



Installation Manual

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV

== ISO/TS 16949:2002 ==

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1.0 GENERAL RECOMMENDATIONS

- Before installing the gas system, disconnect the battery earth cable (unless specified to the contrary by the car maker).
Attention: this may delete the car radio and telephone memories and jam the centralised door locking and anti-theft systems. In this case, you may connect the battery temporarily.
- Always smooth holes after drilling and apply anti-rust to the edges.
- Apply silicon to each cable through-hole to prevent water from entering the interior.
- Install the control unit as far away as possible from areas where water could infiltrate, far away from heat sources (e.g.: exhaust manifolds), far away from high-voltage cables and, wherever possible, with the connector pointing downwards.
- If the fuse blows, do not replace it with one of a higher current rating.
- Do not attempt to open the control unit as this could cause irreparable damage. LOVATO declines all liability for injury to people or damage to property should its equipment be tampered with. In this event the warranty shall also be invalidated.
- Always make electrical connections using the relative joints or soft solder them to prevent the formation of false contacts.
- Always observe the current laws and/or regulations in the State where the LPG system is mounted.
- Remember that, as per the relative standards, all the assembly instructions refer to the driving position.
- Before mounting the electronic control unit, make sure the relative fuses are disconnected.
- Do not wash the engine after installation.

WARNING

FAILURE TO OBSERVE THE INSTRUCTIONS CONTAINED IN THIS MANUAL MAY CAUSE THE SYSTEM TO WORK INCORRECTLY OR NOT WORK AT ALL. THIS MAY CAUSE DAMAGE TO LOVATO COMPONENTS AND INVALIDATE THE WARRANTY.

2.0 CONNECTION OF THE INJECTORS CUT-OFF WIRING.

Verify the polarity of the injectors acting as follows:

- 1 Disconnect all connectors of the original injectors,
- 2 Prepare a multimeter to measure the direct voltage with full range equal to 20V and connect the negative lead to the ground,
- 3 Place the positive lead on one of the contacts of the connector injector,
- 4 Insert the panel and check on the multimeter the measured voltage value. If the reading is about 12V, that is the positive cable.

WARNING

FEEDING OF THE INJECTORS IS TIMED; THEREFORE, AFTER SOME SECONDS FROM SWITCHING ON OF THE PANEL, IT IS DISABLED.

IT IS SUGGESTED TO VERIFY THE POLARITY OF ALL INJECTORS, SINCE SOME CARS HAVE AN INVERTED INJECTOR WITH REFERENCE TO THE OTHERS.

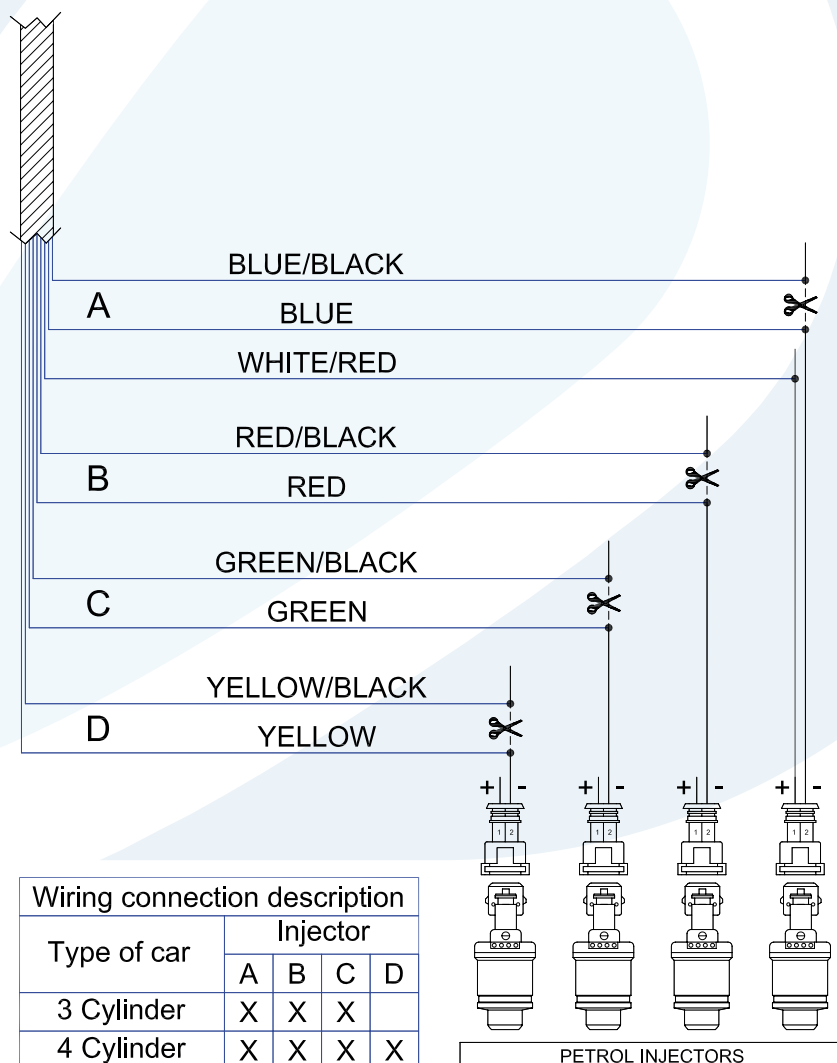
After having verified the polarity of the injectors, it is possible to connect the injector emulation harness.

Cut the petrol injector negative wire. The wires of a single color have to be connected to the injectors; while the corresponding ones with a black stripe have to be connected to the gasoline injection control unit.

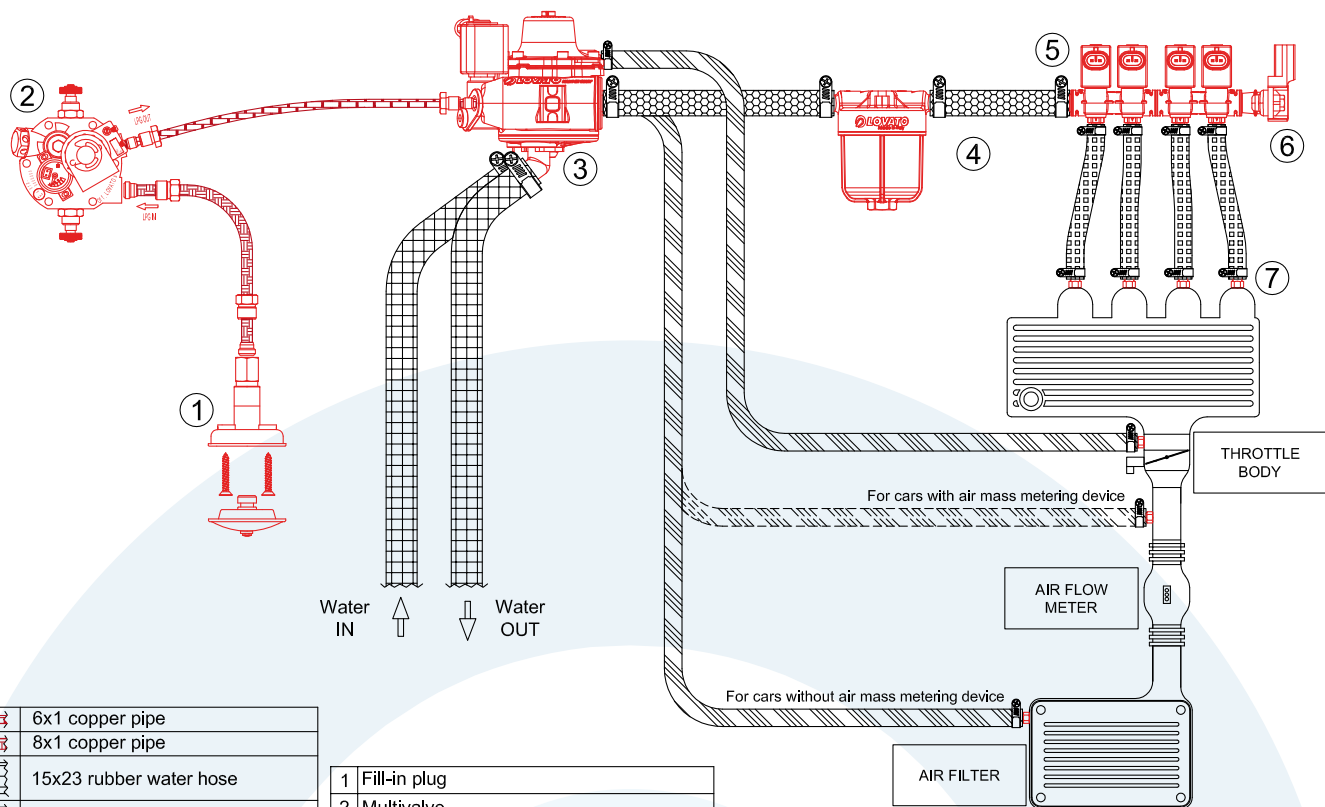
Respect the matching between the sheath of the injector emulator wiring and the gas injector.

On the injector control, where the gas injector "A" has been connected pneumatically, it is necessary to connect the wires of the sheath "A" of the injector emulator wiring (BLUE and BLUE/BLACK wires as shown on the following drawing) . The same is valid for the other injectors.

In case of connection on a 3-cylinder car, the YELLOW AND YELLOW/BLACK wires have to be left disconnected.



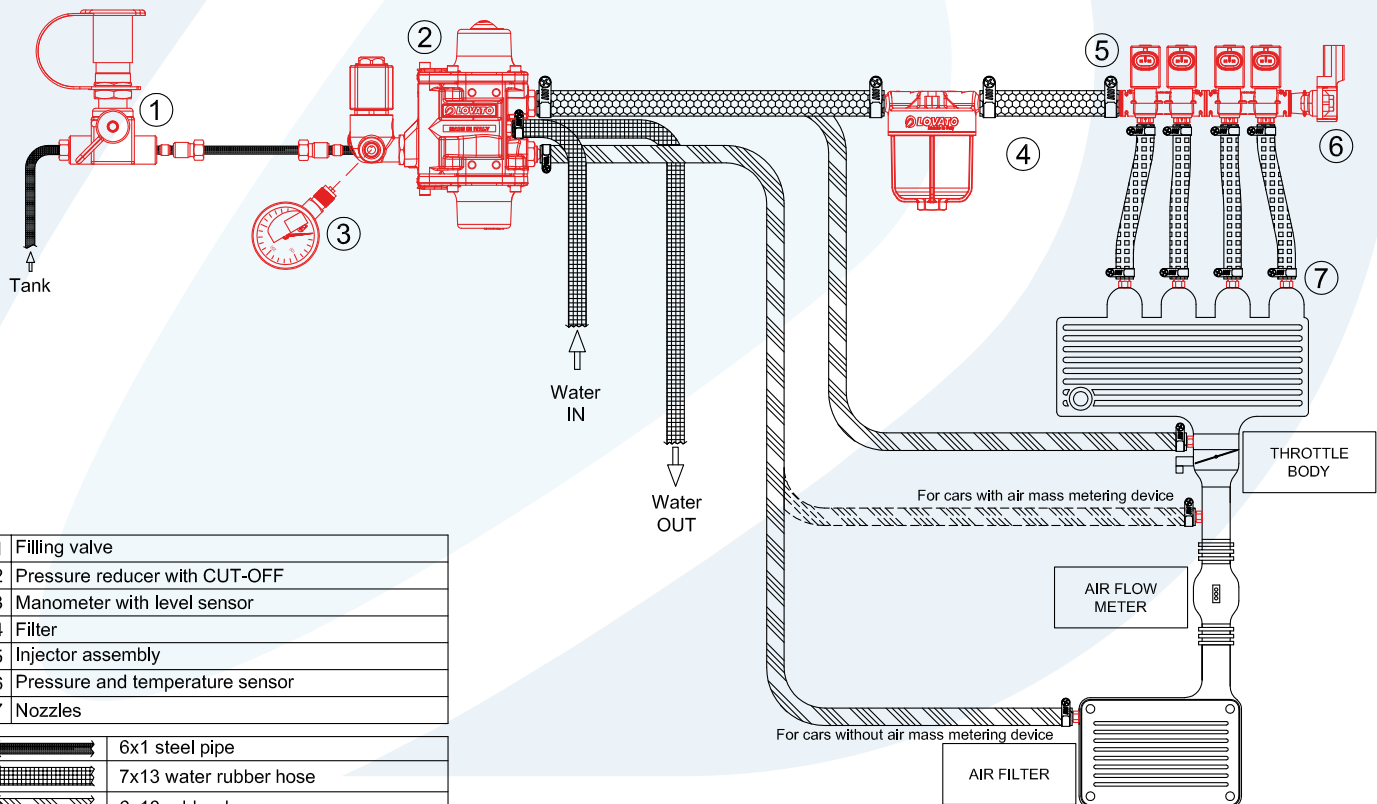
3.0 EASY FAST SMART 4 CYLINDER LPG PNEUMATIC DIAGRAM



	6x1 copper pipe
	8x1 copper pipe
	15x23 rubber water hose
	6x13 rubber hose
	6x13 gas rubber hose
	12x19 gas rubber hose

1	Fill-in plug	
2	Multivalve	
3	Riducer with lock-off valve	
4	Filter	
5	Injector assembly	
6	Pressure and temperature sensors	
7	Nozzles	

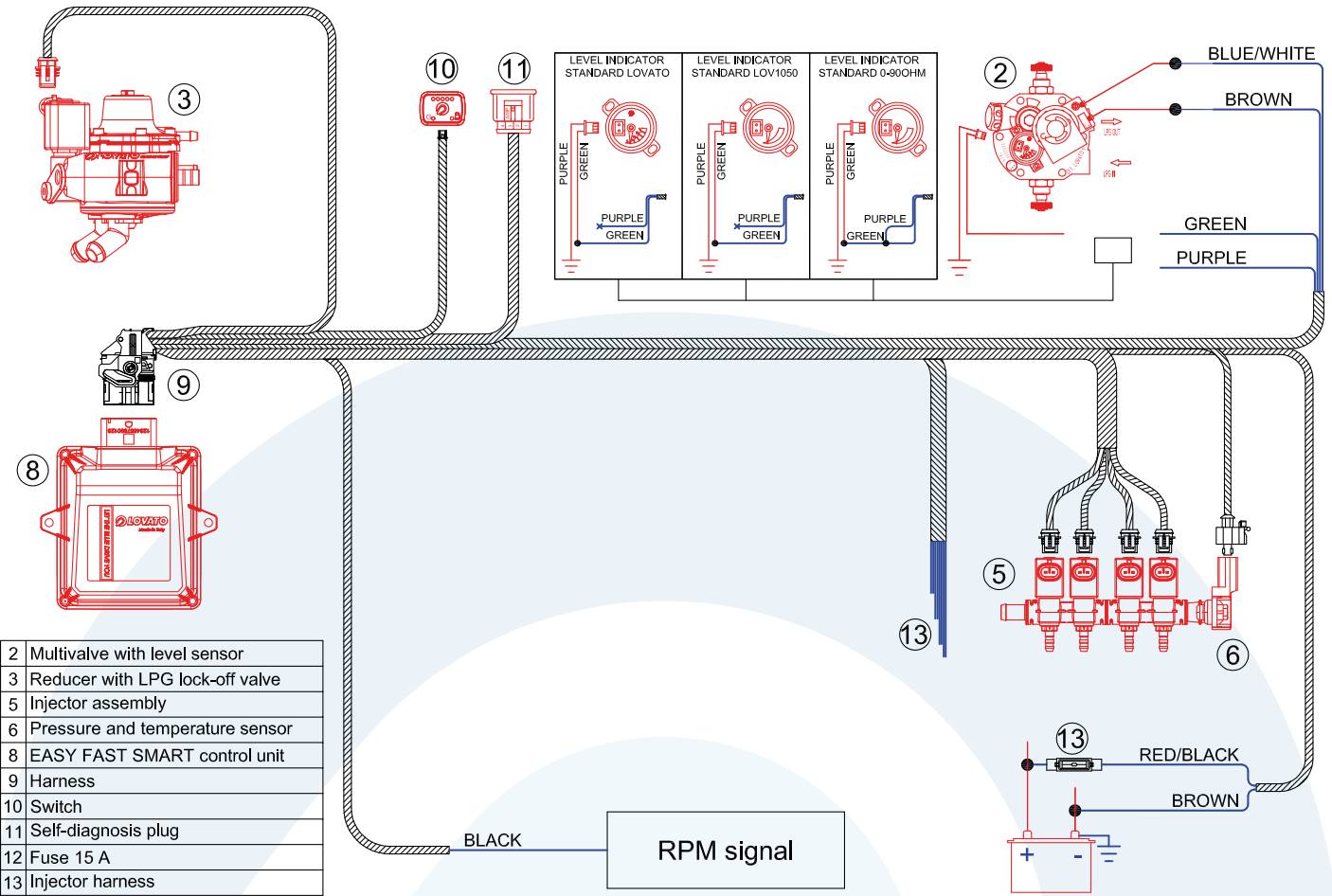
4.0 EASY FAST SMART 4 CYLINDER CNG PNEUMATIC DIAGRAM



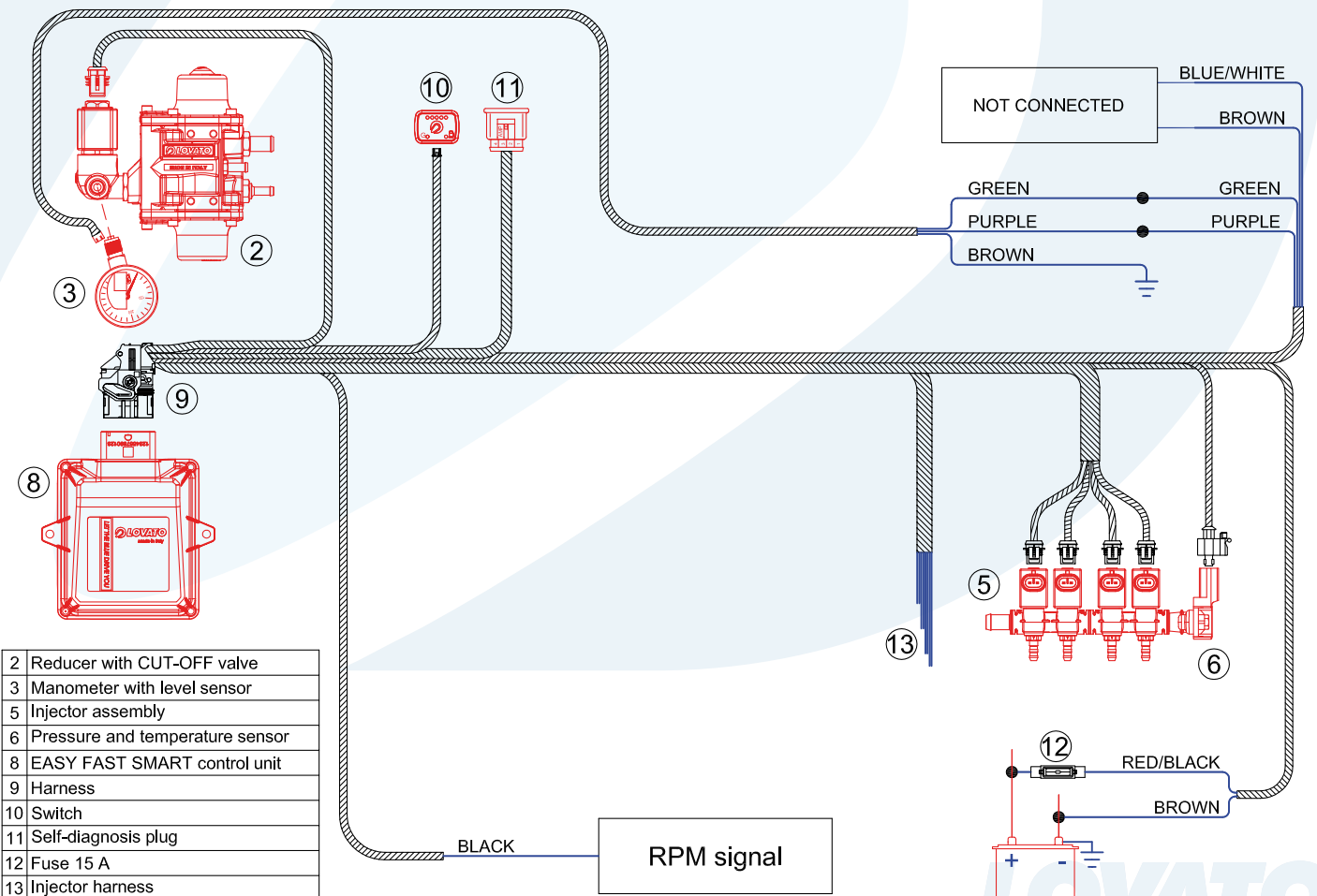
1	Filling valve
2	Pressure reducer with CUT-OFF
3	Manometer with level sensor
4	Filter
5	Injector assembly
6	Pressure and temperature sensor
7	Nozzles

	6x1 steel pipe
	7x13 water rubber hose
	6x13 rubber hose
	6x13 gas rubber hose
	12x19 gas rubber hose

5.0 EASY FAST SMART 4 CYLINDER LPG WIRING DIAGRAM

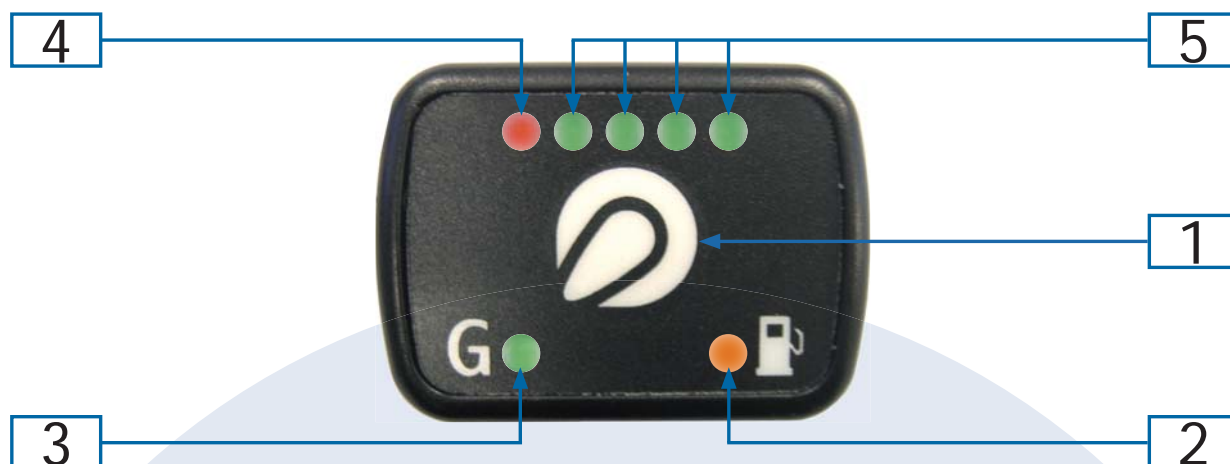


6.0 EASY FAST SMART 4 CYLINDER CNG WIRING DIAGRAM



7.0 OPERATION OF THE SWITCH

The switch supplied with the kit is equipped with a push-button, 7 luminous LEDs, and an internal buzzer.



ITEM	DESCRIPTION
1	Changeover switch
2	[ORANGE LED] Car running on petrol
3	[GREEN LED] Car running on gas and diagnosis indicator
4	[RED LED] Reserve
5	[GREEN LEDs] Quantity of gas in the tank

PUSH-BUTTON

It is used to select the type of feeding (petrol or gas). By pressing it, it is possible to switch from one type of fuel to the other.

FUNCTIONS OF THE STATUS LED

YELLOW LED	GREEN LED	BUZZER	DESCRIPTION
ON fixed	OFF	OFF	Petrol operation.
ON fixed	Blinking	OFF	Petrol operation. Control unit prepared to switch automatically to gas.
OFF	ON fixed	OFF	Gas operation
ON fixed	Blinking	Blinking	Petrol operation. Diagnostics have been operated.
ON fixed	OFF	Blinking	Petrol operation. The control unit has performed the automatic switching to petrol because gas is finished.
OFF	OFF	OFF	Petrol operation. The vehicle is working with petrol and doesn't switch to gas because it doesn't detect the revolutions signal.

SWITCHING TO PETROL DUE TO GAS LOW PRESSURE

When the switch reaches the reserve and the gas pressure falls under a pre-set value, the control unit switches automatically to the petrol feeding. This occurs to avoid that the engine can operate with a too weak mixture damaging in this way the catalytic converter. Before switching again to the gas feeding, perform a fuel filling. The switching to petrol due to GAS LOW PRESSURE is signaled by the switch with the switching-on of the YELLOW LED (petrol operation), the alternated switching-on of the RED LED indicator and of the 4 GREEN LEDs and by the acoustic warning given by the internal buzzer. To restore the switch to the normal operation, it is necessary to press the PUSH-BUTTON once; the YELLOW LED remains switched-on to indicate that the car is petrol fed, and the buzzer stops buzzing.

EMERGENCY

Should the car not be able to start with petrol feeding (e.g. due to problems on the petrol pump, etc.), it is possible to start it directly with GAS feeding. To do this, just start the car keeping the switch push-button pressed.

WARNING

DIRECT GAS STARTING IS TO BE CONSIDERED AN EMERGENCY OPERATION. ITS REPEATED USE CAN LEAD TO DAMAGES TO THE CATALYTIC CONVERTER OR THE SWITCHING-ON OF THE CHECK ENGINE WARNING LAMP.

DIAGNOSIS

Should a diagnosis error be detected and the feeding be consequently switched to petrol, the ORANGE LED is fixed ON (petrol feeding), the GREEN LED blinks and the buzzer buzzes intermittently (the LEDs of the level indicator are OFF). To interrupt the acoustic signaling it is necessary to press the push-button of the switch.

8.0 EASY FAST INTERFACE SOFTWARE

8.1 MINIMUM REQUIREMENTS OF THE COMPUTER TO INSTALL THE SOFTWARE

Operating system	-	Windows 98 2nd edition or following versions
Memory (RAM)	-	At least 16 MB
Hard disk	-	At least free 20 MB upon installation
Screen resolution	-	800 x 600 or higher

Moreover, it is necessary to have installed Internet Explorer 5.5 or later versions.

8.2 SOFTWARE INSTALLATION

To install the calibration software insert the CD-Rom in the reader of the computer and wait until the guided installation window appears.

Should the installation program not start, select "Start" from the "Application Bar". Select "Execute" and enter: "D:\setup.exe" (where "D" indicates the CD-Rom reader).

During the installation you will be asked to select the folder in which the program shall be installed. We suggest not changing the pre-set folder.

After the installation, the program icon is created automatically on the desktop.

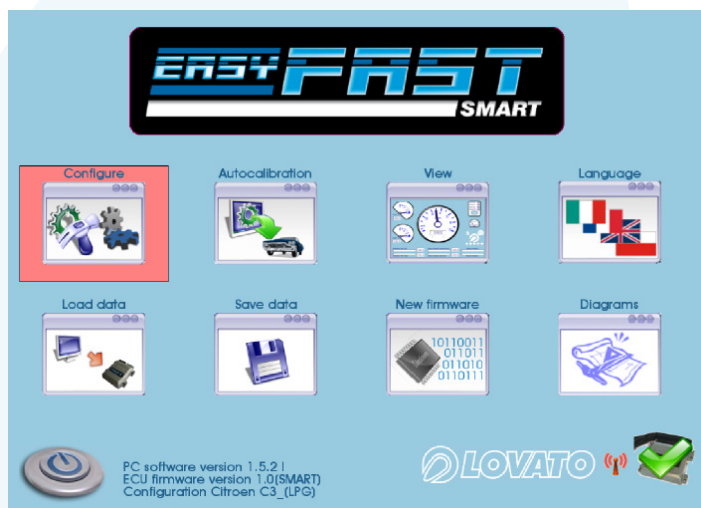
8.3 INTRODUCTION

The calibration software works by hardware key code 7155002 and can be opened without being necessarily connected to the control unit.

To connect to the control unit, it is instead necessary that the PC and the control unit are correctly connected by a serial cable (Code 0570001 Installation kit) and a serial USB adapter, if the PC is not equipped with a Serial port (Code 4685001 Serial USB adapter). Alternatively you can use the SERIAL KIT WIRELESS cod. 1685001.

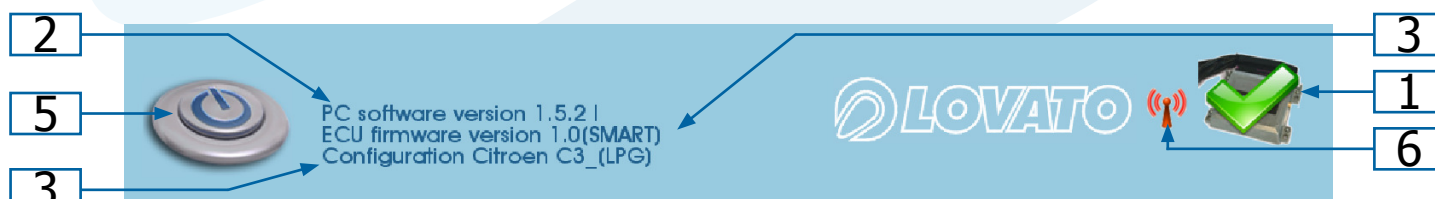
Moreover, the control unit has to be connected to the +12 volt battery (RED - BLACK wire), to the ground (BROWN wire) and to 12V under key (dashboard ON - engine OFF).

8.4 MAIN MENU



From this menu, it is possible to access all sub-menus of the calibration software that are given and individually described here below.

On the lower part of the page there is the following information:



- 1) This indicates if the control unit is connected or not to the calibration software. It is important to remember that all settings and regulations being performed with the disconnected control unit will be lost upon connection, unless they are previously stored in a configuration file. When the program is opened, it automatically tries to connect to the control unit.

If the program does not connect, an error window appears. At this point, verify:

- the connection of the serial interface;
- that the control unit is connected to the battery and to the ground;
- if the under-key has been disabled for more than an hour, to connect, it is necessary to enable the panel for some seconds of to star the car.

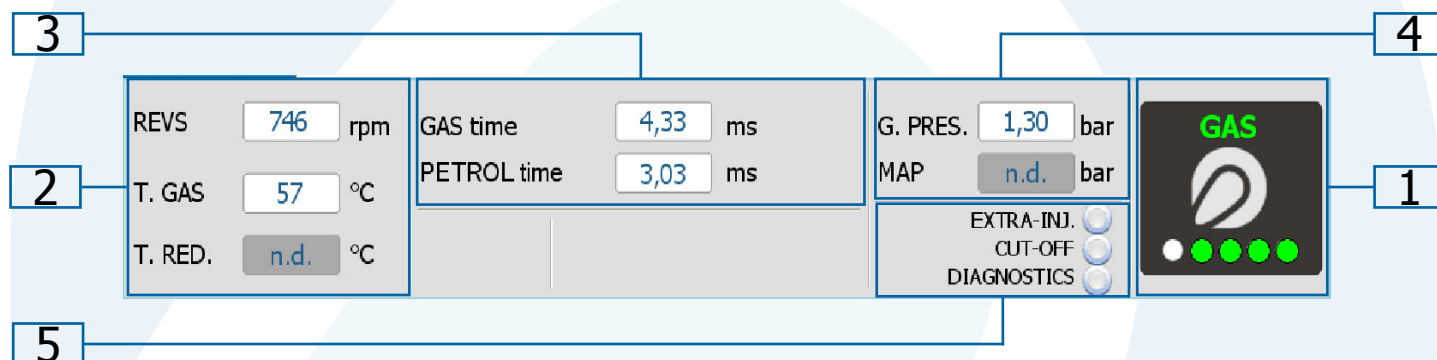
By clicking on the icon 1, it is possible to enable (Ctrl+C) or disable (Ctrl+D) the communication.

- 2) This indicates the software version.
- 3) This indicates the firmware version. To update it access the sub-menu "NEW FIRMWARE" and select the wished firmware among the suggested ones.
NB: This operation is possible only if INTERNET EXPLORER 5.5 or later version is installed.
- 4) This is the name of the car configuration. If a previously saved configuration is loaded on the control unit, the name of such configuration will appear. If the control unit is new, appears the message "StandardSmartLovato#1" followed by "LPG".
- 5) Click on this icon to exit the program.

8.5 CAR CONFIGURATION

This menu consists of 4 screen pages in which it is possible to set the parameters managing the behavior of the gas control unit.

On the upper part of all pages, there is a summarizing display of the current values of the general operation signals of the system.



- 1) This box shows whether the car is PETROL or gas fed, as well as the gas level indicator; moreover, there is the push-button allowing the switching via software.
- 2) This box shows:
REVS These are the engine revolutions measured in real time by the gas control unit.
T GAS This is the gas temperature detected by the temperature sensor positioned on the filter.
- 3) This box shows the gas (gas time) and petrol (Petrol time) injection times. For each variable, it is possible to have one or two values according to the number of main bearings set in the drop menu "Number of main bearings" of the window "Sensors".
- 4) This box shows:
GAS PRES This is the pressure difference between the gas present in the gas injectors, and that present in the suction manifolds, detected by the pressure sensor inserted in the filter.
- 5) Within this box there are three warning lamps, which light when the car is in the conditions of EXTRA-INJECTION, CUT-OFF and DIAGNOSTICS.
EXTRA-INJECTIONS If the program detects any extra-injection, the corresponding warning lamp lights with YELLOW color and becomes GREEN for 2/300 ms, so that it is visible for the operator when the extra-injection occurs.
CUT-OFF The warning lamp lights in RED color, when the car is in CUT-OFF status.
DIAGNOSTICS The warning lamp lights in RED color, when an error is detected by the diagnosis system of the plant. By clicking on "Diagnosis", the diagnosis window is opened to monitor the type of error.

8.5.1 CONFIGURATION.

In this window it is possible to set the parameters that characterize the car.

WARNING

ALL PARAMETERS HIGHLIGHTED IN BLUE HAVE TO BE MODIFIED WITH DISABLED PANEL AND OFF SWITCH.

- **TYPE OF FUEL**

This selection is used to initialize the control unit with the characteristic parameters previously set for the correct operation with the type of fuel used. Select:

LPG for cars with LPG feeding.

METHANE for cars with METHANE feeding.

By selecting LPG or METHANE, moreover, it changes also the folder where the configuration files are saved (see Load configuration).

- **INJECTION TYPE**

This function allows selecting the enabling strategy of the gas injectors with reference to the type of system:

SEQUENTIAL (SUGGESTED OPTION) The GAS injector is enabled at each PETROL injection.

FULL GROUP The GAS injector is enabled every 2 PETROL injections.

- **INJECTORS TYPE**

This window allows selecting the type of GAS injectors supplied with the Installation kit.

Should a previously saved configuration be loaded, this window shows the type of gas injectors foreseen in the configuration file.

If the type of gas injectors previously saved in control unit does not correspond to the ones shown in this window, a warning message is displayed. To solve the problem, it is necessary to load a configuration file, which foresees the installed injectors, or to change the type of gas injectors set in the control unit. Should the injectors installed on the car not match the selected ones, the injectors are piloted by wrong parameters causing gas malfunctions or the damaging of the same injectors.

- **TYPE OF REVOLUTION SIGNAL**

It pre-arranges the control unit for the detection of the revolution signal by means of the BLACK wire:

STANDARD Select this option when the BLACK wire is connected to one of these signals:

- revolution counter wire with square wave signal 0 ÷ 12 V;
- coil negative.

WEAK SIGNAL Select this option when the BLACK wire is connected to one of these signals:

- revolution counter wire with square wave signal 0 ÷ 5 V;
- static switching-on signal with square wave signal 0 ÷ 5 V.

These signals can be identified only using an oscilloscope.

- **TYPE OF IGNITION**

This parameter is used by the control unit to calculate correctly the engine standard operation, which varies according to the type of ignition on which the BLACK wire is connected. Set:

SINGLE COIL for cars with a coil every cylinder, if the BLACK wire is connected to the negative pole of one of the coils;

DOUBLE COIL for cars with a coil every 2 spark plugs, if the BLACK wire is connected to the negative pole of one of the coils;

REVOLUTION COUNTER for cars with a coil and mechanical distributor, if the BLACK wire is connected to the negative pole of this coil, or on all the cars where the BLACK wire is connected to the wire signal revolution counter.

REVOLUTION COUNTER 2 not used

- **NUMBER OF CYLINDERS**

This parameter is used to indicate to the control unit how many cylinders has the car and, therefore, how many gas injectors shall it control; set 3 CYLINDERS or 4 CYLINDERS in function of the number of cylinders of the car.

- **RESET**

By clicking on the push-button of program reset cancel all settings of the control unit and loads the default configuration.

8.5.2 SWITCHING.

This window allows selecting the switching mode from petrol to gas and vice versa.

The screenshot shows the 'Switching' configuration window in the Lovato control unit software. The window is divided into several sections:

- Top Section:** Contains various engine parameters: REVS (722 rpm), T. GAS (57 °C), T. RED. (n.d. °C), GAS time (4.48 ms), PETROL time (3.11 ms), G. PRES. (1.31 bar), and MAP (n.d. bar). There are also buttons for 'EXTRA-IND.', 'CUT-OFF', and 'DIAGNOSTICS'.
- Anticipates injection sequence:** A checkbox labeled 'Anticipates injection sequence' (Petrol strategies disabled in gas mode) is currently unchecked.
- Switching:** A dropdown menu is set to 'in deceleration'. Below it, 'Rev threshold for switching' is set to 1600 rpm.
- Idle operation:** A section with three checkboxes: 'GAS' (checked), 'Change back to petrol' (unchecked), and 'Petrol' (checked).
- Operation at high revs:** A section with three checkboxes: 'GAS' (checked), 'Petrol addition' (unchecked), and 'Petrol' (checked). There is also a checked checkbox for 'Petrol addition once time gas limit is reached' with a note 'Modify this setting only with the engine off.'
- Switching delay with engine warm:** A field set to 25 s.
- Switching to petrol for low gas temperature:** A field set to 0 °C.

- **SWITCHING**

During acceleration

The switching from PETROL to GAS occurs during acceleration when the car exceeds the number of revolutions set under “REV THRESHOLD FOR SWITCHING”.

During deceleration

The switching from PETROL to GAS in this case can occur following any of these two conditions:

- When the number of engine revolutions exceeds the reference set under “REV THRESHOLD FOR SWITCHING” and then falls under such reference.
- When a Cut-Off condition occurs with the number of engine revolutions higher than the reference set under “REVOLUTION THRESHOLD FOR THE SWITCHING”

- **REV THRESHOLD FOR SWITCHING.**

This identifies the engine revolutions at which one wishes to perform the petrol-gas switching.

- **SWITCHING DELAY WITH WARM ENGINE.**

This indicates the minimum time from the start of the engine for the switching from PETROL to GAS.

We suggest setting a time not shorter than 25 seconds to assure the correct operation of the system.

- **SWITCHING TO PETROL FOR LOW GAS TEMPERATURE**

If the temperature of GAS falls below the threshold set, the ECU switches to the petrol mode and the corresponding diagnosis is activated (code S110). The ECU automatically back to gas mode when the gas temperature allows it

- **ANTICIPATE INJECTION SEQUENCE.**

This is a guided procedure allowing the automatic acquisition of the injection sequence, as well as the enabling of an advance phase shift of the gas injection; the entity of the phase shift depends also on the command “Number of main bearings” of the page F3 Sensors.

This advance can increase the car operation above all in case of gas injectors far from the suction manifold.

This function is to be used only if really necessary, since it disables the characteristic of GRADUAL PETROL-GAS switching performing such switching instantaneously.

- **IDLE OPERATION.**

GAS - By enabling this function, the car at minimum always works by GAS feeding (default and suggested option).

CHANGE BACK TO PETROL - During the return to minimum the car switches for some seconds to petrol and then returns to gas feeding, avoiding in some cases the shut-off during this phase. It is suggested to use this function only if necessary. The value “Revolutions for identifications of the minimum (Giri per identificazione del minimo)” determines the number of revolutions under which this procedure is enabled.

PETROL - The operation at minimum, under the set value of revolutions, is always by petrol feeding. The restoration of gas operation occurs when the revolutions exceed the set value. This function has to be used only when the operation at minimum by gas feeding is impossible, unstable and results in frequent shut-offs.

The indication that the system is working by petrol feeding does not occur by means of indication on the switch that remains on gas feeding, but by the reading on the computer of the gas injection time that becomes null.

In fact, in this phase the switch keeps signaling the gas operation and the gas solenoid valves remain enabled.

In case of presence of the advance converter, which remains fed in this phase, it is necessary to pay attention that introduced advance does not disturb the operation of the system.

- **OPERATION AT HIGH REVOLUTIONS**

GAS - The car works on gas. If the gas time limit is reached (gas exceeds the time of cycle), a small correspondent quantity of petrol is added at the same time. The signalling on the switch remain on gas operation.

Removing the cue from the check box you disable this function and if the gas time limit is reached the car automatically changes back to petrol with consequent signalling on the switch.

PETROL - The car temporarily runs on petrol mode at high rpm and high engine loads.

You can set the number of rpm and the injection time over which car will run in petrol: both conditions must be met to run on petrol mode.

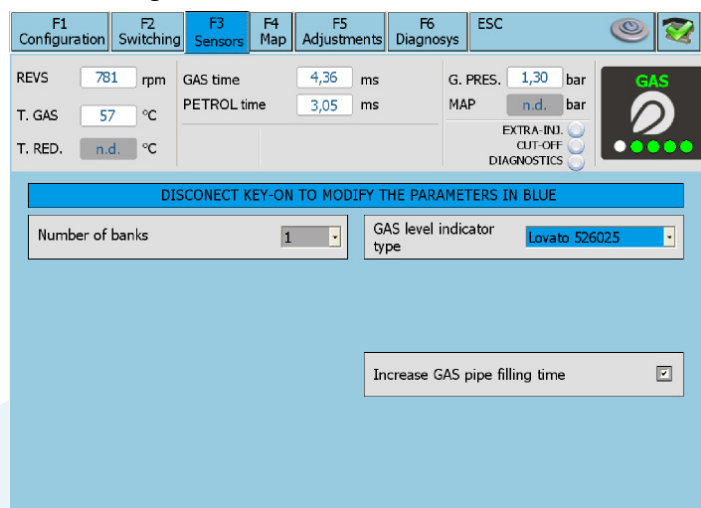
In this case, the switch is on gas mode

PETROL CONTRIBUTION – You can make a small contribution of petrol during gas mode. You can set the injection time beyond which you can get the petrol contribution and set the milliseconds of contribution.

This contribution is then subtracted from the petrol injection time before calculating the corresponding gas injection time

8.5.3 SENSORS.

In this window, it is possible to configure the level sensor.



- **NUMBER OF BANKS.**

This selection is necessary to set the number of the main bearings in which the engine is subdivided.

- **SECOND BANKS CORRECTOR.**

By setting the number of the main bearings on two, this item appears. On cars equipped with two front lambda probes, this allows modifying (strengthening or weakening) linearly the GAS carburetion concerning the second main bearings when the two main bearings work slightly unbalanced.

In detail, by acting on this parameter, in case 4-cylinder cars the carburetion of the gas injectors B and C is unbalanced with reference to that of the gas injectors A and D.

- **GAS LEVEL INDICATOR TYPE.**

This indicates to the gas control unit what type of level sensor has been used:

LOVATO1050 - set LOVATO/AEB 1050 if to the gas control unit it is connected a sensor with standard output signal LOVATO1050. For the connection refer to the assembling diagram of the gas control unit.

LOVATO 526025 - set LOVATO if to the gas control unit it is connected a sensor with standard output signal LOVATO1050. For the connection refer to the assembling diagram of the gas control unit.

0 - 90 ohm - set 0-90 ohm if to the gas control unit it is connected a sensor with output signal ranging from 0 to 90 ohm. For the connection refer to the assembling diagram of the gas control unit.

Not standard - Set this option if it is connected a LPG or METHANE resistive sensor with a variable STRAIGHT signal (lower value (Ohm) with empty level and higher value (Ohm) with full level).

Not standard inverted - Set this option if it is connected a LPG or METHANE resistive sensor with a variable INVERTED signal (higher value (Ohm) with empty level and lower value (Ohm) with full level).

References for the not standard indicator - This option appears only if, in the box "TYPE OF GAS LEVEL SENSOR" it is set NOT STANDARD or NOT STANDARD INVERTED.

Set the reference values necessary for the setting of the level sensor as follows:

- manually shift the indicator of the sensor starting from the full value and write down the indicated value for each reference (RESERVE, 1/4, 2/4, 3/4).

- enter the noted values in the corresponding bo-

xes.

- press the push-button ACCEPT.

On the switch, it is therefore possible to see the following changes:

Reserve = LEVEL value when the LED of 1/4 switches off and the reserve one switches on.

Reference 1/4 = LEVEL value when the LED of 2/4 switches off.

Reference 2/4 = LEVEL value when the LED of 3/4 switches off.

Reference 3/4 = LEVEL value when the LED of 4/4 switches off.

• GAS PIPE FILLING TIME.

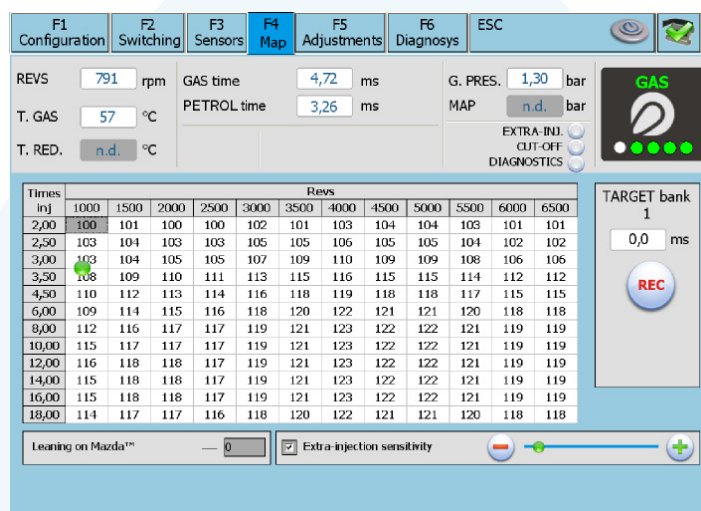
Usually, the gas control unit, to prevent the possible shut-off of the car during the switching from one type of fuel to the other, enables the gas solenoid valves 5 seconds before performing the switching: this allows a greater filling of the piping.

It is possible to disable this function. In this case, the gas solenoid valves are enabled only for about 1 second.

WARNING

IT IS SUGGESTED NEVER TO DISCONNECT THE PETROL PUMP

8.5.4 MAP.



This menu allows performing a numerical display of the multiplication coefficients called K used by the control unit in the calculation of the gas injection time.

The table shows on the vertical axis the petrol injection times, while on the horizontal axis there is the number of engine revolutions. The red point shown on the map identifies the revolutions references and the petrol injection times with which the engine is working (with gas feeding the point is green).

By increasing the value of K, at same PETROL injection time, the gas injection time is strengthened, while reducing the value of K, the contrary operation is performed obtaining a weaker mixture in the system.

To modify the values of K, select one or more boxes of the map and press the key enter. A window appears with the following modification modes:

ABSOLUTE - it allows bringing the map exactly back to the value corresponding to the one entered.

LINEAR - It adds or deduces (in case a number with negative sign is entered) the entered value to/from the one already present in the selected box(s).

PERCENTAGE - It adds or deduces in percentage the entered value to/from the one already present in the selected box(s).

- **EXTRA-INJECTIONS SENSITIVITY.**

The EXTRA-INJECTIONS are very short injections performed additionally to the normal injection and are carried out during the petrol feeding, usually during acceleration, to enrich slightly the carburetion increasing the engine yield.

The extra-injections can be recognized by observing the signaling LED or the movement of the point.

During the gas operation, if we manage the extra-injections as a normal injection we could enrich too much the carburetion risking to increase the engine revolutions jaggging (this occurs above all in the methane plant; in the LPG ones this problem is usually less relevant).

By enabling the tick next to “EXTRA-INJECTIONS SENSITIVITY” it is possible to modify the parameters concerning the gas extra-injections increasing or decreasing the opening time of the gas injectors during the extra-injection. By shifting the slider towards the negative sign (-), the extra-injected gas time decreases and the mixture becomes weaker. By shifting the slider towards the positive sign (+), the gas extra-injections time increases and the mixture becomes richer.

By not enabling the tick, the extra-injection is not considered as such and the gas control unit manages the impulse as a normal fuel injection.

- **LEANING ON MAZDA.**

On some MAZDA models, during the petrol feeding during acceleration, a switching occurs from a SEQUENTIAL type injection mode to a half-group injection mode with opening by pairs of the petrol injectors.

This condition can be easily recognized observing during the acceleration the movement of the RED point on the map or the PETROL injection time.

During the switching from one injection mode to the other, it is possible to observe that the injection time usually displayed acquires a value equal to about the half of the one previously carried out (for example from about 8 ms it shifts to about 4 ms) and a continuous variation of the RED point is displayed between these two values or, in some cars, such point remains fixed on a given number of revolutions to return consequently to the initial PETROL injection time.

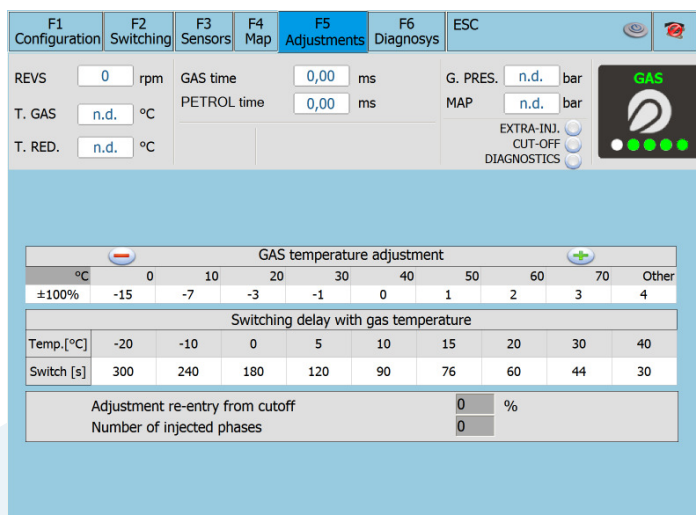
During the gas operation this work condition can cause malfunctions since when the injection switches from a sequENTIAL mode to a half-group mode (low injection time), the GAS carburetion tends to enrich very much causing rips.

Therefore, to avoid this problem, just enter under “Weakening on MAZDA” a proper value to contrast this trend.

- **TARGET**

By pressing the push-button REC, it is possible to store on screen the petrol time (PETROL time) (with petrol feeding) on a given area of the map to ease the comparison with the petrol time (PETROL Time) (with gas feeding) in the same condition.

8.5.5 ADJUSTMENTS.



GAS temperature adjustment										
°C	0	10	20	30	40	50	60	70	Other	
±100%	-15	-7	-3	-1	0	1	2	3	4	

Switching delay with gas temperature										
Temp. [°C]	-20	-10	0	5	10	15	20	30	40	
Switch [s]	300	240	180	120	90	76	60	44	30	

Adjustment re-entry from cutoff	0	%
Number of injected phases	0	

GAS TEMPERATURE ADJUSTMENTS

By clicking the cursor to LESS the temperature correction is reduced. By clicking the cursor to PLUS the temperature corrector is increased. On corrector vectors you can see such as percentage changing in the correction coefficients applied then on the map.

DELAY FOR FIRST SWITCHING TO GAS

In this vector is expressed (in seconds) the waiting time for the first switching to gas related to the gas temperature read at the time of starting the car. The delay time can be modified if necessary. In any case comparing the vector value with the “switching delay with warm engine (par.8.5.2)” the system will take the higher value

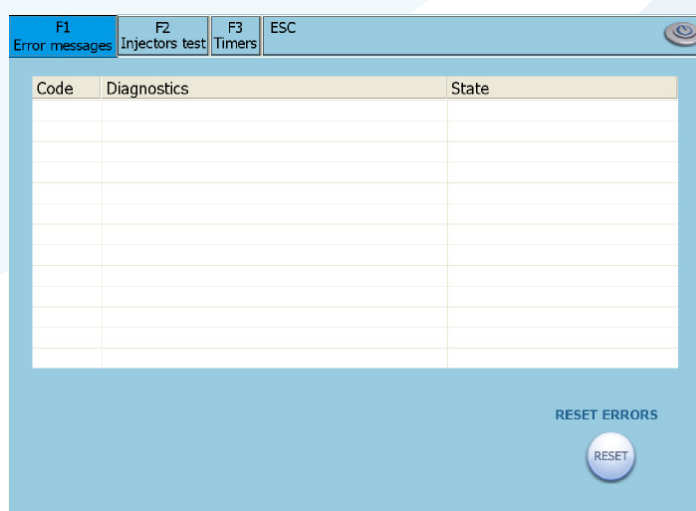
ADJUSTMENT RE-ENTRY FROM CUT-OFF

After you return from a CUT-OFF is possible strengthening or weakening the fuel mixture for a number of injected. Editing the parameter “Adjustment re-entry from CUT-OFF”, you can increase or decrease in the percentage the coefficients of the map. This change remains for the number of injected set in the parameter “Number of injected phases”.

8.5.6 DIAGNOSTICS.

This page shows all parameters that the control unit controls through the diagnosis.

When the gas control unit detects a diagnosis error on the read parameter, it performs the action corresponding to the detected error.



Code	Diagnostics	State

RESET ERRORS
RESET

- ### ERROR MESSAGES

CODE	DIAGNOSIS	ACTION
S101	Connection of petrol injectors	None

S104	Gas pressure sensor	Switching to Petrol
S106	Gas temperature sensor	Switching to Petrol
S108	Switch presence	None
S111	Gas temperature too low	Switching to petrol with system ready to switch on gas.

The detected diagnostic errors can be deleted from the memory of the control unit simply by pressing the key on the bottom right “Errors resetting”.

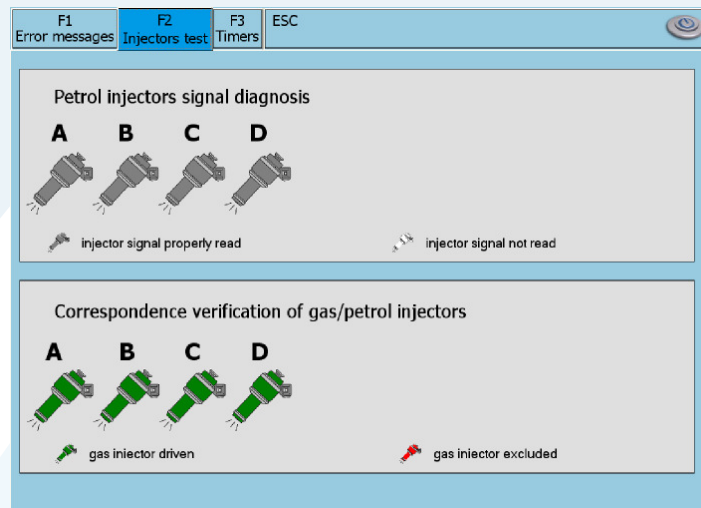
The detected error will be signaled to the driver by the switching-on with fixed light of the YELLOW LED and the slow blinking of the green LED on the switch. Moreover, to ease the identification of the alarm status, it is enabled the buzzer present within the switch itself.

To disable the acoustic alarm, press the push-button of the switch switching the car feeding from gas to petrol.

To return to GAS operation, it is necessary to shut-off and re-start the vehicle.

In the case of diagnosis “Gas temperature too cold” (S111) the display is different: the switchover indicates the switch to gasoline, but the system is ready to re-switch to gas as soon as the conditions for switching to gas are restored.

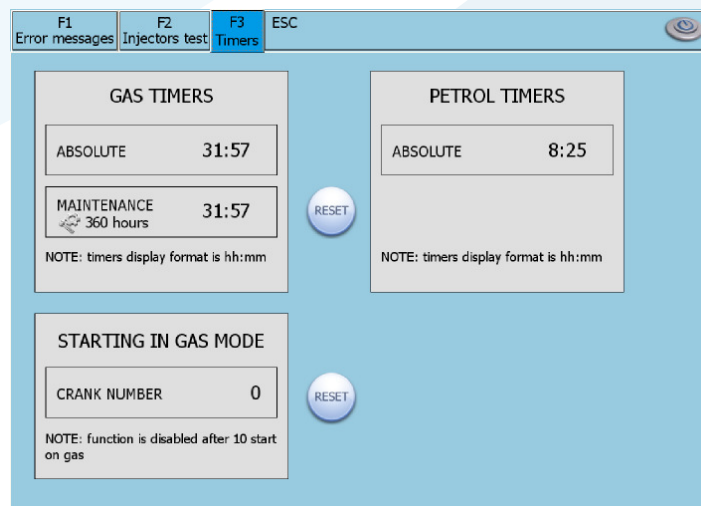
- **INJECTORS TEST.**



Petrol injectors signal diagnosis - You can check if the wiring of petrol injectors have some problems (verification of the emulator cable wiring)

Verification of gas /petrol injectors correspondance – When the car is gas powered, you can exclude a gas injector and activate the correspondent petrol injector: if the connection aren't correct a cylinder isn't powered and another is double powered (gas and petrol) with obvious anomalous operation of car's engine. When you exit from thi window the gas injectors are activated. If the advance of injection sequence is activated, it isn't possible to execute this test.

- **TIMERS**



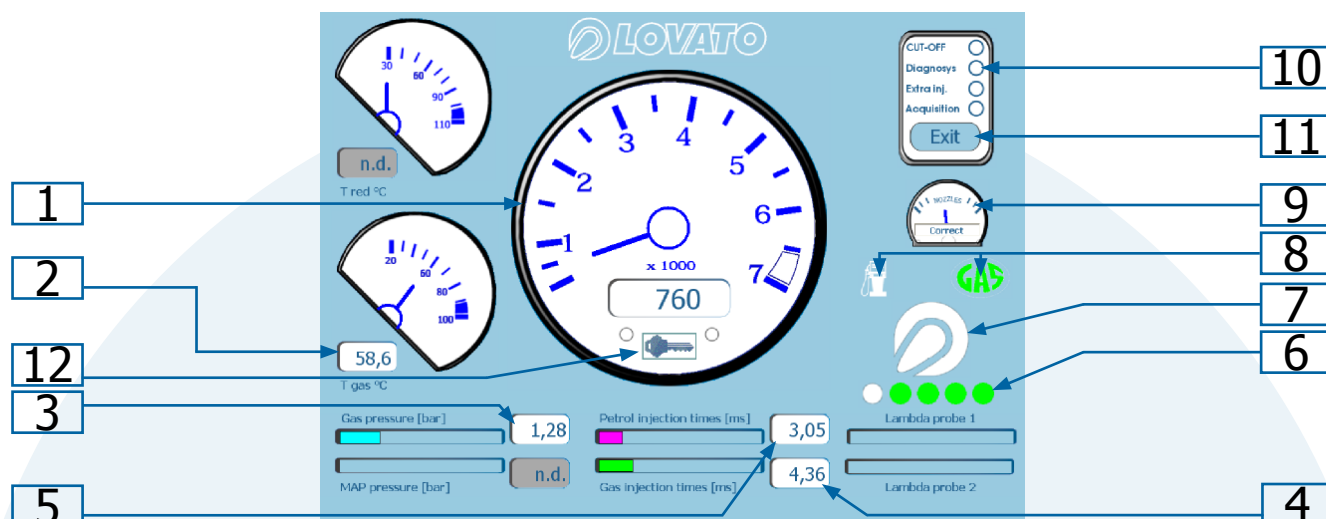
Operating gas time – The absolute and partial hours of gas mode operating are visualized. The counter of partial hours can be erased by the user after a maintenance

Operating petrol time – The absolute hours of petrol mode operating are visualized

Forced gas star – The number of forced gas start is visualized. If you use ten time forced gas start, if you use five time forced gas start, this function is unable to be used in order to safeguard the car's carburation. Only with a PC you can reset the counter for enable again this function.

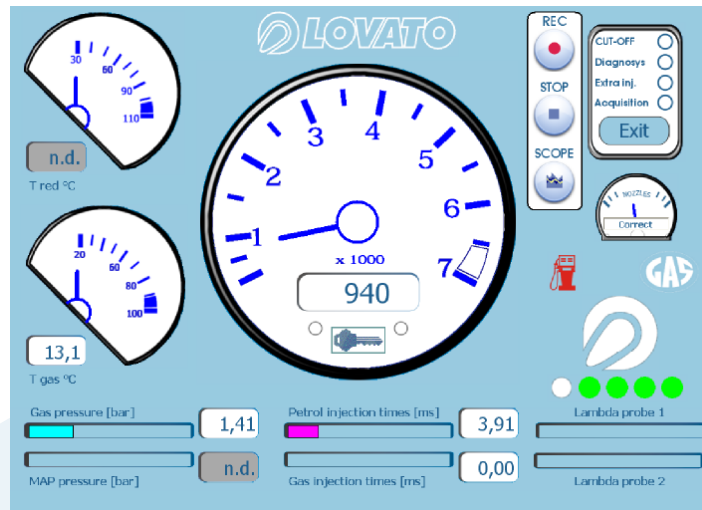
8.6 DISPLAY.

This page shows all signals managed by the control unit.

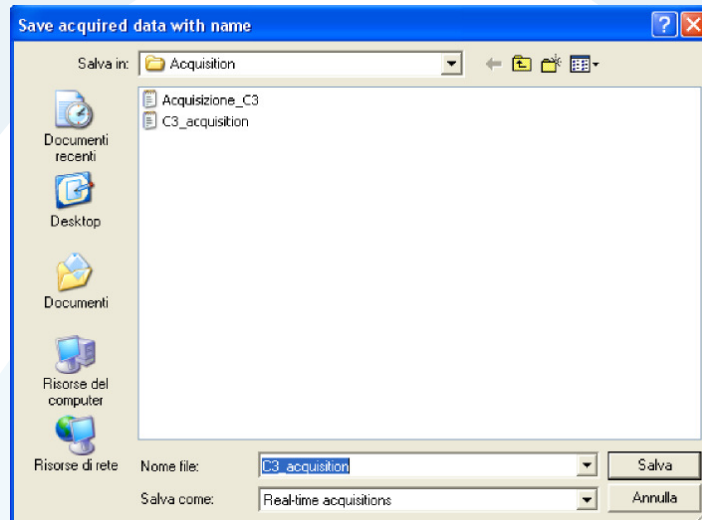


- 1) This shows the number of engine revolutions in real time (rpm);
- 2) This shows the gas temperature (expressed in °C);
- 3) This shows the gas pressure present in the filter (bar);
- 4) This shows the gas injection time in real time (ms);
- 5) This shows the petrol injection time in real time (ms);
- 6) This shows the level of gas present in the tank;
- 7) This allows the switching from petrol to gas by computer;
- 8) This indicates whether the car is working in gas or petrol mode;
- 9) This supplies useful hints on the correct dimensioning of the nozzles installed on the gas injectors;
- 10) This supplies a visual indication on some operation statuses of the car and of the plant with gas CUT-OFF, extra-injections, diagnostics or to enable the acquisition function.
- 11) This allows returning to the main menu.
- 12) This shows the presence or not of the key-on signal. A red cross will appear over the key if the signal is not present.

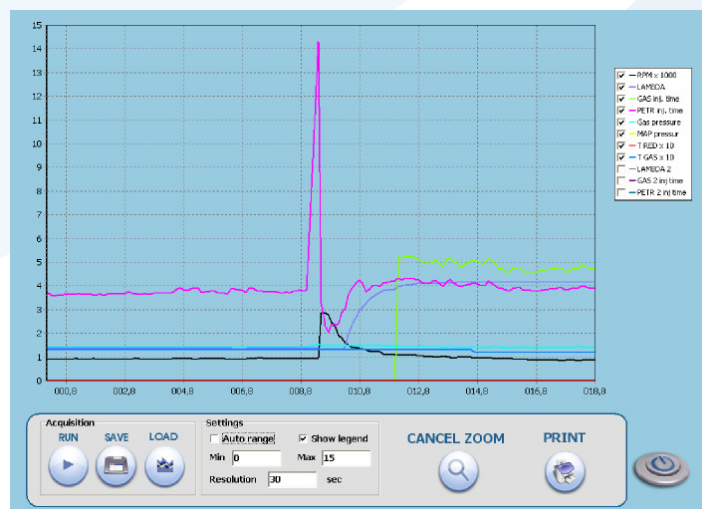
8.6.1 ACQUISITION.



By clicking on acquire, the window “displays” opens the following window. By clicking on “REC” the program starts to record the tracks of the various set variables. When the push-button “STOP” is pressed, the program ends the recording and opens the window to save the recording.



By clicking RUN the signals are showed into the SCOPE window, while clicking STOP the acquisition is stopped. You can store the acquisition by using the SAVE button. With the LOAD button you are able to view a chart previously saved.




It's possible in the settings window to set the time resolution and the amplitude, while into the legend you can enable or disable the display of individual tracks. The program also offers the possibility to zoom a part of the graph and print it.


8.7 SELF-CALIBRATION


In this section, it is possible to perform the automatic calibration of the gas control unit in order to obtain an averagely correct carburetion of the car during the gas operation.


Before starting the self-calibration procedure it is necessary to verify that the car is in good petrol feeding conditions, since the gas feeding system bases on the petrol one.


By pressing the push-button "Self-calibration" the following window will open.

REVS	725 rpm	GAS time	4,36 ms	G. PRES.	1,31 bar	
T. GAS	58 °C	PETROL time	3,05 ms	MAP	n.d. bar	
T. RED.	n.d. °C			EXTRA-INJ.	<input type="radio"/>	
				CUT-OFF	<input type="radio"/>	
				DIAGNOSTICS	<input type="radio"/>	

Press return to start autocalibration 




REVS	818 rpm	GAS time	5,94 ms	G. PRES.	2,25 bar	
T. GAS	19 °C	PETROL time	3,70 ms	MAP	n.d. bar	
T. RED.	n.d. °C			EXTRA-INJ.	<input type="radio"/>	
				CUT-OFF	<input type="radio"/>	
				DIAGNOSTICS	<input type="radio"/>	



Disable any TAP
Turn off the engine loads (conditioner - headlights - fan - etc.)

Press return to start autocalibration 


CNG



To perform the self-calibration follow these instructions:


- 1) Start the car with petrol feeding.
- 2) Start the self-calibration procedure by pressing the key ENTER and follow the instructions given on screen.

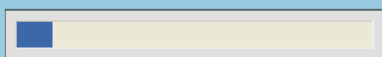
The system checks the operating time from the time of starting the engine. If the engine has been started recently the software will display the following windows.


REVS	764 rpm	GAS time	0,00 ms	G. PRES.	1,33 bar	
T. GAS	60 °C	PETROL time	3,06 ms	MAP	n.d. bar	
T. RED.	n.d. °C			EXTRA-INJ.	<input type="radio"/>	
				CUT-OFF	<input type="radio"/>	
				DIAGNOSTICS	<input type="radio"/>	


REVS 764 rpm

500 1000 1500 2000 2500 3000 3500

Waiting for warming (27 sec.) 




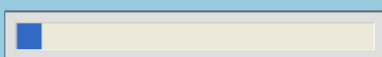



REVS	741 rpm	GAS time	4,39 ms	G. PRES.	1,30 bar	
T. GAS	60 °C	PETROL time	3,04 ms	MAP	n.d. bar	
T. RED.	n.d. °C			EXTRA-INJ.	<input type="radio"/>	
				CUT-OFF	<input type="radio"/>	
				DIAGNOSTICS	<input type="radio"/>	


REVS 741 rpm

500 1000 1500 2000 2500 3000 3500

Wait: checking parameters 




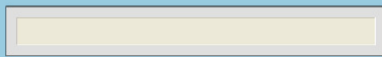



REVS	839 rpm	GAS time	0,00 ms	G. PRES.	2,37 bar	
T. GAS	20 °C	PETROL time	3,79 ms	MAP	n.d. bar	
T. RED.	n.d. °C			EXTRA-INJ.	<input type="radio"/>	
				CUT-OFF	<input type="radio"/>	
				DIAGNOSTICS	<input type="radio"/>	

REVS 839 rpm

500 1000 1500 2000 2500 3000 3500

Leave the vehicle idling switched to petrol 





During methane autocalibration you must store the maximum gasoline injection time on idle. So we need to press the accelerator pedal 4-5 times. Between an acceleration and the subsequent, wait that the rpm are stabilized around at the minimum value.

REVS 823 rpm GAS time 0,00 ms G. PRES. 2,36 bar PETROL
 T. GAS 21 °C PETROL time 3,76 ms MAP n.d. bar
 T. RED. n.d. °C EXTRA-INJ. CUT-OFF DIAGNOSTICS

REVS 818 rpm

Press the accelerator pedal and release quickly

CNG

REVS 1885 rpm GAS time 0,00 ms G. PRES. 2,91 bar PETROL
 T. GAS 21 °C PETROL time 0,00 ms MAP n.d. bar
 T. RED. n.d. °C EXTRA-INJ. CUT-OFF DIAGNOSTICS

REVS 1885 rpm

Repeat this operation 4-5 times and press ENTER to continue
 (Value acquired:18,26)

CNG

REVS 730 rpm GAS time 4,50 ms G. PRES. 1,31 bar GAS
 T. GAS 58 °C PETROL time 2,77 ms MAP n.d. bar
 T. RED. n.d. °C EXTRA-INJ. CUT-OFF DIAGNOSTICS

REVS 730 rpm

Calibration in progress

REVS 709 rpm GAS time 0,00 ms G. PRES. 1,34 bar GAS
 T. GAS 59 °C PETROL time 3,39 ms MAP n.d. bar
 T. RED. n.d. °C EXTRA-INJ. CUT-OFF DIAGNOSTICS

REVS 709 rpm

Calibration complete, data transfer in progress

REVS 764 rpm GAS time 0,00 ms G. PRES. 1,34 bar PETROL
 T. GAS 59 °C PETROL time 3,11 ms MAP n.d. bar
 T. RED. n.d. °C EXTRA-INJ. CUT-OFF DIAGNOSTICS

Calibration terminated correctly
 The system is now switched to petrol, as per normal ignition

After having concluded the SELF-CALIBRATION test the car with gas feeding verifying that it works correctly and correct, if necessary, the carburetion acting on the map as previously described. During the self-calibration, the car is brought to gas feeding automatically and the slider gives an indication of the self-calibration progress status. The slider moves forward rapidly during the first calibration and then slowly during the final calibration.

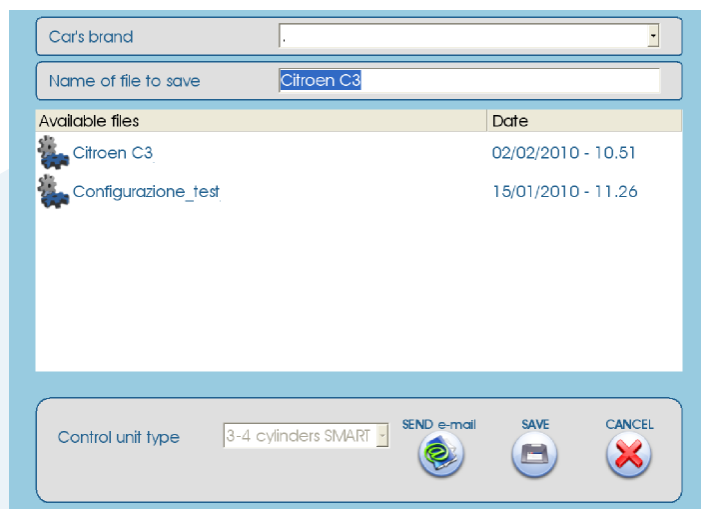
8.8 SAVE CONFIGURATION.

In this submenu it is possible to save in a file all calibration parameters set in the menu “car configuration”.

This file can then be used to configure other control units installed on cars of the same model and with the same type of fuel, METHANE or LPG.

Remark: the selection of the number of cylinders (on the bottom of the window) appears only if the control unit is not connected to the computer.

If the control unit is connected to the computer, this information is automatically stored.



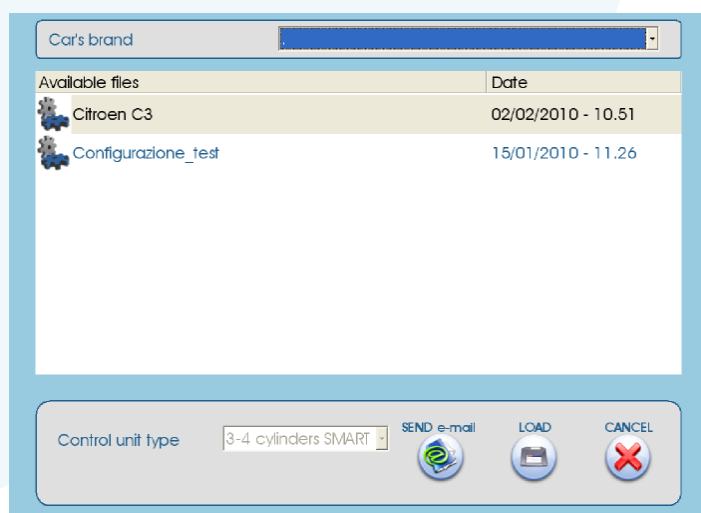
To save select the brand of the car from the drop menu, if you wish to file the configuration on the specific folder of the brand; specify the “Name of the file to be saved” and click on “SAVE”.

By selecting a configuration from the list of the available ones, it is possible to send by e-mail the file that will be automatically attached to the message.

8.9 LOAD CONFIGURATION.

From this submenu, it is possible to load onto the control unit an already existing configuration.

The configuration files are contained in two separate folders: one for LPG configurations and the other for the methane configurations.



Before loading a configuration, it is necessary to access “VEHICLE CONFIGURATION” and select under “Fuel type” methane or LPG according to the configuration that one wishes to load.

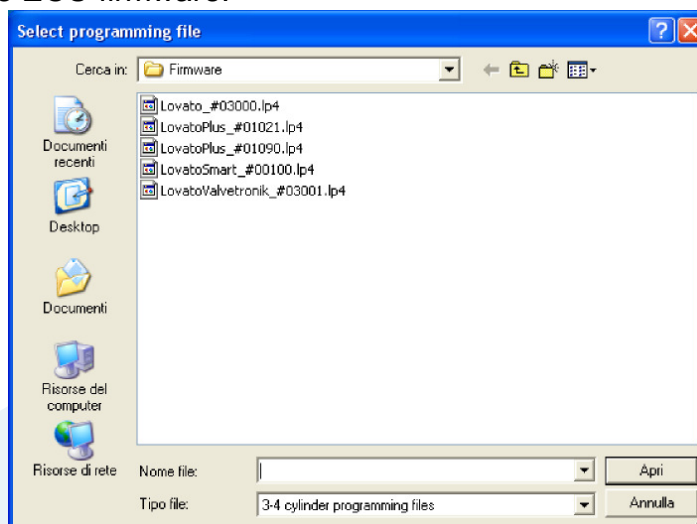
The selection of the number of cylinders (on the bottom of the window) appears only if the control unit is not connected to the computer.

If the control unit is connected to the computer, the lists suggests only the configurations available for the model of control unit automatically recognized.

Select the file that you wish to load and click on “LOAD”.

8.10 NEW FIRMWARE.

It allows you to update the ECU firmware.



Choose the right firmware to be inserted and follow the instructions.

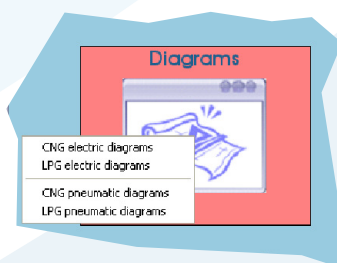
8.11 LANGUAGE.

It is possible to choose the language of the software by clicking on language button and select the one you want on the menu.



8.12 DIAGRAMS.

It is possible to see wiring and pneumatic diagrams by clicking on diagrams button and choose the desired pattern.



9.0 TROUBLESHOOTING

ERROR CODE	ERROR CATEGORY	CODE DESCRIPTION	INDICATOR LAMPS ON SWITCH	DIAGNOSTIC WINDOW ON SOFTWARE	DIAGNOSTIC SYSTEM BEHAVIOUR	TROUBLE AREA	ERROR REMEDY 1	ERROR REMEDY 2	ERROR REMEDY 3
P01	Communication Error	Communication missing	None	Pop UP window with error code and description	ECU doesn't communicate	USB-COM port (problem with PC Port) Connectivity of Serial Interface or ECU Functionality of Serial Interface or ECU	Check the connectivity of ECU (fuse & power supply) Check the connectivity and functionality of serial interface device	Check that the USB-COM port of PC are running or virtual N° device is number from 1 to 9	Replace the ECU or the PC or the Serial Interface Device as the case
P02	Communication Error	ECU is incompatible	None	Pop UP window with error code and description	ECU doesn't communicate	ECU	Use a correct model of ECU		
P03	Communication Error	Can't opening Input Data File	None	Pop UP window with error code and description	Update firmware not possible	Input Data File	Input Data File corrupted Replace the file	Reinstall the Calibration Software Tool	
P04	Communication Error	Error in decrypting of file of programming	None	Pop UP window with error code and description	Update firmware not possible	Operation System on the PC	Check the version of Internet Explorer. It's requires the presence of Internet Explorer version 5.5 or next, with encryption at least 128 bit.		
P05	Programming Error	Wrong voltage of programming	None	Pop UP window with error code and description	ECU Programming doesn't run	Internal ECU Power Supply	Check the power ECU supply and try again to program ECU	Replace the ECU	
P06	Programming Error	Error cancelling flash	None	Pop UP window with error code and description	ECU Programming doesn't run	ECU Microprocessor	Turn off the power supply and try again to program ECU	Replace the ECU	
P07	Programming Error	Error during initialization	None	Pop UP window with error code and description	ECU Programming doesn't run	ECU Microprocessor	Turn off the power supply and try again to program ECU	Replace the ECU	
P08	Programming Error	Error during initialization	None	Pop UP window with error code and description	ECU Programming doesn't run	ECU Microprocessor	Turn off the power supply and try again to program ECU	Replace the ECU	
P09	Programming Error	Error during start programming	None	Pop UP window with error code and description	ECU Programming doesn't run	ECU Microprocessor	Turn off the power supply and try again to program ECU	Replace the ECU	
P10	Programming Error	Empty size of input data	None	Pop UP window with error code and description	ECU Programming doesn't run	Input Data File	Input Data File corrupted Replace the file		
P11	Programming Error	Wrong mode of encryption	None	Pop UP window with error code and description	ECU Programming doesn't run	Input Data File	Input Data File corrupted Replace the file		
P12	Programming Error	Generic programming error	None	Pop UP window with error code and description	ECU Programming doesn't run	ECU Microprocessor	Turn off the power supply and try again to program ECU	Replace the ECU	
From P1000 to up	Programming Error	Error during Record programming	None	Pop UP window with error code and description	ECU Programming doesn't run	ECU Microprocessor	Turn off the power supply and try again to program ECU	Replace the ECU	
C01	Connection Error	Communication missing	None	Pop UP window with error code and description	ECU doesn't communicate	USB-COM port (problem with PC Port) Connectivity of Serial Interface or ECU Functionality of Serial Interface or ECU	Check the connectivity of ECU (fuse & power supply) Check the connectivity and functionality of serial interface device	Check that the USB-COM port of PC is running and virtual N° device is number from 1 to 9	Replace the ECU or the PC or the Serial Interface Device as the case
C02	Connection Error	Error loading the identification data of the ECU	None	Pop UP window with error code and description	ECU doesn't communicate	Connectivity of Serial Interface or ECU Functionality of Serial Interface or ECU	Check the connectivity of ECU (fuse & power supply) Check the connectivity and functionality of serial interface device	Replace the Serial Interface Device or the ECU as the case	
C03	Connection Error	Firmware version not compatible	None	Pop UP window with error code and description	ECU doesn't communicate	Firmware of ECU	Use the correct Input Data File		
C04	Connection Error	Software version not compatible	None	Pop UP window with error code and description	ECU doesn't communicate	PC Software (calibration tool)	Upgrade the software version		

ERROR CODE	ERROR CATEGORY	CODE DESCRIPTION	INDICATOR LAMP ON SWITCH	DIAGNOSTIC WINDOW ON SOFTWARE	DIAGNOSTIC SYSTEM BEHAVIOUR	TROUBLE AREA	ERROR REMEDY 1	ERROR REMEDY 2	ERROR REMEDY 3
S100	System Error	Reserved for other type of ECU							
S101	System Error	Connection of petrol injector	Usual status displayed	Diagnosis red lamp is light on Error Code and Description are showed in the Diagnostic Table	The corresponding gas injector is disable	Connectivity Petrol Injector	Check the connectivity with gas ECU	Check the petrol system	Replace the ECU
S102	System Error	Reserved for other type of ECU							
S103	System Error	Reserved for other type of ECU							
S104	System Error	Gas Pressure Sensor	Orange petrol-status led is light on Green gas-status led blinking Long buzzer beep	Diagnosis red lamp is light on Error Code and Description are showed in the Diagnostic Table	Petrol status forced	Pressure and temperature sensor: Gas Pressure Sensor (short circuit or open circuit or power supply failure)	Check the connectivity with gas ECU	Check presence of +5V power supply of sensors	Replace the temperature and pressure sensor or the ECU if necessary
S105	System Error	Reserved for other type of ECU							
S106	System Error	Gas Temperature Sensor	Orange petrol-status led is light on Green gas-status led blinking Long buzzer beep	Diagnosis red lamp is light on Error Code and Description are showed in the Diagnostic Table	Petrol status forced	Pressure and temperature sensor: Gas Temperature Sensor (short circuit or open circuit)	Check the connectivity with gas ECU	Replace the temperature and pressure sensor	
S107	System Error	Reserved for other type of ECU							
S108	System Error	Presence of Switch	None (All LEDs are off)	Diagnosis red lamp is light on Error Code and Description are showed in the Diagnostic Table	ECU don't work in gas mode	Change Over Switch (problem with connectivity or power supply failure)	Check the connectivity with gas ECU	Check the +5V power supply of the Change Over Switch	Replace the Switch or the ECU as the case
S109	System Error	Reserved for OE application							
S110	System Error	Reserved for other type of ECU							
S111	System Error	Gas temperature too cold	Orange petrol-status led is light on Green gas-status led blinking	Diagnosis red lamp is light on Error Code and Description are showed in the Diagnostic Table	Petrol status forced Ready to switch gas	Gas is too cold	Car power exceeds the power reducer (use a post-heating or a major reducer)	Check water heater circuit	