

CAR GAS

BARDOLINI

MULTIPOINT SEQUENTIAL INJECTION SYSTEMS

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MAIN FEATURES

Dear costumers,

Let us to introduce an exceptionally live product – CARGAS and BARDOLINI sequential injection system. The system has been developed and designed exclusively for cars with sequential injection systems.

Furthermore, the CARGAS and BARDOLINI systems can also work successfully with older engines – parallel injection system. In the design and construction of this product we have laid particular stress on the high quality materials and hubs, and on the simplicity of installation and service.

This system has all of the attributes and benefits of the earlier multi point system. In addition, it is super intelligent and it has the ability to inject gas in a truly sequential manner, just like the latest petrol vehicles. It achieves the latest European exhaust emission requirements with ease. This has a double meaning to the LPG driver – A car that pollutes the least can be the most fuel efficient as little fuel is wasted.

The CARGAS and BARDOLINI systems require even more information from the engine but use a lot of data from the vehicle's existing engine management instead of picking it up raw at source at the earlier system did.

Additional information required is:

- Gas temperature
- Gas pressure
- MAP
- Rail temperature
- Petrol injector pulse length
- Oxygen (Lambda) sensor signal(s)

The system has its own ECU (Electronic Control Unit), which is working in collaboration with the Petrol ECU, instead of working alongside like the earlier non sequential systems. All signals from Petrol ECU are picked up raw at source and then used by the LPG ECU to deliver the correct mixture for the corresponding conditions.

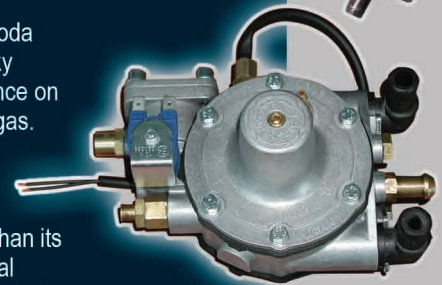
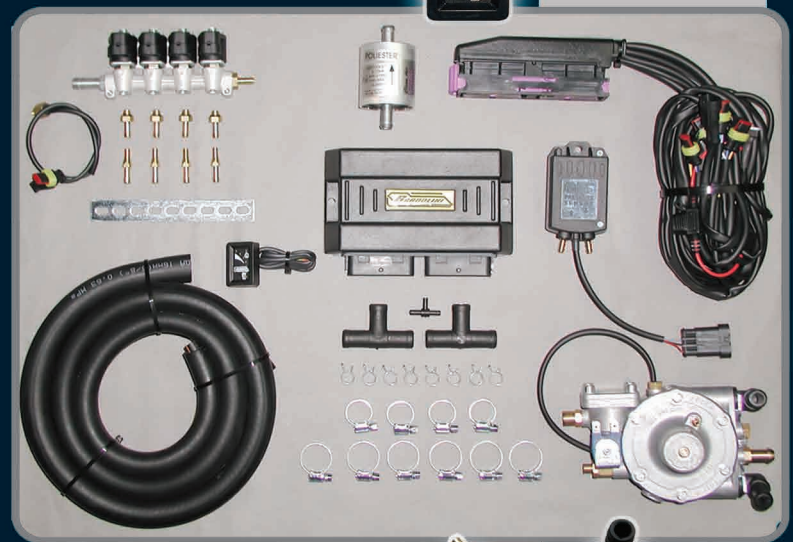
Even more benefits of performance and economy are delivered by the new BSM system, along one or two useful bonuses:

1. The new system will 'sense' that gas pressure is low and switch back to petrol before the gas tank runs dry – a very useful trick. It will even give you an audible warning to tell you it has done this. A 'self check' protocol has been added to the changeover procedure so that the system will not move on to gas if a problem exists.
2. The system now 'feed' engines up to 320 PS with a single reducer, which makes life easier for us and more reliable for you.

Last but not least, the latest 'FAST' or 'NORMAL' type injectors can be stripped and cleaned using only basic tools.

We have installed these new kits on our test cars, a Honda Logo (low power), Honda Stream & Skoda Oktavia (middle power), Lexus RX300, Audi A8 (high power, Euro 3) and many others was the lucky recipients. We were not disappointed. Lot of cars were road tested for over 300 000 km. Performance on LPG is just the same as with petrol and one can not even tell when the system has switched over gas. The experience from 20 000 sold systems helped us to research and reach best results for the system and the software.

We would like to draw your attention to the attractive price of the system which is over 50% lower than its equivalents produced by other companies. In addition to the system, we have developed the special software for Windows and Pocket PC through which all the necessary adjustments from the system to the car are done easily and lightly. We offer this software to all technicians of our system for free. If needed, we are able to conduct training for the settlement and maintenance of this software for the team that will be installing the system.



MAIN COMPONENTS

1 – Injector rail

It is controlled by ECU and is used to feed a right quality fuel to each of cylinders individually.

2 – Filter

It is installed between the reducer and the injector rail. Working pressure – Max 2.5 bars.

3 – ECU (Electronic Control Unit)

Using information from the original petrol Electronic Control Unit, the LPG ECU executes some mathematical operations to correct the petrol injectors pulse length and adapt them to LPG working process. The ECU automatically changes over petrol – LPG, showing the moment condition by LED.

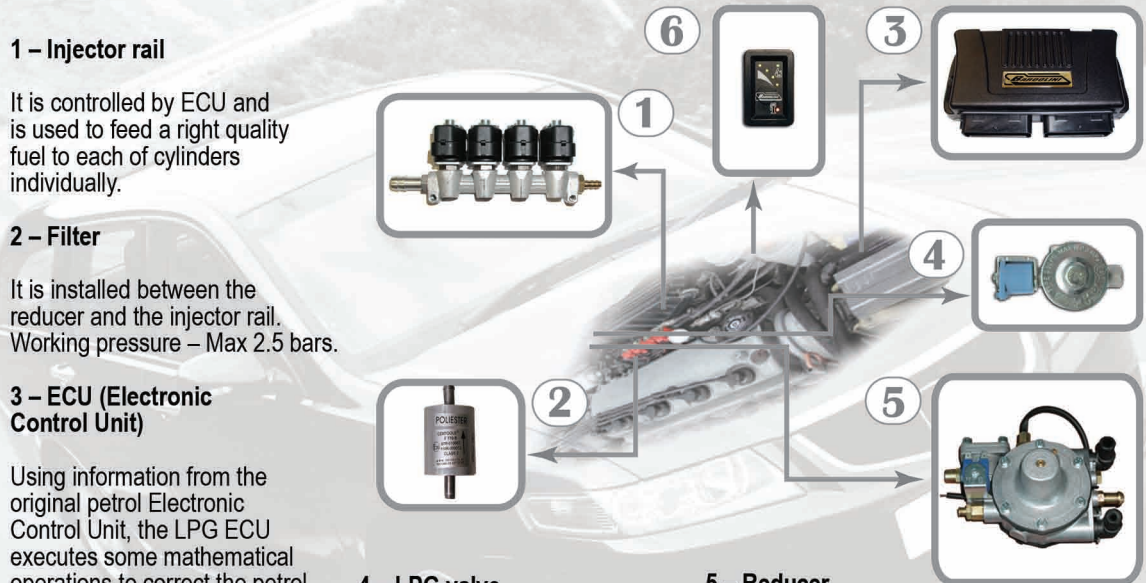
4 – LPG valve (for 6/8 cylinder kits)

It is installed between the LPG tank and the reducer and cuts off the LPG supplying. There is build in filter for the liquid gas.

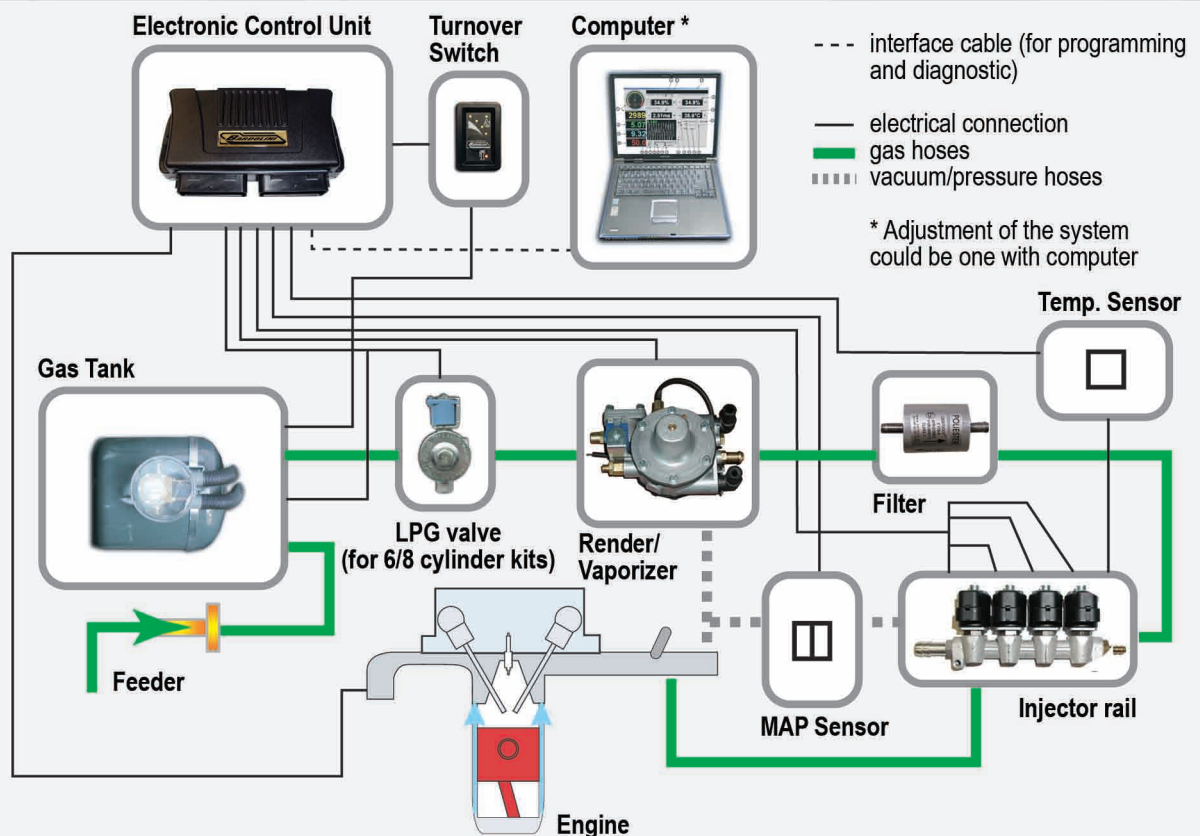
5 – Reducer

The reducer is one stage type which holds up constant outgoing pressure (1.5 atm), compared to the air-intake manifold.

6 – Turnover switch



PRINCIPLE DIAGRAM



TECHNICAL CHARACTERISTICS

Recommendation data for nozzle choice, according to the power of the engine, with injectors:

RAIL (VALTEK)

engine power (hp)	4 cylinders nozzle holes						
	1,4	1,6	1,8	2,0	2,2	2,5	2,8
0 - 64							
68 - 82							
83 - 101							
102 - 120							
121 - 137							
138 - 182							
183 - 200							
201 - 204							

MATRIX

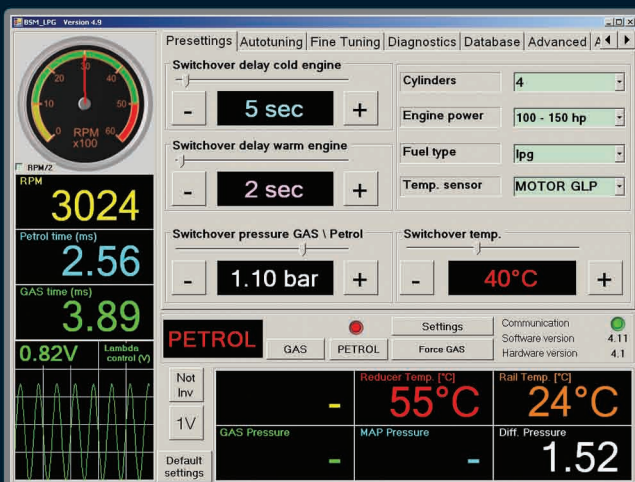
engine power (hp)	4 cylinders nozzle holes						
	1,2	1,4	1,6	1,8	2,0	2,2	2,5
0 - 67							
68 - 82							
83 - 101							
101 - 120							
121 - 137							
138 - 182							
183 - 200							
201 - 204							

Some important parameters of the system

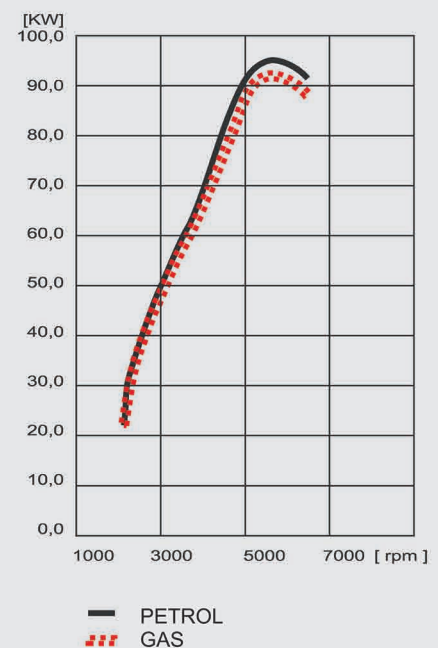
Cylinder number	3,4,5,6 or 8
Maximum power of the engine with 1 reducer	up to 174 kW / 320 PS
Working pressure of the reducer	1,5 (1,0 - 1,9) bar
Operating temperature	from -40°C to +125°C
Operating voltage	6,5 – 18 V
Impedance of the injector coil	1; 1,5; 2; 3; 6 ohm
Size of the calibration nozzles	1,2; 1,4; 1,6; 1,8; 2,0; 2,25; 2,5; 2,75; 3,0; 3,25; mm
Working pressure of the injectors	0,8 – 4,0 bar
Guarantee number cycle of the injectors	
For RAIL (VALTEK)	150 000 000
For MATRIX	500 000 000
Microcontroller	8 bit; 20 MHz; communication protocol BSM-G

ADJUSTMENT OF THE SYSTEM PARAMETERS

According to the engine power, the number of cylinders and some construction features for the intake manifold you can tune the system up with specialized software a few parameters: durations, temperatures, motions and other. There are opportunities with build in data in the software to enter automatically in the ECU all wanted coefficients. For some car models we foresee to give software, witch allows to be loaded the adjustment data by pressing a single button.



Comparison curves for petrol engine with both of fuels



BSM LPG Version 4.4

Presettings | Autotuning | Fine Tuning | Diagnostics | Database | Advance | M | Update

Single cylinder switchover LPG \ Petrol

Petrol Injectors Sequence

RPM: 3032

Petrol time (ms): 4,35

LPG time (ms): 7,52

Lambda control (V): 0,05V

PETROL

Reducer Temp. [°C]: 55°C

Rail Temp. [°C]: 45°C

LPG Pressure: 0,77

MAP Pressure: -0,72

Diff. Pressure: 1,50

BSM LPG Version 4.3

Autotuning | Fine Tuning | Diagnostics | Database | Advance | MAP | Update

Switchover RPM Gas to Petrol

Switch Off

Type of GAS Sensor Level: Non standard

Petrol cycles after Cut off: 0

Current level value: 5,00V

Level value: 0,41V

Reserve: 0,82V

1 / 4: 1,31V

2 / 4: 1,65V

3 / 4: 1,65V

PETROL

Reducer Temp. [°C]: 31°C

Rail Temp. [°C]: 72°C

LPG Pressure: -

MAP Pressure: -

Diff. Pressure: -

BSM LPG Version 4.4

Presettings | Autotuning | Fine Tuning | Diagnostics | Database | Advance | M | Update

0.0 - 1.6 ms	1,58	7.4 - 8.2 ms	1,66
1.6 - 2.5 ms	1,58	8.2 - 9.0 ms	1,63
2.5 - 3.3 ms	1,61	9.0 - 9.8 ms	1,63
3.3 - 4.1 ms	1,67	9.8 - 10.6 ms	1,60
4.1 - 4.9 ms	1,73	10.6 - 11.5 ms	1,56
4.9 - 5.7 ms	1,73	11.5 - 12.3 ms	1,53
5.7 - 6.6 ms	1,74	12.3 - 13.1 ms	1,49
6.6 - 7.4 ms	1,70	> 13.1 ms	1,43

Driving mode: Economic, Normal, Sport

Calculate MAP

PETROL

Reducer Temp. [°C]: 55°C

Rail Temp. [°C]: 45°C

LPG Pressure: 0,77

MAP Pressure: -0,72

Diff. Pressure: 1,50

BSM LPG Version 4.4

Presettings | Autotuning | Fine Tuning | Diagnostics | Database | Advance | M | Update

TUNING

Start AutoTuning

Save

Driving mode: Economic, Normal, Sport

Ръчна настройка

Before start autotuning procedure please ensure all consumers are switched off (Air conditioner, rear heater, lights etc. Keep the RPM near 3000)

PETROL

Reducer Temp. [°C]: 55°C

Rail Temp. [°C]: 45°C

LPG Pressure: 0,78

MAP Pressure: -0,74

Diff. Pressure: 1,52

In order to decrease the book-keeping for the fitter and the checking for the guarantee and post guarantee service we envisage provide for some additional information by dates, system software and adjustment for each client.

Inspired from our big experience in multipoint sequential injection system a new powerful analytic procedure was introduced for optimization of the combustion process in different loads of the engine, temperature RPM etc. There are several opportunities for regulating the system, depending on the preferences for the driver, which ones can be related to the group 'convenience for the driver'. The system is managed with the high level requirements for combustion of the fuelling not allowing the ECU turning on lamps for check (incorrect mixture, Euro 3, Euro 4). By increased number of sensors the system precisely control the important parameters when the engine works on LPG which gives the excellent consumption ratio LPG/petrol (not more than 1,05 – 1,15).

BSM LPG Version 4.4

MAP Modify

Range: -100 - 100

Mode: absolutely, linearity, percentage

0.0	1,58	1,58	1,60	1,60	1,61	1,61	1,63	1,63
10.6	1,64	1,64	1,62	1,62	1,60	1,60	1,62	1,64
11.5	1,59	1,59	1,57	1,57	1,56	1,56	1,57	1,59
12.3	1,56	1,56	1,55	1,55	1,53	1,53	1,55	1,56
13.1	1,56	1,56	1,55	1,55	1,53	1,53	1,55	1,56
> 13.1	1,56	1,56	1,55	1,55	1,53	1,53	1,55	1,56

PETROL

Reducer Temp. [°C]: 55°C

Rail Temp. [°C]: 45°C

LPG Pressure: 0,77

MAP Pressure: -0,74

Diff. Pressure: 1,51

BSM LPG Version 4.4

Presettings | Autotuning | Fine Tuning | Diagnostics | Database | Advance | M | Update

Customer Data

Auto Data: Honda, logo, 1.4i, 2001, 1.6 mm, MOTOR GLP, RAIL

Customer name: BSM

Car plate number: CA1234

Engine number: 5678

Kilometers: 160000

Installation date: 12 MapT 2007

PETROL

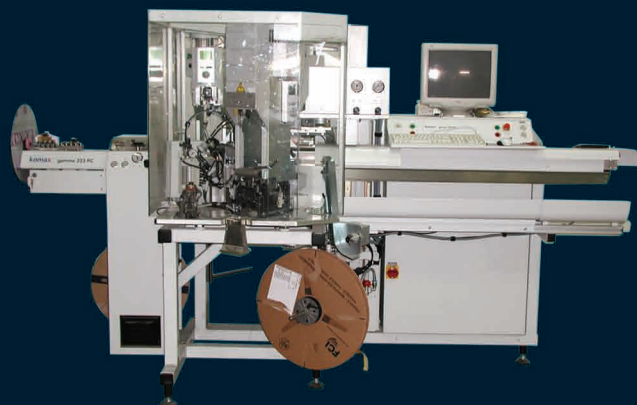
Reducer Temp. [°C]: 55°C

Rail Temp. [°C]: 45°C

LPG Pressure: 0,77

MAP Pressure: -0,72

Diff. Pressure: 1,50



BSM is a private company, established in 1992 in Sofia, Bulgaria by a team of engineers and specialists in Acoustics from the Technical University, Sofia. In the beginning, our activity was concentrated exclusively on production of sirens for car alarm systems. Later on, the scope of our activity was broadened and currently includes a wide range of sirens of different kinds. In 1994, the company developed and started producing one volume car-alarm systems (middle class). At the same time it increased the volume of the horn electrodynamic radiators up to 8000 pcs. per month. Due to constantly rising demand of sirens in Bulgaria in the recent years the production volume has increased substantially.

In 1996, the personnel of the BSM Company reached 20 full staff positions. During the same year, the company started exporting to Macedonia, Algeria, Ukraine, Turkey, Serbia and Thailand. In 2004 the company released on market our LPG Sequential system BARDOLINI and CARGAS. Now, the company is a technological Leader on the market for sirens, car-alarm systems and many articles for the security systems and LPG sequential systems in Bulgaria. We have our own manufacturing and Engineering Design Department, which develops the full range of production articles. Since August 2007 BSM Ltd. obtained certificate for system quality control ISO 9001:2000 by SGS. At present the company has RED Department of 8 people and staff of 50 people, with ability for production of 10000 alarm systems and 6000-10000 LPG sequential systems monthly.



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