

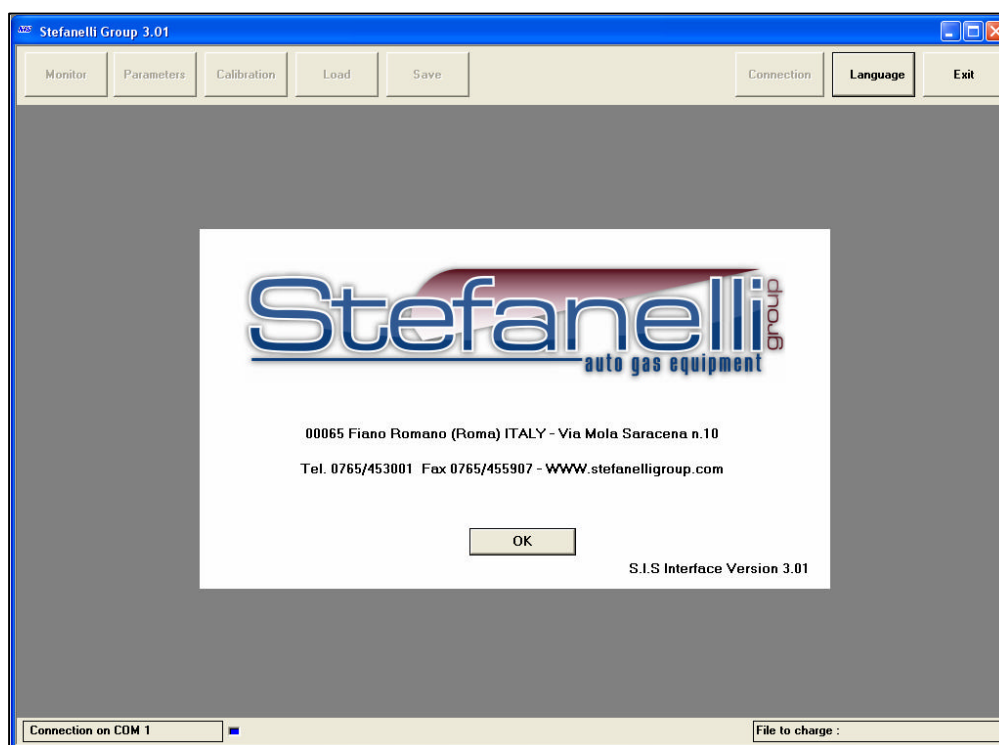
SIS AND SIS PLUS PROGRAMMING MANUAL

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1 Calibration program start-up procedure.

1.1 Program start-up

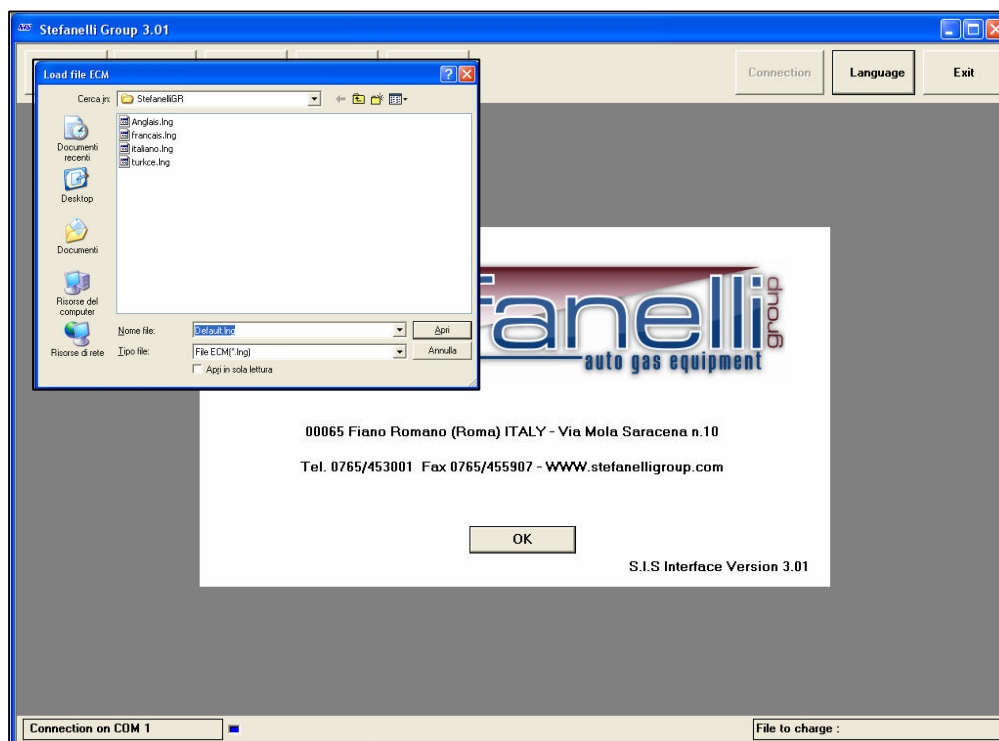
Double-click on the program icon:



1.2 Language selection

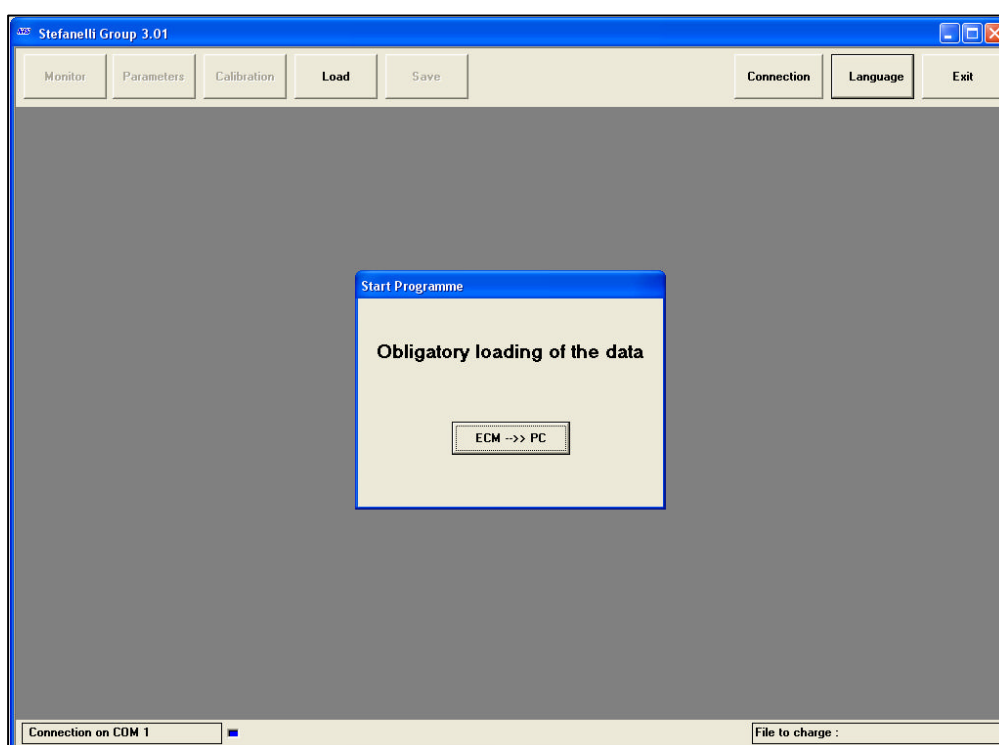
Click on the “LANGUAGE” button to select the desired language. This operation needs to be carried out only once.

Select the desired language in the new window and click on “OPEN”.

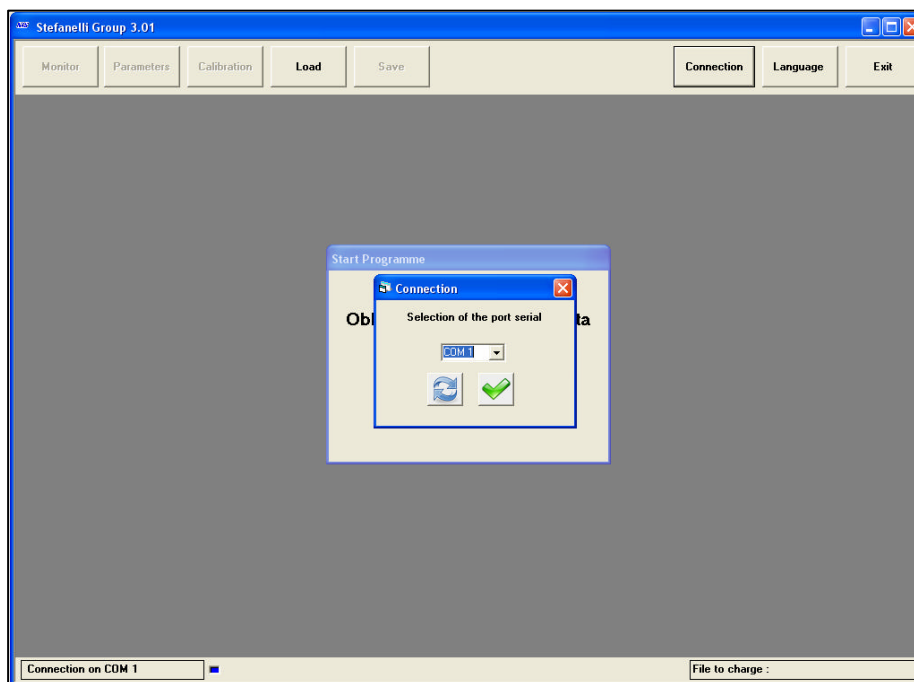
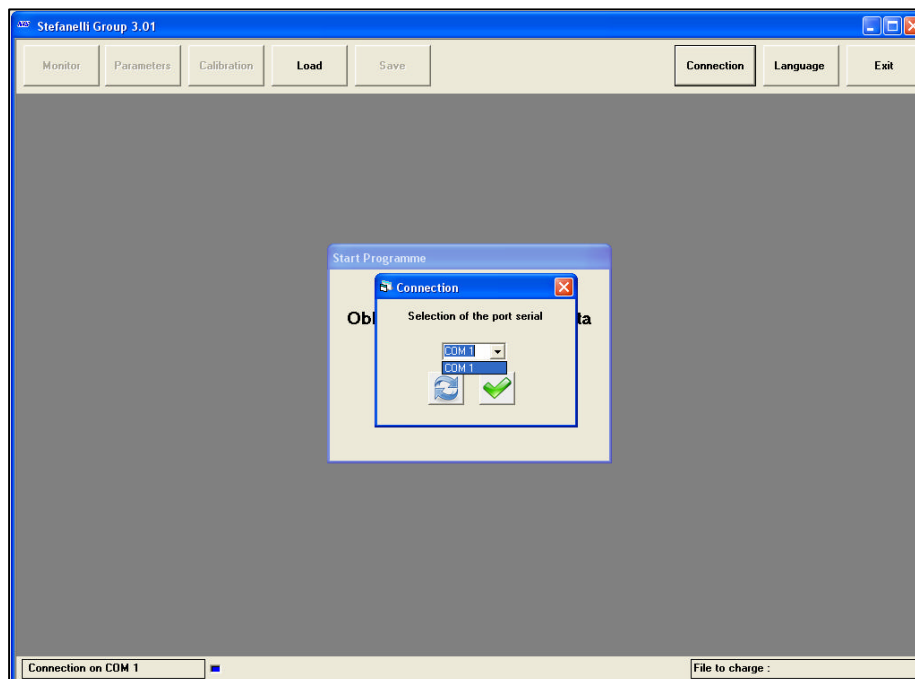


1.3 Connection selection

Click on the “CONNECTION” button to select the desired type of connection. This operation needs to be carried out only once.



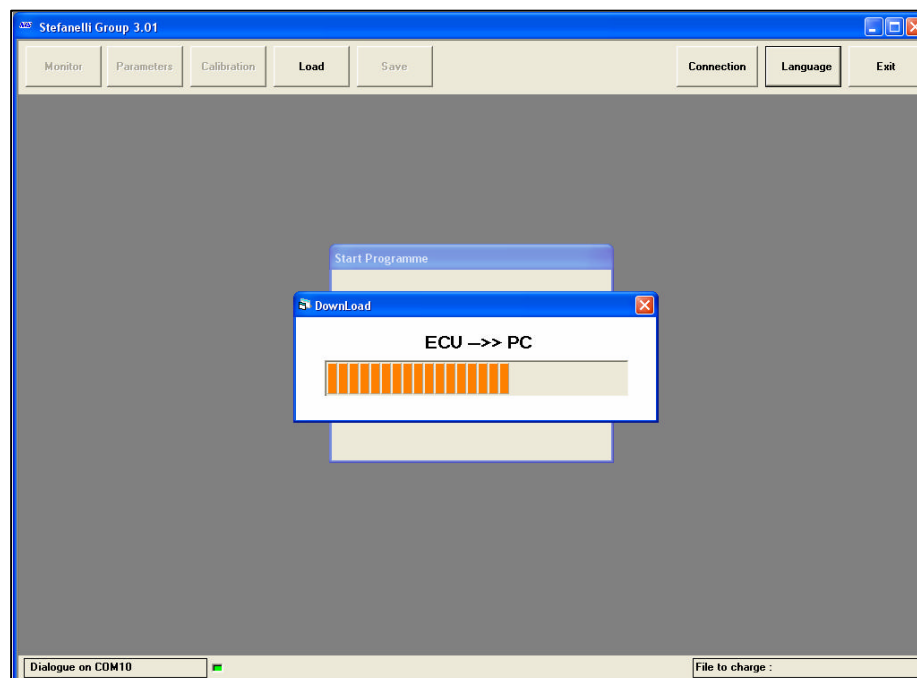
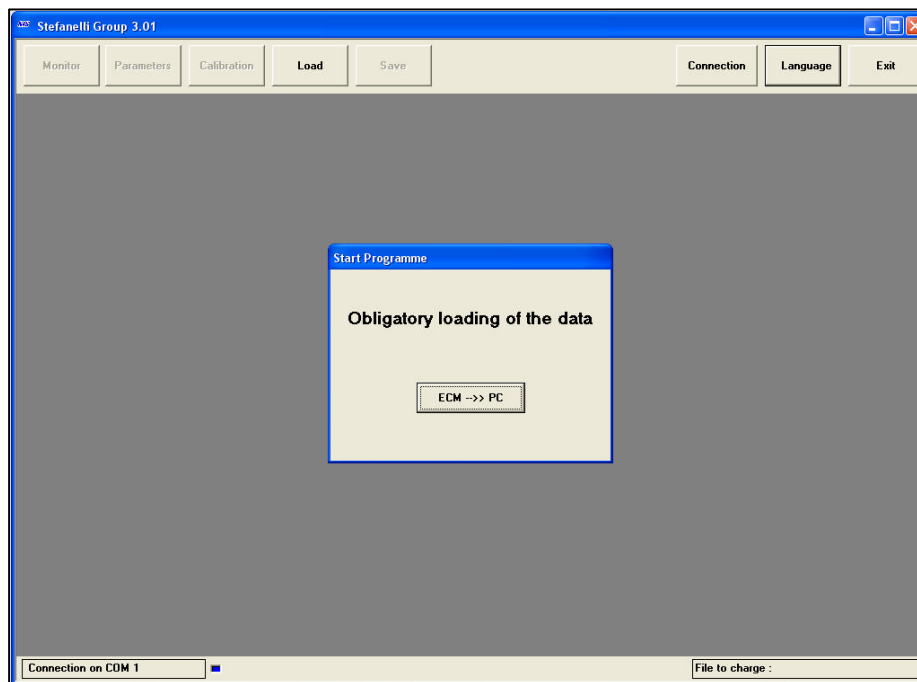
Open the pull-down menu to select the “COM” port.



Click the green “tick” to confirm.

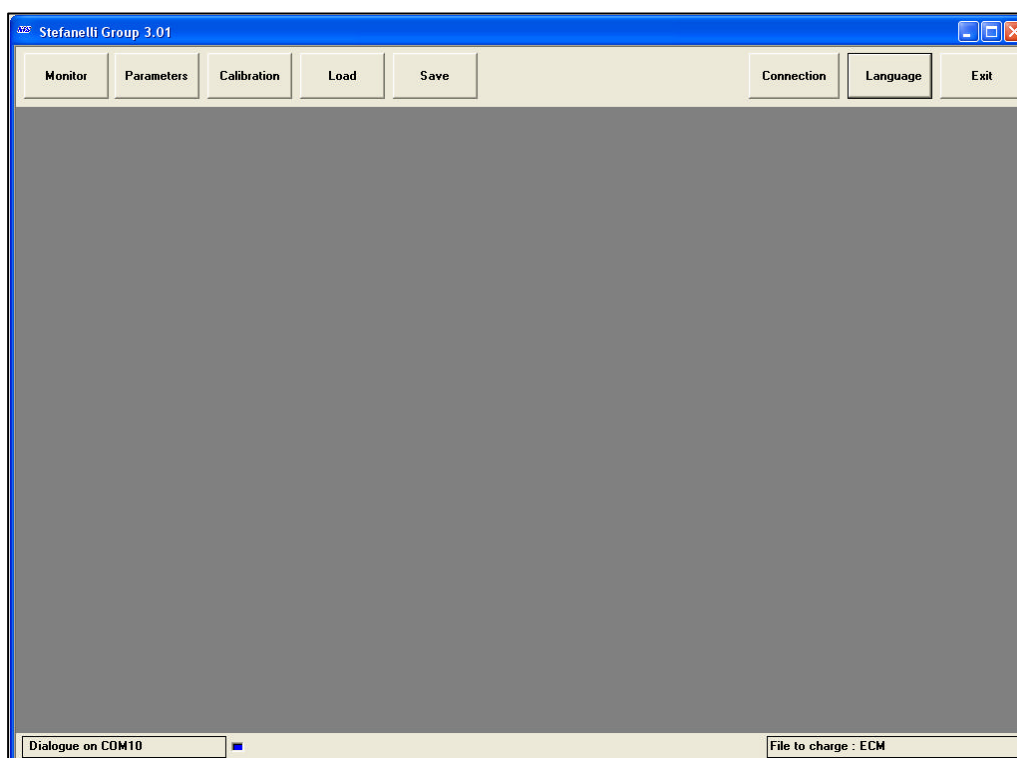
1.4 Load the ECU data onto the PC

Click on the “ECU ->> PC” button to load the ECU data onto the PC.



2 Software description

2.1 Main window

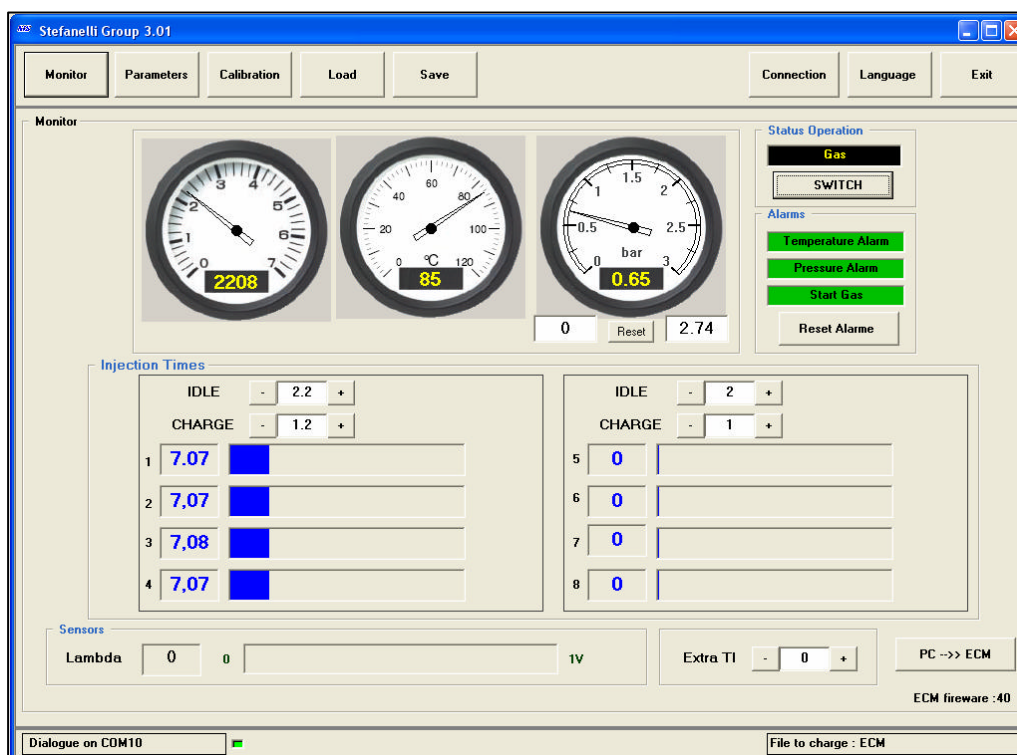


- Monitor: to access the system status window
- Parameters: to access the system parameters window
- Calibration: to access the system calibration window
- Load: to download the previously saved calibration data from the PC
- Save: to save the completed calibration data on the PC
- Connection: to change the connection
- Language: to change the language
- Exit: to exit the program

2.2 Monitor

1. The three pointer dials indicate respectively:

- **Revolutions per minute (RPM)**
- **Reducer temperature**
- **Gas pressure** at the electro-injectors. The two boxes under this dial indicate the minimum (box on the left) and the maximum (box on the right) working pressure. This function makes it possible to verify the working pressure range of the system. Click on the **“Reset”** button to reset the two above-mentioned values.



2. The **“Fuel status”** panel includes:

- ✓ a window which indicates the current status of the system:
 - **Petrol:** the selected fuel is petrol, the engine is running on petrol
 - **Checking:** the selected fuel is LPG, the engine is running on petrol while waiting for the changeover parameters (set in the “Parameters” window) to reach the LPG changeover values.
 - **Gas:** the selected fuel is LPG, the engine is running on LPG
- ✓ **“CHANGEOVER SWITCH”** to select the fuel.

3. The **“Alarms”** panel includes:

- ✓ **“Temperature Alarm” LED:**
 - **green LED:** no errors detected
 - **red flashing LED:** alarm in progress. The reducer temperature has dropped below the threshold value set in the “Parameters” window.
- ✓ **“Pressure Alarm” LED:**
 - **green LED:** no errors detected
 - **red flashing LED:** alarm in progress. The LPG pressure at the electro-injectors has dropped below the threshold value set in the “Parameters” window.
- ✓ **“Alarm Start” LED:**
 - **green LED:** fuel changeover without errors
 - **red flashing LED:** alarm in progress. An emergency start has been forced. The system has switched over to gas without reaching the correct changeover parameter values (set in the “Parameters” window).
- ✓ **“Alarm Reset”** button to reset the alarm status.

4. The **“Injection Times”** panel includes:

- ✓ eight windows to indicate the injection time values. They are divided into two zones which represent two engine cylinder banks. The two banks are identified by the electric connection type: bank I is defined by the “INPUT A” cable, whereas bank II is defined by the “INPUT B” cable.
- ✓ **“IDLE”** parameter window with two buttons, “+” and “-” for each bank, to display and control the parameter of the calibration at idle.
- ✓ **“CHARGE”** parameter window with two buttons, “+” and “-” for each bank, to display and control the parameter of the calibration under load.

Note that the injection times displayed are those defined by the petrol ECU while running both on petrol and on gas.

5. The **“Sensors”** panel indicates the functioning of the lambda probe.

6. The **“TI Excl”** panel includes a window with two buttons, “+” and “-”, to control the “extra injection” times.

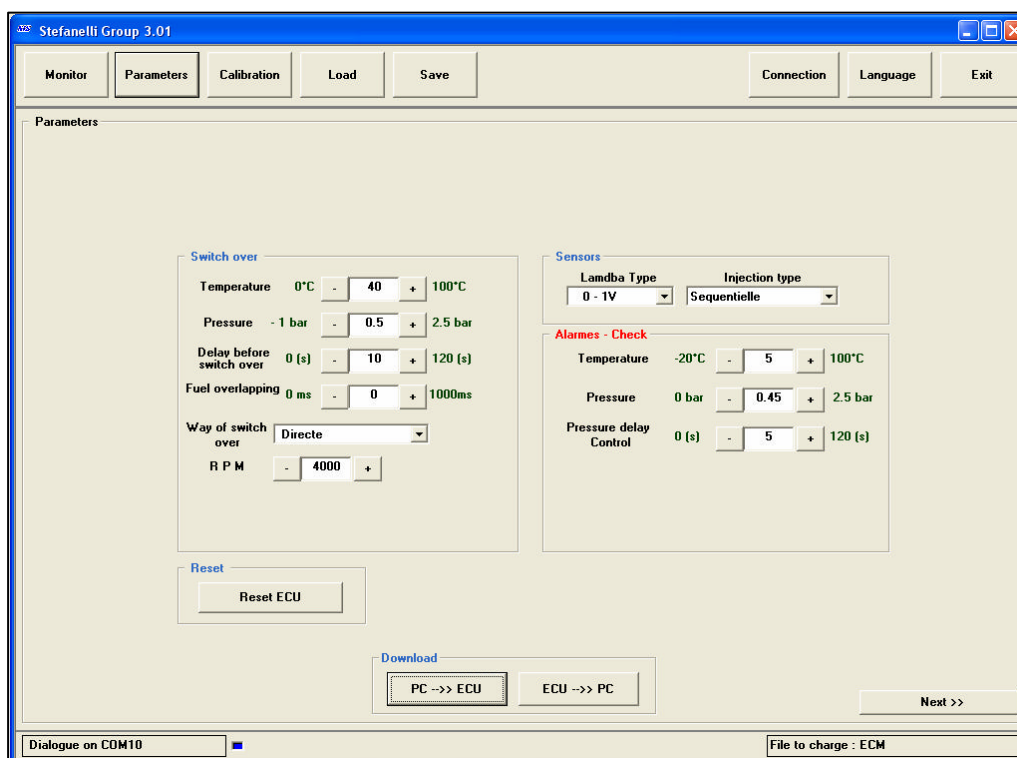
7. The **“PC - >>ECU”** button serves to download the data from the PC onto the ECU.

2.3 Parameters

In this window it is possible to define the changeover and alarm parameters

1. The **“Changeover”** panel includes:

- ✓ **“Temperature”** window with two buttons, “+” and “-”: it serves to set the changeover temperature.
- ✓ **“Pressure”** window with two buttons, “+” and “-”: it serves to set the changeover minimum pressure.
- ✓ **“Changeover Delay”** window with two buttons, “+” and “-”: it serves to set the time necessary to warm up the lambda probe before switching over to gas. The time count starts at the moment the ECU is powered.
- ✓ **“Fuel Overlapping”** window with two buttons, “+” and “-”: it serves to set the overlapping time of the two fuels while switching over to gas.
- ✓ **“Changeover Mode”** window with a pull-down menu: it serves to set the changeover mode: direct, during acceleration, during deceleration.
- ✓ **“RPM”** window with two buttons, “+” and “-”: it serves to set the minimum rpm value necessary to switch over during acceleration or during deceleration.



2. The “**Sensors**” panel includes:

- ✓ “**Lambda Type**” window with a pull-down menu: it serves to select the type of the lambda probe present in the car to work with.
- ✓ “**Injection Type**” window with a pull-down menu: it serves to select the fuel-injection type of the car to work with. This information is necessary only to determine the correct rpm count and it is not necessary for carburation.

3. The “**Alarms - Control Lights**” panel includes:

- ✓ “**Temperature**” window with two buttons, “+” and “-”: it serves to set the temperature value below which the system alarm will be triggered and the system will automatically switch over to petrol.
- ✓ “**Pressure**” window with two buttons, “+” and “-”: it serves to set the pressure value below which the system alarm will be triggered and the system will automatically switch over to petrol.
- ✓ “**Pressure Control Time**” window with two buttons, “+” and “-”: if the system starts up with an insufficient pressure value, it will carry out a control by putting the circuit under pressure to check its tightness. This windows serves to set the time of the tightness control.

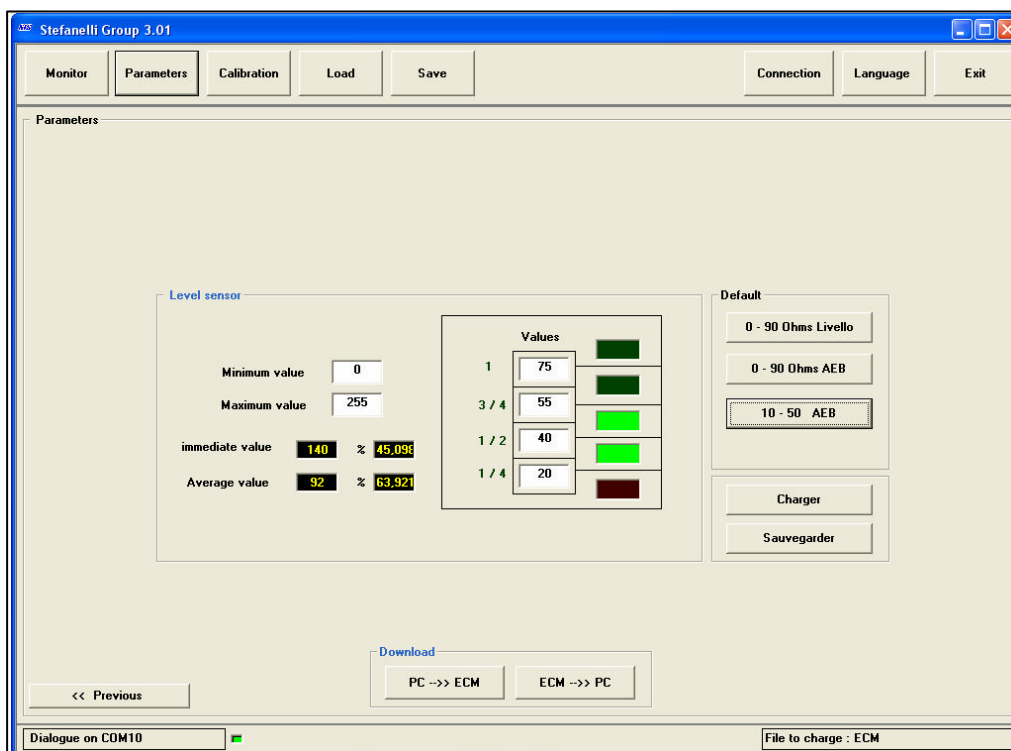
4. The “**Reset ECU**” button resets the ECU to the default values.

5. The “**Download**” panel includes:

- ✓ “**PC - >>ECU**” button: it serves to download the data from the PC onto the ECU.
- ✓ “**ECU - >>PC**”: button: it serves to download the data from the ECU onto the PC.

Click on the “**Next**” button situated down on the right to access the level sensor calibration window:

1. The “**Level sensor**” panel serves to calibrate the level sensor.



2. The “**Default**” panel includes:

- ✓ “**0-90 ohm level**” button: it serves to download the default values. For the **SIS** system.
- ✓ “**0-90 ohm AEB**” button: it serves to download the default values. For the **SIS PLUS** system.
- ✓ “**10-50**” button: it serves to download the default values. For the **SIS PLUS** system.

3. The “**Load**” button serves to download the previously saved level sensor calibration data from the PC.
4. The “**Save**” button serves to save the current level sensor calibration data on the PC.
5. The “**Download**” panel includes:
 - ✓ “**PC - >>ECU**” button: it serves to download the data from the PC onto the ECU.
 - ✓ “**ECU - >>PC**”: button: it serves to download the data from the ECU onto the PC.

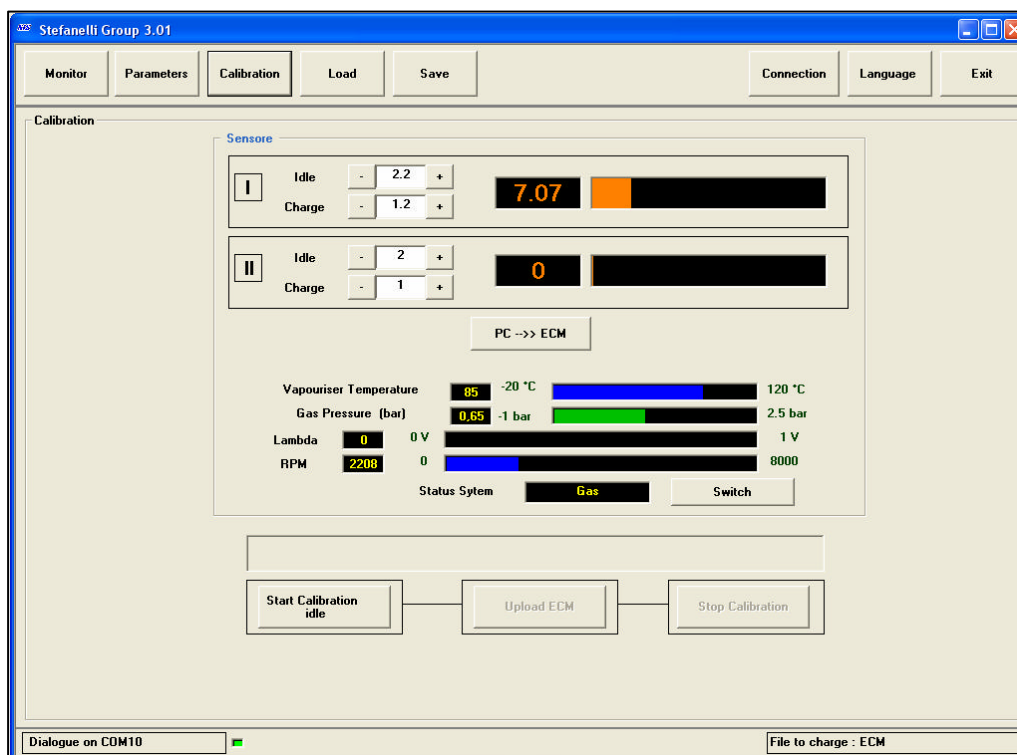
Click on the “**Back**” button situated down on the left to return to the previous window.

2.4 Calibration

In this window it is possible to carry out the calibration of the carburation process

1. The “**Sensors**” panel includes:

- “**I**” zone to indicate the injection time of the first bank, “**IDLE**” window with two buttons, “**+**” and “**-**”, to display and control the parameter of the calibration at idle and “**CHARGE**” window with two buttons, “**+**” and “**-**”, to display and control the parameter of the calibration under load.
- “**II**” zone: indicate the injection time of the second bank, “**IDLE**” window with two buttons, “**+**” and “**-**”, to display and control the parameter of the calibration at idle and “**CHARGE**” window with two buttons, “**+**” and “**-**”, to display and control the parameter of the calibration under load.



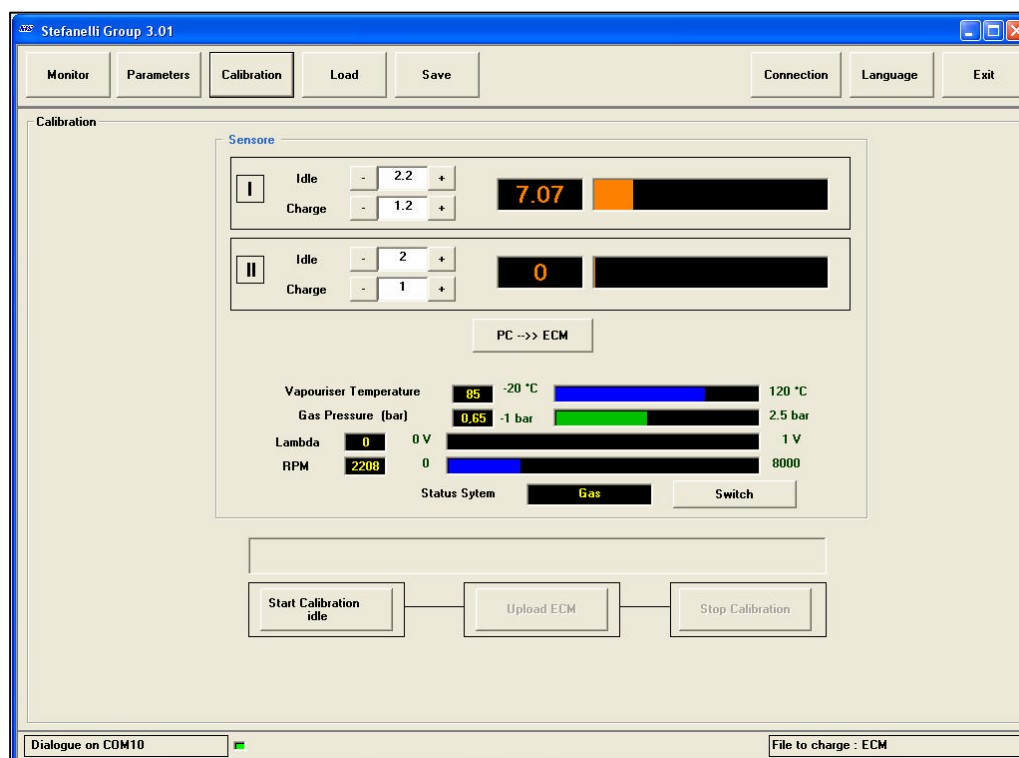
Remember that the displayed injection times are those defined by the petrol ECU while running both on petrol and on gas.

- **Reducer temperature**
- **Gas pressure at the electro-injectors**
- **Lambda probe**
- **Revolutions per minute**

➤ Fuel status

- ✓ a window which indicates the current status of the system:
 - **Petrol:** the selected fuel is petrol, the engine is running on petrol
 - **Checking:** the selected fuel is LPG, the engine is running on petrol while waiting for the changeover parameters (set in the "Parameters" window) to reach the LPG changeover values.
 - **Gas:** the selected fuel is LPG, the engine is running on LPG
- ✓ **"CHANGEOVER SWITCH"** to select the fuel

2. The **"Idle Calibration Start"** button: it serves to start the automatic car calibration at idle.
3. The **"Upload ECU"** button: once the automatic calibration at idle has been completed (the notice becomes black), it serves to upload the calculated idle parameter value onto the gas ECU.
4. The **"Calibration Stop"** button: once the automatic calibration has started (the notice becomes black), it serves to stop it.

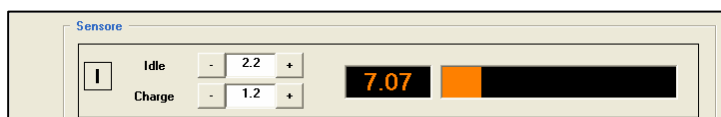


3 Calibration procedure.

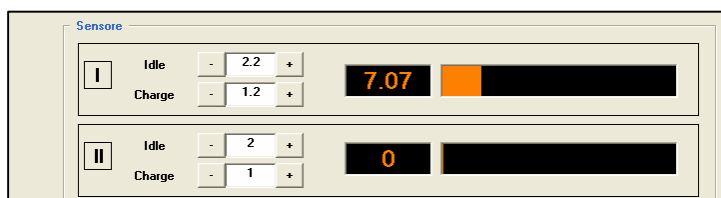
The calibration program of **SIS** and **SIS PLUS** systems is based upon two fundamental parameters called "**IDLE**" and "**CHARGE**". These values strictly depend on the LPG pressure value.

Taking into account that the strategy of the SIS and SIS PLUS ECU is to emulate the functioning parameters on petrol while running on gas, the goal of the calibration procedure is to keep the displayed injection times (defined by the petrol ECU) equal, both on petrol and on gas, by working upon the **IDLE** parameter with the engine at idle and upon the **CHARGE** parameter with the engine under load.

For 3 and 4 cylinder engines the calibration procedure refers only to the "**I**" zone (one bank).

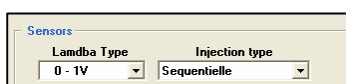


For 6 and 8 cylinder engines the calibration procedure refers to the "**I**" zone for the first bank and to the "**II**" zone for the second bank.



The following are the fundamental steps to carry out a correct car calibration procedure:

1. select the lambda type and the injection type in the parameters window



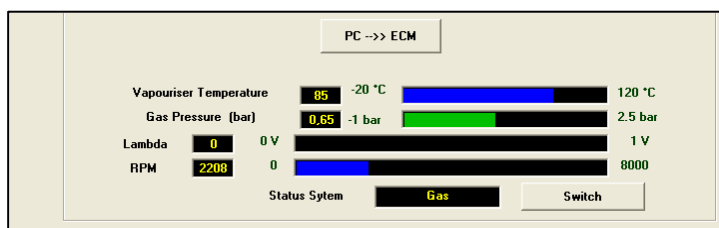
2. calibrate the reducer pressure (described in the following paragraphs)
3. calibrate the IDLE parameter (described in the following paragraphs)
4. calibrate the CHARGE parameter (described in the following paragraphs)
5. calibrate the IDLE parameter (described in the following paragraphs)
6. verify the LPG pressure under load (described in the following paragraphs)
7. calibrate the changeover and alarm parameters (described in the following paragraphs)
8. TI Excl parameter operation
9. calibrate the level sensor (described in the following paragraphs)

3.1 Reducer pressure calibration

Start the engine on petrol and let it warm up so as to activate the cooling fan, then switch over to LPG, facilitating the changeover process by keeping the engine speed at about 3000 rpm. In order to switch over from petrol to gas, click on the “**CHANGEOVER SWITCH**” button. Verify the pressure and, if necessary, adjust its value following the table (the pressure indicated in the table refers to an engine running at idle on LPG).

REDUCER TYPE	POWER		RELATIVE PRESSURE (bar)
	kW	hp	
GEO 110 Type N	Up to 73.5	Up to 100	0.7 ÷ 1.0
GEO 110 Type N	73.5 ÷ 110	100 ÷ 150	Max 1.25
GEO 110 Type M	Up to 147	Up to 200	Max 1.3
BIG GEO	Up to 200	Up to 250	Max 1.3

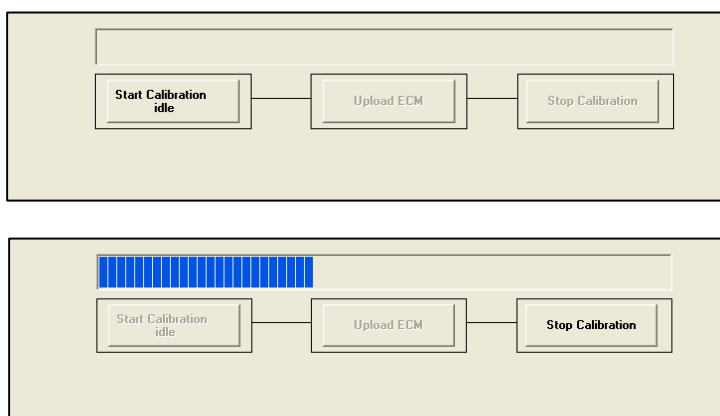
In order to adjust the pressure, work upon the reducer adjusting screw.



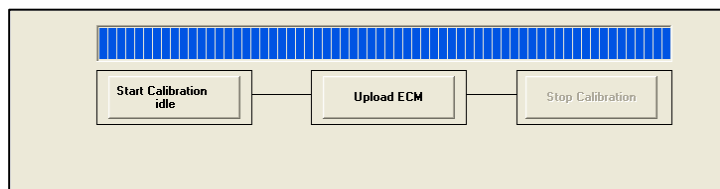
3.2 Calibration of the “IDLE” parameter

3.2.1 Automatic calibration of the “IDLE” parameter

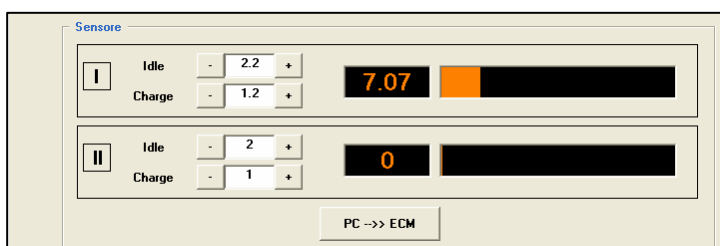
1. Start the engine on petrol and let it warm up so as to activate the cooling fan. Make sure that the engine is running without any additional burden (air-conditioning, lights and other facilities).
2. Click on “**Idle Calibration Start**”:



3. Once the automatic calibration has been completed, the “**Upload ECU**” button becomes black. Click on the button to transfer the calculated value to the ECU.

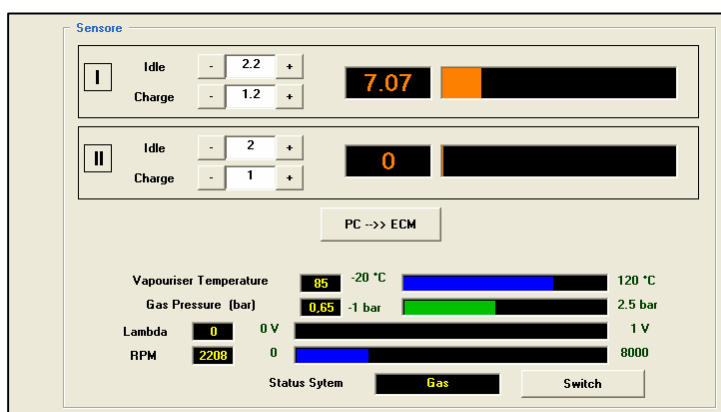


4. Carry out a visual control of the injection times. Read the petrol injection times and compare them with the gas injection times. In order to switch over from petrol to gas and vice versa, click on the “**CHANGEOVER SWITCH**” button. The two values must be equal within a margin of +/- 0,1 ms. If the obtained result is not satisfying, proceed to the manual calibration of the “IDLE” parameter.



3.2.2 Manual calibration of the "IDLE" parameter

1. Start the engine on petrol and let it warm up so as to activate the cooling fan. Make sure that the engine is running without any additional burden (air-conditioning, lights and other facilities).
2. Read and memorize the **petrol injection times** with the engine running at idle.

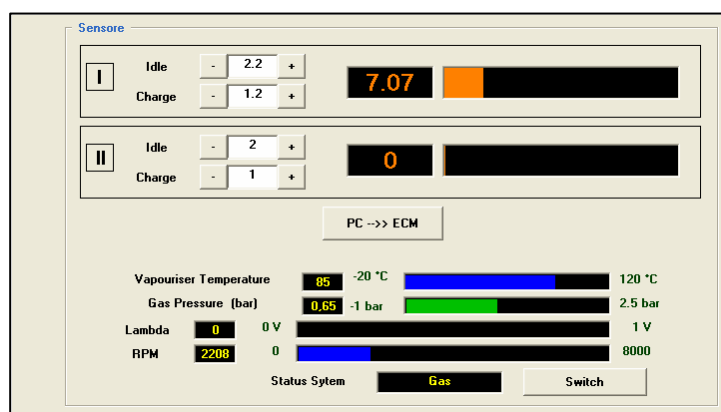


3. Switch over to gas (if this is the first changeover to gas, facilitate the changeover process by keeping the engine speed at about 3000 rpm). Wait until the engine work is sufficiently regular and then read the **gas injection times** while the car engine is running at idle.
4. Comparison of the previously read and memorized injection times:
 - a. if the "**petrol injection times**" are **higher** than the "**gas injection times**", the LPG carburation is **rich**, so it is necessary to reduce the "IDLE" parameter value. The reduction of the value should be more or less equal to the difference between the two injection times. Click on the "**PC->> ECU**" button to confirm the modified value.
 - b. if the "**petrol injection times**" are **lower** than the "**gas injection times**", the LPG carburation is **lean**, so it is necessary to raise the "IDLE" parameter value. The increase should be more or less equal to the difference between the two injection times. Click on the "**PC->> ECU**" button to confirm the modified value.
 - c. if the "**petrol injection times**" are equal (within the margin of tolerance) to the "**gas injection times**", the LPG carburation at idle is **correct**.
5. Verify that the "**petrol injection times**" and the "**gas injection times**" are equal. Otherwise, repeat the procedure until obtaining a satisfying result (acceptable difference: +/- 0,1 ms).

3.3 Calibration of the “CHARGE” parameter

The calibration of the “**CHARGE**” value must be carried while driving on a regular road with a slight slope where it is possible to keep the engine under constant elevated load. This procedure can be carried out only manually. Proceed as follows:

1. Bring the car to the above-mentioned conditions while running on petrol. The optimal mode is to drive in 4th gear at a low speed and to step on the accelerator pedal until the $\frac{3}{4}$ of its stroke. The goal is to display elevated injection times.
2. Read and memorize the “**petrol injection times**”.



3. Switch over to gas. Read the “**gas injection times**”, making sure that the driving conditions are the same as when reading the petrol injection times.
4. Comparison of the previously read and memorized injection times:
 - a. if the “**petrol injection times**” are **higher** than the “**gas injection times**”, the LPG carburation is **rich**, so it is necessary to reduce the “**CHARGE**” parameter value. The reduction should be more or less equal to the percentage difference between the two injection times. Click on the “**PC->> ECU**” button to confirm the modified value.
 - b. if the “**petrol injection times**” are **lower** than the “**gas injection times**”, the LPG carburation is **lean**, so it is necessary to raise the “**CHARGE**” parameter value. The increase should be more or less equal to the percentage difference between the two injection times. Click on the “**PC->> ECU**” button to confirm the modified value.
 - c. if the “**petrol injection times**” are equal (within the margin of tolerance) to the “**gas injection times**”, the LPG carburation under load is **correct**.
5. Verify that the “**petrol injection times**” and the “**gas injection times**” are equal. Otherwise, repeat the procedure until obtaining a satisfying result

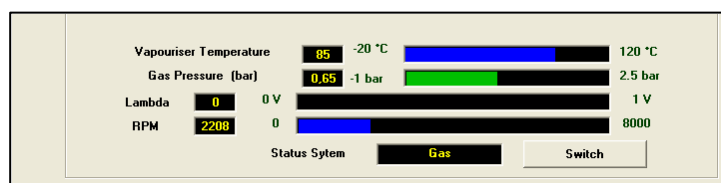
(acceptable difference: +/- 0,2 ms), taking care to keep the engine under the same load conditions.

6. Repeat the calibration of the "IDLE" parameter procedure.

3.4 LPG pressure control while under load

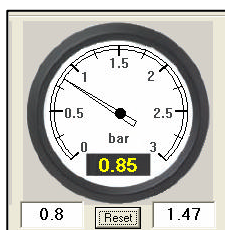
Verify that the LPG system fuels correctly at high rpm.

1. While driving in 2nd or in 3rd gear, bring the engine to the maximum rpm and check whether the LPG pressure drops below 0,5/0,6 bar. Verify also the lambda probe status so as to obtain a correct carburation process at high rpm (see the probe functioning bar where the red colour indicates a rich mixture).
2. In case the pressure drops below the indicated value and/or the probe detects a lean mixture (the bar becomes green), proceed to raise the LPG pressure by means of the reducer adjusting screw. In such a case it is necessary to repeat the previously described calibration procedures of the "IDLE" and "CHARGE" parameters.



3.5 Changeover and alarm parameters calibration

Once the procedure of the pressure control under load has been completed, read the maximum and the minimum pressure values in the "Monitor" window.



1. The minimum registered pressure value (in the example above it is 0,8 bar) reduced by 0,2 bar (0,6 bar) indicates the alarm pressure value to be inserted in the “Parameters” window.

The screenshot shows two panels of the software interface. The left panel, titled 'Switch over', contains settings for Temperature (0°C to 100°C), Pressure (-1 bar to 2.5 bar), Delay before switch over (0 s to 120 s), Fuel overlapping (0 ms to 1000ms), Way of switch over (Directe), and RPM (-4000 to +). The right panel, titled 'Sensors', contains settings for Lambda Type (0 - 1V), Injection type (Sequentielle), and a section for 'Alarms - Check' with Temperature (-20°C to 100°C), Pressure (0 bar to 2.5 bar), and Pressure delay Control (0 s to 120 s).

2. As far as the changeover pressure is concerned, it is recommended to insert the pressure value registered at idle, with the engine running on LPG, reduced by 0,3 bar.
3. As for the other changeover and alarm parameters, it is recommended to apply the following values:

Changeover	
Temperature	40 °C
Changeover delay	15 sec
Fuel overlapping	0
Changeover mode	Deceleration
RPM	2000 rpm.

Alarms - Control lights	
Temperature	5 °C
Pressure control time	5 sec

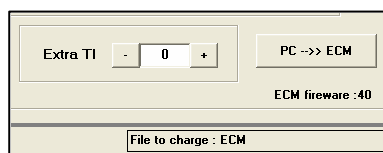
3.6 TI Excl parameter operation

In some car models the petrol ECU generates impulse trains of the injection times to compensate for particular burdens (for example: hydraulic power steering when it arrives at the limit switch, air conditioning etc.). In some cases these signals result in gas system malfunctioning. While running on gas, these impulses can be blocked by means of the TI Excl parameter operation.

For example, when this parameter is set to 1,2 ms, the ECU on gas will cut off all the signals below 1,2 ms.

Check that the parameter value does not exceed the half of the idle injection time value.

Example: displayed idle injection time value: 2 ms, set the TI Excl parameter to 1 ms at the most.



3.7 Level sensor calibration

Follow the procedures described in points 1, 2 and 3 to calibrate the SIS 10-90 and the SIS PLUS 10-50 sensor levels.

- 1) Using a magnet, set the sensor pointer to the minimum, read the value which will appear in the **“Immediate value”** box and insert the value into the **“Minimum value”** box.
- 2) Set the sensor pointer to the maximum, read the value which will appear in the **“Immediate value”** box and insert the value into the **“Maximum value”** box.
- 3) Once the minimum and the maximum tank level values has been set, it is necessary to define the steps according to which the LEDs of the changeover switch will gradually light up or switch off (percentage correspondence).

In order to make each LED correspond to a percentage tank level value, proceed as follows:

- ✓ set the pointer to $\frac{3}{4}$ of its stroke. The corresponding percentage value will appear in the **“Immediate value %”** box; insert the value in box “1”.
- ✓ set the pointer to $\frac{1}{2}$ of its stroke. The corresponding percentage value will appear in the **“Immediate value %”** box; insert the value in box “ $\frac{3}{4}$ ”.
- ✓ set the pointer to $\frac{1}{4}$ of its stroke. The corresponding percentage value will appear in the **“Immediate value %”** box; insert the value in box “ $\frac{1}{2}$ ”.

- ✓ set the pointer to an intermediate position between $\frac{1}{4}$ and the minimum value of its stroke. The corresponding percentage value will appear in the “**Immediate value %**” box; insert the value in box “ $\frac{1}{4}$ ”.

