Autogas system
4SAVE LPG/CNG
User Manual

Concerns 4SAVE LPG/CNG system with control units

4SAVE BEST, 4SAVE ECO, 4SAVE MAX 8, 4SAVE MAX 6, 4SAVE MAX 4, 4SAVE MAX 6 Lite

in all years of production

The manual is an integral part of the gas system

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1. User Manual

1.1. 4SAVE LPG/CNG system

The 4SAVE system is a technologically advanced system for converting a petrol engine to LPG/CNG. The system works in the same way as the original engine control system, very precisely injects LPG/CNG into the engine, thanks to which it is able to meet the stringent exhaust emission standards. With a properly installed and configured system **4SAVE** the use and performance of a vehicle on LPG/CNG should not differ significantly from those on petrol.

1.2. Description of the system components

Each LPG/CNG system consists of the following components:

- **LPG/CNG controller** – installed in the engine compartment, a computer that controls the operation of the gas system. It reads engine control signals from the car's original controller and, based on them, controls gas injectors and other actuators of the gas system.
- **Fuel switch –** fuel type selector switch installed in the driver's cabin.
- **Gas injectors –** Injectors installed in the engine's intake manifold delivering the alternative fuel LPG or CNG to the engine.
- **Gas pressure regulator –** A mechanical device installed in the engine compartment that reduces the gas pressure from high (such as it is in the tank) to low pressure of about 1 [bar].
- **Gas pressure sensor –** A sensor installed in the engine compartment that measures the gas pressure, gas temperature and air pressure in the engine's intake manifold.
- **Gas electrovalve –** An electrically controlled valve installed in the engine compartment that cuts off the gas supply from the gas pressure regulator in the event of engine shutdown or switching to the original fuel (petrol).
- **Volatile phase filter –** a filter installed in the engine compartment that prevents impurities from entering into the gas injectors.
- **Gas tank –** alternative fuel storage tank, usually installed in the car boot. The tank is additionally equipped with a manual cut-off valve and an electrically operated valve that cuts off the gas flow from the tank in the event of engine shutdown or switching to the original fuel (petrol).
- **Gas inlet** - an element of the gas installation allowing for refuelling the vehicle's tank at the LPG station. There may be different types of gas inlet depending on the country, so when traveling abroad it may be necessary to use an additional adapter to refuel the gas.

1.3. The 4SAVE system operation.

1.3.1. Performance characteristics

A vehicle with the installed LPG/CNG system can be used in the same way as when running on petrol. It must be remembered that the main fuel is still petrol, so it should always be in the tank.

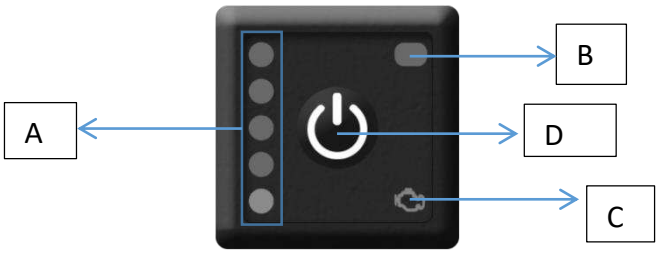
1.3.2. The first start-up of the gas installation

After installing and calibrating the LPG/CNG system in the vehicle by a professional facility that installs LPG/CNG system, it is ready for use. The user should remember to perform periodic inspections of the system in a professional facility that installs LPG/CNG systems.

1.3.3. Control panel (petrol/gas switch)

1.3.3.1 Description of the control panel

The control panel is equipped with a indicator of gas level in the tank (A), a diode indicating the operating status (B), a diode indicating a system failure (C), a button for changing the operating status (D).



(A) Gas level indicator

- 4 green LEDs lit - tank full
- 3 green LEDs lit - ¾ tank
- 2 green LEDs lit - ½ tank
- 1 green LED lit - ¼ tank
- **red** LED lit - **tank empty**

If **VLS** (virtual gas level sensor) is turned on and the controller calculates that the current gas level is 0[%], then **red** LED will start flashing.

(B) LED indicating the operating status

- **Off** - operation on petrol
- **Flashes** - waiting for switching to petrol
- **Flashes quickly** - operation on petrol (no gas or fault)
- **On** - operation on gas

(C) LED indicating the system fault

- **Off** - the system operates normally

- **On** - system fault
- **Flashes** - system inspection or emergency operation required

(D) Button for changing the operating status

- After pressing the button, the fuel will be changed.

1.3.3.2 Sound signals

The control panel signals the following events with sound signals:

- Button pressing
- Gas exhaustion in the tank
- Necessity to perform inspection
- Detection of a gas system fault.
- Emergency mode operation (see 1.3.3.4)

1.3.3.3 Setting the current gas level in the tank

Using the control panel (switch), the user can set the gas level in the tank. This feature has dual functionality:

✓ In the case when **VLS** is off (ask the workshop performing the installation), the user has the option to correct the current gas level, if the displayed gas level is incorrect.

✓ In the case when **VLS** is on (ask the workshop performing the installation), the user can set the amount of refueled gas.

In order to set the gas level:

- Switch the engine to gas
- Hold down the button for min. 3 seconds (until you hear a sound signal). The LEDs displaying the current gas level will start flashing
- By pressing the button, the user can set the correct gas level.
- To terminate the function, hold down the button for min. 3 seconds (until you hear a sound signal) or do not press the button on the switch for 15 seconds.

1.3.3.4 Emergency start of the system on gas

In the event of a fault in the engine's petrol supply system, it is possible to start the engine directly on gas in an emergency. In order to start the engine on gas in an emergency:

- Turn the ignition on
- Hold down the button for min. 3 seconds (until you hear a sound signal).
- Start the engine

The LED **(D)** flashes during emergency operation and every minute a sound signal is generated to inform about the emergency status.

You should only start the engine in the emergency mode in the event of a malfunction of the petrol fuel system. During operation in this mode, some elements of the

gas system, such as: reducer, injectors may be subjected to damage. Therefore, to protect these components and the vehicle engine, use very light engine loads until the vehicle engine reaches the normal operating temperature.

1.3.4. LPG/CNG level indicator

The amount of LPG/CNG fuel in the tank is displayed by LEDs on the control panel (see. 1.3.3.1), which is located in the passenger compartment, in an easily accessible place, defined by the user. Lighting of the red LED on the gas level indicator shows that the gas tank is empty (there is a small amount of gas left in the tank). The gas level indicator is not a precise device and the displayed values should be treated as indicative.

1.3.5. No gas in the tank

During operation on gas, the gas controller continuously checks whether the gas pressure is correct. In the event that the gas in the tank runs out, the controller detects that the gas pressure is below the minimum and will automatically switch to petrol, the LED **(F)** signalling the operating status will flash rapidly and a sound signal will sound. After refuelling with gas, the system will automatically switch to gas.

1.3.6. Refuelling with gas

To refuel the gas tank, follow the procedure below:

1. Park the vehicle on a level surface.
2. **Switch off the engine!**
3. Unscrew/remove the gas inlet cap.
4. Connect the refuelling gun.
5. Refuel the gas.
    a. For LPG - up to a maximum of 80 [%] of the tank's water capacity, further refuelling should activate the cut-off valve in the tank, making a characteristic sound.
    b. For CNG, please follow the regulations in force in your country regarding the refuelling with CNG.
6. Disconnect the refuelling gun.
7. Screw back/put on the gas inlet cap.

Attention!

<u>When refuelling with gas, it is particularly important to be careful, in the same way as when refuelling with petrol.</u>

1.3.6.1 Gas quality

For the system to work properly, the gas that is refueled into the tank should at least meet the DIN EN 589 standard. If the quality of the fueled gas does not meet the aforementioned standard, the system warranty is no longer valid.

1.3.6.2 Gas consumption

1.3.6.2.1 LPG consumption

LPG has a lower calorific value per 1 liter of fuel compared to petrol; therefore, LPG consumption is 15 – 25[%] (depending on the ratio of propane to butane in LPG) higher than that of petrol.

1.3.6.2.2 CNG consumption

CNG is compressed (up to a pressure of 200 – 250[bar]) natural gas, most frequently it is settled in normal [m^3] (pressure ≈1[bar]). Calorific value of 1[m^3] CNG is approximately equal to one liter of petrol. Therefore, the CNG consumption calculated in [m^3] should be close to the petrol consumption calculated in liters.

1.3.7. Performance under normal conditions

The performance of the vehicle with the 4SAVE LPG/CNG system should not significantly differ from those on petrol.

1.3.8. Environmental conditions

A car equipped with a 4SAVE LPG/CNG system can be used in the same environmental conditions as when running on petrol. While operating on LPG at very low external temperatures below -20[°C], operation on gas may not be possible due to the too low gas pressure in the tank resulting from the ambient temperature and the refueled propane-butane mixture.

1.3.9. Extreme temperature

Extreme temperatures can affect the operation of the system, and it may take longer to switch from petrol to gas at very low temperatures. In extreme situations, when the system detects that the external conditions do not allow for operation on gas, it will automatically switch to petrol.

1.3.10. Handling manual cut-off valves

Manual cut-off valves are an element of the gas system located at the gas tank and used to cut off the flow of gas from the tank. In the event of a gas leak or other hazard, you should:

- Locate the manual valve at the gas tank, for LPG it may be necessary to unscrew the gas-tight cover of the gas tank.
- Close the manual valve cutting off gas flow from the tank (turn in the "C" direction, clockwise if there is no marking).

1.3.11. Petrol controller diagnostics

In the case when it is necessary to perform diagnostics of the petrol controller in a vehicle equipped with the 4SAVE LPG/CNG system with the OBD support, it is necessary to disable this support for the time of connecting an external diagnostic tester. To do this:

- Switch the car to petrol while the engine is running on gas.
- Stop the engine
- Turn the ignition on
- Connect the external diagnostic tester

1.4. Engine operation on LPG/CNG

1.4.1. Starting the engine

The engine with the installed LPG/CNG system is always started on petrol (the exception is emergency start of the engine on gas, see 1.3.3.4). When the set engine temperature is reached, the system automatically switches to gas. For the proper operation of the system, **a small amount of petrol is required** to start the engine and allow for its work until it is switched to gas.

1.4.2. Switching from petrol to gas and vice versa

While the engine is running, you can change the fuel used by the engine at any time by pressing a button on the control panel. The type of fuel the engine is currently running on is signaled by the appropriate LED diode on the control panel (see 1.3.3.1)

1.4.3. The engine refuses to run on gas

1.4.3.1 Basic functions

If the engine refuses to run on gas and the system does not report a fault, check the following:

- Is there enough gas in the tank?
- Is there enough petrol in the fuel tank?
- Is any of the **fuses** of the gas system damaged? (they are located in the engine compartment, near the battery. They protect the electronic system against overload).

A fuse with a higher amperage than the damaged one must not be installed!

In the event when after checking the above-mentioned items, we are not able to solve the problem ourselves, please **contact a professional facility** that installs LPG/CNG systems in order to solve the problem.

1.4.3.2 System error

In a situation where the system detects damage or malfunction of actuators or sensors, it reports a failure signaled by an LED (system failure indicator) on the control panel and a sound signal. When a fault is detected, the system may report two types of errors:

- **Non-fatal error** - further driving on gas is possible (the LED indicating operating status **on** - operation on gas, the LED indicating a system failure **on**) without the risk of damaging the engine, but a visit to a professional facility that installs LPG/CNG systems will be necessary.
- **Fatal error** - further driving on gas is impossible (the system automatically switched to petrol, the LED indicating the operating status) **flashes quickly** -

fatal error, the LED indicating a system failure **on**), in order to remove the defect, please contact a professional facility that installs LPG/CNG systems.

1.5. Safety

1.5.1. Suggestions

In order to ensure the correct operation of the system, please follow the suggestions below:

- **Remember to keep the petrol tank always filled to a minimum of ¼ of its capacity**. The low petrol level in the tank may cause damage to the fuel pump and engine injection system.
- Refuel the car at verified stations that offer gas meeting at least the DIN EN 589 standard, thanks to which you will avoid system failures caused by poor gas quality.
- Perform the first inspection up to one month or up to 1000 km from the installation of the gas system. Thanks to this, you will be sure that the controller and all elements of the gas system are working properly as a whole.
- Regularly perform periodic inspections of the gas system and the vehicle in accordance with the manufacturer's recommendations, thanks to which you will avoid more serious faults of the vehicle.
- Remember that all repairs, inspections and changes in settings should be performed only by an authorized workshop, never do it alone.
- Always drive safely and in accordance with the road traffic regulations.

1.5.2. Notes

Failure to comply with the above provisions (see 1.5.1) may lead to a fault of the vehicle or gas system components, which will not be repaired under the warranty. In some cases, a fault of the vehicle may lead to its immobility.

1.5.3. Warnings

1.5.3.1 Interference with the system

Under no circumstances should the user interfere with the gas system installed in the vehicle. Modifications, repairs, periodic inspections of the gas system performed by the user independently pose a risk of **damage to property, loss of health, and in extreme cases, life** and are strictly forbidden.

1.5.3.2 Garaging a vehicle with the LPG/CNG system

Garage for vehicles equipped with gas systems should be equipped with adequate ventilation. LPG is heavier than air and may accumulate in the lower part of the room (e.g. in a pit). CNG is lighter than air and may accumulate in the upper part of the room. Gas escaping from the LPG/CNG system may create an explosive mixture with the air, which may ignite or explode.

1.5.3.3 Gas leakages

In the event of a gas leak (smelling LPG/CNG), immediately switch the engine to petrol, close the manual cut-off valve on the gas tank (see 1.3.10) and **contact a professional facility** that installs LPG/CNG gas systems.

1.5.3.4 Car fire

In the event of a car fire, you must immediately **leave the vehicle and move away to a safe distance** and call the emergency services. The gas tank is equipped with a safety valve that releases excess gas in the event of pressure increase (caused by high temperature), thus protecting the tank against explosion.

1.5.3.5 Car repair in a spray booth

If it is necessary to place the car in a spray booth, the LPG/CNG tank should be disinstalled. High temperature during drying may cause **an increase in gas pressure in the tank** and the activation of the safety valve.

1.5.3.6 Gas system disinstallation

If it is necessary to disassemble a vehicle equipped with an LPG/CNG system, special attention should be paid to disassembling the tank and other components with pressurized gas. Before the vehicle is compressed, **the LPG/CNG tank must be removed!**

1.6. Periodical inspections

The LPG/CNG system installed in the car requires performing periodic inspections, failure to perform them in accordance with the recommendations of the manufacturer/installing workshop may lead to damage to the gas system and, in extreme cases, damage to the car. In such situations, the warranty for the installed gas system does not apply. All periodic inspections of the gas system should be performed in accordance with the provided warranty book, the performance of the inspection should be confirmed by an entry in the warranty book.

In the absence of a warranty book, inspections should be performed every 10,000[km] (± 500[km]) or every 12 months (± 1 month). When inspecting the gas system, the following steps should be performed:

- Gas filter replacement
- Checking the tightness of the gas system
- Computer diagnostics of the gas system

The correct operation of the gas system is also greatly influenced by the correct operation of the basic engine components, which should be regularly inspected in accordance with the manufacturer's recommendations. Particular attention should be paid to the **engine ignition system**, and the following elements should be inspected even more frequently than recommended by the manufacturer:

- Ignition plugs

- Ignition leads
- Ignition coils

1.6.1. Signalling the need for an inspection

In the case when the service that installed the gas system in the car has selected this option in the software, the controller will inform the user about the necessity to perform a periodic inspection. When it is time to perform the inspection of the gas system, after turning on the ignition, the LED indicating a fault in the control panel starts flashing and a sound signal is generated reminding you about the necessity to perform the inspection.

1.7. Warranty - exclusion, limitations

Terms of the warranty

1. A correctly completed warranty book with an excerpt from the approval certificate for the installation method or another document confirming the components of the system constitute the basis for granting a warranty for the gas system.
2. The installing workshop provides the customer with a warranty for the gas system and provides all services related to the warranty free of charge
3. The warranty for 4SAVE components is provided for a period of 24 months from the date of sale. The remaining elements of the system are covered by a warranty according to the manufacturer's specifications.
4. The installing workshop is responsible for faults caused by malfunctions in the gas system. If a malfunction of the gas system is detected, the customer is obliged to immediately report this fact to the installing workshop, otherwise the workshop's liability is excluded.
5. The guarantor does not refund the costs of travel or delivery of the vehicle to the workshop in the event of the need to perform check-up, inspection or repair of the gas system.
6. In order to maintain the rights under the warranty, the buyer is obliged to perform the first free inspection after driving 1000 [km] ± 100 [km] from the installation of the gas system. Then they are obliged to perform paid inspections every 10,000 [km] (± 500 [km]) or every 12 months (± 1 month).
7. The warranty does not cover elements subject to normal wear and tear, their effects and the replacement of these elements. The warranty does not cover damage caused by contaminated LPG/CNG. Interference by third parties (repairs/changes) with the gas system automatically voids the warranty liability.
8. The warranty shall not exclude, nor limit, nor suspend the buyer's rights arising from the goods being inconsistent with the contract.