

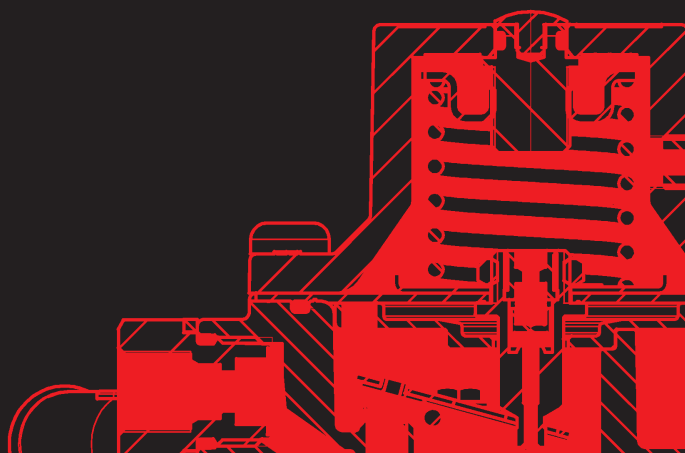


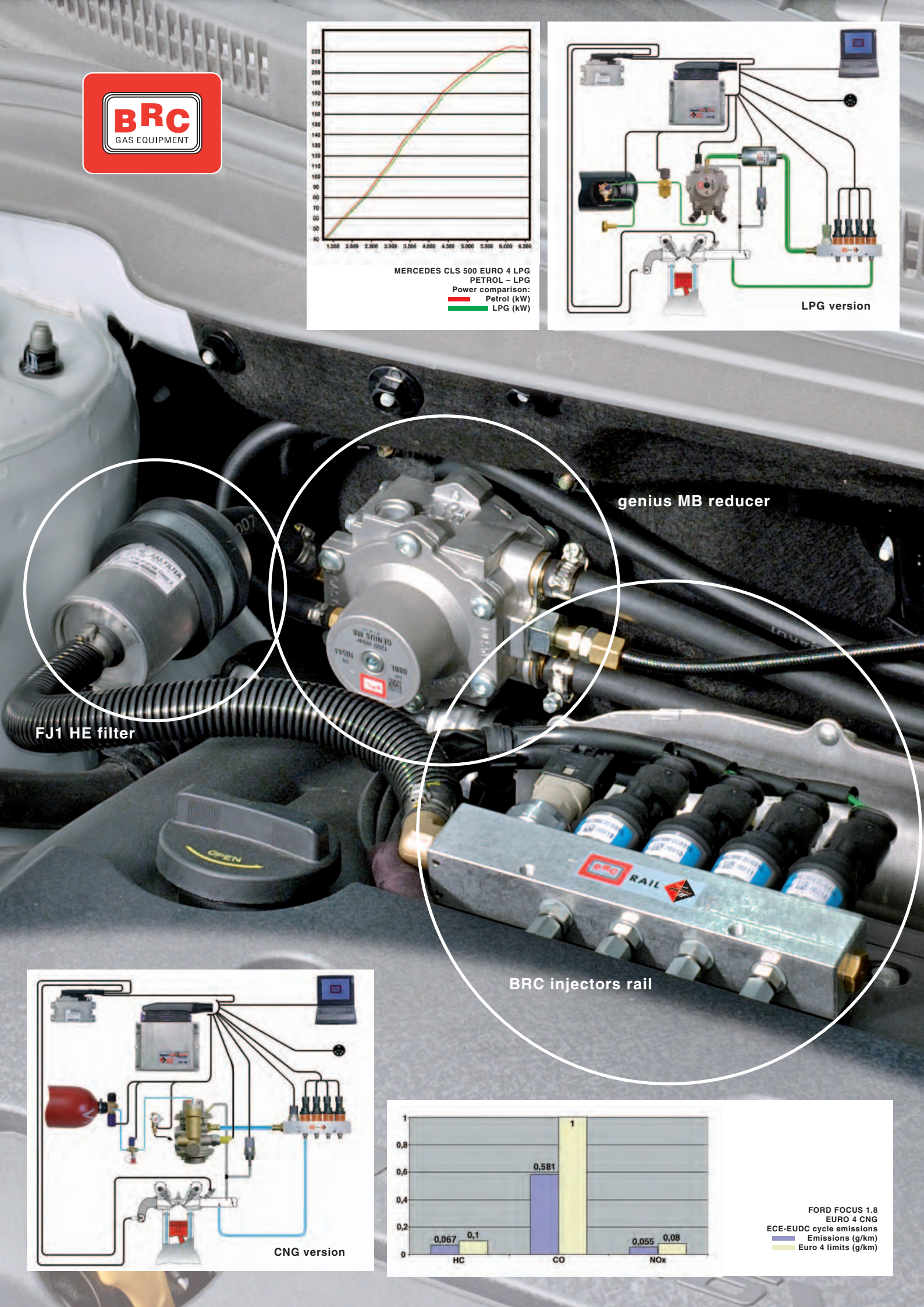
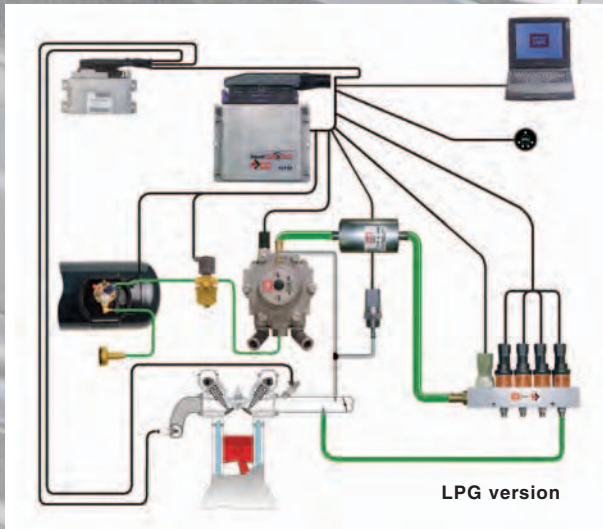
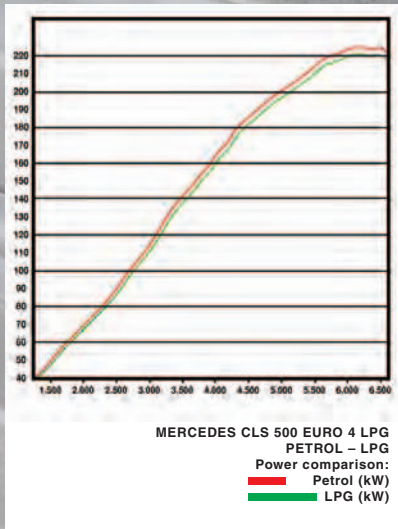
SEQUENT PLUG & DRIVE

LPG and CNG sequential injection system



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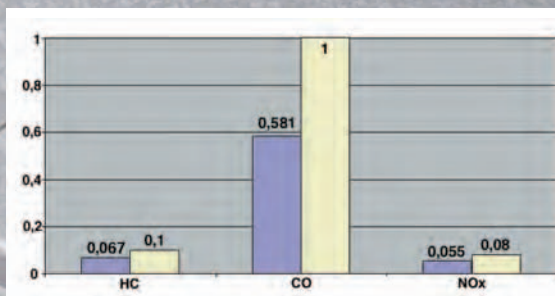
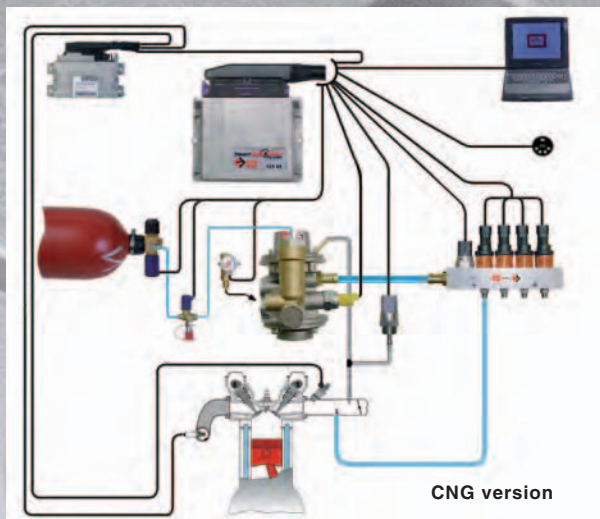




FJ1 HE filter

genius MB reducer

BRC injectors rail



FORD FOCUS 1.8
EURO 4 CNG
ECE-EUDC cycle emissions
Emissions (g/km)
Euro 4 limits (g/km)



Sequent Plug&Drive is the new CNG and LPG conversion system developed by BRC. It grows out of the basis of Sequent Systems experience, but it is characterized by a **completely innovative approach** able to simply manage both natural gas and LPG, for supplying engines with controlled starting. System is based on a strengthened hardware structure which includes pressure reducer, BRC injectors, pressure and temperature sensor integrated in the rail and a solid and powerful ECU. **Main innovation is the software** controlling the engine that, thanks to new management algorithms, allows optimising the gaseous fuel dosing in a simple and intuitive way, so that the installer could obtain easily the best results. In order to assure a higher integration with the petrol engine control satisfying OBD requirements, Sequent Plug & Drive has an update diagnostic on the gas system and allows communicating with the vehicle original OBD system.

CONFIGURATION

Pressure reducer is able to assure a precise and stable pressure adjustment during the time, quick reply times to better follow power changes required to the engine and, thanks to high flows, feed of powerful engines with the Genius Max version (up to 240 kW). ECU, developed on the BRC great experience in the field of sequential injection systems, works with a powerful, versatile and strong hardware structure. In fact, it can assure a more and more precise and timely control of the fuel quantity to inject in every working condition, in addition to be preset for a very advanced gas diagnostic system able to satisfy future norms and requirements of car builders. Versatility is assured by many arrangements made to manage even the most exigent vehicles and by the possibility to communicate with the car petrol OBD system. The design criteria followed, the components choice and the rigid validation tests to which the ECU is submitted during its development phases, assure its strength even in case of wrong installation operations.

Another big innovation is the wiring. System has been designed in order to totally simplify the installer's work. This allowed to reduce the number of cables to be connected to three only: the supply one, the under key positive one, and the lambda oxygen sensor in reading one. All others necessary connections, instead, have specific connection (sensors, gas injectors, petrol injectors cut). If possible, and to enter some additional functions, cables for OBD plug connection have been preset. Some accessory connections are available if necessary.

The new **changeover switch** also assures a very good aesthetic impact on the driver, joining the functions of level indication, used fuel and changeover in a very compact device. It can be installed externally or incorporated in the dashboard, for a better integration on the car. The buzzer, very important in case of gas fuel exhaustion, can be installed separately and, so, hidden at the driver's sight.

Sequent Plug&Drive adopts very small sensors with integrated connectors. These sensors, allowing a more precise reading of physical parameters, linked to the engine control that improves system working, are:

- **Gas pressure and temperature sensor:** it's situated in the rail body, and it reads precise gas and pressure temperature values. Its introduction in the rail avoids searching for its place in the engine compartment.
- **MAP sensor with integrated connector:** it is a small and light sensor suitable for both intake and supercharged engines. It's easy to install thanks to its small dimensions and weight.
- **Coolant liquid temperature sensor:** it's installed in the pressure reducer body. It allows realizing petrol/gas changeover as soon as the necessary conditions happen.

FUNCTIONS

After installing **Sequent Plug&Drive**, the whole system and supply control goes to the gas ECU, which manages it by means of electro-injectors piloting, according to the petrol ECU injection times, that are translated into the corresponding gas injection ones. Sequent Plug&Drive regulates in this way gas carburetion, keeping the same control strategies of the petrol ECU, and optimising in real time the fuel quantity in order to obtain the best carburetion, even with respect to pollution, and this not depending on external conditions (as temperature) and on fuel composition.

Sequent Plug&Drive controls all engine working phases, from idle to the most extreme tip-in and running conditions, keeping the original equipment strategies during normal working conditions and applying suitable improvements if gas fuel needs them. This assures the higher compatibility with the original supply system, keeping practically unchanged the builder's engine control diagnostic, but allowing, however, an optimal working in the most special conditions too. System acts, in fact, in "closed loop" thanks to the petrol ECU, correcting in real time the air/gas mixture title, according to the information coming from the petrol injectors piloting made by the petrol ECU itself. The petrol ECU, therefore, will remain able to carry out the car-builder's strategies, based on the Lambda oxygen sensor, to maintain the right mixture title. The fuel quantity sent to each engine cylinder is controlled by electro-injectors in gaseous phase, that allow dosing gas and introducing it directly into each single intake manifold pipe, (close to the petrol injectors of original system) eliminating the backfire risk. So, task of the ECU is to evaluate the injection time signals coming from the petrol ECU and, by linking them with vehicle working conditions according to specific predefined mappings, calculate the injection times for gas injectors. The right stoichiometric ratio characterising the system, therefore, depends on both the extreme decision quickness of the digital system inside the gas ECU, and the reply quickness and precision that gas injectors can guarantee.

Sequent Plug&Drive manages the petrol injectors cut-off and emulation assuring the passage from a fuel to another in a soft way thanks to a sequential changeover (BRC patent). Function of re-changeover to petrol mode for end of gas exhaustion avoids discontinuity of the supplied torque in these conditions too, by advising user through the buzzer.

In the new built-in changeover switch used by the system, functions of level indication, fuel type and changeover are integrated. You can connect the gas ECU (by means of suitable communication wiring) to the portable PC for the system programming and diagnostic, and for an easy and deep setting procedure. A powerful and valid interface program allows communicating with the ECU and intervening on every system setting parameter in real time.



ECU

- Automotive microprocessor 16 bit 40 MHz
- Operating Temperature: -40 °C + 105 °C
- Watertight through immersion
- According to automotive norms for protections and inlet/outlet signals
- Operating voltage: 8 V ÷ 16 V
- Sensors and actuators diagnosis compatible with EOBD
- Communication and reprogramming with PC through K-line
- It supports KWP2000 communication protocol
- It supports CAN 2.0 communication
- EMC compliant
- It pilots up to 8 injectors
- Integrated injectors cut and emulation
- Approval: R67-01 – R110 - 2004/104/CE



BRC IN03 ELECTROINJECTOR

BOTTOM FEED

Floating shutter in friction total absence

Impedance: 2.04 Ω / 2.35 mH at 20 °C

Temperature: -40 °C ÷ 120 °C

Voltage: 6 V ÷ 16 V

Seal: Rubber on metal

Approval: R67-01; R110

LPG feed powers

		Genius MB800	MB1200	MB1500	Genius MAX
Normal Type	Aspirated	17 kW/cyl.	21 kW/cyl.	23 kW/cyl.	-
	Supercharged	22 kW/cyl.	26 kW/cyl.	28 kW/cyl.	-
Max Type	Aspirated	-	26 kW/cyl.	30 kW/cyl.	30 kW/cyl.
	Supercharged	-	32 kW/cyl.	36 kW/cyl.	36 kW/cyl.
Super Max Type	Aspirated	-	-	35 kW/cyl.	35 kW/cyl.
	Supercharged	-	-	42 kW/cyl.	42 kW/cyl.

Values by way of example only.



PTS SENSOR (LPG VERSION)

- Gas pressure and temperature sensor
- Weight: 22 grams
- Overall dimensions: ϕ = 24 mm, h= 64,5 mm
- Integrated connector
- Operating temperature -30 °C ÷ 130 °C
- Resistive outlet
- Approval: R67-01 - R110



MAP MANIFOLD PRESSURE SENSOR

Weight: 17 grams

Overall dimensions: ϕ = 22 mm, h= 63 mm with pipe-holder

Pressure Range: 0 ÷ 2,5 bar

Integrated connector

Precision 1,5 % F.S.

Operating temperature -40 °C ÷ 125 °C

Outlet 0 ÷ 5 V



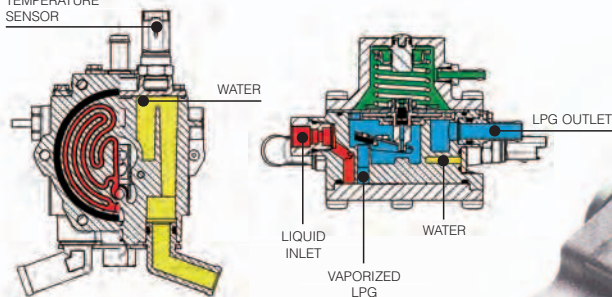
GASEOUS PHASE FILTER

Filter with cartridge

Load loss: 35 kPa with Q= 18000 NI/h air

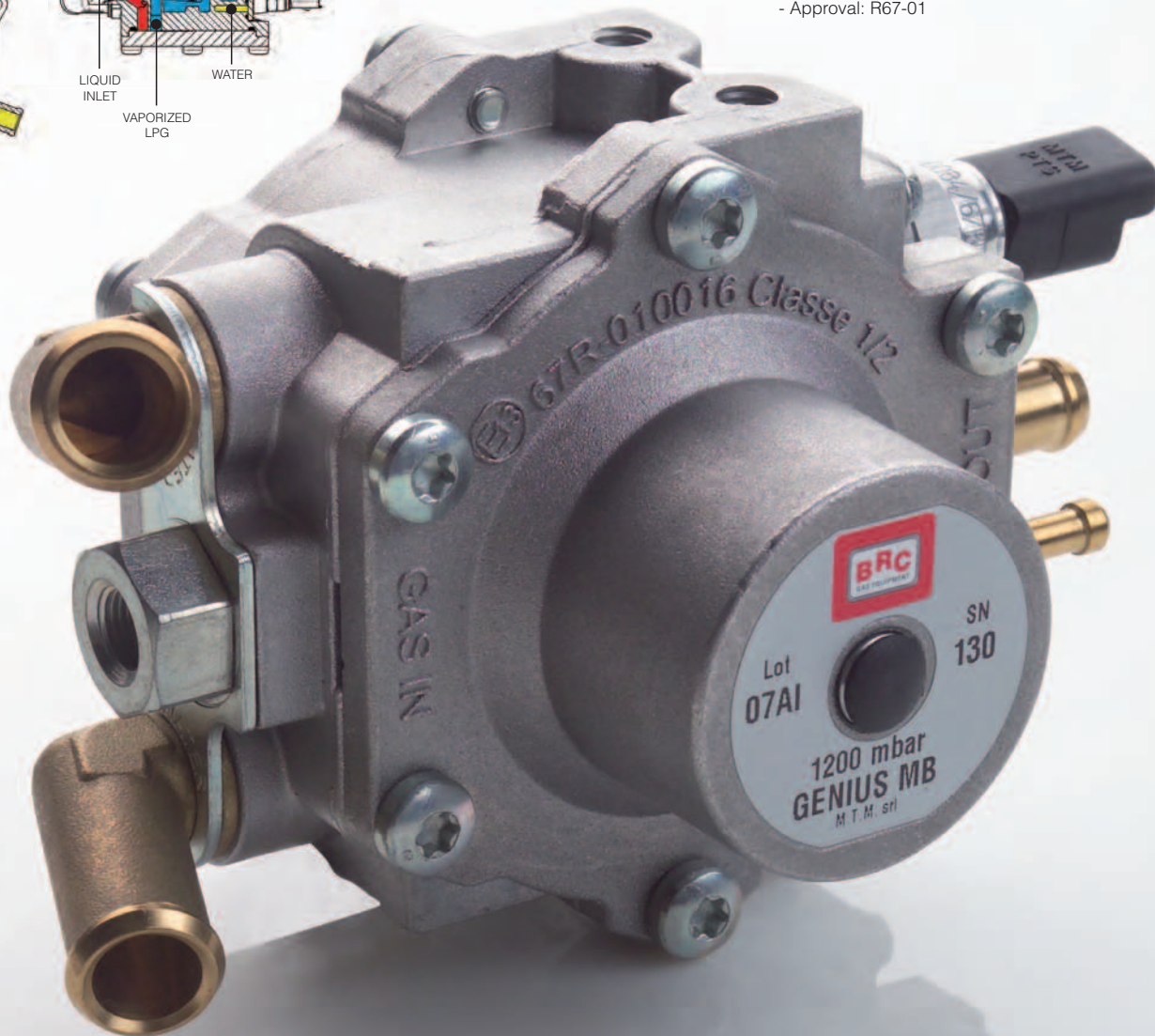
Filtration degree: $\beta_{10} \geq 75$

Approval: R67-01; R110



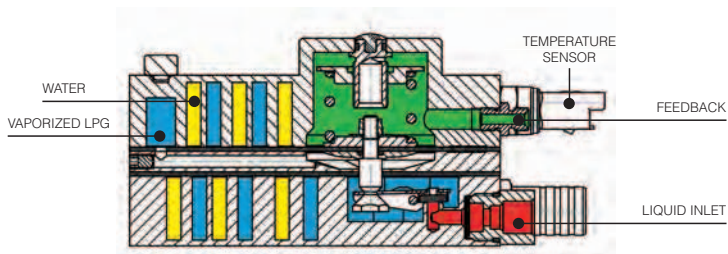
GENIUS MB REDUCER

- Diaphragm single-stage type building
- Adjusted pressure: 80 kPa, 120 kPa or 150 kPa relative to the intake manifold pressure
- No bleeding operation needed
- Maximum supply power with P&D system: 160 kW
- Approval: R67-01



GENIUS MAX REDUCER

- Diaphragm single-stage type building
- Adjusted pressure: 150 kPa relative to the intake manifold pressure
- No bleeding operation needed
- Maximum supply power with P&D system: 240 kW
- Approval: R67-01



PUSH-PUSH CHANGEOVER SWITCH

- SMD single-stable changeover switch
- \varnothing outside 26 mm
- Possible installations:
 - built-in with \varnothing 23 mm hole and 2 mm dimension
 - external on the dashboard with \varnothing 14 mm hole and 9 mm dimension
- Acoustic indicator (buzzer)
- N° 4 green LEDs for level indication
- N° 1 bi-colour (green/red) LED for mode working indication



SOFTWARE

The Sequent Plug&Drive interface software has been developed with the aim to join easiness of system setting (or mapping) and powerful tools able to allow optimisation of vehicles needing it.

According to this philosophy, a standard setting procedure has been developed; it only needs three deep accelerations (with steady vehicle) and some seconds at idle condition.

If vehicle requires a dosage optimisation during tip-in/tip-out or full load conditions, some easy and intuitive-to-set functions are available in order to obtain the best results. Communication (optional) with petrol OBD allows displaying the most significant parameters for diagnostic on board, integrating in this way on a single instrument specific data of both gas and petrol system. Diagnostic and actuators test functions, useful while checking the system, are available such as for the other systems of Sequent family.





ECU

- Automotive microprocessor 16 bit 40 MHz
- Operating Temperature: -40 °C + 105 °C
- Watertight through immersion
- According to automotive norms for protections and inlet/outlet signals
- Operating voltage: 8 V ÷ 16 V
- Sensors and actuators diagnosis compatible with EOBD
- Communication and reprogramming with PC through K-line
- It supports KWP2000 communication protocol
- It supports CAN 2.0 communication
- EMC compliant
- It pilots up to 8 injectors
- Integrated injectors cut and emulation
- Approval: R67-01 – R110 - 2004/104/CE



IN03 ELECTROINJECTOR

BOTTOM FEED

- Floating shutter in friction total absence
- Impedance: 2.04 Ω / 2.35 mH at 20 °C
- Temperature: -40 °C ÷ 120 °C
- Voltage: 6 V ÷ 16 V
- Seal: Rubber on metal
- Approval: R67-01; R110

CNG feed powers

		Zenith Δp 1600	Zenith Δp 2000	Zenith Δp 2500
Normal Type	Aspirated	15 kW/cyl.	17 kW/cyl.	20 kW/cyl.
	Supercharged	18 kW/cyl.	20 kW/cyl.	23 kW/cyl.
Max Type	Aspirated	19 kW/cyl.	22 kW/cyl.	25 kW/cyl.
	Supercharged	22 kW/cyl.	25 kW/cyl.	29 kW/cyl.
Super Max Type	Aspirated	22 kW/cyl.	25 kW/cyl.	29 kW/cyl.
	Supercharged	27 kW/cyl.	31 kW/cyl.	34 kW/cyl.

Values by way of example only.



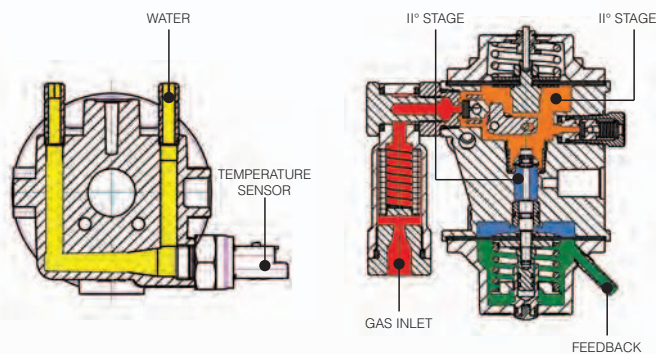
PTS SENSOR (CNG VERSION)

- Gas pressure and temperature sensor
- Weight: 17 grams
- Overall dimensions: ϕ = 22 mm, h= 54 mm with pipe-holder
- Integrated connector
- Operating temperature -40 °C ÷ 120 °C
- Resistive outlet
- Approval: R67-01 - R110



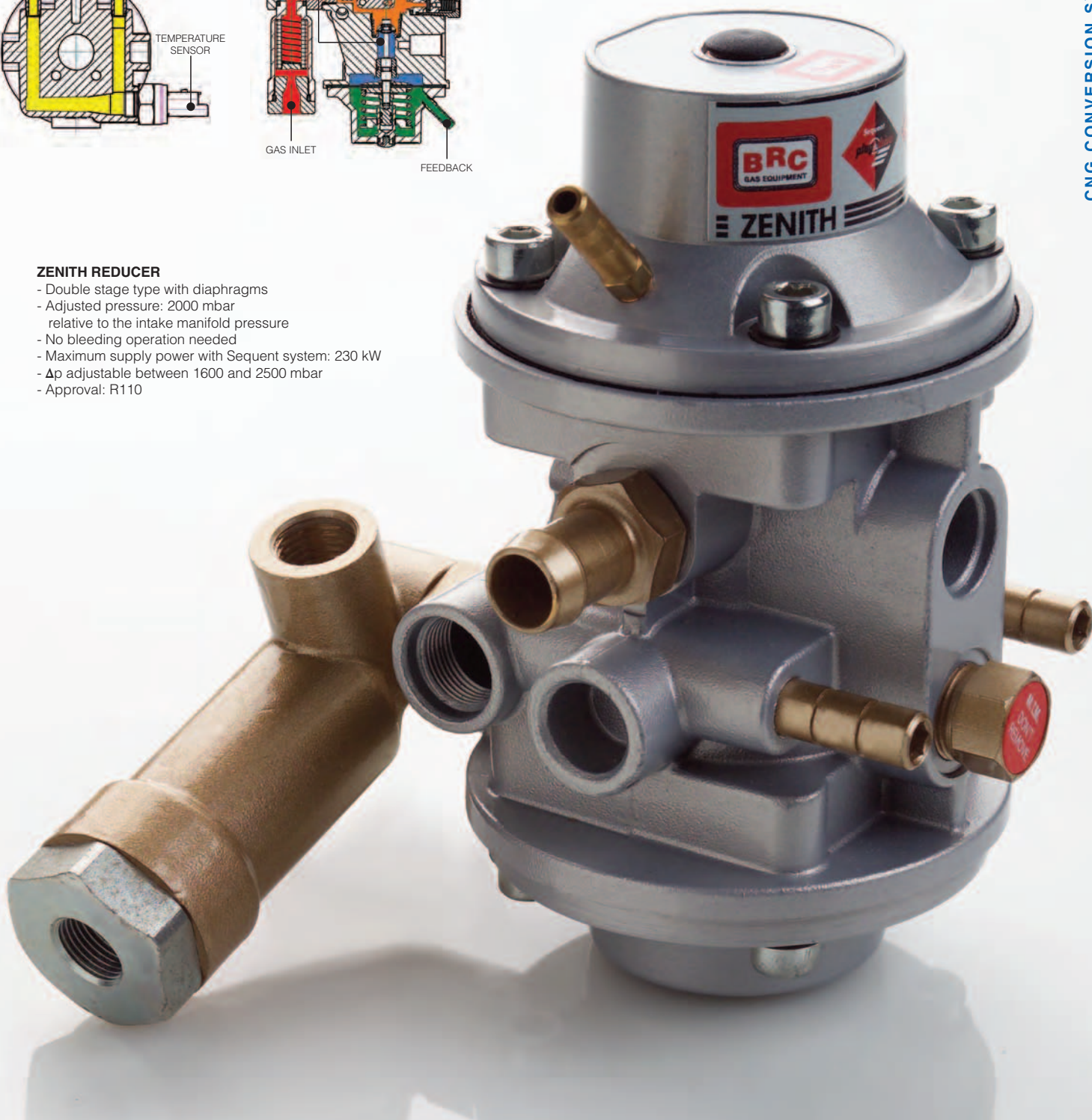
MAP MANIFOLD PRESSURE SENSOR

- Weight: 17 grams
- Overall dimensions: ϕ = 22 mm, h= 63 mm with pipe-holder
- Pressure Range: 0 ÷ 2,5 bar
- Integrated connector
- Precision 1,5 % F.S.
- Operating temperature -40 °C ÷ 125 °C
- Outlet 0 ÷ 5 V



ZENITH REDUCER

- Double stage type with diaphragms
- Adjusted pressure: 2000 mbar relative to the intake manifold pressure
- No bleeding operation needed
- Maximum supply power with Sequent system: 230 kW
- Δp adjustable between 1600 and 2500 mbar
- Approval: R110



PUSH-PUSH CHANGEOVER SWITCH

- SMD single-stable changeover switch
- \varnothing outside 26 mm
- Possible installations:
 - built-in with \varnothing 23 mm hole and 2 mm dimension
 - external on the dashboard with \varnothing 14 mm hole and 9 mm dimension
- Acoustic indicator (buzzer)
- N° 4 green LEDs for level indication
- N° 1 bi-colour (green/red) LED for mode working indication



SOFTWARE

The Sequent Plug&Drive interface software has been developed with the aim to join easiness of system setting (or mapping) and powerful tools able to allow optimisation of vehicles needing it.

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If vehicle requires a dosage optimisation during tip-in/tip-out or full load conditions, some easy and intuitive-to-set functions are available in order to obtain the best results. Communication (optional) with petrol OBD allows displaying the most significant parameters for diagnostic on board, integrating in this way on a single instrument specific data of both gas and petrol system. Diagnostic and actuators test functions, useful while checking the system, are available such as for the other systems of Sequent family.



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