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Assembly Instructions

of

GAS TECH 700S and GAS TECH 400S gas injection control systems

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IMPORTANT!

The manufacturer does not bear any responsibility for using the device notin accordance with the service manual. The service manual is an integral part of a device and is handed on to its users.

It is forbidden to introduce any changes to GAS TECH 700S or GAS TECH 400S which may result in losing guarantee rights.

Opening of the controller casing or damage of the lead guarantee seal will result in the loss of guarantee rights.

IMPORTANT!

The controller should be mounted far from damp sites, strong magnetic fields and extremely hot places (e.g. near the exhaust manifold)

Electric wires must be well insulated and connectors and conductors secured along their whole length against insulation damage.

First-rate electric soldered connectors ought to be used.

Injectors and feeding cables should not be assembled near any electromagnetic interference sources.

The company bears no responsibility for any damages caused by the improper assembly of the set.

The Windows trade-mark used in these instructions is a registered mark of the Microsoft company.

The GAS TECH 600S system must be installed only by persons who hold an appropriate license and are instructed by an authorized distributor of the D.T. Gas-System.

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TECHNICAL DATA

The most crucial technical data of the gas injection control system LPG “GAS TECH 700S” “GAS TECH 400S” and are presented in the table 1.1.

Table 1.1. Technical data of gas injection control system LPG “GT 700S” and “GT 400S”

Description	Value
Nominal supply voltage	12 V
Admissible supply voltage range	10 ÷ 16 V
Maximum value of current consumption	3.65 A
Minimum value of velocity signal voltage	3V
Admissible range of ambient temperature	−40 °C to +120 °C
Protection degree	IP66

The most important technical data of gas injectors are included in Table 1.2.

Table 1.2. Technical data of gas injectors

Description	Value
Time lag when the valve is opened	< 1.5 ms
Maximum time when the injector is opened	40 ms
Supply voltage	12V
Average current consumption by the injector	2A /injector
Guaranteed durability	2 years or 30,000 km

Table 1.3. Description of additional equipment:

Description	Value
Type of engine	Petrol spark- ignition combustion engine
Types of the petrol injection	- simultaneous multi-point - MPI (Multi-Point Injection) - sequential– SFI (Sequential Fuel Injection)
Capacity	from 700 cm ³
Number of cylinders	from 1 to 4 (or 1 to 8)
Cylinder layout	optional
Power	from 5 kW

1. SYSTEM OPERATION

General purpose of the system

The gas injection system control “GAS TECH 700S”/“GAS TECH 400S” is an electronic control device which is designed to control the fuel-air mixture ratio in a car spark ignition engine provided with one or two lambda sensors. Propane-butane gas is its fuel. The device works in parallel with the petrol controller of the engine and is responsible for controlling the composition of injected fuel-air mixture.

Based on the input signals of (Fig. 2.1):

- opening time of petrol injectors,
- rotational speed of engine n ,
- output voltage of the oxygen sensor (or sensors),
- gas temperature in the reducer,
- gas pressure,
- the status of the gas/petrol switch of the central unit, the controller controls:
- the opening time of injection array's electrovalves ,
- closing /opening of the gas electrovalve (fuel pump),
- switching on /switching off petrol injection emulators,
- visualization of the controller's work status in the central unit.

The most important controlling quantities are the opening times of electrically controlled valves which are placed in the gas injectors 10 (Fig. 2.1). The amount of gas flowing into each of the engine's cylinders is controlled by a group of two coupled electrovalves. The gas injectors are connected with supply manifold of the engine by means of rubber pressure conduits 12. After the valve's opening, the gas flows to the manifold where it is sucked into the combustion chamber by the engine. The gas controller sets the valve's opening time in the gas injectors on the basis of the opening times of petrol injectors and correction quantities. Its aim is to maintain the composition of the burnt mixture in accordance with the one of the petrol controller. The overpressure adjustment of gas which feeds the engine takes place in the reducer/evaporator 5, whilst injected stream gas control takes place thanks to the valves placed in the gas injectors.

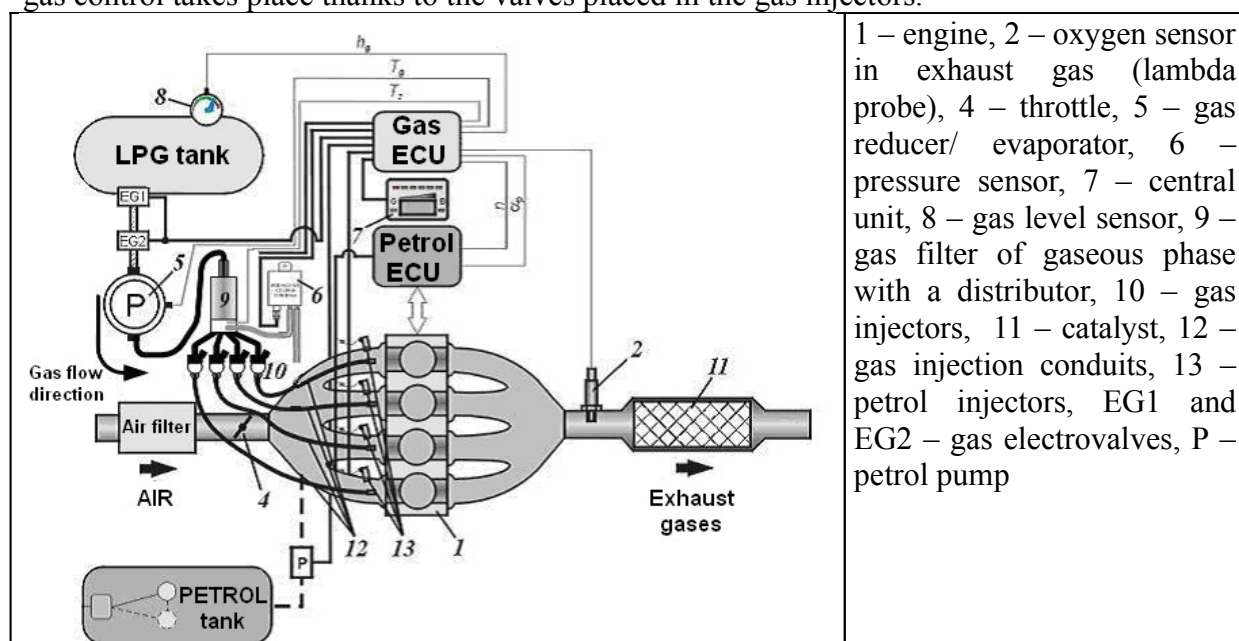


Figure 2.1. Block diagram of the connections of gas flow controller

The controller is equipped with an injection emulator. During the engine supply with propane-butane, it is necessary to switch off petrol injectors so that they do not inject petrol. During the engine's petrol operation, electric impulses of the injection generated by the petrol controller should reach the injectors without any obstacles. The operation of the injection emulator does not only consist in electric disconnection of injectors. Diagnostic procedures saved in the petrol controller are capable of detecting the lack of injectors' resistance. In order to prevent it, a substitute circuit is formed.

The change of fuel type from petrol to propane-butane gas takes place upon the driver's request, after pressing the button in the central unit 7. After reaching the assumed working conditions (expressed mainly by the rotational speed and thermal state of the gas system) by the engine, the gas controller switches off the petrol supply, gas electrovalves *EG1* and *EG2* are opened and electrovalves situated in the gas injectors *10* begin to be controlled. Limiting conditions of the engine's operation required to change the fuel type are set during the procedure of system control calibration. The "GT700S" / "GT400S" computer program is used for this purpose.

Major differences between „GT 400S” and „GT 700S” gas systems

The major difference between GT 700S and GT 400S gas injection systems is the possibility to work with more gas injection devices, including low-resistance injectors. Besides, GT 700S system has more complex calibration procedure (using feedback information from OBD), which, in connection with fast BlueTech injectors makes it possible the entire system to work with the most technologically advanced and modern car petrol engines, including turbo-charged ones.

Above chart presents the types of injection rails and injectors that can work with the chosen system. However, please note that GT 400S system is equipped and sold with GreenTech injectors, while GT 700S with BlueTech ones.

	GT 400S	GT 700S
1	GreenTech	BlueTech
2	Pegas	GreenTech
3	Matrix	Pegas
4		Matrix
5		Valtek 3 Ω

InTech (BlueTech and GreenTech) injectors

InTech injectors are designed to install sequential gas injectors in automotive vehicles. This equipment makes provision for the evaporated gas feed into the engine. After going through the filter with a distributor, gas supplies particular injectors and is suitably batched to reach the engine supply system. The gas injectors are electromechanic batching devices equipped with electrically controlled valves. Each valve is opened and closed via an electromagnetic coil. An impulse sent from the control unit triggers appropriate coils with a valve system, which causes the opening of the socket and gas injection into the conduits connecting the injector with a supply system. The amount of flowing gas is altered through the change of a valve's opening time, which causes the change of the burnt fuel-air mixture composition.

The most important advantages of InTech injectors manufactured by D.T. Gas System include:

- Linear characteristics approximating the characteristics of petrol injectors (see Fig. 2.2.).

- Opening time lag of the valves is below 1.5 ms which meets the requirements of Euro IV norms.
- Their parameters have values approximating the best Japanese injectors.

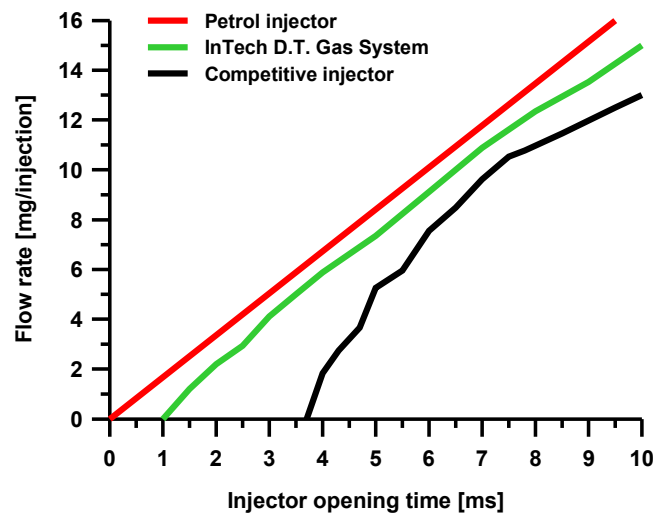


Fig. 2.2. Characteristics of InTech injectors

The most important competitive features of InTech injectors :

- They are dismountable which allows for periodical cleaning.
- They are resistant to damage as the coil is not in contact with gas and gas flow through the injector is optimized.
- The innovative design of the injector is protected by a patent.
- The injector's design is not complicated which guarantees durability and operational reliability.

Gas pressure sensor in the filter of the gaseous phase

The gas pressure sensor measures relative pressure in the gas filter. The sensor is located in the filter of the gaseous phase. Pressure is measured against atmospheric pressure and it is needed to determine gas volume flowing through gas injectors in a time unit.

Temperature of the gas reducer

A PTC resistance sensor is used to measure the temperature of the gas reducer. Information about temperature value is needed to switch the engine supply from petrol to gas, which happens at a specific temperature.

Rotational speed of the engine crankshaft

For the estimation of engine crankshaft rotational speed n , the gas controller uses the RPM rotational speed signal transferred from the ignition circuit to the petrol controller. This is a rectangular wave voltage signal with the frequency dependent on the type of ignition system.

The central unit

The controller controls the gas mixture composition which supplies the engine automatically. The driver can only change the type of feeding by switching the central unit.

The central unit (Fig. 2.2) installed inside a car acts as a petrol/gas switch, and the indicator of gas level in the tank and informs about the kind of fuel a car is supplied with.

The central unit is equipped with:

- petrol /gas switch,
- six diodes informing about the gas level in the tank,
- diodes informing about the device's work mode (**B** - petrol, **G** – gas)

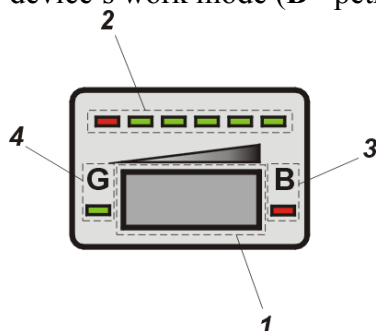


Figure 2.2. The cabin central unit: 1 – petrol/gas switch (B/G), 2 – diodes signalling gas level in the tank, 3 – diode signalling the petrol supply, 4 – diode signalling the gas supply.

The petrol/gas switch enables petrol-to-gas and gas-to-petrol changeover. After pressing the switch, the controller is introduced into the mode change of fuel supply. Gas-to-petrol switching and vice versa does not result in an instant change of supply type. The controller changes petrol-to-gas supply only after reaching the rotational speed memorized by the gas injector (e.g. 2000 rotations/min) and an appropriate temperature (e.g. 20°C). No additional requirements need to be satisfied during gas-to-petrol changeover. It follows immediately after pressing the switch in the central unit

On the top of the central unit there are diodes which inform a driver of the gas level in the tank. The flashing of all green diodes means that the tank is full. The single lighting of the red diode signals the reserve fuel level.

Table 2.1. The modes of the system operation

The modes of the system operation	The status of signalling diodes in the central unit	
	G (gas) - green	B (petrol) - red
Automatic	blinking	no lighting
Gas	lighting	no lighting
Petrol	no lighting	lighting

The three modes of the system operation are signalled by the diodes lettered G (green) and B (red). They follow each other when the switch in the central unit is pressed. After turning the key in the ignition switch, the central unit changes over to the automatic mode - the diode (G) starts to blink waiting until the moment when the gas-supply working conditions described earlier are fulfilled. When that moment comes, the green diode starts to burn in an uninterrupted manner and the system changes over to the gas supply mode (if the conditions are not fulfilled it is possible to force the system changeover by pressing the switch in the central unit). The pressing of the switch in the central unit will result in the changeover into the petrol supply mode. The red diode (B) lights up while the green diode (G) turns off. As soon as the central unit switch is pressed again the installation returns to the automatic mode.

If the switch of the central unit is pressed longer, sound signals sent by an internal buzzer are on/off. The conditions in which the central unit issues sound signals can be set up in the Configuration -> Controller menu. The “Controller” bookmark appears only when the GT700S or GT400S programme is connected with the gas control computer.

Oxygen sensor's signal

The “O2_IN” voltage oxygen sensor signal (lambda probe signal) located before a catalyst together with the time of petrol injector opening is used to control the opening time of the gas injectors. The controller weakens or enriches the mixture to approximate its ratio to the stoichiometric level. The voltages of oxygen sensors vary according to their types in the range : $0 \div 1$ V; $1 \div 0$ V; $0 \div 5$ V; $5 \div 0$ V; $0.8 \div 1.6$ V..

Controlling gas electrovalves and petrol injectors

The controller opens and closes electrically controlled gas inflow valves depending on the working mode (petrol/gas) as well as switches the injectors' emulator on or off. After switching over to gas supply, the petrol supply is switched off and two gas electrovalves are opened: in the gas multivalve as well as the electrovalve which is assembled in the vicinity of the gas reducer. During gas-to-petrol switchover, the gas valves are closed and the petrol injectors' control is brought back.

Gas level in the tank

The gas level in the tank is determined on the basis of the voltage value of the resistance sensor installed in the multivalve which is an element of the gas tank (see assembly instructions of the hallotron sensor).

2. INSTALLATION DESCRIPTION

Diagrams of electric connections for a different types of GAS TECH 700S and GAS TECH 400S system are presented in the figures 3.1, 3.2 and 3.3.

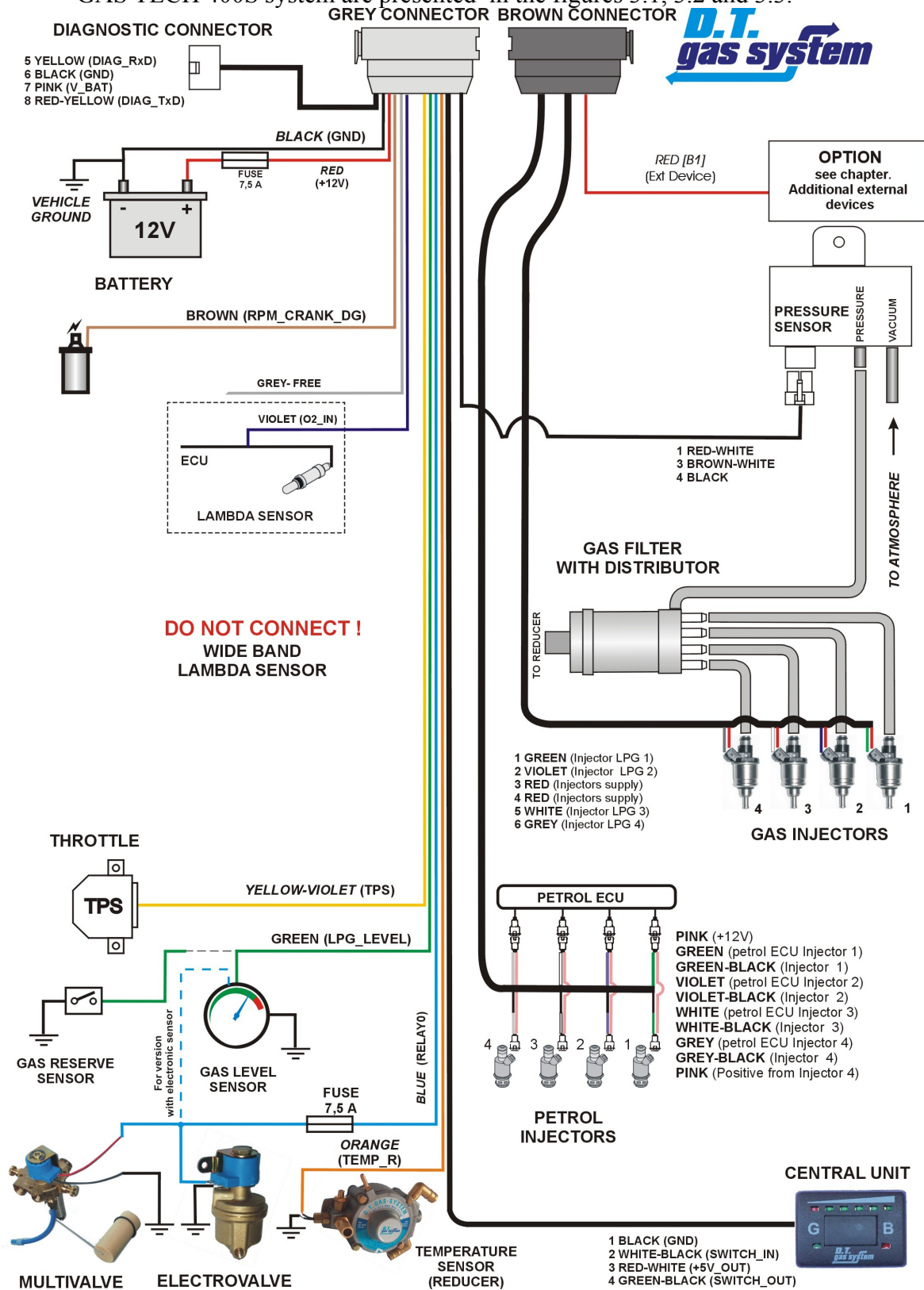


Fig.3.1. A diagram of electric connections for the LPG “GAS TECH 704S” gas injection system (4 injectors)

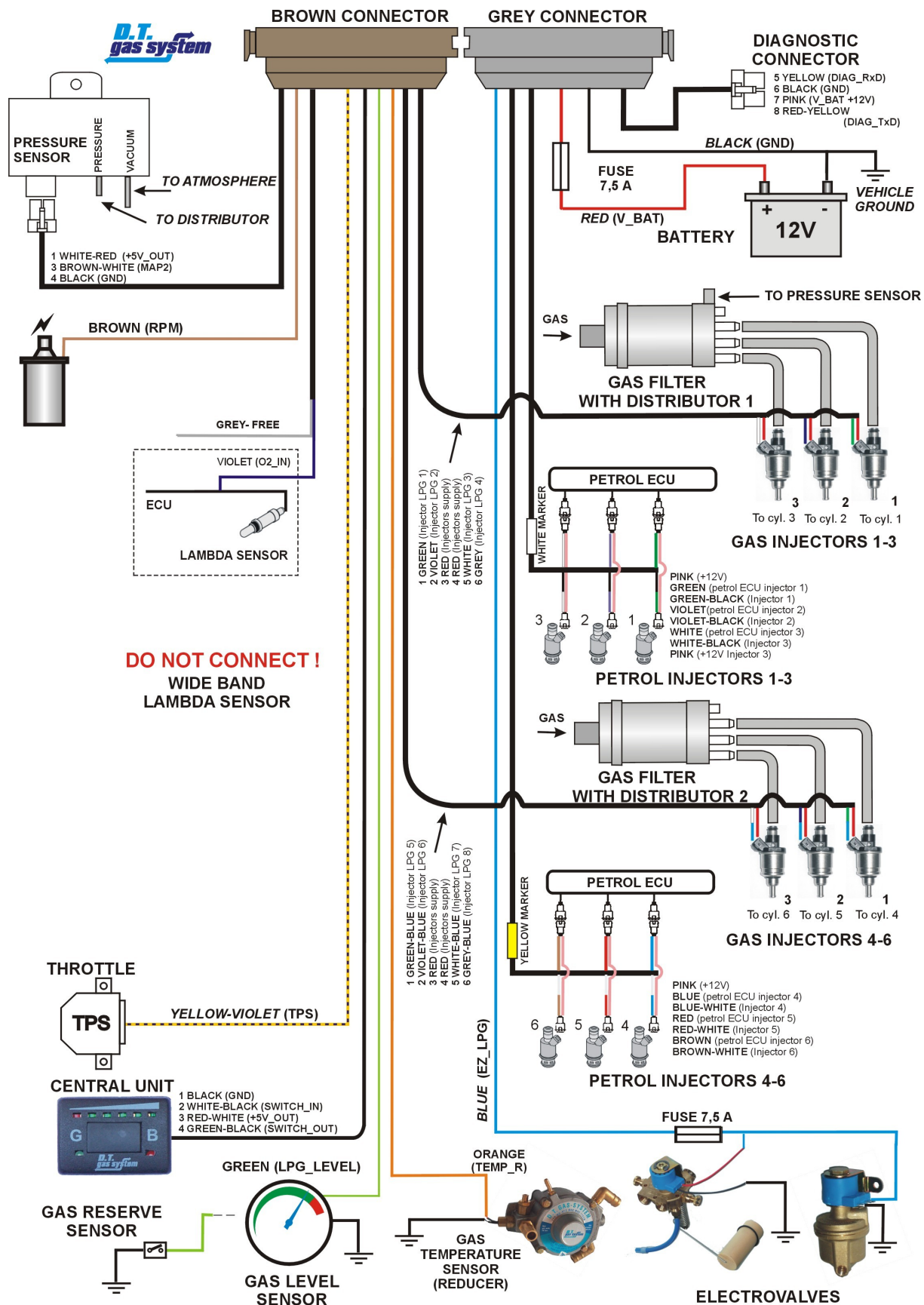


Fig.3.2. A diagram of electric connections for the LPG “GAS TECH 706S” gas injection system (6 injectors)

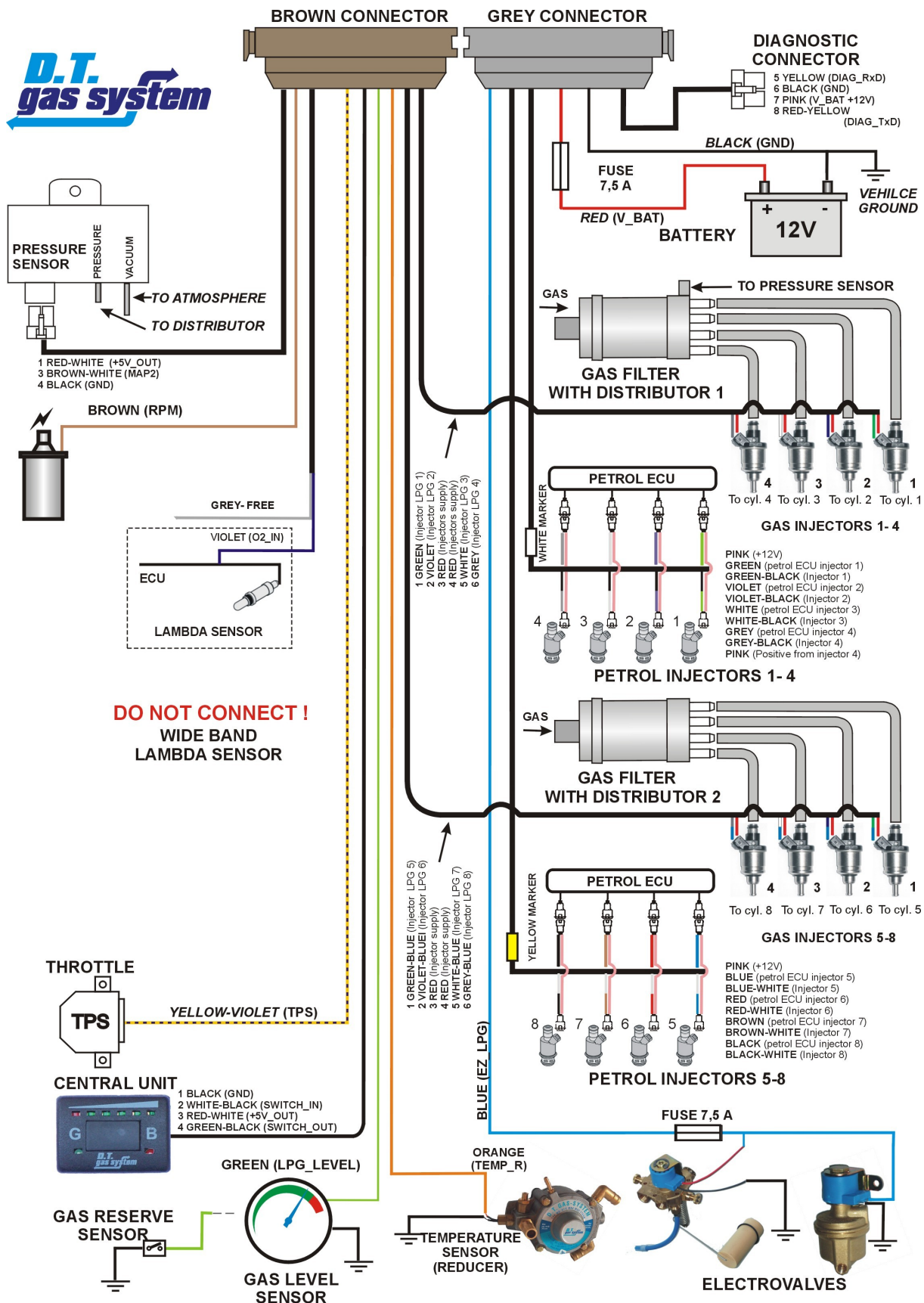


Fig.3.3. A diagram of electric connections for the LPG “GAS TECH 708S” gas injection system (8 injectors)

GAS-TECH 700S and GAS-TECH 400S systems should be installed according to the following instructions:

The installation of the refuelling valve

Install the refuelling valve at a distance not less than 70cm from the exhaust system. Make a hole $\phi 54$ in the bumper and fasten the valve using bolts included in the set.

Another method is to suspend the refuelling valve under the bumper using the bracket included in the set.

The installation of the gas tank

Install gas tank using a rack. Drill holes in the car body through the holes in the rack. Next, protect the holes against corrosion and screw down the rack using bolts and washers. Screw down the gas tank to the rack using clamp hoops. Drill two holes $\phi 27$ for ventilation and protect them against corrosion. Those holes cannot be located at a distance less than 35 cm away from the exhaust system. Insert bushes to the holes and mount them using sheet metal screws included in the set.

Screw down the casing and the multivalve to the gas tank using bolts included in the set.

Connect the multivalve with the refuelling valve using a $\phi 8$ conduit using brazen bolts and clamps included in the set. The conduits between the floor and the multivalve in the boot compartment are led in the ventilation duct.

Fasten the toroidal tank to the floor using bolts and washers included in the set. Drill holes in the floor through the holes in the cylinder and protect them against corrosion. Drill a $\phi 52$ ventilation hole through the holes in the cylinder. Mount the ventilation ferrule using sheet metal screws. Next, screw the cylinder down with bolts. Screw the multivalve down with the bolts included in the set.

The installation of the gas reducer

Install the gas reducer using two sheet plates. Mount the gas reducer and the gas valve in the engine compartment in a location far away from a direct heat source (the exhaust manifold). Select a location to mount the gas reducer which is optimal to connect the gas reducer with the engine cooling system, located as close as possible to the injectors. Drill holes and protect them against corrosion. Next, screw down the gas reducer using bolts included in the set.

Connect the gas tank with the gas valve by a $\phi 8$ conduit using bolts and brazen clamps. Fasten the conduit to the car floor at the fuel conduits using metal plates included in the set. In the case of a gas tank, the conduits are led in the ventilation duct. Mount the gas reducer so that the membrane is perpendicular to the surface on which the car is located.

Connect the gas reducer to the cooling system using T-pipes and water conduits included in the set; secure them by clamp hoops.

Connect the injectors with the gas reducer using a rubber conduit; mount a filter of the gaseous phase with a distributor half way in the conduit's length. Secure all connections with clamp hoops.

The installation of the controller in the engine chamber

Install the controller far away from any sources of electromagnetic disturbances (e.g. an ignition coil), and from high temperature sources (e.g. the engine's exhaust manifold), and at a safe distance from any tanks containing liquids (e.g. cooling fluid equalizing tank.)

The connection of the rotational speed signal

The gas controller uses the RPM rotational speed signal transferred from the ignition module (high voltage ignition coil or the integrated DIS module) to the petrol controller to define the value of the rotational speed of the engine crankshaft. The engine shaft rotational speed value is needed for the gas supply changeover which follows at the rotational speed set by a computer program (usually at about 2,000 rotations per minute). This signal is generated with a frequency depending on the type of the ignition system used and on the engine's rotational speed. The signal pin may be detected by a voltage tester or an oscilloscope. The frequency of the impulse transmitted to the petrol controller increases together with the engine rotational speed and so does the blinking frequency of the voltage tester and the frequency of the signal maximums on the oscilloscope screen.

The voltage amplitude value of RPM signal within the 12V limit is defined as a STRONG signal whilst the one within 2.5V is defined as a WEAK signal. The RPM wire ought to be put far away from high voltage conductors and any electromagnetic interference sources. If the signal is lower than 2,5 V, an RPM amplifier must be additionally installed.

The connection of oxygen sensor's signal (lambda probe)

The oxygen sensor's (lambda probe's) signal is one of the basic signals for the regular operation of the controller. The oxygen sensor signal installed before the catalyst is used as feedback to control the fuel-air mixture composition burnt by the engine. In order to connect the oxygen sensor with the gas controller, the probe's signal wire needs to be found, cut and soldered to the controller's wire lettered O2_IN (violet). The other end of the wire cut (at the petrol controller side) should be soldered to the O2_OUT (grey) gas controller or only the violet wire should be soldered, and then the gas controller reads the voltage value from the lambda probe. Absolutely **DO NOT CONNECT** wide range lambda sensor.

The connection of the tank's gas level sensor

The signal wire of the gas level resistance sensor should be soldered to the gas controller's wire lettered LPG_LEVEL (white) (see the assembly instructions of the hallotron sensor).

The connection of gas electrovalves

The gas electro-valves installed at the gas tank (the multivalve) and near the gas reducer/evaporator should be connected to the gas controller wire lettered *E_LPG* (blue)

The installation of a gaseous phase filter with a distributor

The gaseous phase filter is to be installed between the evaporator and the gas injectors according to the flow direction marked on the casing, using pressure rubber conduits. The connectors ought to be protected with metal band clamps. A distributor included in the filter's casing is designed to divide gas flow to particular injectors.

The installation and connection of injectors

Install the injectors in the vicinity of the suction manifold and locate it as far as possible from high-voltage conduits. Drill holes and screw down brazen ferrules (diameter 4mm) at the ends of supply manifold, near the engine's inlet valves, so the gas will flow through them. Decline the main axes of the ferrules in the direction of the throttling valve and make an acute angle of about 75 ° against the collector. Connect the pipes with the ferrules of the injector electrovalves using rubber pressure conduits (see Table 3.2). The connectors ought to be protected with metal band clamps. **The length of the rubber conduits which**

connect injectors with supply manifold should be as short as possible. Connect the harness of supply and control conduits of the gas controller terminated in a 6-conduit plug with the injectors.

Tabela 3.1. Method of selection of gas injectors type: GreenTech and BlueTech:

GreenTech	Cylindrical cubic capacity* [cm³/cyl]
A13+	Up to 275
A14-	from 275 to 300
A14+	from 300 to 350
B17+	from 350 to 400
B18-	from 400 to 450
B18+	from 450 to 500
BlueTech recommended for:	above 500 and all types of turbo supercharged engines

BlueTech	Cylindrical cubic capacity* [cm³/cyl]
A14+	Up tp 275
A15-	from 275 to 300
A15+	from 300 to 350
B19-	from 350 to 400
B19+	from 400 to 450
B20-, 20+	from 450 to 500
C21 to C22	above 500 and all types of turbo supercharged engines

* **Cylindrical cubic capacity** is calculated as follows: **engine capacity value** is divided by **number of cylinders**, e.g.:

1200 cm³ : 4 cyl = 300 cm³/cyl

2400 cm³ : 6 cyl = 400 cm³/cyl

Table 3.2. Recommended diameters of the rubber conduits:

Lolalization	Internal diameter [mm]
Reducer - distributor	Ø 13
MAP sensor - distributor	Ø 4
Injectors – supply manifold	Ø 5

The connection of the evaporator temperature sensor

The signal of the gas temperature sensor in the evaporator is used to determine the time of petrol to gas switch-over. The temperature sensor installed in the gas reducer/evaporator is to be connected with the conduit marked TEMP_R of the gas controller.

The installation and connection of pressure sensor

Connect the connection conduit marked “**Pressure**” with the connection conduit installed in the filter of the gaseous phase using a rubber pressure conduit. The “**Vacuum**” ferrule must be connected with the atmospheric air. However, it is necessary to mount a rubber conduit with a length of around 5cm on the “**Vacuum**” ferrule. That conduit must be directed downwards.

The installation and connection of the central unit

The central unit should be installed inside a vehicle, at an easily accessible location and should be visible from the driver’s seat. After the control unit is mounted, the harness of wires should be connected with a four-conductor square-cross section plug.

Power supply connection

For safety, the power supply should be connected at the end of all installation activities.

IMPORTANT!

Inspect all electrical connections for any breakdowns (electrical insulation) before power supply is connected.

Next, the following devices need to be connected:

- the GND (black) cable to the battery negative terminal (-).
- the +12V controller supplying cable (red) with the battery positive terminal (+)

The installation of fuses

Finally, the car’s flat-fuses are installed in the sockets of the power supply cables and electric valves (in accordance with the assembly diagram).

3. THE PROGRAMMING AND CONFIGURATION OF THE CONTROLLER

A description of the calibration program

In order to program and configure the controller, the “GT 700S” program working in Windows™ and Windows 98 SE operating system or its later version is required.

To program and configure the drivers for GT 400S and GT 700S, the software „GT600S” (version 2.20.6 and latest ones) operating in Windows™ are used. As for PC software, Windows 98 SE or its later version is required. Firmware, which is a program loaded to drivers' memory, is common for all versions of drivers (4- and 8- valves, too) and it is marked as 1.20.00.

After starting the program, the *Main Menu* window appears. Program operation can be carried out using the keyboard or the computer mouse. After pressing a function button or clicking on the right screen key button, a sub-window is displayed.

IMPORTANT:

1.All the values given in the assembly instruction of configuration parameters are demonstration values only. Their precise value differs in various models, types and even the parts of the same vehicle (engine). Their optimal values, among many other things, depend on the capacity or the stage of the engine's consumption, and need to be set individually for each car.

2.The images illustrating the functioning of the program may differ from the delivered program due to the version.

The status of the controller connection is displayed in the program main window as the text string “Connected” when establishing communication or as “An error of the COM port” in the case of failure. The connection status is symbolized in particular windows by the colour of the bottom bar background on which the values of the engine operation parameters are displayed. The blue colour means “Connected” status, while the grey colour stands for “Connecting” status. The same thing concerns a connection with the board diagnostic OBD II / EOBD. The computer programme automatically retries to connect which can be set in the “Options” window. A connection status with the OBD II / EOBD system is displayed in the programme's main window as “Connected” when communication is established or as “Disconnected” in the case of failure.

A connection with the OBD II / EOBD system is established via an OBD diagnostic connection via an OBD – USB interface available at D.T. Gas System branches. A connection with the system mentioned allows you to obtain information on Short Term Trim and Long Term Trim values of a petrol injection correction previewed in the top right part of the screen in the **CALIBRATION** and **VISUALISATION** windows.

NOTE:

When a motor vehicle is equipped with a OBD system diagnostic connection, a signal with data from that system must be used to carry out the calibration process and also to update the general estimation of the quality of petrol injection control by the petrol controller. It is connected with a requirement to have the OBD – USB interface available at D.T. Gas System branches.

The Main Menu window

In the “MAIN MENU” window there are keys used to navigate between different sub-windows of the program. The user switches to windows by mouse click on an appropriate button or by pressing a suitable key from the keyboard. Additionally, the connection status and version as well as the type of the attached controller are displayed in the window. It is easy to find out what type of gas system it is, GT 400S or GT 700S, judging by its drivers' type. The code symbol **GT 404S** means that this is the driver destined for the engines of 4 cylinders maximum, while **GT 708S** means the driver for the engines of 8 cylinders maximum.

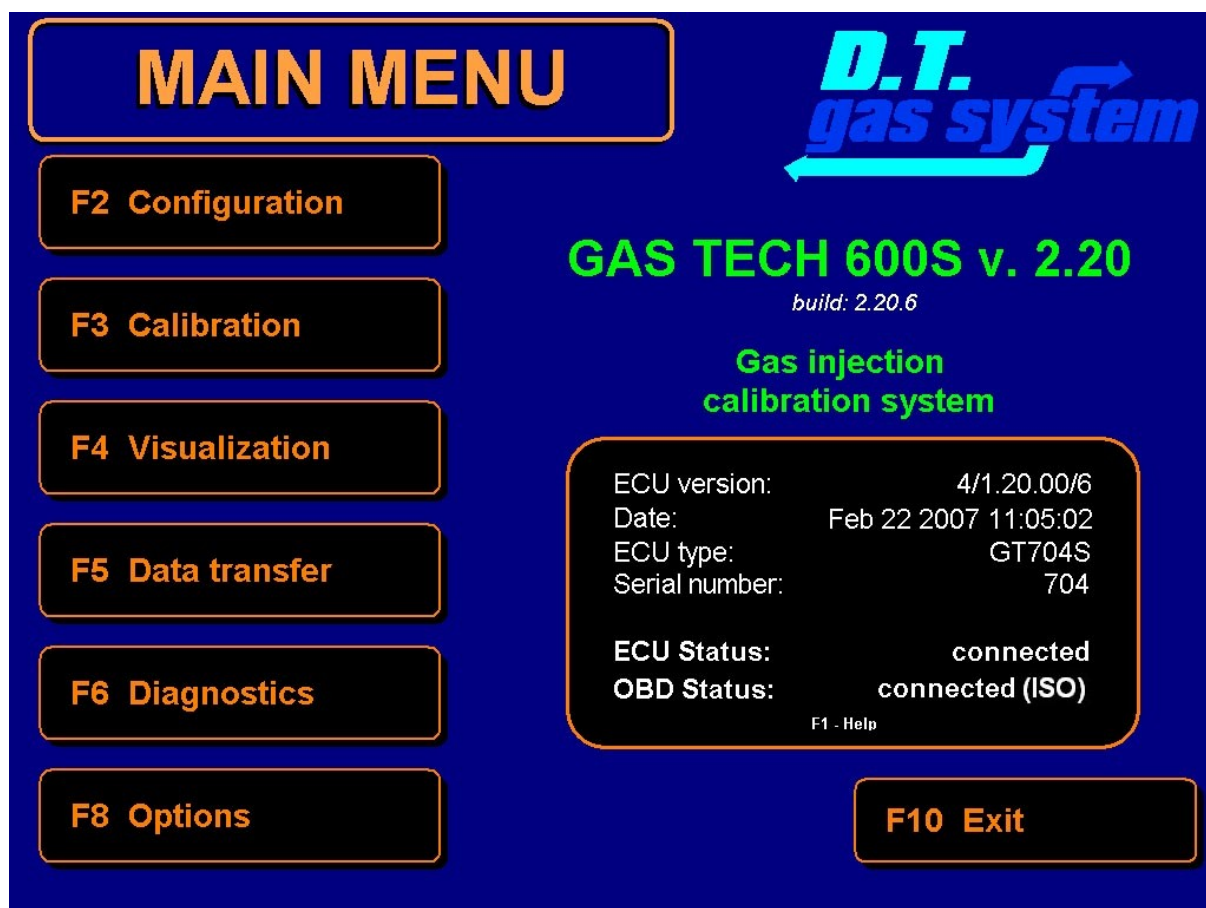


Fig. 4.1. Image presents the window of the *Main Menu* “GT 700S” programme

The assembly diagram of the system is displayed after pressing the **F1** key.

The Configuration window

The following can be set up in the **CONFIGURATION -> Engine** window:

- The type of the oxygen sensor (lambda probe)
- The level of the rotational speed signal,
- The configuration of the rotational speed measurement,
- The type of injection system of the petrol engine,
- Engine's cubic capacity,
- Turbocharging of the engine.

The current values of the following parameters are displayed at the bottom of the screen:

- The engine's rotational speed [rotations/minute],
- The time of petrol injection [ms],
- The time of gas injection [ms],
- Gas pressure [bar],
- The voltage of the oxygen sensor [V]

NOTE!

For a vehicle with a fuel semi sequential or simultaneous injection the signal of RPM rotational speed should be directly taken from the engine speed indicator. In this case the connection of the RPM conduit with the induction coil may result in incorrect operation of the gas supply system.

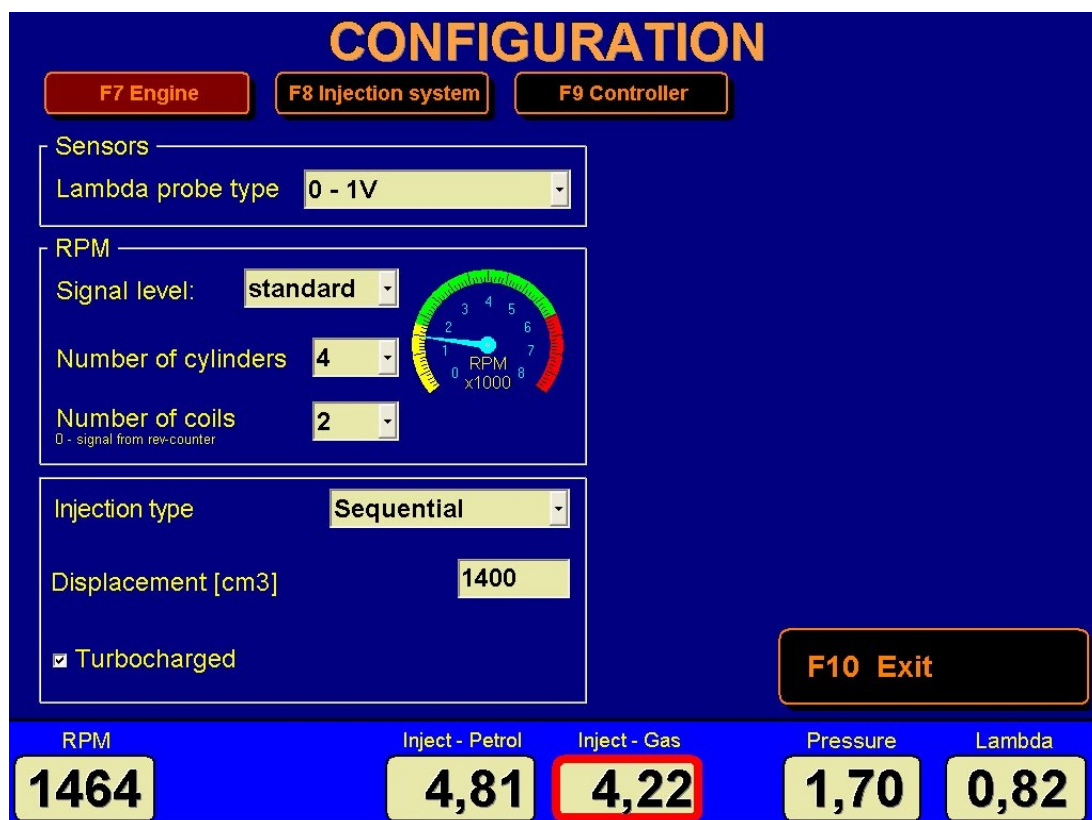


Fig. 4.2. Image presents the menu of *Configuration->Engine* “GT 700S” programme

The following parameters can be set up in the **CONFIGURATION -> injection system** window:

- The type of fuel supply (LPG or CNG),
- The type of gas injection rail or injectors (the range of gas injection systems that can be served by gas injection rail or injectors depends on the drivers' type that is used)
- The diameter of a nozzle installed in the engine's supply manifold,
- The type of gas reducer temperature sensor,
- The connection method of the gas pressure sensor in the gas reducer (to the supply manifold or to the atmosphere),
- The type of gas level sensor,
- Whether the display filter is on or off.

CONFIGURATION

F7 Engine F8 Injection system F9 Controller

Fuel type: LPG

Injection rail type: BlueTech A

Nozzle diameter [mm]: 4,0

Reducer temperature sensor type: KTY83-110

Pressure sensor connected to: Atmosphere

Gas level sensor: Hallotron DT

Display filter: Disable

F10 Exit

RPM: 732 Inject - Petrol: 4,84 Inject - Gas: 4,25 Pressure: 1,44 Lambda: 0,82

Fig. 4.3. Image presents the *Configuration -> injection system* window of the “GT 700S” programme

The following parameters can be set up in the **CONFIGURATION -> Controller** window:

- Conditions for switching the buzzer on (i.e. the sound signal of the central unit).

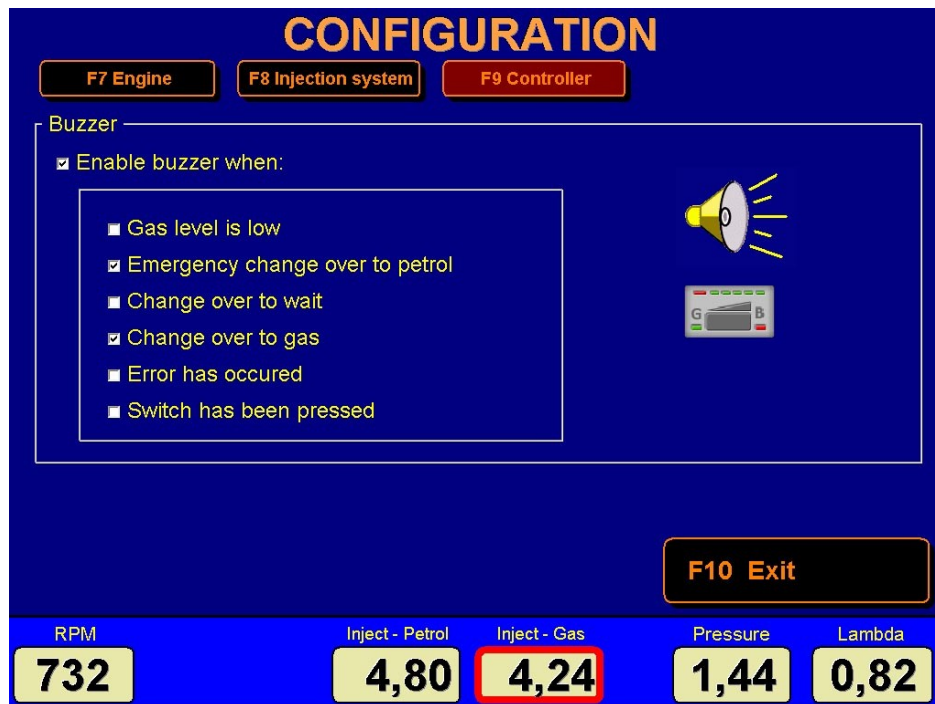


Fig.. 4.4. Image presents the *Configuration -> Controller* window of the “GT 700S” programme

The CALIBRATION window

In the **CALIBRATION->Switching over** window, it is possible to set the parameters of petrol/gas switch-over. The red column situated on the left corresponds with the parameters responsible for petrol switch-over, while the green column presents those responsible for gas switch-over.

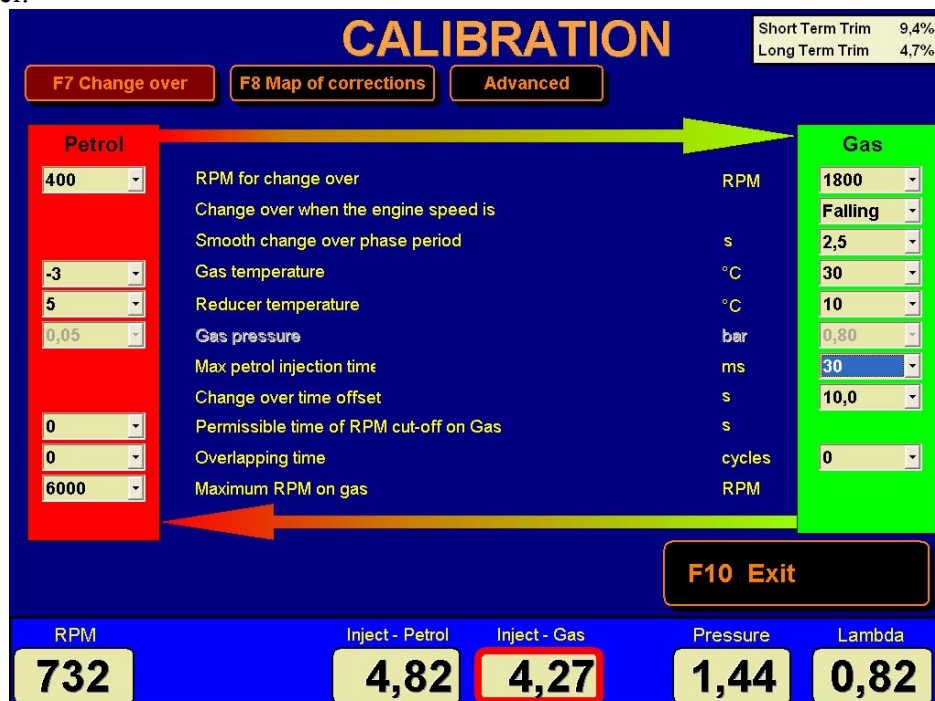


Fig. 4.5. Image presents the *Calibration -> Switching-over* window of the “GT 700S” programme

The **CALIBRATION -> Map of corrections** allows for the system’s calibration. A full description is available in the System Calibration paragraph.

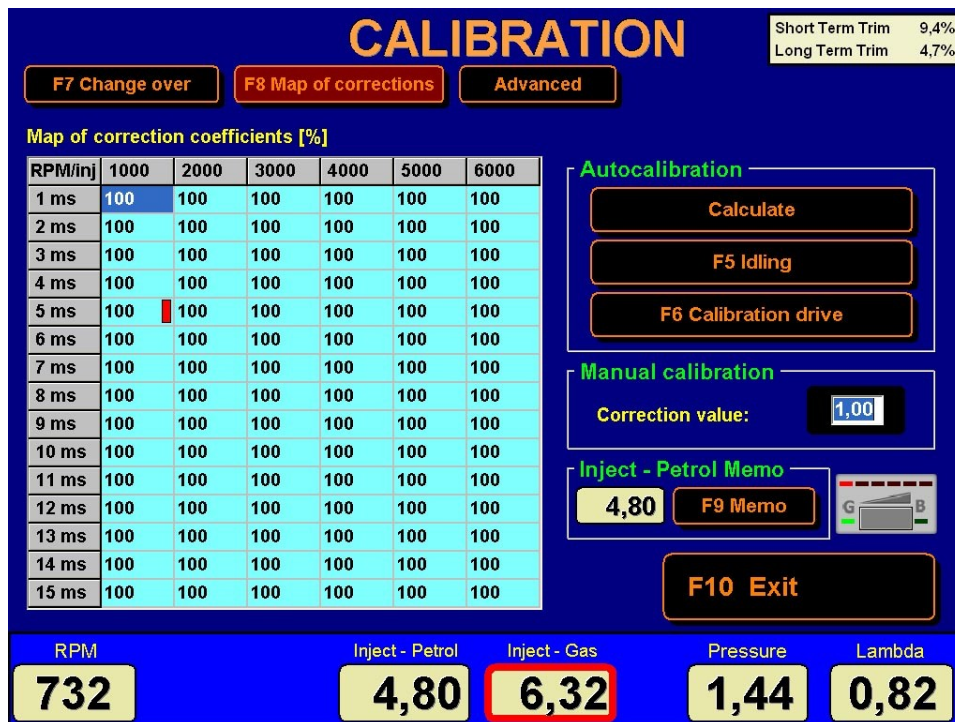


Fig. 4.6. Image presents the *Calibration -> Map of corrections* window of the “GT 700S” programme

In the *Calibration* window, by pressing *Advanced* button it is possible to set up the option of gas injector's warm-up in order to make it easier the smooth switching-over of petrol/ gas supply engines's running mode, particularly in very low ambient temperatures. This option is updated automatically.

CAUTION!!! This option is recommended for GreenTech and BlueTech injectors only. For other types of gas injectors or injection rails that can work with GT 400S and GT 700S gas systems, the warm-up option should be disactivated by choosing **WarmUp – Off**.



Rys. 4.7. Image presents the *Calibration-> Advanced* window of the „GT 700S” programme

The Visualization window

In the **Visualization** window, the current values of the most crucial quantities characteristic of the engine work are displayed. We can switch-over petrol/gas supply by pressing the central unit's button displayed on the screen.

This window is very helpful, mostly for carrying out the calibration drives and test drives, because all major working parameters of gas and petrol systems can be observed simultaneously in the same window.

Besides, the button **F6 „Save to file”** placed in this window, makes it possible to save all major working parameters of gas system to file. Also, it is helpful in diagnostics of gas injection system, by carrying out the test drives with available option of saving to file all abnormal symptoms of working mode of gas injection system that can be easily detected.



Fig. 4.7. Image presents the **Visualisation** window of the “GT 700S” programme

The Data exchange window

The **DATA EXCHANGE** window enables:

- saving the configuration in a file,
- the configuration readout from a file,
- saving the configuration in the controller.
- going back to the settings of the controller applied by the manufacturer

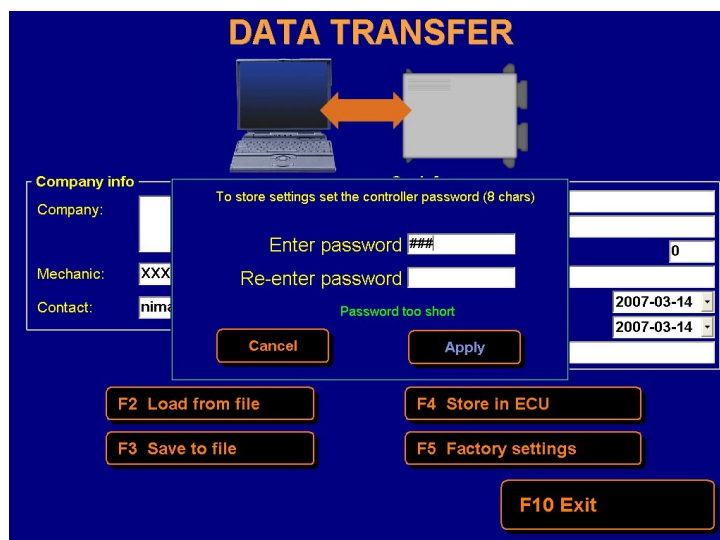


Fig. 4.8. The *Data Exchange* window of the “GT 700S” programme

IMPORTANT

Press the “Store in ECU” button and set the controller’s password to avoid losing the controller’s settings in the case of power supply failure. The password must include 8 characters and will be required at every attempt to connect with the controller.

The Programme Options window

The **PROGRAMME OPTIONS** window enables the following:

- selection of the port number through which the programme’s communication with the gas injection controller is established,
- selection of the port type and number through which the programme’s communication with the OBD diagnostic system is established
- selection of the connection of logging in to the OBD system,
- selection of the language in which descriptions in particular programme windows are displayed,
- programming of the controller depending on sending the control programme to the FLASH memory.

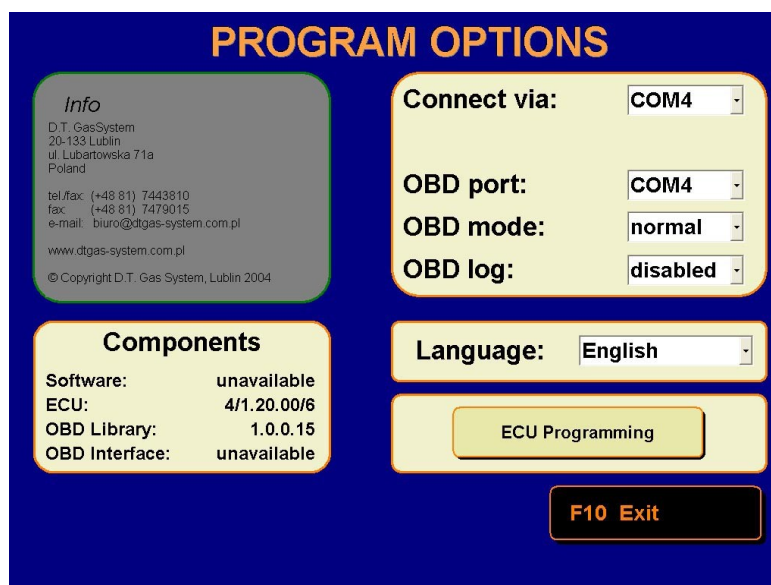


Fig. 4.9. The *Options* window of the “GT700S” programme

The Diagnostics window

The **DIAGNOSTIC** window enables the user to conduct active tests of the gas electrovalves located in the gas cylinder multivalve and at the evaporator. It also facilitates the operation check of the electrovalves in the gas container and petrol injectors. The function allowing tracing injection average times of both petrol and gas injectors is also very helpful. The active chart with white dots presented under the image of petrol injectors displays the work sequence of particular petrol injectors and makes it possible to observe additional injections, if any.

It is also possible to read or delete error codes recorded in the the gas injection memory (the **DIAGNOSTICS -> error codes** sub window).

When there are any connections with the OBD II / EOBD system it is possible to read or delete error codes recorded in the memory of the petrol controller (the **DIAGNOSTICS -> OBD** sub window).



Fig. 4.10. The *Diagnostics* window of the “GT 700S” programme
Calibration GT 400S and GT 700S systems

IMPORTANT!

Calibrate the system after the configuration of all sensors and working elements. The engine needs to be warmed up and the petrol injection times at idle should be stable and constant in a longer period of time

The Calibration procedure of GT 400S gas system should be done as follows:

1. verify the correctness of indications of all sensors.
2. warm-up the engine to 60°C min.
3. carry out the calibration at idle.
4. carry out the calibration without OBD.
5. carry out the calibration manually, if required.
6. change the settings on map of correction coefficients, if required
7. save data from ECU.

The Calibration procedure of GT 700S gas system should be done as follows:

1. verify the correctness of indications of all sensors.
2. warm-up the engine to 60°C min.
3. control the correctness of connections with OBD II / EOBD systems.
4. carry out the calibration at idle.
5. carry out the calibration drive with OBD.
6. change the settings on map of correction coefficients, if required
7. save data from ECU.

The autocalibration procedure can be started if the indications of all sensors during the petrol-supply operation do not raise any reservations; with the exception of gas pressure if the gas valve has not been opened yet.

CAUTION!

In case of assembly of brand new gas installation or even periodical replacement of used injectors for new ones, the calibration procedure should be repeated after the drive of 200 km mileage appx.

CALIBRATION

Short Term Trim 9,4%
 Long Term Trim 4,7%

F7 Change over
F8 Map of corrections
Advanced

Map of correction coefficients [%]

RPM/inj	1000	2000	3000	4000	5000	6000
1 ms	100	100	100	100	100	100
2 ms	100	100	100	100	100	100
3 ms	100	100	100	100	100	100
4 ms	100	100	100	100	100	100
5 ms	100	100	100	100	100	100
6 ms	100	100	100	100	100	100
7 ms	100	100	100	100	100	100
8 ms	100	100	100	100	100	100
9 ms	100	100	100	100	100	100
10 ms	100	100	100	100	100	100
11 ms	100	100	100	100	100	100
12 ms	100	100	100	100	100	100
13 ms	100	100	100	100	100	100
14 ms	100	100	100	100	100	100
15 ms	100	100	100	100	100	100

Autocalibration

Calculate

F5 Idling

F6 Calibration drive

Manual calibration

Correction value:

1,00

Inject - Petrol Memo

4,80
F9 Memo

F10 Exit

RPM

732

Inject - Petrol

4,80

Inject - Gas

6,32

Pressure

1,44

Lambda

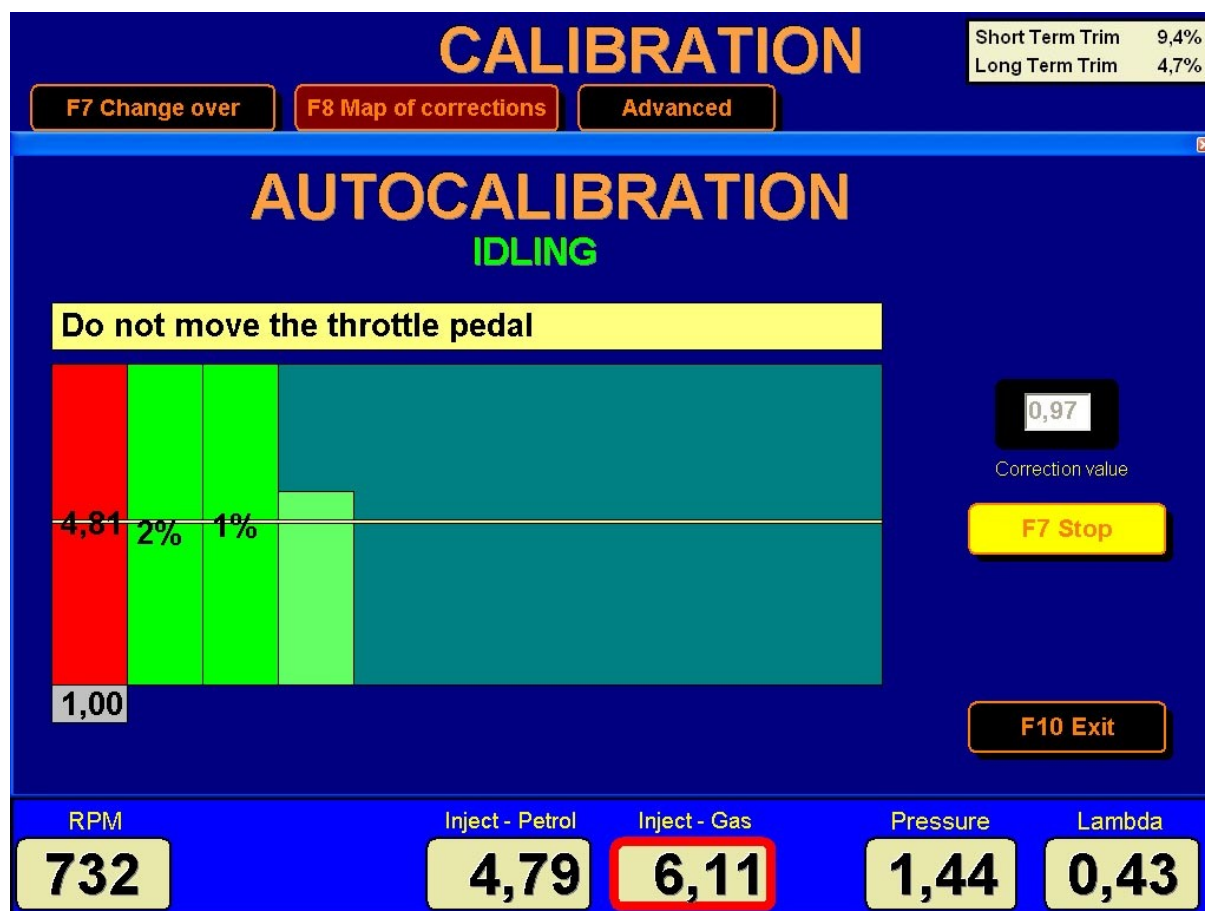
0,82

Calibration „Calculate”

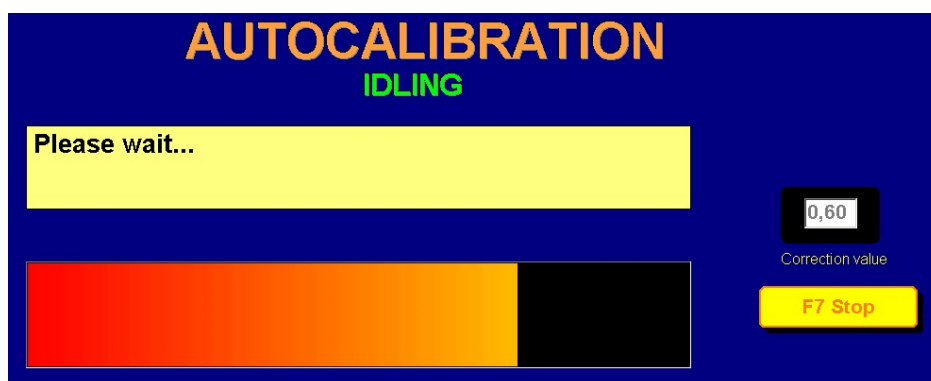
Autocalibration is started when the user presses the “**Calculate**” button in the **CALIBRATION** window or uses the **F4** key. This function allows the user to generate a theoretical value of the petrol→gas conversion factor based on constructional data such as engine capacity, or the nozzle diameter in the screw plug in the suction manifold. The correction value received becomes the starting point for calibration at idle.

Calibration at idle

Calibration at idle is started after the user presses the “**Idle**” button in the **CALIBRATION** window or uses the **F5** key. A chart is displayed in the newly opened window, which will be filled in the calibration process at idle. Next, switch off all electric equipment such as lights, rear window heating, or the air conditioning unit. Press the “**Start**” button to start calibration. Follow the “**Do not move the gas pedal**” instruction during calibration. The engine will be automatically switched over to petrol and the measurement of petrol injection average time opening at idle is started. Procedure progress is symbolized by a growing red column. When this measurement is completed, an average value of petrol injection time is displayed. Next, the engine is switched over to gas supply and an average petrol injection time is calculated for the current correction value located on the right side of the chart. The progress of this process is presented by green columns. The percentage value of an error appears when the green column reaches a high level and an automatic correction of the error follows. This calculation process is repeated until an appropriate error average value of four recent measurements is received. Calibration at idle can be subsequently carried out with the inclusion of electric loads mentioned above, and also at a higher idle speed (2,000÷3,000 rotations/minute). Such measures are recommended in the case where instability of idle rotations makes it impossible to carry out calibration.



After obtaining a satisfactory conversion factor value a new window appears with the instruction: **“Set the vehicle at idle and switch off all loads such as lights and air conditioning”**. Follow this instruction and press the **“OK”** button. A wide horizontal bar appears on the screen and the system starts to measure pressure in the gas reducer.



Wait until the measurement is completed. The value of pressure in the gas reducer during the engine's operation at idle measured in this manner will be used as a reference point to switch-over the system from gas to petrol when there is no gas in the tank.

NOTE:

The value of the petrol→gas conversion factor received after pressing the **“Calculate”** button and during calibration at idle is not the ultimate measurement of

calibration process quality. Calibration drive must be conducted when vehicles are equipped with an OBD II / EOBD system diagnostic connector).

Calibration drive without OBD system.

This sort of calibration drive is very usefull for calibrating the vehicles without OBD system. It is also recommended for vehicles equipped with OBD system, if short- and long-term trims values of petrol injection are false and incorrect. Calibration drive without OBD is available for GT 400S system after pressing „**Calibration drive**” button in **CALIBRATION** window, while for GT 700S system after chosing „**No OBD**” option in the same window.

In this sort of calibration the coefficient *Petrol→Gas* is set on the basis of the constructional data such as: gas injector efficiency, (this value can be seen on the box), engine cubic capacity, diameter of the nozzle placed in screw plug in suction manifold or fi zmierzenia maksymalnego czasu wtrysku wtryskiwacza benzynowego.

In order to perform the calibration drive without OBD option, the tested vehicle should be on the move with 4-th gear on. After pressing the „**Start**” button system switches over to petrol supply and „**Awaiting RPM below 2500**” instruction appears on the screen. This instruction must be followed and RPM ratio decreased below 2500 RPM /min. Once a new instruction: „**Awaiting RPM above 3000**” will appear, the accelerator pedal should be pushed until RPM value of 3000 RPM/min is reached. If all is done correctly the following notice appears: „**Calibration completed successfully! Injection Time: 17,5 ms**”.

Kalibracja zakończona pomyślnie!

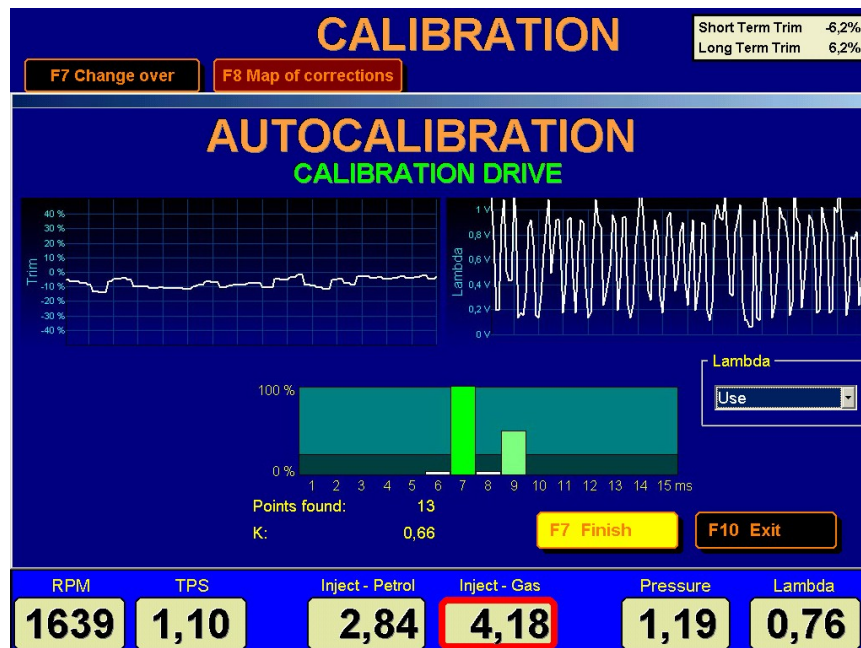
Czas wtrysku: 17,5 ms

Calibration drive with OBD system.

Calibration drive with OBD is available for GT 700S gas system only, not for GT 400S. This sort of calibration can be carried out in vehicles equipped with an OBD II / EOBD system diagnostic connector only. It makes it possible the correct reading of short- and long- term trims of petrol injection.

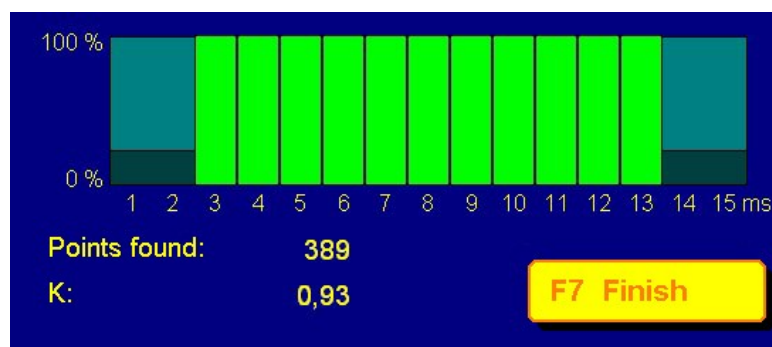
Calibration drive is started when the user presses the “**Calibration drive**” button in the **CALIBRATION** window or uses the **F6** key. The newly opened window displays a graph of the corrections (short and long term) total amount of petrol injections, a graph of a lambda probe signal and a chart which will be filled along with the progress of the calibration process. Ranges corresponding with particular petrol injection time ranges are presented on the vertical co-ordinate of the chart. Switch the vehicle over to gas supply. Drive the vehicle to a straight section of road and press the “**Start**” button. The calibration programme starts to search for calibration points for particular petrol injection times. Calibration points correspond with a determined operation of the lambda probe, when its signal is used to obtain the stoichiometric composition of the fuel-air mixture. Similar information may be obtained from the observation of momentary values of the corrections of petrol injection times received from the OBD system. Therefore it is necessary to use the interface for receiving that data. It is also recommended to use the signal from the lambda probe. It increases the calibration process quality. However, when it is suspected that sensor works incorrectly or a wide range lambda probe is used, the “**Lambda -> Do not use**” option located in the right part of the calibration window must be selected.

Calibration progress is presented by growing columns corresponding with particular petrol injection times.



Calibration drive should be continued until the entire chart of petrol injection times in a vehicle is completed. It is connected with the need to force drive conditions by the driver so that he collects points corresponding with particular injection times. It should be stressed that the calibration programme collects points during defensive driving. Therefore, the driver should avoid fast throttle movements or a frequent change of gears. In the case of any difficulties with the completion of the whole chart due to for example difficult road conditions it is possible to end the calibration drive earlier using the “**Stop**” button. The calibration programme is able to collect information based on just a few points corresponding with various injection times. Generally, the more points collected the better. It should be stressed that the points corresponding with large injection times are particularly important for the correct course of the calibration process.

An example of a correctly completed chart is presented below.



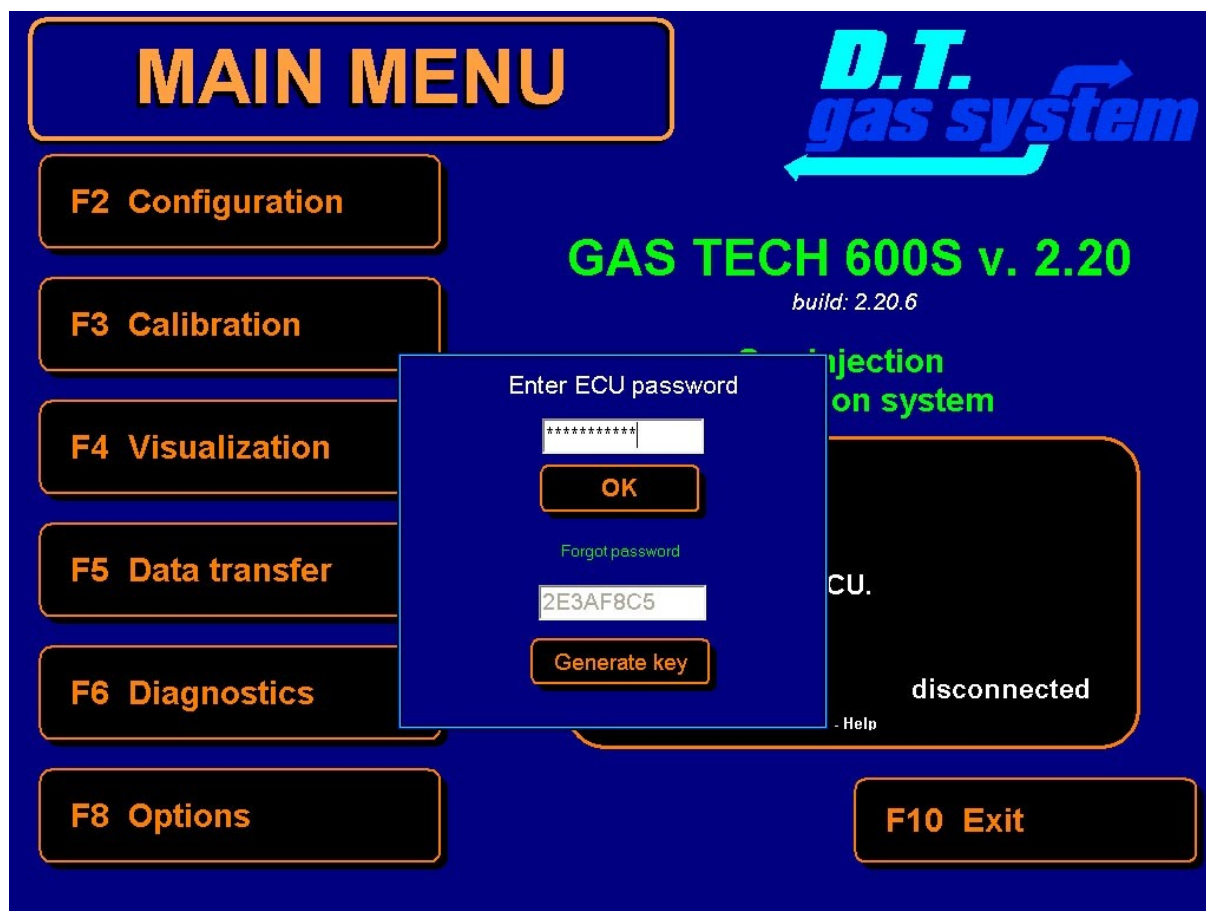
Calibration drive is ended by pressing the “**Stop**” button. Next, the calibration programme calculates the petrol → gas conversion factor based on the points collected.

In the case of any discrepancies regarding the value of the correction received from calibration and calibration drive at idle, the correctness of the calibration coefficient at idle must be checked. Storing the petrol injection time during the operation at idle during petrol supply, the user must switch to gas supply and check whether petrol injection time during gas operation is similar to that during petrol operation. Corrections, if any, must be carried out by changing correction coefficients on the map in the **CALIBRATION** window. After highlighting with a mouse the area corresponding to the work at idle (the top left corner; it is possible to highlight a few cells at the same time) and pressing the “**Enter**” button a correction must be typed in a newly opened window. The correction can be introduced

as an absolute value or as percentage increase. The correction increase will result in the shortening of the petrol injectors' opening time while working on gas whilst its decrease will lengthen it. The correction within $\pm 10\%$ is permissible. The necessity of correcting the values beyond this boundary means that autocalibration is to be repeated.

At the end, the data in the controller should be stored using the **DATA EXCHANGE** window.

The emergency password



To do that:

1. Select "I forgot the password" bookmark in the "Enter the ECU password" window,
2. Press the "Generate the key" button,
3. The programme will generate an emergency code, which must be memorized,
4. A one-time emergency password based on the generated code may be obtained from the Customer Service Office or from the Manufacturer's website,
5. The emergency password obtained allows the user to gain emergency entry to the system.

The installation of drivers for the OBD AMX530 diagnostic interface

The AMX530 reader, version RS232 does not require installation of any drivers. After connecting AMX530-USB to the computer, the Windows system will automatically detect a new device compliant with USB. During the first start up the drivers must be installed; they are located on a CD supplied, in the *drivers/AMX530USB* driver directory

The installation of drivers for the Windows 98 system

Carry out the following steps to install AMX530-USB drivers for Windows 98:

1. Connect the AMX530 with the computer using the USB cable. After a while a message about the detection of a new device will be displayed by the operating system.

2. The “Add new equipment wizard” window should appear within a few seconds (the figure on the right) – you should click on the “Continue” button.

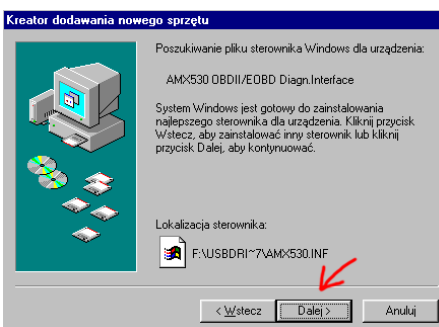
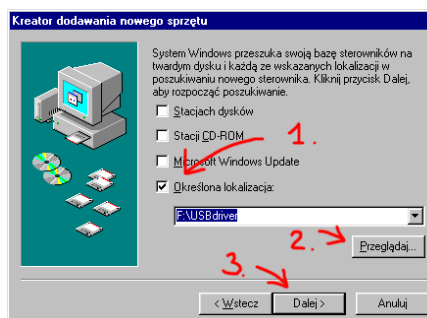
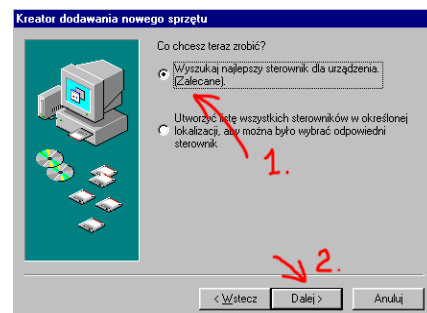
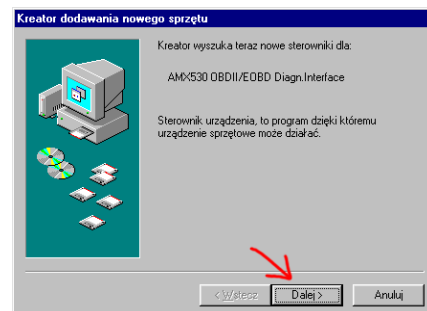
3. Select the “Search for the best driver for his device” (recommended) in the next window, and next click the “Continue” button.

4. In the next stage drivers will be located. To do that:

- select the “Location Defined” option;
- click the “View” button and select a path to the *drivers/AMX530USB driver* directory on the CD;
- confirm using the “Continue” button

5. When all the above steps are carried out correctly, a screen is displayed informing you about finding the required drivers; select the “Continue” button.

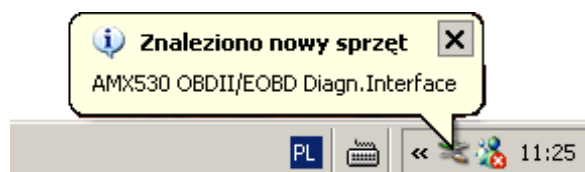
6. The device has been installed successfully.



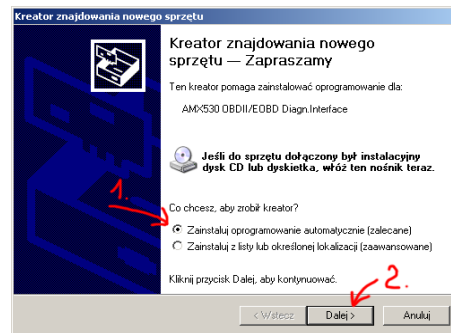
The installation of drivers for the Windows XP driver

To install the AMX530-USB drivers for Windows XP, do the following steps:

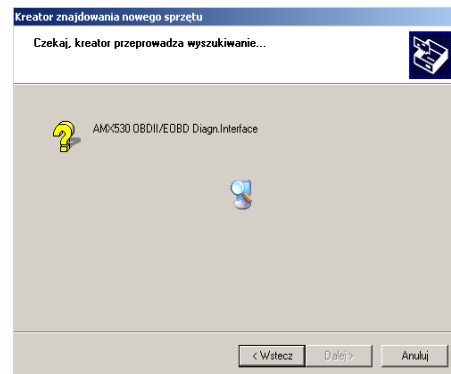
1. Connect the AMX530 with the computer using the USB cable. After a while a message about the detection of a new device will be displayed in the bottom right part of the computer screen.



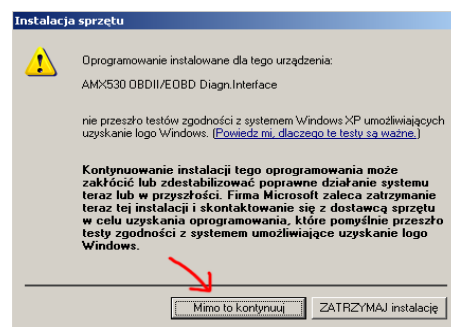
2. The “*Detect new equipment wizard*” window should appear within a few seconds. Select the “*Install automatically*” option (*recommended*), and next select “*Continue*”.



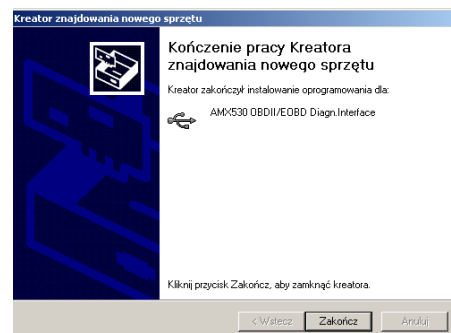
3. The system will start to automatically search for the drivers – this operation may last a few or between ten and twenty seconds.



4. After finding the appropriate drivers – a window warning that there is no compliance between the device and WINDOWS XP will be displayed. Select “*continue anyway*”.



5. The driver installation procedure ends successfully with the window displayed in the figure on the right. The device is ready to use; there is no need to restart the computer.



4. THE INSTALLATION INSTRUCTIONS OF THE LPG LEVEL SENSOR

1. Install the sensor according to Fig. 2a or 2b checking the location of the electrical power connector.
2. Screw down the sensor initially using two screws, leaving the possibility of adjustment.
3. Connect the conductors according to Fig. 1 and connect the pin with the sensor.
4. Start the engine and switch the system over to gas supply.
5. Connect with the driver using the diagnostic program. Select the Hallotron sensor as the LPG level sensor and switch off the display filter option. That option is located next to the sensor selection field. The display filter causes slow changes in the display of the LPG

level in spite of the fast changes of the sensor indications. This eliminates diode blinking of the LPG level on the panel while driving on an uneven surface but makes the calibration of the sensor more difficult. The filter must be switched off.

6.By turning the sensor clockwise or anticlockwise set the required quantity of diodes displayed on the panel display (on the computer screen in the Visualization window.)

7.Screw down the sensor firmly.

8.If the Hallotron sensor is not the default sensor, retain the ECU settings.

9.Disconnect the diagnostic connector from the computer. The display filter will be automatically switched on when the ignition switch is switched off.

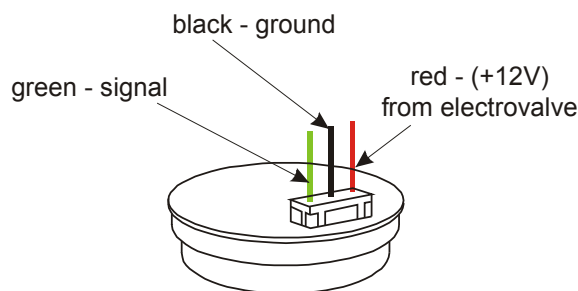


Fig.1. A view of the hallotron sensor

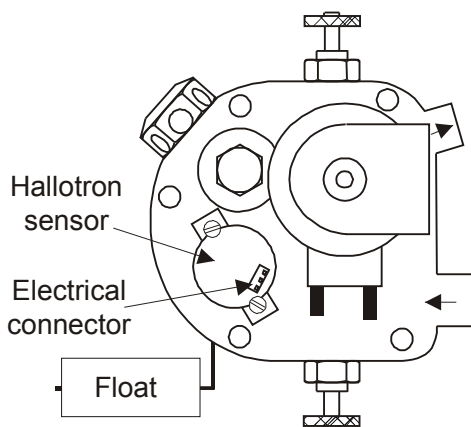


Fig. 2a Right Lovato valve

The turning of the sensor clockwise results in the reduction of the quantity of diodes displayed on the panel, while the turning of the sensor anticlockwise results in the increase of the quantity of diodes displayed on the panel.

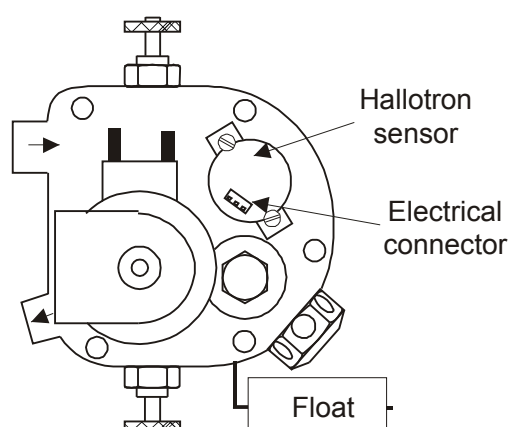


Fig. 2b Left Lovato valve

The turning of the sensor clockwise results in the increase of the quantity of diodes displayed on the panel, while the turning of the sensor anticlockwise results in the reduction of the quantity of diodes displayed on the panel

5. SYSTEM SERVICE

GAS TECH 700S and GAS TECH 400S controller does not need any periodical inspection or regulation. Its incorrect operation can be caused by damage or an incorrect acting of devices which work with the controller. Typical symptoms and defect causes have been included in the table below. Suggested defect identification has also been described.

Typical symptoms and causes of defects

No.	Defect	Possible cause of defect	Method of defect location
1.	It is impossible to start the engine.	The damage of the injection emulator module	Connect the conduits controlling petrol injectors with the exception of an injection emulator and start the engine. If it was possible to start the engine, the defect cause was damage of the injection emulator.
2.	The petrol to gas changeover is impossible, although the engine has worked with the higher rotational speed than the one required to switch over	Lack of RPM rotational speed signal or a signal with high interferences	Check quality of the electric connections between the petrol ignition module and the controller.
3.	The engine runs down	The mixture is too rich or too lean	Check the air overflow ratio of the mixture with an exhaust gas analyzer. The defect's cause can be the evaporator's incorrect operation, the incorrect operation or lack of the oxygen sensor signal (lambda probe) or gas container damage. It is suggested to checking the oxygen sensor when the engine is petrol supplied. The oxygen sensor output voltage should vary a few times per minute. Checking the stepping motor can be done with a special diagnostic device. <u>IMPORTANT : Direct supply of the gas container's electrovalves coils with the battery voltage can result in their damage</u>
4.	Too large fuel (gas) consumption	The mixture is too "rich"	Check the air overflow ratio of the burned mixture. Inefficiency can be caused by the defect or lack of oxygen sensor signal. The oxygen sensor should be checked according to item 3 of the procedure.
5.	The engine works irregularly	The mixture is too "lean"	as above
6.	No mixture ignition in one of the cylinders	The damage of one of injection array's coils	The coil test needs to be performed with using the diagnostic program.

Manufacturer's recommendations

Periodical inspections are performed:

- every 10,000 km – change the air filter and ignition plugs (at authorised service centres or at a gas installation centre)
- every 20,000 km – change gas filters at an authorised service centre
- every 20,000 km – an inspection and adjustment should be performed using an analyzer as well as leakproofness should be checked (at a comprehensive inspection and adjustment authorised service centre)

Software updating

The updating of calibration software

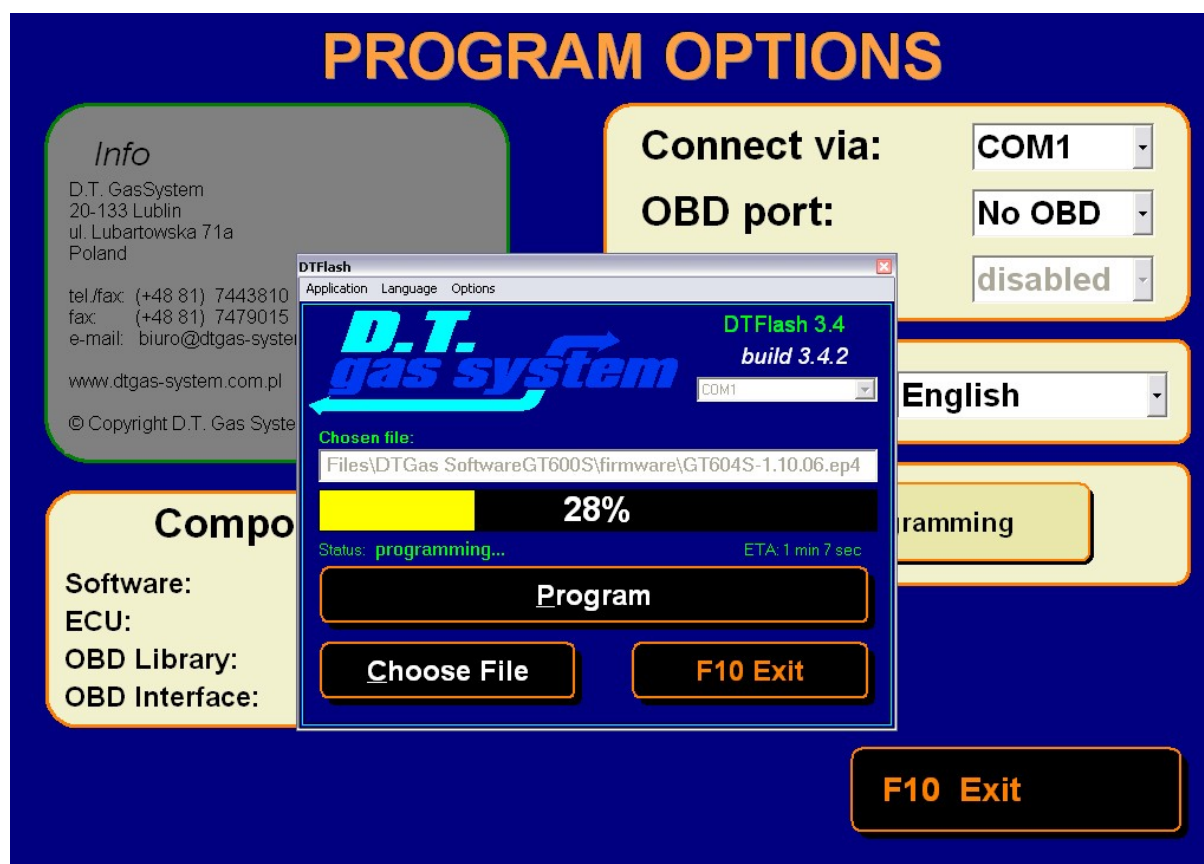
The up-to-date versions of system calibration programs are available on the manufacturer's website: <http://dtgas-system.com.pl/serwis.html>.

The updating of the controller's firmware

The up-to-date versions of the controller's firmware are available on the manufacturer's website: <http://dtgas-system.com.pl/serwis.html>

In order to programme or update the controller, the program DTFlash.exe is required (it is available on the manufacturer's website).

Programming takes place in a car with a gas installation. Before updating the software, it is recommended to save the controller's configuration on a disc using the GT700S or GT400S programmes.



The procedure of updating the controller's firmware:

1. Connect PC to the controller via a diagnostic connector.
2. Start GT700S.exe OR GT400S.exe programme and select ECU PROGRAMMING in the OPTIONS window (or start DTFlash.exe program directly.)
3. Select communication port (COM1, 2.)
4. Select the program file to download (the file with the extension *.cp4, available on the manufacturer's website).
5. Press the "**Programme**" button .
6. The programming should be completed when the "SUCCESSFUL" message is displayed.
7. The controller is ready to work.

In the case of programming failure repeat procedure starting from point 5.

If any subsequent failure follows:

1. Unplug the main fuse which supplies the gas system,
2. Press the "**Programme**" button,
3. Plug the fuse supplying the gas system (contact sparking must be avoided) within 30 s from the moment the "**Programme**" button is pressed.

