

# SEQUENT FASTNESS

Modular Common Rail System for Gas

## CNG Multipoint sequential injection system





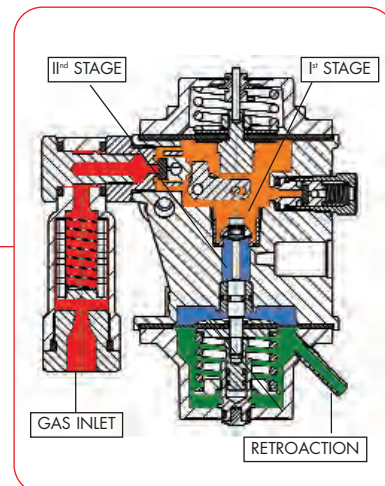
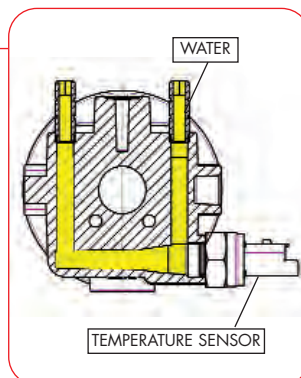
## SEQUENT FASTNESS: BRC CNG SEQUENTIAL INJECTION SYSTEM

### COMPONENTS CHARACTERISTICS

CNG Zenith Sequent Fastness Reducer



Double stage construction with diaphragms  
Set pressure:  
220 kPa as for the manifold pressure  
Drain operations not needed  
Maximum power fed with Sequent Fastness system: 230 kW  
Delta p ( $\Delta p$ ) adjustable between 1600 and 2500 mbar  
Approval: R110



Electro-injector BRC "IN03"



BOTTOM FEED  
Floating shutter during friction absence  
Impedance: 2.04  $\Omega$  / 2.35 mH a 20 °C  
Vibrations: 1,5 g between 50 Hz and 400 Hz  
Temperature: -40 °C ÷ 120 °C  
Voltage: 6 V ÷ 16 V  
Tightness: gomma su metallo  
Noise: < 90 dB  
Regulation: R67-01; R110

CNG feeding capacities				
		Zenith $\Delta p$ 1600	Zenith $\Delta p$ 2000	Zenith $\Delta p$ 2500
Injectors <b>Max Type</b>	Asp.	19 kW/cyl.	22 kW/cyl.	25 kW/cyl.
	Superch.	22 kW/cyl.	25 kW/cyl.	29 kW/cyl.
Injectors <b>Normal Type</b>	Asp.	15 kW/cyl.	17 kW/cyl.	20 kW/cyl.
	Superch.	18 kW/cyl.	20 kW/cyl.	23 kW/cyl.

Values by way off example only.

Sequent Fastness FLY SF electronic control unit



Microcontroller automotive 32 bit 20 MHz  
Operating Temperature: -40 °C + 125 °C  
Waterproof tightness for immersion  
Observance of the automotive rules on protections and input/output signals  
Operating voltage: 6.5 V ÷ 18 V  
Sensors diagnosis and compatible actuators with EOBD  
Communicates and it is re-programmable by PC through K line  
Supports the communication protocol KWP2000  
Supports CAN 2.0 communication  
EMC compliant  
Pilots : up to 4 injectors in the version with one connector  
up to 8 injectors in the two connectors version  
Integrated injectors cut-off  
Integrated timing advance processor  
R.P.M. signal reading also from crankshaft  
Regulation: R67-01; R110

## SEQUENT FASTNESS: BRC CNG SEQUENTIAL INJECTION SYSTEM

### COMPONENTS CHARACTERISTICS

Weight: 17 grams  
 Overall dimensions:  $\varnothing = 22$  mm,  $h = 63$  mm with rubber holder  
 Pressure Range:  $0 \div 2,5$  bar  
 Integrated connector  
 Accuracy 1,5 %  
 Operative temperature  $-40^{\circ}\text{C} \div 125^{\circ}\text{C}$   
 Outlet  $0 \div 5$  V

MAP manifold pressure sensor

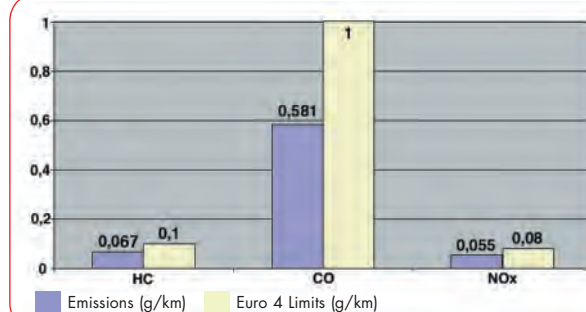


A system that guarantees all advantages of CNG feeding without worsening the original power of the engine is the aim achieved with **SEQUENT FASTNESS**.

#### SYSTEM FIELD OF USE

The CNG, clean fuel, is available for automotive purposes and, by using the **SEQUENT FASTNESS** sequential injection system allows to reach emission levels lower than the present and future ones.

Ford Focus 1.8i Euro 4 CNG – Emissions cycle ECE-EUDC



#### THE INTERFACE SOFTWARE

**SEQUENT FASTNESS** is a versatile system thanks to powerful interface software developed by BRC. By means of a portable PC, the software allows to communicate with the Fly SF ECU and reach all its functionalities.

##### FLY SF ECU Programming

The programming of the gas ECU necessary to obtain the correct working of the equipped vehicle is simple and quick. A simple and driven procedure instead allows developing independently the configurations for those cars which are still not available from other sources.

##### Diagnostic

Thanks to the diagnostic functions it is simple to verify the correct installation or find out the causes of malfunction. The ECU inspection on input and output faults and the consequent error message, the possibility to act actuators to verify the correct working, the alphanumeric and graphical monitoring of all data related to the system working make this interface software like an instrument able to simplify the complex things.

##### Offline/utility

A series of functions, qualified even if disconnected from the Fly SF ECU, allows to check and manipulate data and configurations previously filed, organising like that an archive or preparing a subsequent work.





The evolution of SEQUENT system allows introducing new and always more sophisticated components suitable to achieve even higher performances.

From Sequent experience comes the new Sequent FASTNESS version: the new BRC gaseous sequential injection system, studied for the CNG feeding of controlled ignition.

The substantial targets SEQUENT FASTNESS intends to reach with the various changes are to make the system stronger, easy to install and able to solve even the more difficult situations always keeping unchanged the essential characteristics of the best gaseous systems present on the market.

### Configuration

The new Zenith reducer is studied exclusively for CNG application and has the advantage to allow a more precise and stable adjustment, faster response time and the possibility to feed more powerful vehicles (with same injectors and Delta-p basic setting).

Sequent FASTNESS system adopts new very small sensors with integrated connectors. These sensors allow an attentive reading of the physical parameters related to engine control with the resulting improvement of the system operation such as:

- The pressure and gas temperature sensor inside the rail can accurately read the temperature and gas pressure values. The introduction inside the rail makes not necessary the installation of this device in the engine compartment.
- MAP sensor with integrated connector: this is a small, light sensor suitable for both vacuum and turbo engines. It is easy to install thanks to its small dimensions and weight.
- Cooling liquid temperature Sensor: it is installed inside the Zenith pressure reducer. It allows the petrol/gas changeover as soon as necessary conditions are achieved.

Another innovation is the harness for CNG feeding that allow the fast connection of all sensors and actuators to the ECU with a few welds. The auxiliary harness for the signal connection used in the engine control is not necessary. Colours closed to the sensors' connectors make easy to know the correct plug in:

- Sensor with yellow connector to the yellow thermo-contracting (cooling liquid temperature)
- Sensor with grey connector to the grey thermo-contracting (MAP),
- Sensor with black connector (Gas Temperature).

The harness also has a 5 poles connector useful to connect the crankshaft sensor for the advance management and/or the rpm reading (harness used for external spark timing advancers, too).

### Functions

During the emission tests for the system approval we obtained

such results that prove the exceptionally good quality of the carburation control system that is the same of the previous systems. The tests according to R110, R10 and EMC (Electromagnetic compatibility) norms have a successful result underlining the strength to electromagnetic interference confirming the validity of the designing strategies and adopted solutions.

After the installation of the SEQUENT FASTNESS, the control of the whole installation goes through the FLY SF ECU and the electro-injectors piloting based on the petrol injection ECU timing that are translated in gas injection ones. SEQUENT FASTNESS provides to the gas carburation adjustment keeping unchanged the petrol ECU strategies and optimising the fuel quantity in real time to reach the optimal carburation for the pollution point of view, too and all this independently from external conditions (temperature, ..) and fuel composition.

SEQUENT FASTNESS controls all engine operation phases, from idling to transient extreme conditions and steady state and keeps the strategies of the original installation. By doing this he obtain the best compatibility level with the original installation and we keep the carmaker engine control diagnostic unchanged. The system acts in "closed loop" through the petrol ECU correcting in real time the air/gas mixture title according to the information coming from the piloting of the petrol injectors by the petrol ECU itself. This latter will be able to carry out the carmaker strategies based on the oxygen sensor for keeping the mixture title correct.

The fuel quantity sent to the engine is very important for its correct operation. Too "lean" or too "rich" mixtures can affect performances, consumption and an efficacious catalysis of the exhaust gas.

The fuel quantity control for each engine cylinder is checked by the electro-injectors during the gaseous phase and allows dosing the gas and introducing it directly inside each intake manifold (close to the original petrol injectors) avoiding backfire problems.

The aim of the FLY SF ECU is to evaluate the injection time signals coming from the petrol ECU and connect them to the vehicle operation conditions according to pre-adjusted maps and to calculate the injection time for the gas injectors. The correct stoichiometric ratio comes from the fast decision of the digital system contained in the FLY SF ECU, from the fast response and the precision the gas injectors can assure.

SEQUENT FASTNESS manages the stopping and emulation of the petrol injectors and the built-in changeover switch embodies a level indicator with 4 green LEDs. For the system diagnostic, the programming and the practical and deep setting procedure, there is the possibility to connect the FLY SF ECU to the PC by using a suitable communication harness.

A valid and powerful interface programme allows communicating with the ECU and intervening on all system parameters in real time.

