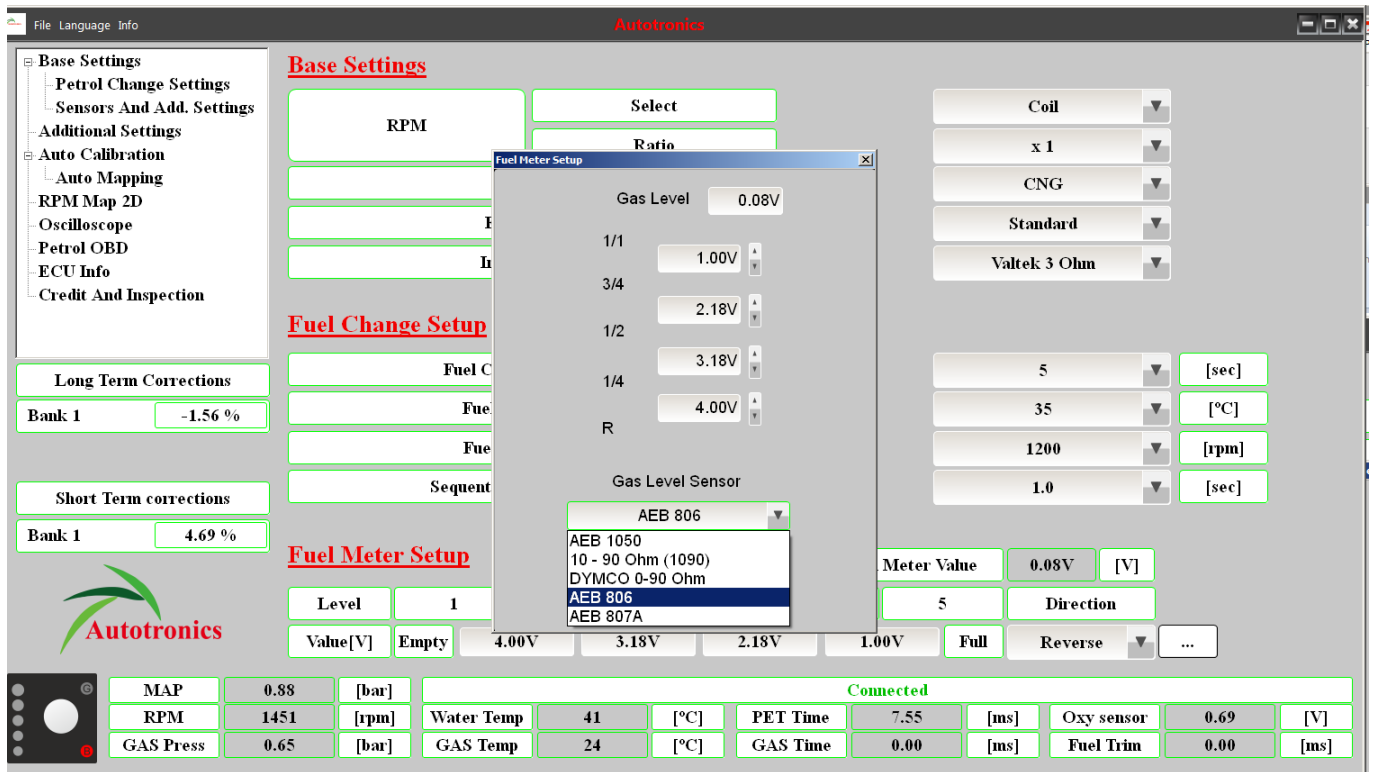
At this step, the minimum pressure for the controller to recognize empty gas tank is set automatically as 60% of the reference pressure (the pressure maintained by the reducing valve during work with gas on low revolutions).

Optionally the function of switching into gas for each cylinder could be set - option 'Sequential Switching Delay'.

Other options in this window:

- **Fuel Change Wait Time** – added time for first switching after long stay, in case when gas pipes are empty or low pressure, then system has a delay to fulfil system for normal working pressure in switching time.

- **Gas Level Sensor** – we allow various type of level sensor both for LPG and CNG which can work properly with our system.



- all of them are factory calibrated with our system.
- Using type of sensor not listed - you have possibilities to calibrate manually, checking indications in small window, changing values for proper indications by arrows.

Setting for typical sensors will be suggested automatically upon choosing relevant type from the list.

There is hidden option in this tab. Enabling hidden options in software is under main menu 'Info->Enable hidden features'.

- **custom** RPM ratio – which gives possibility use other than ignition type RPM signal.

# Petrol Change Settings

**Petrol Change Settings**

**Change Low GAS Press Mode**

Change Lower GAS Pressure: 0.6 [bar]

Change Waiting Time: 0.8 [sec]

Working Pressure: 1.2 [bar]

**Change Higher RPM Mode**

Change Higher RPM: 8000 [rpm]

Change Injection Time: 0 [ms]

**Change Low Gas Temp Mode**

Low Gas Temp: 0 [°C]

**Long Term Corrections**

Bank 1

**Short Term corrections**

Bank 1

**Autotronics**

**Connected**

MAP	0.43	[bar]	Water Temp	41	[°C]	PET Time	2.98	[ms]	Oxy sensor	0.69	[V]
RPM	1001	[rpm]	GAS Temp	24	[°C]	GAS Time	0.00	[ms]	Fuel Trim	0.00	[ms]
GAS Press	0.55	[bar]									

In this tab there are options and algorithm for switching to petrol from gas:

- **Change Low Gas Pressure:** pressure fall below this value causes switching to petrol during gas mode, it indicates low gas level in tank. It's automatically set after autocalibration for 60% of nominal working pressure.
- **Change Waiting Time:** this is factory set parameter, it gives only information that every 0,8 s we read pressure and vacuum values, we recommend not to change it, it can be changed only in case when pressure and vacuum are floating / long pipes /
- **Working Pressure:** It's automatically set after autocalibration, gives information to gas ECU what is base pressure for correction
- **Change Higher RPM and Change Injection Time:** these parameters allow to set requested RPM working on gas, when reducer condition make a high pressure drop on max speed or fitted injectors have not enough output
- **Low Gas Temp:** with this option we can protect reducer from freezing, when gas temperature falls to close 0 C degree.



# Sensor and Additional Settings

In this window there is some parameters which may need changes, especially temperature sensors type and pressure sensor type. Most of parameters are set as a factory setting according to that what is delivered in accessories bag. Our value of temperature sensors is 4.7 kOhm, in case when you are using other supply items please check and change according to proper values.

Gas Temperature Sensors are chosen automatically when injector rail type is changed for e.g. OMVL injectors type automatically changes temp. sensor for 4.7 kOhm.

Other options:

- **Turn on injectors warming up:** after enabling that options we can set period of time for which the gas injectors coils should be preheated by single pulses from ECU (properly shortened so they won't cause opening of injector) before first changeover to gas (function works only if the reducer temperature is less than set warming off temp.... C degree). The length of pulse is being set automatically depending on the type of selected injector. Option has 2 variants (STD and Extended)
- **Warming time:** is time of warming up procedure.
- **Warming impulse:** gas injection time during warming up.  
Last two options are inactive with Warming Extended, which is better procedure for low temperatures (below 0 C degree)
- **Gas valve turn on before switching over:** this option cause turning on gas valves when reducer meets switching temperature. Without this function on, gas valves are activated after 5 sec of start-up, so that to avoid reducer damage in cold days we recommend using this function.
- **Injector configuration:** meaning the way the gas injectors signals against petrol injectors signals should be controlled (full sequence, semi sequence or non-sequence). It may be set manually or using **Detect** tool with engine working on idle.

Here in this tab we also have hidden option:

- **Injector configuration diagram** - which shows current configuration and allows to manually reconfigure gas injectors assignment to petrol injectors signals, it can be helpful also for permanently deactivation particular gas injectors and leave that cylinder on petrol.

Picture below shows default sequence injection assignment where first gas injector is driven by signal of first petrol injector.

**Up-to-Down are Petrol Injectors and Left-to-Right are Gas Injectors**

The screenshot shows the Autotronics software interface. The 'Sensors And Additional Settings' tab is active. The 'Injector configuration' section features a grid with colored blocks: a yellow block in the top-left, a green block in the second row, first column, a red block in the second row, second column, and a blue block in the third row, second column. The status bar at the bottom displays the following data:

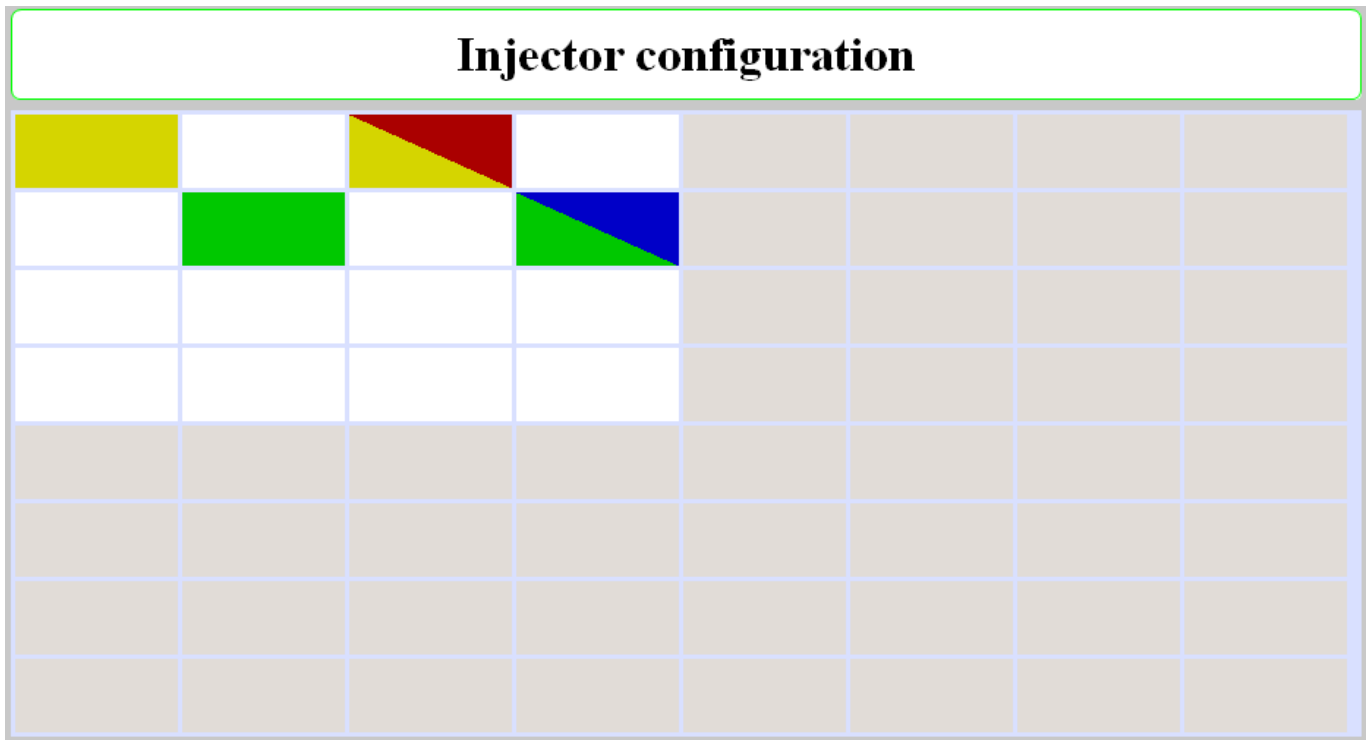
MAP	0.34	[bar]	Connected								
RPM	1784	[rpm]	Water Temp	42	[°C]	PET Time	2.98	[ms]	Oxy sensor	0.69	[V]
GAS Press	1.18	[bar]	GAS Temp	24	[°C]	GAS Time	0.00	[ms]	Fuel Trim	0.00	[ms]

Pictures below shows Gas Injectors assignment in case **Full-Group** where all Gas Injectors are driven by only first petrol signal (all other signals are the same).

The 'Injector configuration' grid is shown with the following data:

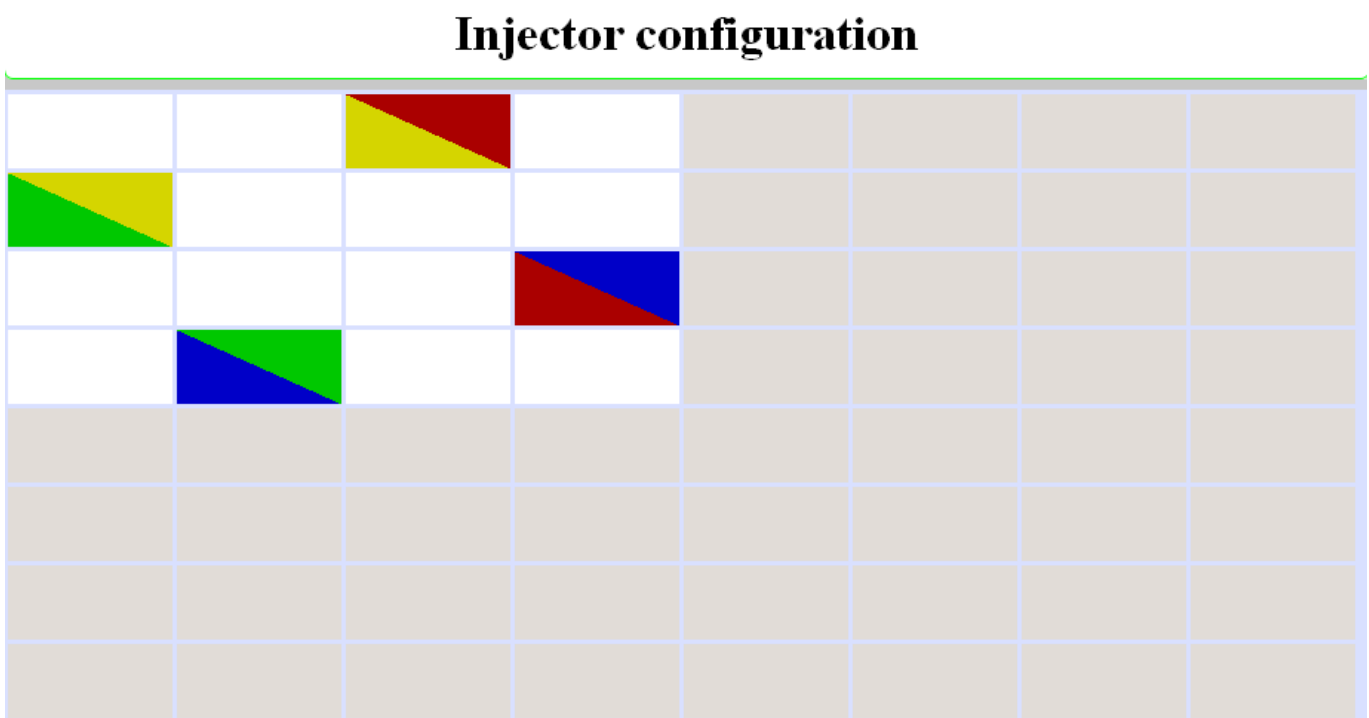
Row	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8
1	Yellow	Green	Red	Blue				
2								
3								
4								
5								
6								
7								
8								

and configuration of **Half-Group** (Semi-Sequential) petrol strategy looks as follows:

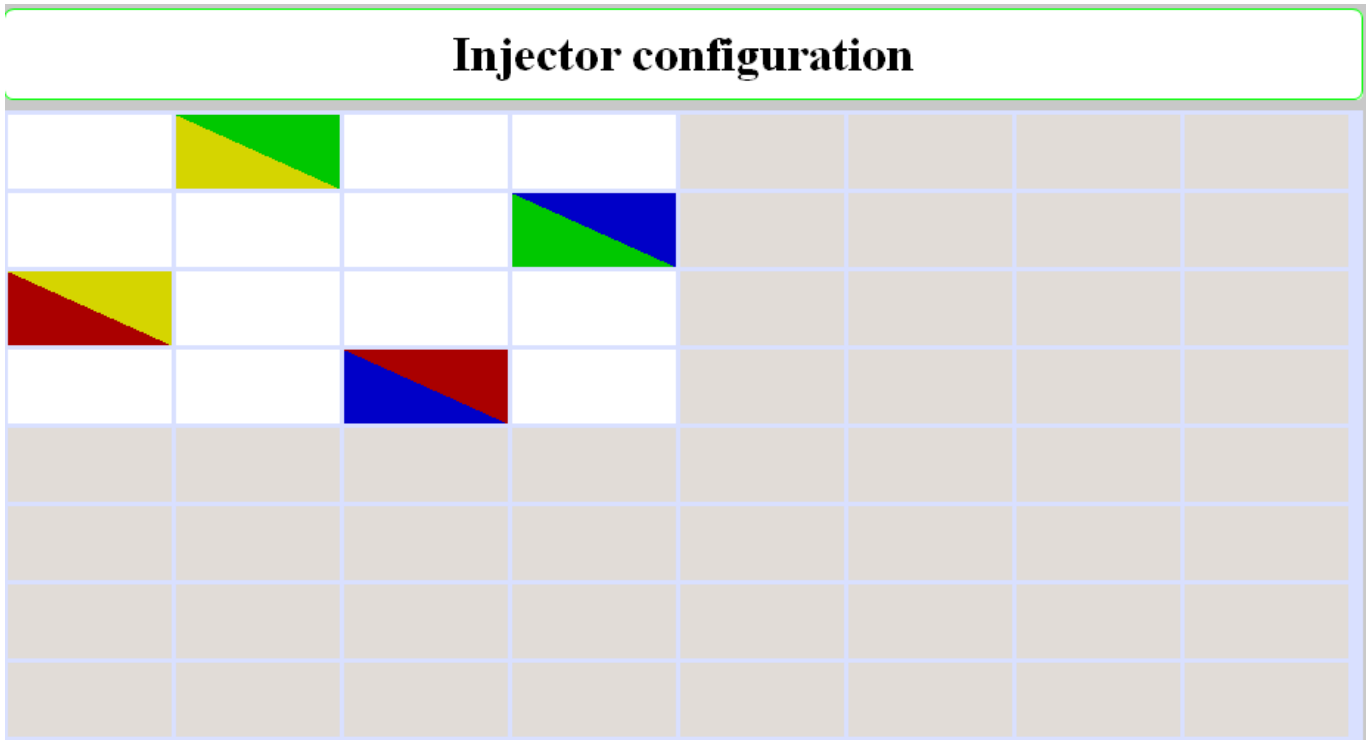


There are possibilities with this configuration diagram to activate strategy of gas supply called “advance gas injection”.

It should be used only as workaround for troubles caused by too long gas hoses between gas injectors, nozzles and manifold applicators. Below is example of that strategy on engine with most popular firing order 1-3-4-2:



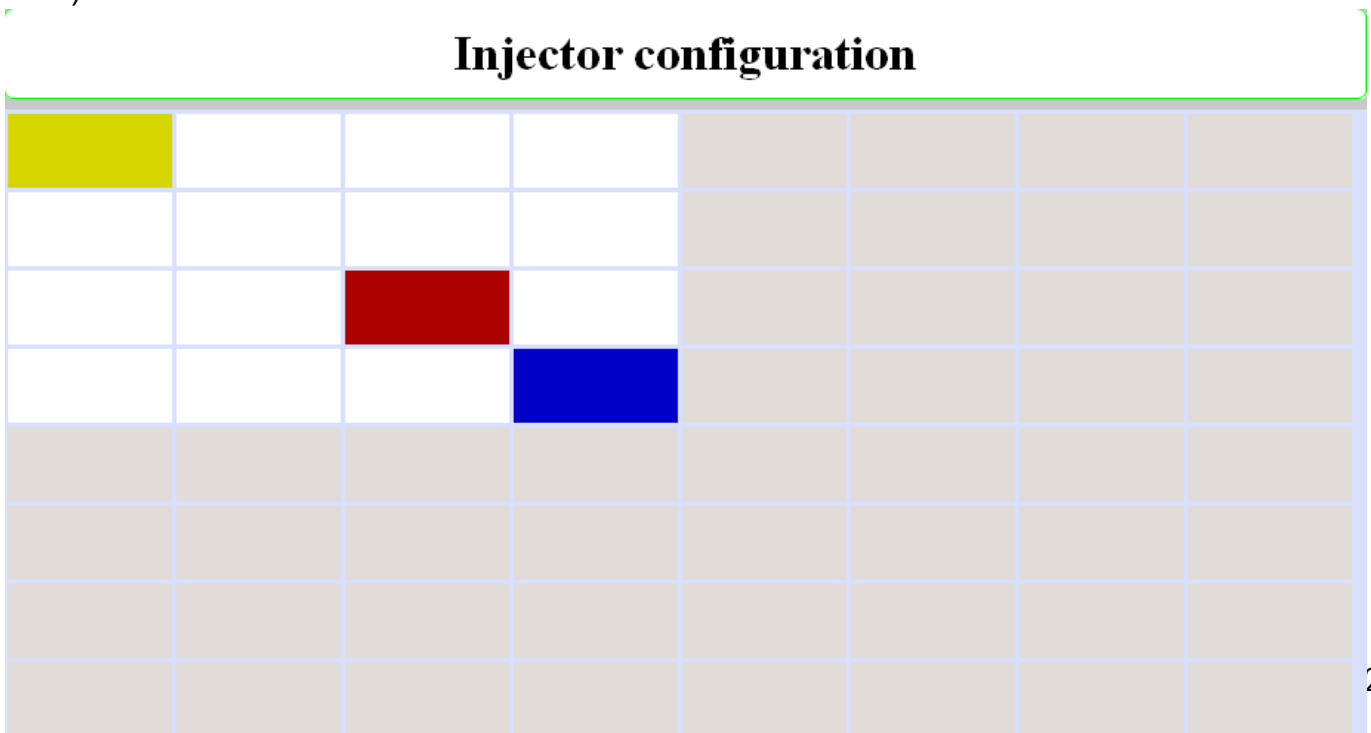
and next picture is for less popular firing order 1-2-4-3:



**Please note that advance gas injection has one restriction: there is no possibility to use “Sequential Switching Delay” parameter other than 0 due to bad switchover. Before any changing configuration other than predefined (sequence, half group, full group) this parameter should be set to 0 (all cylinder’s switchover in the same time).**

This tool is also useful for troubleshooting with single gas injection malfunction. Un-clicking active square with colour of unwanted gas injector cause switching that particular cylinder to petrol mode and give chance to operate under gas mode until resolving problem with not working gas part and re-enable this cylinder back to gas mode on injection configuration diagram.

Here is example of temporary fixing problem with 2<sup>nd</sup> gas injectors (until replace non-working gas injector).



# Additional Settings

The screenshot shows the 'Additional Settings' window in the Autotronics software. The window title is 'Autotronics'. The sidebar on the left is expanded to 'Additional Settings'. The main area contains the following settings:

- Petrol Injectors Activated by +12 V:** A checkbox that is currently checked.
- Valvetronic:** A checkbox that is currently checked.
- Fast Switch:** A checkbox that is currently checked.
- Long Term Corrections:** A section with a 'Bank 1' field set to '0.78 %'.
- Short Term corrections:** A section with a 'Bank 1' field set to '-6.25 %'.
- Ignore Extra Times:** A dropdown menu set to '0.0' with a unit of '[ms]'.
- Petrol Post-Injection:** A dropdown menu set to '0' with a unit of '[%]'.
- RPM Above:** A dropdown menu set to '500' with a unit of '[rpm]'.

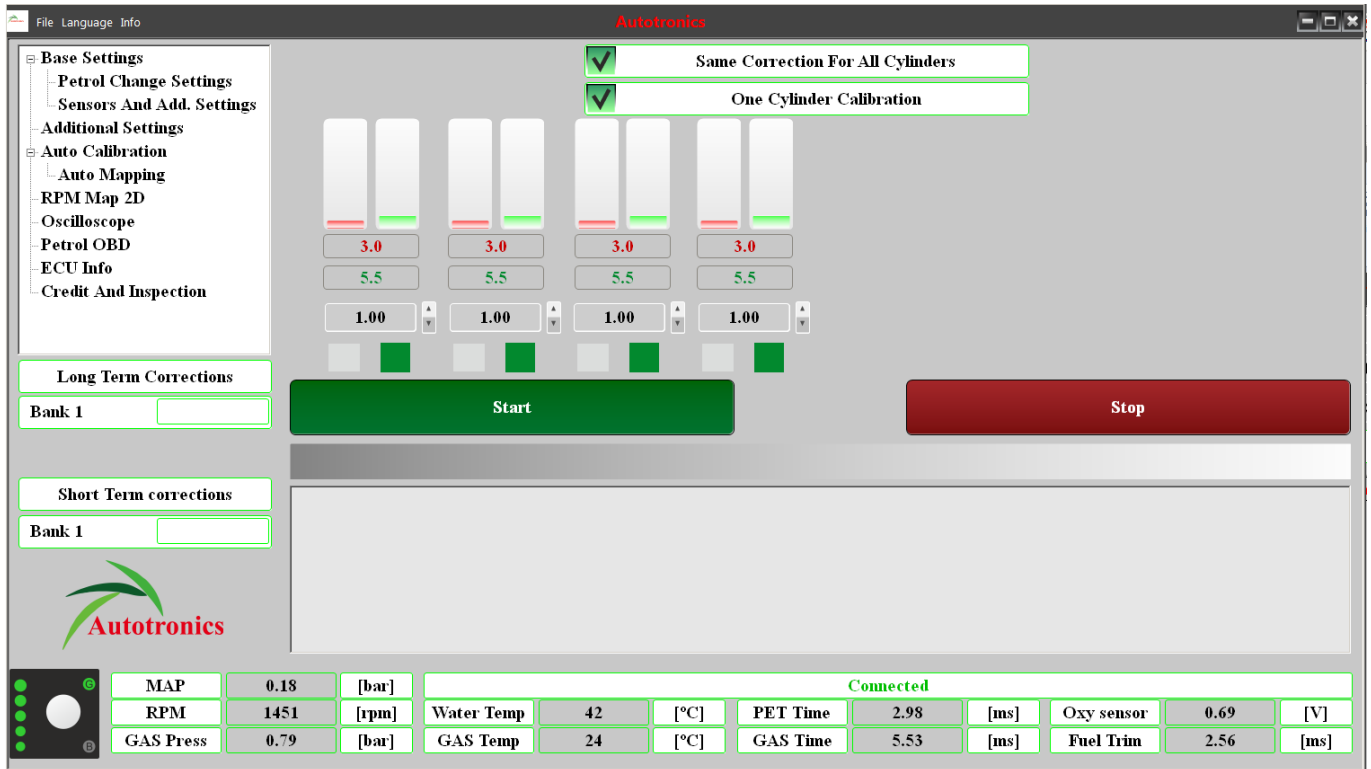
At the bottom of the window, there is a status bar with the following data:

MAP	0.88	[bar]	Connected								
RPM	1451	[rpm]	Water Temp	41	[°C]	PET Time	7.55	[ms]	Oxy sensor	0.69	[V]
GAS Press	0.65	[bar]	GAS Temp	24	[°C]	GAS Time	0.00	[ms]	Fuel Trim	0.00	[ms]

In this window there is some functions which may be changed when needed:

- **Petrol injectors activated by +12:** is an option for engines with non-standard injector driving polarity
- **Valvetronic:** gives information that engine has no vacuum signal and mapping during drive by OBD is necessary.
- **Fast switch (engine hot):** when the engine is hot, cars starts at once on gas, without any delay.
- **Ignore Extra Times:** this parameter sets the minimum value of petrol injectors opening time which will be moved onto gas injectors. This option should be enabled when petrol injection controller generates very short pulses on petrol injectors (from 0,3 [ms] up to 1 [ms]), which normally doesn't cause dosage of fuel but after summing with all the corrections (main correction, multiplier correction and map correction) might cause unnecessary gas injection (partial cut-off). Default value "0" means that every pulse from petrol injector will be moved onto gas injectors.
- **Petrol post-injection:** or Lubrification is an algorithm for adding a small amount of petrol during gas mode with RPM above setpoint. 0% means – option disable, max value 100% will give 25% participation of petrol.

# Auto Calibration



Upon setting the basic controller parameters the next activity involves the gas controller calibration. After setting the auto calibration the software will sequentially switch the controller from petrol into gas and generate the corrections to finally input final values into the controller after a few such cycles.

For this controller type, autocalibration cylinder by cylinder is possible.

Upon successful process of calibration, the controller may be switched into '**AUTO**' mode and perform the test drive.

In special cases when the corrections are generated in the auto calibration process and differ from correct values, the application informs the user. There are two situations possible:

The size of gas injectors chosen is too large, and therefore during the auto calibration the following message is displayed:

Generated correction: 0.3 ms does not fit recommended limit between 0.5ms and 2.5ms.  
Changing injectors into smaller ones is recommended.

When the gas injectors are too small, the following message may be displayed:

Generated correction: 2.2 ms does not fit in recommended limits between 0.5ms and 1.5ms.  
Changing injectors into smaller ones is recommended.

These messages do not stop the process of auto calibration and only indicate the necessity of replacing used gas injectors nozzles.

Option '**One Cylinder Calibration**' may be useful and it causes switching from petrol into gas during auto calibration to be smoother and eliminates damping during auto calibration.

During auto calibration a parameter 'Main Correction' is generated. It is a correction that states the gas injections duration increase in milliseconds against fuel durations.

For correct selected gas injectors, the Main Correction should incorporate between 0.5 ms and 1.5 ms. The correction is generated automatically in "Auto calibration", but it is also possible to amend it manually. In the case of manual amendments, different Main Corrections may be specified for the different gas injectors (various engine cylinders). To do this '**Same correction for all cylinders**' must be off, when is turned on (by default) changing manually main correction for one cylinder will set up the same for all.

The described situation is presented below: Even Cylinders have a different correction from the Odd ones.

**Note: The procedure 'Auto calibration' generates only one main correction for all cylinders.**

For manual modifications of the Main Correction it is handy to change it using the indicator next to the value indicated

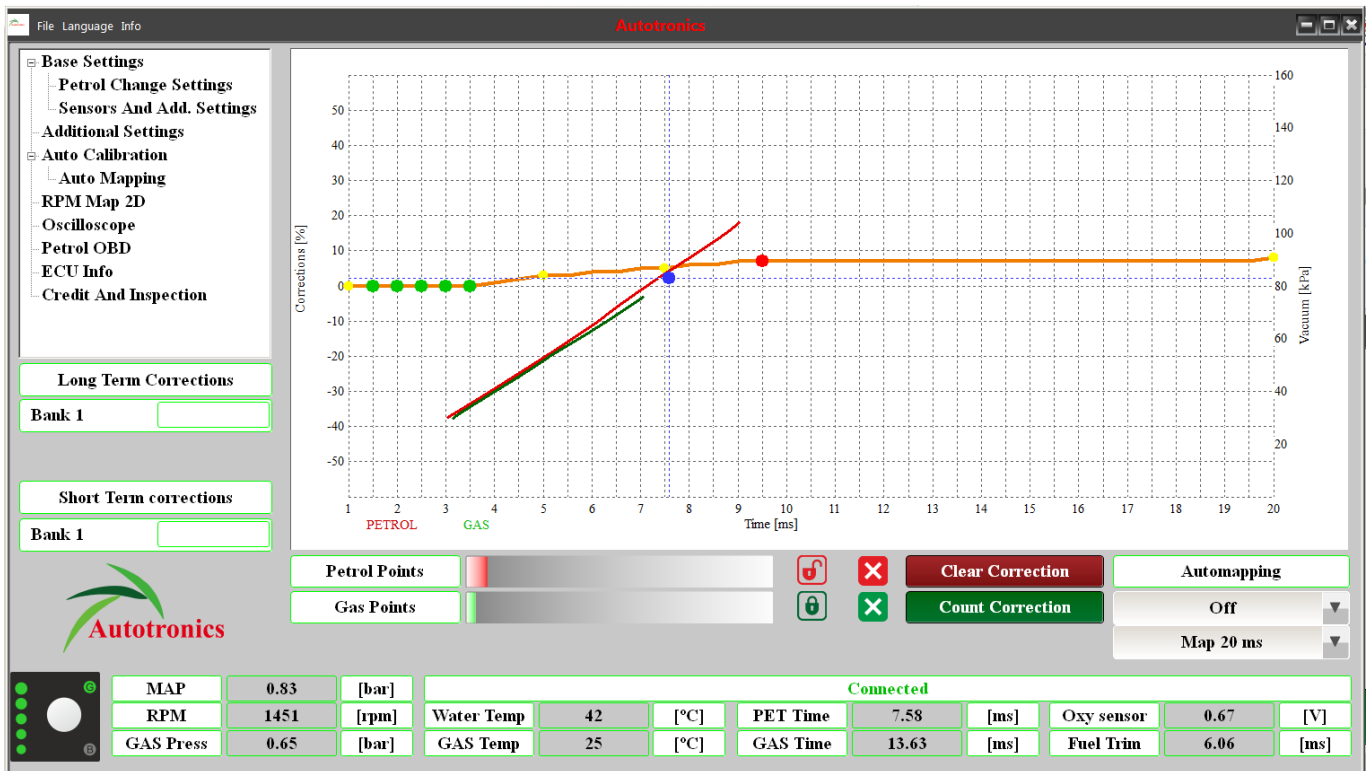


The gas controller may work, depending on the petrol injection type in the following modes: Sequence, Half group, Full group.

It is possible to detect the control type by the petrol injection system providing that all petrol injector control signals are connected to the controller (each injector with own gas controller emulator).

# Auto Mapping (Create MAPs)

The corrections table placed below the graph helps to set the gas controller correctly depleting or enriching the mixture with tolerance +/- 50% for sequences of petrol injections duration.



## MAP creating using vacuum changes:

During car calibration, the program generates reduced injection maps for petrol controller during driving on petrol and gas. Afterward the program generates corrections for both the maps to agree. Generated corrections will be suggested for input. Red dot shows range of present working parameters ms and bar, red dot is movable by left/right, up/down arrows, confirming blue dot position on the bank map is made by ENTER button.

**Note: Automatic car tuning during driving should be done upon auto calibration on standing.**

The calibration procedure during driving is as follows:

1. Switch the Autotronics controller to petrol and press Start.
2. Perform test drive on petrol trying to collect the most points equally on the whole negative pressure scale (from about 0.3 bar to 1 bar).

**Notes concerning driving: Driving should be performed the way that the Lambda probe works continuously i.e. avoid long acceleration with the accelerator pressed maximum (Closed loop mode). Optimal driving time is about 10 minutes.**

3. After driving on petrol, switch the Autotronics controller into gas mode and perform the same test drive on gas.
4. After collecting all points on both fuel there is enough to press button calculate corrections. Suggested corrections are entered immediately and may be modified manually later.



## Auto Mapping option

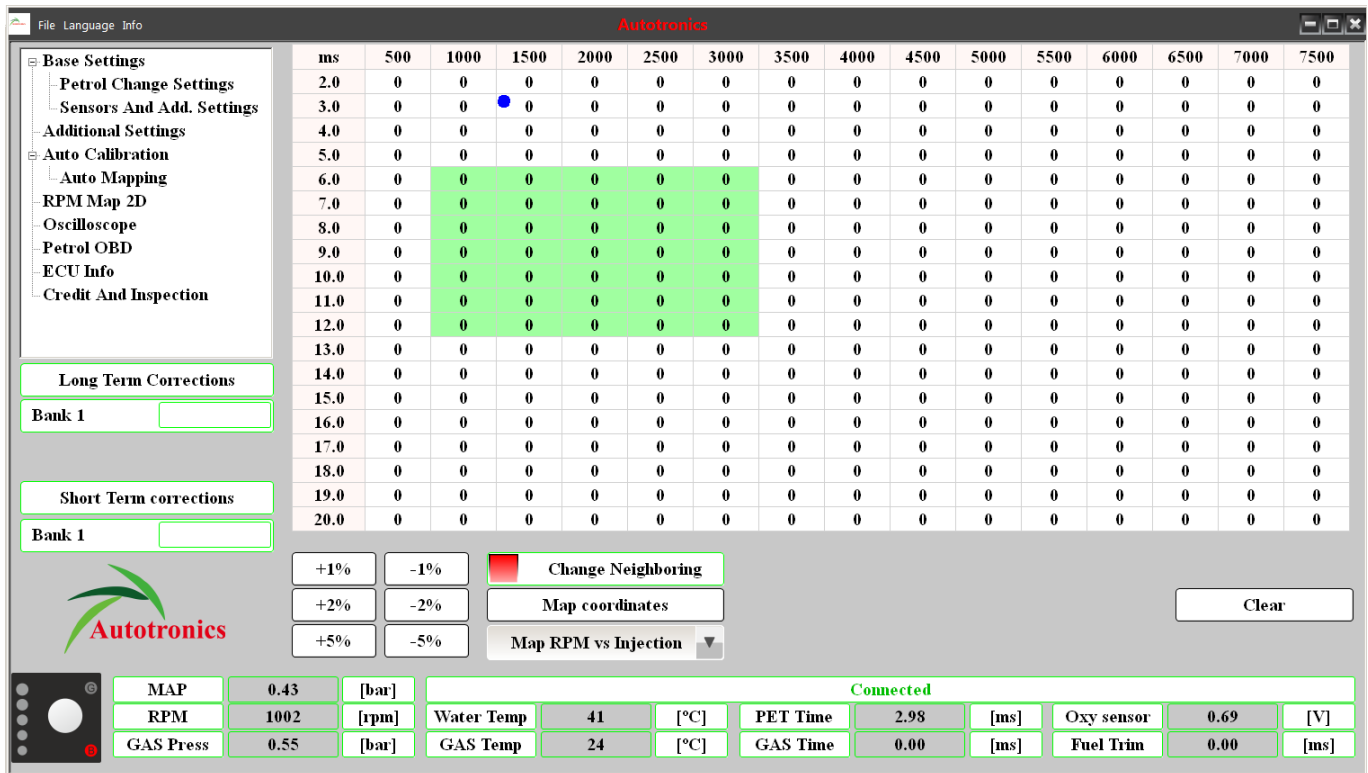
There are possibilities to do Map creating automatically without PC software connected. There are two ways of automapping:

- **Single mode** – gas ECU will control count and ranges of collected points on petrol map, if not enough points gas ECU will hold petrol mode to finish map collecting. If petrol map is finished automatic switch to gas occurs and after successful gas map collecting corrections will be calculated and written to setup. This action is done only once after activation, when finished automapping stays in Off mode.
- **With interval 70h** – works similar but it works periodically and after one is finished, next will run after next 70 hours of driving.

This function will be turning off every time when driver manually press switch button during automapping.

## MAP creating using OBD trims and /or manual corrections:

The Autotronics controller enables a very precise adjustment of the mixture in every engine work area. It is shown in the map of corrections in the tab 'RPM map 2D'.



Edition of single cells is possible by marking cell/cells with left mouse button, after marking cell/cells keeping CTRL button, there is possible to change the values by arrows up/down. System automatically changes also value in neighbour cells also, so that to avoid jumps of values (option Change neighbouring).

The above graph shows a sample map of corrections, which may enrich the gas mixture for high and low revolutions up to %.

Using the map enables corrections of the gas mixture within a range between -50% and +50%.

**Note: The map is written into the device automatically.**

The blue dot on the map indicates present engine work conditions, meaning the petrol injection duration and revolutions.

Default limit on the map for injection duration are from 2 to 20ms every 1ms. Changing the scale on the map for injection duration (**Map coordinates** button) is possible from 1 to 30 or more ms every 0.5ms, for more precise correction input.

## MAP creating using OBD trims

The screenshot shows the Autotronics software interface. On the left is a sidebar menu with options like Base Settings, Petrol Change Settings, Sensors And Add. Settings, Additional Settings, Auto Calibration, Auto Mapping, RPM Map 2D, Oscilloscope, Petrol OBD, ECU Info, and Credit And Inspection. Below the menu are sections for Long Term Corrections (Bank 1: -7.81%) and Short Term corrections (Bank 1: 4.69%). The main area is a table with columns for ms (500 to 7500) and rows for injection duration (2.0 to 20.0). A blue dot is visible at 1500ms and 3.0ms. Below the table are buttons for +1%, -1%, +2%, -2%, +5%, -5%, Change Neighboring, Map coordinates, and Map RPM vs Injection. On the right are Start, Stop, Calculate, and Clear buttons, along with a checked 'Mapping From OBD' option. At the bottom, there's a 'Connected' status bar with various sensor readings: MAP (0.34 [bar]), RPM (1401 [rpm]), GAS Press (1.18 [bar]), Water Temp (42 [°C]), GAS Temp (24 [°C]), PET Time (2.98 [ms]), GAS Time (4.61 [ms]), Oxy sensor (0.69 [V]), and Fuel Trim (1.64 [ms]).

ms	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500
2.0	0	3	3	3	0	0	0	0	0	0	0	0	0	0	0
3.0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0
4.0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0
5.0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
6.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**This algorithm enables using OBD fuel trims (both LTFT and STFT) to tune gas mode. There is no need to drive on petrol. When enabling this option, we'll see additional buttons. To create and write map of OBD corrections the procedure is as follow:**

- Press **Start** button – for start collecting correction in actual conditions
- Press **Stop** button – when all desired ranges are filled with collected corrections
- Press **Calculate** and wait for writing

**Note: Collected corrections are collected in current software session and are not written to the gas ECU automatically. Closing software before pressing Calculate button will lose all collected data.**

## Description of the Gas Control Panel.

- 1) Automatic mode (before switching to gas, Green LED G on the right is flashing simultaneously)
- 2) Petrol mode (Red LED B on the right side is on)
- 3) Gas Finished (after switching into petrol, the LED's switch on sequentially)

Switching into petrol after the pressure reduction caused by an empty gas tank is indicated by the control panel by flashing of each LED sequentially: one goes on when the previous one goes off (an effect of floating diodes).

4) After switching into gas, the control panel shows its amount in the tank:

- gas – full tank
- gas - 3/4 of the tank
- gas - 1/2 of the tank
- gas - 1/4 of the tank
- gas - Reserve (red LED flashes)

## Review and Deleting the Error Codes.

The tab 'Device info' shows a board with all code's errors saved in the controller.

The error may be deleted after correcting the error by pressing the key 'Clear errors'.

All errors can have additional information, called freeze frames, which give information in what condition error occurs.

This page contains also information about controller version, serial number, manufacture date and petrol, gas work duration statistics.

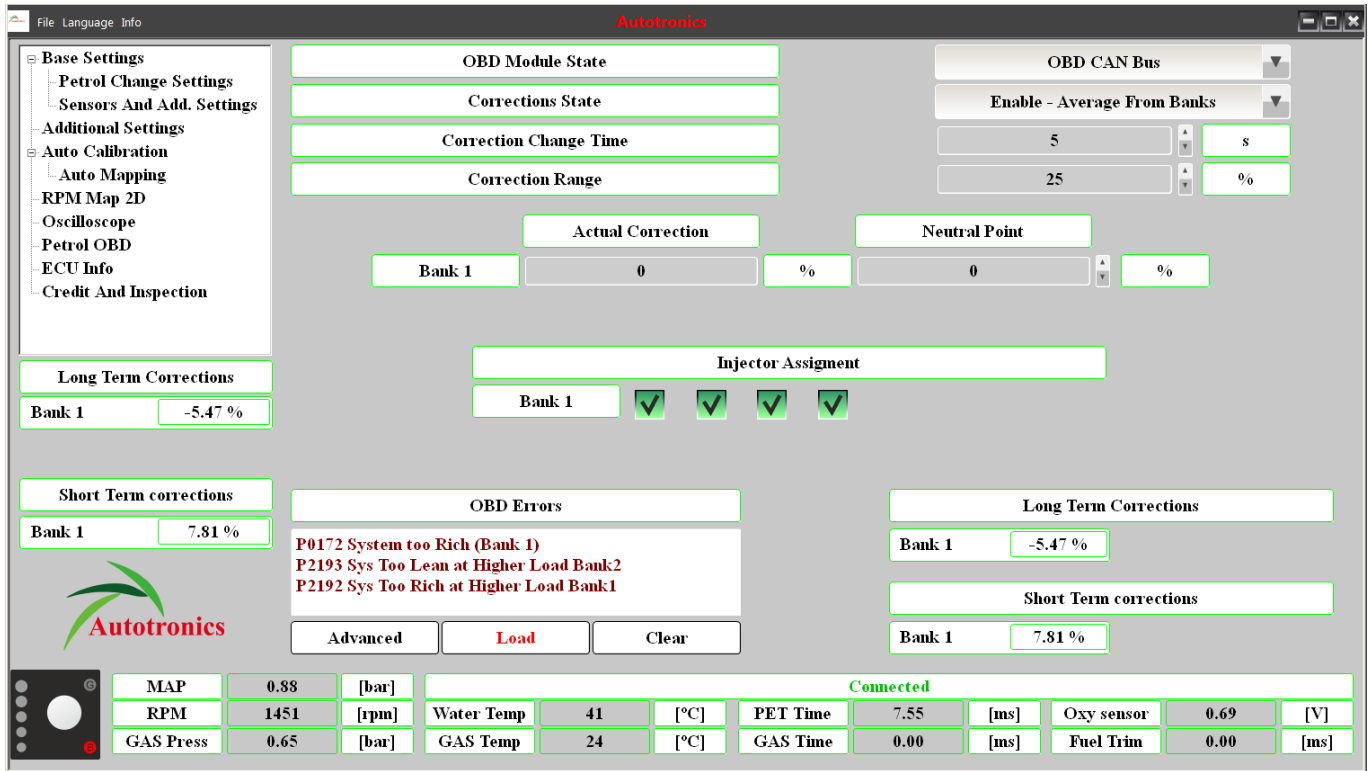
The screenshot displays the Autotronics software interface. The main window is titled 'Autotronics' and contains several sections:

- Left Panel:** A tree view showing settings categories: Base Settings, Petrol Change Settings, Sensors And Add. Settings, Additional Settings, Auto Calibration, Auto Mapping, RPM Map 2D, Oscilloscope, Petrol OBD, ECU Info (highlighted), and Credit And Inspection. Below this are sections for Long Term Corrections and Short Term corrections, each with a 'Bank 1' input field.
- Top Right:** Fields for Program Version (v 3.33), Serial Number (EDA90000000048), Production Date (06/04/2018), Petrol Driving Time (3 h: 18 min), and Gas Driving Time (0 h: 00 min).
- Center:** Two tables: 'Errors' and 'Freeze Frame'. Both tables have columns for Error, Description, Parameter, and Value. The 'Errors' table is currently empty.
- Bottom Center:** Buttons for 'PC Connections', 'Read Errors', and 'Clear Errors'.
- Bottom Left:** The Autotronics logo.
- Bottom Right:** A status bar showing 'Connected' and various real-time data points: MAP (0.43 [bar]), RPM (1001 [rpm]), GAS Press (0.55 [bar]), Water Temp (41 [°C]), GAS Temp (24 [°C]), PET Time (2.98 [ms]), GAS Time (0.00 [ms]), Oxy sensor (0.69 [V]), and Fuel Trim (0.00 [ms]).

# OBD Functions

The Autotronics controller enables connecting to the OBD system through the CAN controller area network and loading current work parameters and OBD error codes. For applying these options, it is necessary to use the CAN L and CAN H Autotronics system loom and connect it to the OBD connectors.

After connecting to the OBD system and setting the option 'OBD switched on' we can observe the selected parameters in the Autotronics application.



After clicking the button “Read errors” it is possible to read the OBD errors written in original car’s petrol controller. We can clear these errors from its memory by pressing button “Clear OBD errors”.

**By enabling option “Enable OBD corrections” we have possibility to correct gas injectors opening time according to actual readings of “Long Term Fuel Trims”, separately for each petrol BANK data 1 and 2. The time interval of reading the corrections can be set in parameter “Correction Change Time”.**

**Thanks to above feature the Gas Injection Controller self-adapts itself to Car’s original OBD in real time. If rest of Sequential Gas Injection System has been chosen and installed properly it makes possible to eliminate MIL (“check engine” light) during drive on gas and all the time has same parameters of petrol ECU during driving on gas. This function helps avoid problems with defective map in petrol ECU during driving on gas with incorrect settings of mixture.**

Attention: Feature “Enable OBD corrections” might be used only in cars which are having OBD on CAN bus, because only this type of data bus is capable to ensure proper communication quality with the controller. For some cars with older OBD transmission like KWP 2000 and ISO 9141-1, ISO 9141-2, we have also a choice.

## Connection OBD CAN to ISO9141/KWP2000:

We maintain also ISO9141/KWP2000 protocols with Autotronics controller in case when car doesn't have OBD on CAN bus but has OBD with ISO9141/KWP2000 protocol. (Pin 7 and optional 15 are present in OBD connector) in case when pin 15 (L-line) is not present do not connect green wire of converter (NC). In case when both pin 7 and 15 not present do not connect to any other pins

Recommended value for "Correction Change Time" parameters is as shorter as better. In some cases, 2 sec is recommended time for reading corrections. This parameter sets the time interval after which the averaged value of Long Time Fuel Trim is being read.

**Parameter "Correction Range" shouldn't be bigger than +/- 20-25 % for European and Japanese cars and about +/- 45 % for most USA cars. This parameter sets the maximum value of Long Time Fuel Trim which gas controller will try to adjust by changing petrol injection opening time during driving on gas and comparing to ideal parameters in petrol ECU.**

Autotronics controller reads the value of mixture corrections from OBD petrol ECU and sets the amount of fuel injected so the "Long Time Fuel Trim" (LTFT) will be oscillating as close to expected car's manufacturers default values as possible. STFT and LTFT mixture corrections are referring to the corrections dynamically imported to table of injection opening times in original petrol ECU.

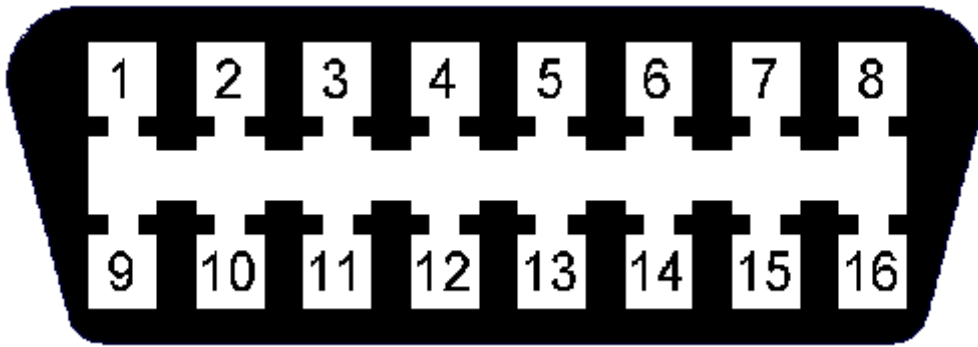
Corrections are showed up as a percentage. Positive value means that in that particular moment the mixture is too lean and petrol ECU is trying to elongate the petrol injectors opening time to enrich it. Negative value means that mixture is too rich and petrol ECU is trying to shorten the injection opening time to make it leaner.

The concept of banks is referring to "V" type engines. Cylinder marked as no. 1 should be always in bank no. 1. "V" type engines should always have one side assigned to bank no. 1 (cylinders with numbers from 1 to 3 or from 1 to 4) and another side to bank no. 2 (cylinders with numbers from 4 to 6 or from 5 to 8). Of course, this type of cylinders assignment is made in case when each bank has his own oxygen sensors. There is also a V type engine with one oxygen sensor for two banks then it's recommended to choose average corrections from BANK1 and BANK 2. So generally, the numbers of oxygen sensors before catalyser is recommending the type of automatic corrections. Algorithm of controller's adaptation in dependency of OBD corrections is basing on reading actual values of STFT and LTFT and depending on these values elongating or shortening gas injection opening times. In result of such actions mixture is being enriched or leaned to keep the STFT and LTFT in desired range.

**Injector assignment is an option for engines with at least two OBD banks, at this moment 4-cylinder cars have only one bank, so for 4-cylinder cars this option is for future. On modern 6- and 8-cylinders cars there we have 2 banks and two set of OBD corrections, sometimes it's needed to assign correctly gas channels to banks. Correct Change time should be max 5 sec, just like factory setup, range +/-15 is enough in case when we have done calibration at idle.**

Actual value of calculated corrections we should control from time to time. Too big absolute value of these correction mean that some mechanical part might be worn out and we should make some mechanical adjustments to some parts of sequential gas injection system.

## Description of the OBD II Connection



Pin 4 - Ground

Pin 5 - Ground

Pin 6 - CAN High (J-2284)

Pin 7 - ISO9141-2/KWP2000 K line

Pin 14 - CAN Low (J-2284)

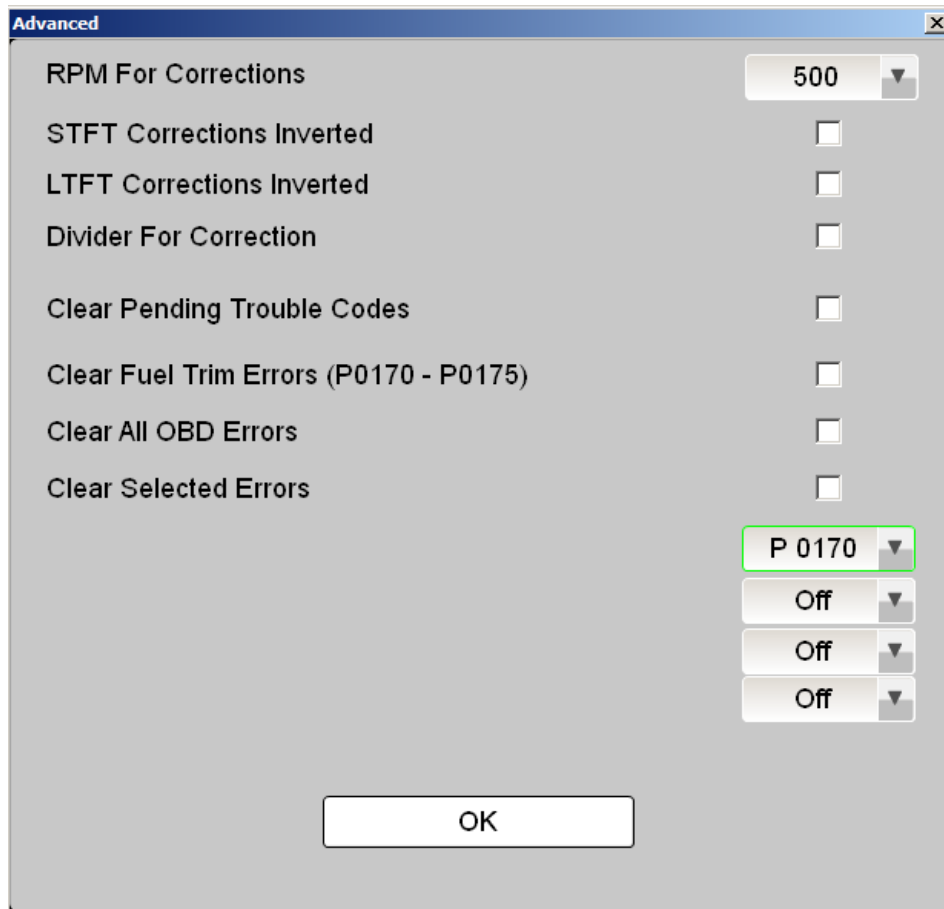
Pin 15 - ISO9141-2/KWP2000 L line (optional)

Pin 16 - +12V

If the car has the OBD on the CAN, then the pins 6 and 14 should have voltage +2.5V against the mass.

# OBD Advanced Options

Some useful options are enabled under button 'Advanced' on OBD tab:



- **RPM for corrections** -on some cars there is need to disable OBD corrections on idle. Setting this parameter with value a bit above idle will do this.
- **STFT/LTFT corrections inverted** – normally corrections in plus means for ECU: mixture is lean so need to increase amount of fuel in plus to meet stoichiometry at output. But some petrol ECU interpret fuel trims conversely and sometimes it concerns to LTFT or STFT or both.
- **Divider for corrections** – some ECU interpret fuel trims values otherwise. Correction +20% gives only +5% of increase amount of fuel. For that ECU corrections range is not +-25% but +-100% and enabling extra divider is needed.
- **Clear pending trouble code** – depending of OBD system capabilities, it's possible to configure gas ECU automatic error cancelling system to clear not only constant errors (check light is on) but also when errors are only pending in temporary memory and may stay permanently.
- **Clear fuel trim errors** – causes automatically clearing errors from range P0170 – P0175,
- **Clear all OBD errors** – causes automatically clearing every error
- **Clear selected errors** – its user defined what errors will be cleared (pending or constant). There are up to four user-defined errors.

**Options about clearing errors can be turned on together.**

## **Saving/loading Car Setting into File**

All settings and application data can be saved to a file and used later for setting the same types of vehicles, without having to calibrate and map them from scratch. Save the file containing settings, clicking in the left top corner, pane FILE/SAFE SETTINGS TO FILE.

Enter the file name and click SAVE. When the first file is saved, a new folder is on the C: drive is created automatically, and all data files are stored there. Path to the folder is as follows:

My Documents\Autotronics\Settings.

## **Reload Factory Settings**

Restoring factory settings is a safety feature provided in case controller crashes and does not response to inputs. It is always possible to restart the controller and start the procedure from the beginning.

## **Controller Update**

Every updated version of controller software contains folder "Firmware". The function is available in the Info menu (Device update...). When the controller is connected to the engine and engine is running, it is always possible to update software of the controller. Update procedure takes several seconds. During the attempt of software update, a system message is displayed, asking if the software is to be upgraded or downgraded.



# Trouble Shooting

To avoid problems with tuning engine on gas there are few things that must be check before start autocalibration:

1. Check all petrol injection times that have very similar value (software shows them all under autocalibration tab).
2. It's recommended before autocalibration make switching to gas with RPM more than 1500 and check correct connections of petrol injectors cables. If there is no petrol injection time for particular cylinder under gas mode, then there is mistake in connection to petrol signal wire.
3. With first switching to gas we have to be also sure that gas injector rail is not empty before autocalibration at idle and that engine will not die during this procedure at idle. It's also meaningful to check order of connected gas injectors related to petrol injectors. Below is an example of checking 2<sup>nd</sup> gas injectors connection to 2<sup>nd</sup> petrol injectors. By clicking left box under 2<sup>nd</sup> injector we switch this cylinder to petrol mode and if engine working is not worse, we have sure that electrical connection on that cylinder is correct.
4. When during calibration at idle engine dies or is working bad when switching petrol mode to gas mode then, "One Cylinder Autocalibration" should be unchecked and re-enabled once again with switching between all fuel cylinder at same time. Problem of bad engine working or dying can be resolved also by increasing and holding stable RPM and then re-running procedure once again. That autocalibration should be considered as preliminary and after finish autocalibration at idle should be made.
5. Especially when converting petrol engine to CNG fuel, there is problem with enrichment during strong acceleration (high engine load). Some small engines lose performance in that condition and it's desirable to use leaning mixture when high engine load at low RPM condition (under 3000RPM). It can be done manually on RPM Map 2D.
6. In case of **Jerking** problem after Calibration, use "Ignore Extra Times" function under Additional Settings Menu.