

# **Gas - Sequential injection system**

## **MAGIC 2**



- **EHK 67.01 homologation**
- **easy auto-setting system**
- **made up for OBD 2**
- **full communication with PC**
- **full- value on- board diagnostic**
- **easy save service interval**

## **1. Description of system MAGIC 2**

System is provided for multipoint injection cars. MAGIC 2 is designed for minimum decreasing of engine power and maximum comfort for users. Due to exact quantization of gas [calculation of open time for gas injection is running in real time] converted cars have very good results in emission and driving condition.

Due to integration of other electrical support component [like an emulators] to one LPG computer unit, it is not necessary to use any external unit. MAGIC 2 is designed for cars with 3 – 8 cylinders.

During running LPG, MAGIC 2 system communicates with petrol control unit and use needed information for itself. On the base of this information and information from own sensors, MAGIC 2 will calculate real value of gas and send signal for open gas – injector.

MAGIC 2 is equipped by auto set - mode for calibration of each type of car, or it is possibility to set system for specific car due to technical data.

During running on petrol, the switch is without led flashing. All LPG valves are closed and gas injectors do not work. In this time LPG control unit is in stand by-mode and does not control engine running.

After switching on to LPG, the switches LED indicator flashes in the red and indicates that system is ready to switch from petrol to LPG. When all needed parameters are completed, Computer unit will automatically switch-over from petrol to LPG. It is possible to set parameters and data for switching. Red LED LPG indicator is lighting and the other LED indicators inform about quantity of LPG in tank (not included in basic set).

## **2. Description and Assembly LPG components**

### **Basic principles of assembly**

Before start to conversion do not remember to disconnect accumulator [or disconnect all necessary fuses including control unit].

Locate MAGIC 2 control unit [CU] beside engine [near the petrol computer unit] and hold it by screw. Avoid locate CU to places with high temperature, petrol or other chemical liquids.

All connections must be soldered together and isolated. All hoses must be ensure against mechanical damages [due to vibrations]. All gas jet located in to the manifold must be leakproof. The screw-thread is recommend to paint by stick. CU has only basic set up and so it is necessary to adjust it for specific car by the diagnostic SW in the PC. During the installation LPG to the car relevant rules and laws must be observed.

### **LPG control unit MAGIC 2 [CU]**

Reading information, processing and sending real output signals to the gas injectors is the main function of CU. Due to incoming information [time of petrol injection, value of lambda sensor, engine temperature, gas temperature, pressure of gas and underpressure in manifold] gas amount is in the real time computed for each cylinder separately. CU contains also emulators of petrol injectors. Connectors and cables have different colours and design, not to be exchanged. CU is produced in 3 modifications, for 4 cylinders, 6 cylinders and 8 cylinders. For 3 cylinders cars must be used 4 cylinders CU [1 output from CU is not connected]

## **Switch (check panel)**

Switch is designed for switching from petrol to LPG. LED indicators inform about quantity of LPG in tank.

During running on petrol, the switch is without led flashing. All LPG valves are closed and gas injectors do not work. In this time LPG control unit is in stand by-mode and does not control engine running.

After switching on to LPG , the switchs LED indicator flashes in the red and indicates that system is ready to switch from petrol to LPG. When all needed parameters are completed, Computer unit will automatically switch-over from petrol to LPG and the red LED indicator is lighting. The other LED indicators inform about quantity of LPG in tank [if they will be connected].

It is necessary to locate the switch to the fascia-board to allow easy manipulation. Hole in the fascia-board for fixation must have diameter 7,8 mm, in case with bigger diameter it will be necessary to stick it.

All connections between cables and switch must be soldered together [colour to colour] and isolated. To the blue cable is possible to connect + buzzer [red to blue] and its second cable [black] to connect to the black -.

## **Reducer**

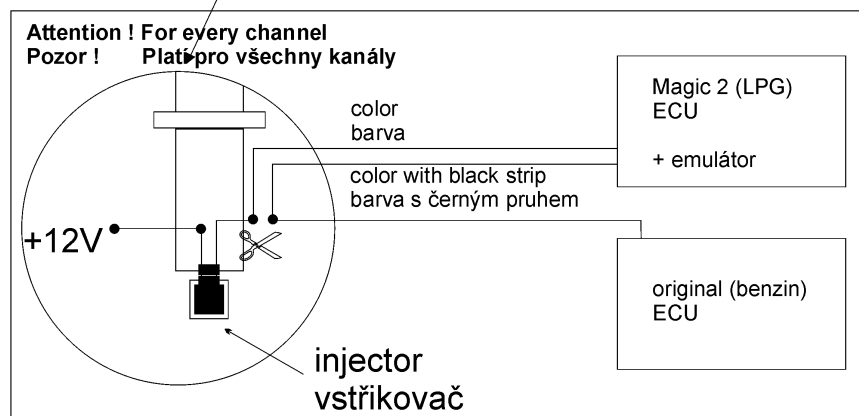
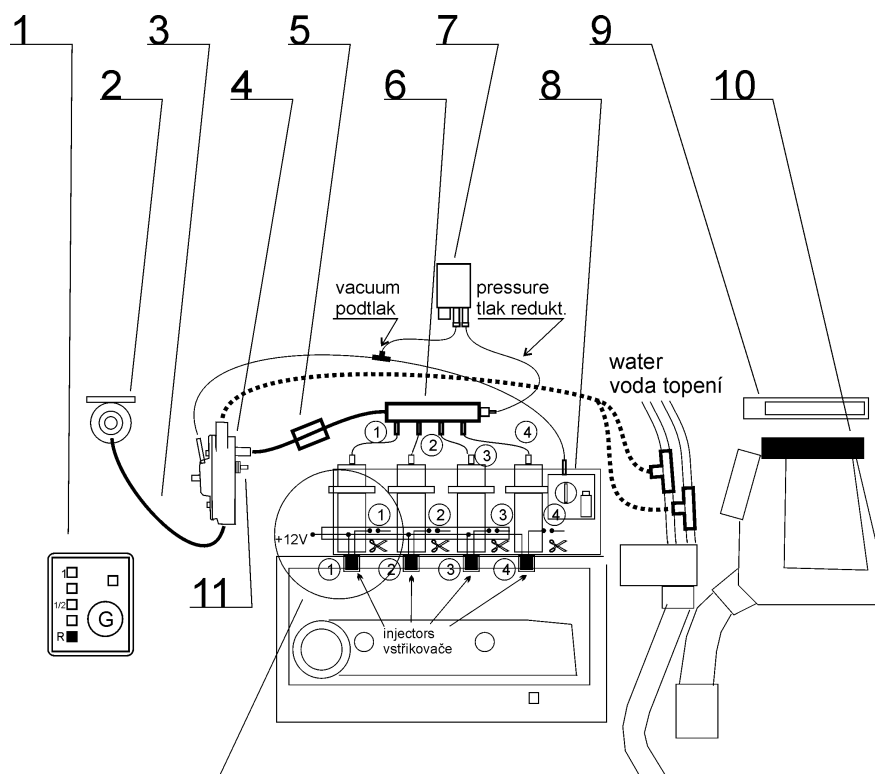
The electronic vaporizer/ pressure regulator is a device, that turns high pressure into the low functional pressure and also converts liquid LPG to its gaseous state. The reduction in pressure (from high to low pressure) which takes place in the working compartment evokes the loss of heat, that is compensated from hot water of engine cooling system . Underpressure inlet of reducer is necessary to connect to manifold of engine to supply fix value of outlet gas pressure [irrespective of engine load].

Value of pressure is from 1 to 1,6 bar (it depends of type of red.) , this value will display on diagnostic sw when the engine is running on LPG.

NTC sensor located in the reducer will not allow running on LPG, when the temperature is low.

Reducer can be located in the lengthwise or crosswise to the travel direction. Due to safety, screw on the reducer tight to the fix bodywork [not moving part – engine].

Reducer is equipped by safety valve. Output of safety valve must be connected to air inlet between air filter and throttle.



### Description:

1-switch, 2-LPG shut-off valve, 3-Cu pipe, 4-reducer, 5-gaseous state filter, 6-Matrix injectors, 7-pressure sensor, 8-throttle (nozzle behind the throttle), 9-petrol ECU, 10-LPG ECU, 11-safety valve

### Attention:

After disconnect petrol injector on first cylinder (nr. 1.), the gas inlet of this cylinder must be connected to the nozzle nr.1. in Matrix.

## Gas injectors Matrix

MAGIC 2 system is delivered with Matrix gas injectors. Injectors of Matrix are build in the line by four in one body. Correct quantity of gas is allowed due to high speed of gas injectors. Matrix common line construction is profitable for fix pressure all injectors. Nozzles in injectors are replaceable to adapt their diameter to the power of engine.

There are 4 sizes of nozzles:

|          |                     |
|----------|---------------------|
| Ø 1,8 mm | 12 – 17 hp/cylinder |
| Ø 2,1 mm | 18 – 24 hp/cylinder |
| Ø 2,4 mm | 25 – 32 hp/cylinder |
| Ø 2,7 mm | 33 – 40 hp/cylinder |

Optimal size will be specify from autocalibration. [parameter of declination].

Sequence of injectors connection:

| PIN Nr. | Colour of cable on Matrix | jet | Cyl. | Colour of cable on CU corresponds to colour disconnected injector |
|---------|---------------------------|-----|------|-------------------------------------------------------------------|
| 1       | yellow                    | A   | 1    | grey                                                              |
| 2       | orange                    | B   | 2    | yellow                                                            |
| 3       | Black + 12V               |     |      | red + 12 V                                                        |
| 4       | Black + 12 V              |     |      | red + 12 V                                                        |
| 5       | red                       | C   | 3    | violet                                                            |
| 6       | brown                     | D   | 4    | blue                                                              |

## Matrix check: measuring

Electric resistance between +12 V and each coil of injector must be 5 Ohm [cold ] and 6 Ohm [hot].

### **Gas pressure sensor + nozzle for manifold**

Different gas pressure sensor measures different pressure between Matrix and manifold.

Drill hole d5 to the manifold [behind the throttle-valve], cut winding M6 and screw nozzle [The screw-thread is recommend to paint by stick to avoid leakproof.].

Use stick LOCTITE 243 for metal and LOCTITE 3430 for plastic manifold. Then connect nozzle to vacuum inlet of sensor by the thin hose. Connect the pressure inlet of sensor t to the Matrix. Do not replace inlets between each other.

### **Gas calibration pressure sensor**

When the all LPG system is installed, then it is necessary to install gas calibration sensor. Due to gas calibration sensor we can read data during drive on petrol and LPG. [important : needful for new car with EURO III and EURO IV.].

### **Temperature sensor [NTC]**

For the faultless working CU temperature sensors of reducer and gas must be installed .

NTC sensor of reducer is section of reducer, NTC sensor of Matrix is enclosed separately.

### **Filter of LPG for liquid and gaseous state**

It is necessary to use LPG filter for liquid and gaseous state for long life Matrix function.

Filter for liquid LPG is build in the LPG shut-off valve. Filter for gaseous state is individual LPG component enclosed to the Magic 2 kit.

### **Nozzles for manifold**

One nozzle must be for each cylinder. Gas flows from the Matrix, through this nozzle, to the manifold.

Nozzles must be installed to the manifold very carefully. Hole for every nozzle drill slowly not to pollute inside of manifold. Holes must be located as near as possible to the cylinder head. Distance and inclination [vertical] of every nozzle to the cylinder must be the same.

Drill all holes d5 to the manifold, cut winding M6 and screw nozzle [The screw-thread is recommended to paint by stick to avoid leakiness. Use stick LOCTITE 243 for metal and LOCTITE 3430 for plastic manifold.]. Some manifold [depend on type of car] it is better to remove out from car and then install nozzles.

To be sure, that nozzles have straight-through hole, try to put through accordant drill.

### **Cables**

Connect all cables according to wiring diagram. All connectors must be locked, all connections between cables must be soldered together and isolated.

## Software Installation to your PC

Minimum computer configuration: Pentium 300 MHz , 32M RAM , 2M HDD free, Windows 95 or higher

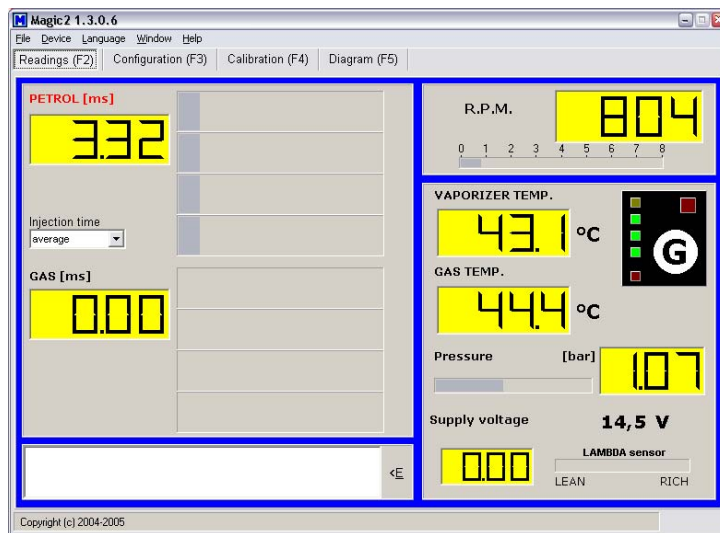
**Magic2-1.3.0.6-v1.3setup.exe** is self extracting file. You must double click on it and it will guide you by installation. After installation set computer to the right COM.

To connect to PC, it is essential to purchase the Lovtec Magic interface connectors (code 4209).

## Set up procedure for AUTOTEST mode.

Check version of PC software and version of unit Magic 2.

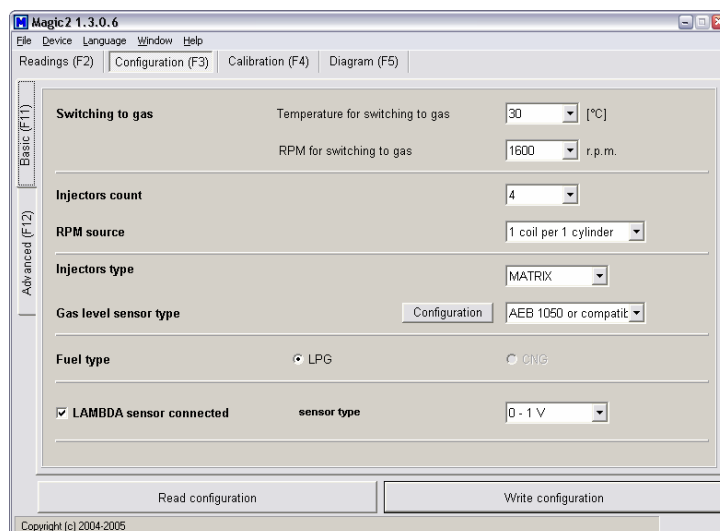
## Software description



After installation of software to your PC we must control if all electric connections are correct. Start engine. While connecting the computer to the CU (Control Unit) by interface (code 4209), connection between your PC and CU “Magic 2” is automatic. Window “Readings (F2)”. The current values of “VAPORIZER TEMP.”, “GAS TEMP.”, “Pressure”, “Supply voltage”, “LAMBDA sensor”(optional), “RPM”, and “PETROL” injection time for each valves” are read.

If all parameters are visible and system is without errors (click on “E”) we can start “**Configuration(F3)**”.

Each changing must be validated by “Enter” key or by “Save” button



In “**Configuration(F3)**” window we modify “Magic2” to concrete vehicle.

- Switch “**Temperature for switching to gas**” from 30 to 70°C , step 5°C.
- “**RPM for switching to gas**” from 1200 to 3000 , step 200 RPM
- “**Injectors count**” 3,4,5,6,8, it depends also of version of Magic 2

- **“RPM source”** 1 coil per 1 cylinder, double coil (DIS), revolution counter.
- **“Injectors type”**, MATRIX, REG, VALTEC, membrane, ZAVOLI
- **“Gas level sensor type”** Reserve, KME PW, AEB 1050 or compatible, 0-90 Ohm or compatible

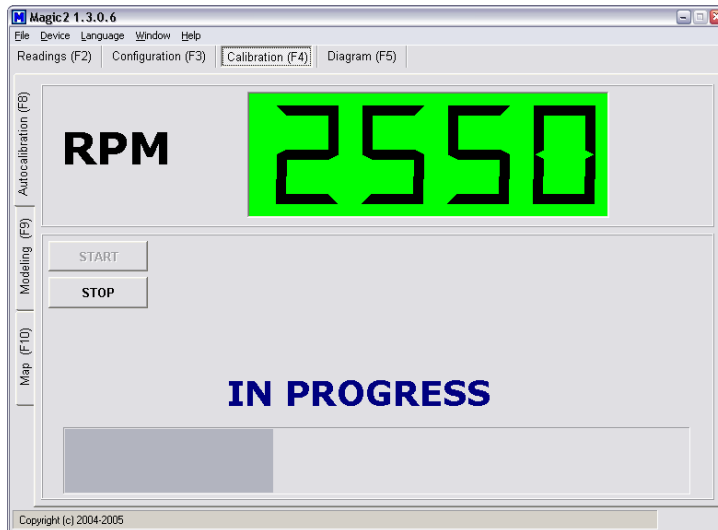
Window **“Modelling (F9)”** shows precise setting of unit to concrete car

Multiplication **“MULT”** means percentual difference between petrol and gas injection time. Ideal value is 1,00.

**“Offset”** means how many gas injector is slower than petrol injector. This time must be added. Ideal value is 0,00 ms.

Offset time for injector which you use is necessary first.

|                       | MATRIX | REG    | VALTEK | ZAVOLI |
|-----------------------|--------|--------|--------|--------|
| <b>Multiplication</b> | 1,00   | 1,00   | 1,00   | 1,00   |
| <b>Offset</b>         | 1 ms   | 2,5 ms | 2,5 ms | 2,0 ms |



Window **“Autocalibration (F8)”**

Warm-up engine at least on 50°C.

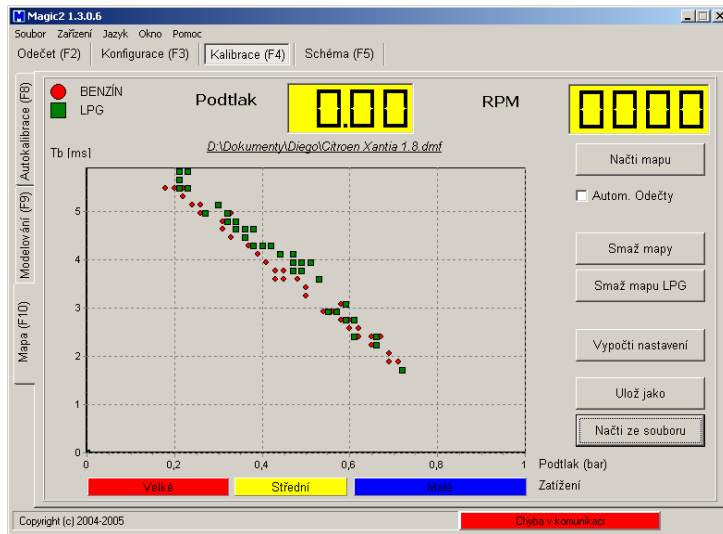
After start an engine we keep rotation speed in value 2.500 +/-300 RPM. Field RPM has green colours. Start auto car-calibration (period about 2 minutes). Having finished of the process calibration Magic\_2 control unit adjusts itself parameter **“MULT.”**.

In window **“Modelling (F9)”** now we can check, if parameter **“MULT.”** unchanged too. Change greater than below presentation will

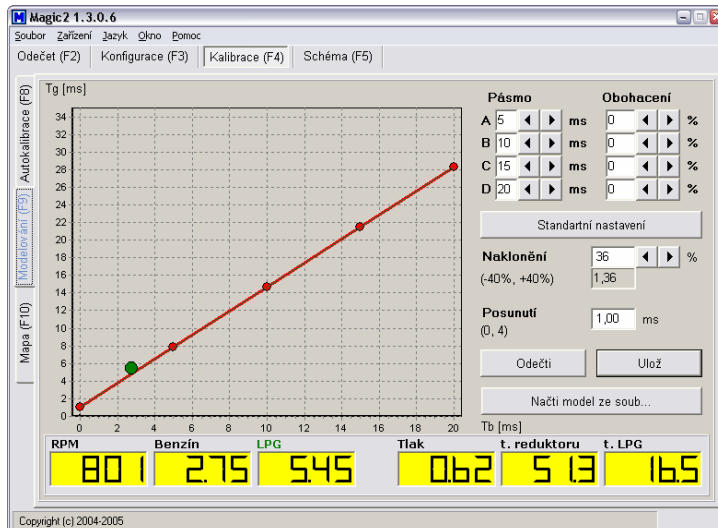
mean wrong selection of nozzles injector. **“MULT.”** greater than 1,3 means that nozzles injector are small and **“MULT.”** under 0,75 means that nozzles injector are too large.

## Precise setting on the run – map of computer unit

After installation system in car is necessary to perform the calibration. For action calibration



and data collection of engine work, it is necessary to connect calibration pressure sensor (code xxxx). See pic.xxx. This sensor will connect only to vacuum from manifold (through the T fitting) See the wiring diagram. Attention , the calibration sensor is the same like a pressure sensor (including connector). Calibration sensor must be connected to the longer wire of calibration cables. It is necessary passing a run on petrol and also on gas. Pass test course on petrol, at a different value of loading (different open of throttle), maintaining rotation speed on fixed level 2.500 +/- 300 RPM. (about 10 minutes for data collection). Now switch on LPG and again pass test course. Conection to computer in time of test isn't necessary. Unloaded working point stays automatically in memory of control unit. Computer displays map of work on petrol and on LPG. Pressing buttons "**Recalculate model**". Software calculate and displays points into graphics in window "**Modeling(F9)**". Adapt characteristics to overlay points at



work on gas and on petrol. Mostly it is necessary to change parameter "**MULT**." in order to full of covering characteristics on petrol and gas. After modification characteristics on basis unloaded map it is necessary tocheck or adjust duration of injection time on LPG in the iddle RPM by setting a parameter "**Offset**".

## Cleaning of Matrix injectors

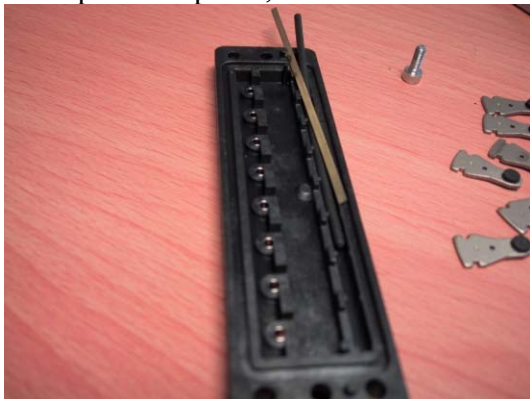
### Disassembly:

Screw out 4 pcs of imbus 2,5 mm. Take down part of body with nozzles.

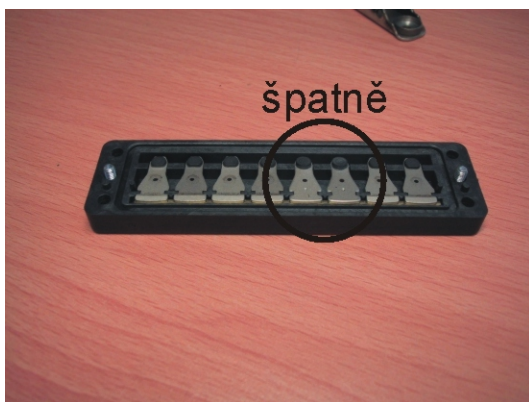
Screw out 2 pcs of imbus 2,5 mm. Attention, everything can go to pieces ! Avoid loss of them.

### Assembly:

At the first, put rubber reversible pad to the plastic part of body. Up to plastic pad put down brass pad. See pic. 1,2



Up to these reversible pads put down metal lame with rubber sit. [8x]. Attention, chamfer face up. See pic. 3 [wrong is signed].



Up to metal lames, put distance pad.  
See pic. 4



Put in peripheral seal and put together with part of body with coils. Screw by 2 pcs of imbus 2,5 mm. See pic. 5,6



Check all O-ring seals and put together with cover of Matrix. Screw by 4 pcs of imbus 2,5 mm. See pic.



#### **Matrix heating up:**

For better working Matrix injectors in winter it is recommended to warm it up by hot water from cooling car system. See pic.

#### **Intervals for servis:**

Every 20 000 km – change gas filter [gaseous state] and part of hose behind the filter

Every 20 000 km – cleaning Matrix injectors

Every 20 000 km – change LPG filter in LPG valve

Every 100 000 km – change membranes in reducer



## Recommended location injectors

