



Description:

A pressure emulator is a standalone device that supports the work of a gas installation. It is required in cars that test the pressure of a fuel rail. When driving on gas, petrol is not used, as a result of which the pressure increases, and this is interpreted as a failure of the car fuel system. There are cars that use the correction of injection times from the pressure of the fuel rail, which makes a car out of adjustment, and driving on petrol is impossible. The device emulates a correct value of pressure of the fuel rail making it the same as it would be at a given time when driving on petrol.

Another feature of the emulator is gas pump control. The pressure emulation itself does not fully guarantee a normal operation of the

car. Due to an uncontrolled pressure increase there will be problems with switching to petrol, rapid deterioration of the fuel pump, and in extreme cases - breaking of fuel line connections.

Pump control allows maintaining constant pressure of the fuel rail while driving on gas and ensures trouble-free switching to petrol without having to worry about the load the car operates under at a given time.

Installation instructions:

1. The emulator should be installed as close to the fuel pump and the control unit as possible. The length of bundle conductors has been selected in a way to prevent installation that would be incompatible with this recommendation. Do not extend the power cables as this may generate trouble and interference.
2. The first step is to find the fuel pump and, if possible, its control module. Each pump is supplied with two conductors, no matter their number in the chip. Once you find the right conductors, you must determine which one is the signal cable, and to do this start the car. The ignition itself does not usually cause permanent operation of the pump. The only effective measurement method is the oscilloscope, which will show rectangular voltage with a frequency of approximately 10kHz and an amplitude that is equal to supply power of the electrical system of the car. Once found, the cable should be marked or its colour should be noted down, because it will be cut in the next steps.
3. The next step is to measure the voltage of the second conductor (hereinafter referred to as direct-current) that supplies the pump based on the mass of the car. If you see +14V on it, it means that the pump is controlled from the mass, and if 0V, it means that the pump is controlled from +. This is a very important step when mounting the emulator as it influences further procedures. Verify that everything so far has been done according to the instructions.

Any mistake can damage the pump control module!

4. Before proceeding to connecting the conductors, switch off the car. We recommend disconnecting the battery, because some models of cars trigger the fuel pump when the door is opened before turning on the ignition.

Power circuits

In the bundle, find a protective pipe of the pump with the following conductors: red, white, brown, and orange. Then, cut the signal conductor of the pump, and according to the diagram connect the white conductor (to the pump), and the orange one (to the incoming side from the pump controller).

Plus controlled pump

Isolate the red conductor remaining in the pump bundle. Find the protective pipe with the red conductor (ending with a fuse), and connect it to the pump module power, or if it is not possible, connect it to the + of the battery. Find the protective pipe with the black conductor, and connect it to the mass of the pump power module, or if it is not possible, connect it to the - of the battery. Cut off excess of both conductors.

Mass controlled pump

Connect the red conductor to the fixed conductor of the pump. Find the protective pipe with the red conductor (ending with a fuse) and isolate it. Find the protective pipe with the black conductor, and connect it to the mass of the pump power module, or if it is not possible, connect it to the - of the battery. Cut off excess of the conductor.

Pressure sensor

Find the fuel rail pressure sensor and the protective pipe with yellow, brown, and green cables. Cut the signal conductor of the pressure sensor, and connect the yellow conductor (to the sensor), and the green conductor (to the other side of the cut conductor). The brown conductor remaining in the protective pipe must be connected to the pressure sensor mass. It is very important to connect the conductor, otherwise the system will not work properly.

Signal conductors

The last protective pipe with yellow, blue, brown, and white cables must be placed near the gas control unit and connected as follows: yellow conductor - petrol injector, blue - gas valve, brown - rotation signal, white - manifold pressure.

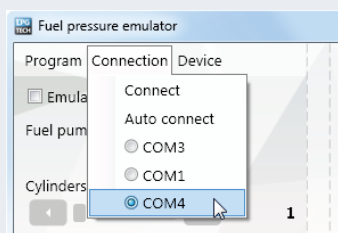
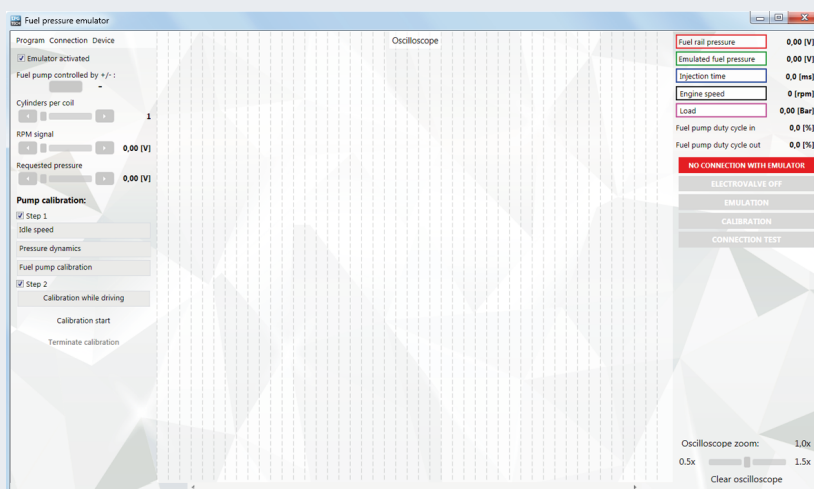
EmuTECH Pb-Pressure-02 calibration:

After installing the emulator, connect the OptoTECH interface, and run the application.

On the right side there is a preview of current values of parameters (rail pressure, emulated rail pressure, injection time, rotations, manifold pressure, input PWM and output PWM of the fuel pump).

On the left side of the screen there are all the settings and control buttons.

In the "Connection" tab, select the correct COM port and click "Connect", and then run the car on petrol.



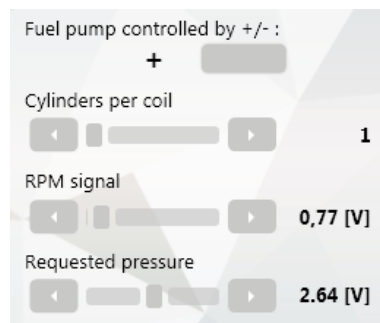
The fuel rail pressure emulator will not establish a connection with the engine off. The established connection is indicated by a green light:

CONNECTED WITH EMULATOR

By default, the emulation function is turned off to avoid accidental activation before entering desired settings. The emulator will be automatically turned on during the calibration process. We can manually turn off the emulator should the need arise (e.g. car tuning with one petrol injector).

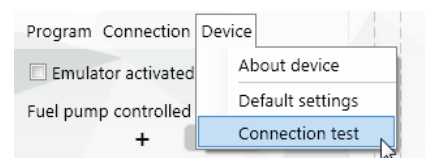
☒ Emulator activated

In the next step we input basic settings for the emulator, pump control type, RPM divider, RPM threshold. Turn off delay is a parameter that determines the time after which the emulator turns off after the valve signal fades. During operation with no emulation, the rail pressure and the emulated pressure should have the same value as the input PWM and the output PWM. After making sure that the current parameters table has all the values set correctly, we can proceed to the next step.



Fuel rail pressure	4.23 [V]
Emulated fuel pressure	3.85 [V]
Injection time	9.90 [ms]
Engine speed	2100 [rpm]
Load	2.34 [Bar]
Fuel pump duty cycle in	4.1 [%]
Fuel pump duty cycle out	4.1 [%]

At idle speed (petrol), press the "correct emulator connection test" button.



The operation in this mode is indicated by a blue indicator light on the right side of the application.

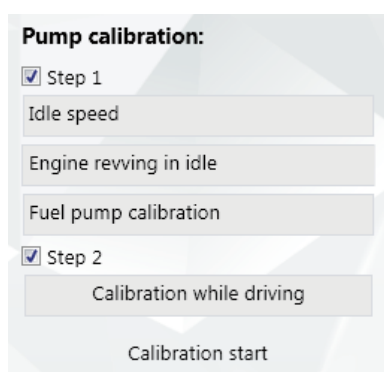
CONNECTION TEST

In this mode, the device enters the emulation mode by copying the read values of pressure and PWM without modifying them. If everything is connected correctly, the car should work without any changes. The pressure and PWM values should remain unchanged. Installation errors will result in a significant increase or decrease in pressure of the fuel rail, and the car will stop as a result. After finishing the test, press the "correct emulator connection test" button again to end the process.

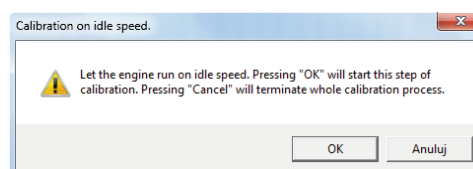
EmuTECH Pb-Pressure-02 tuning:

The next step is calibration of the emulator, which consists of two stages. By default, the program performs both steps one after the other. We leave the car at idle speed on petrol and press the "Start calibration" button.

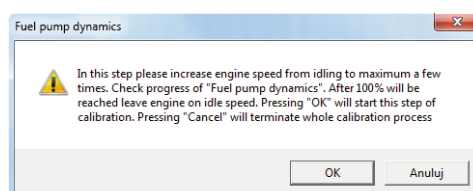
Stage 1:



1. The program will ask you to leave the car at idle speed.



2. This process takes tens of seconds, and then the program will ask you to speed up the car a few times.



The operation in the calibration mode is indicated by the "CALIBRATION" light on the right side of the application.

CALIBRATION

Pump calibration:

☒ Step 1

Idle speed	100%
Engine revving in idle	100%
Fuel pump calibration	100 %

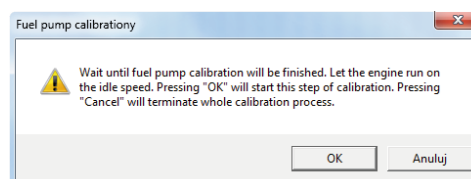
☒ Step 2

Calibration while driving

Calibration start

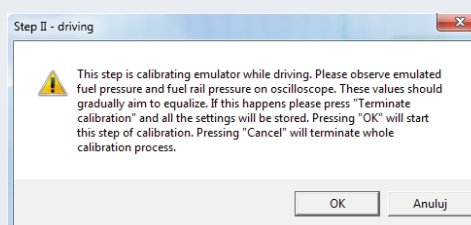
Terminate calibration

3. After the calibration of the pump, the program automatically goes to the second stage.

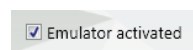


Stage 2:

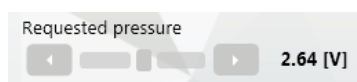
At this stage you should take a calibration drive. The graph presents two curves: red - fuel rail pressure, green - emulated pressure of fuel rail. During the drive, the emulator will adjust to the characteristics of the car, and the lines will be increasingly convergent.



The user decides when the emulator can properly emulate the pressure, and then you should press the "Finish calibration" button. The program will automatically select the "Emulator activated" field.



From now on, when the gas valve signal appears it will trigger the pressure emulation, and this will be signalled by the "ELECTROVALVE ON" and "EMULATION" controls presented on the right side of the application.



Contrary to the first stage, the second stage of the calibration can be continued after stopping, which erases all the settings associated with the calibration. CThe final stage of setting the emulator is to control the fuel pump while operating on gas. For this purpose, use the panel in the lower left corner of the application.

"Set pressure" is the pressure value to be maintained at the fuel rail (red graph) while driving on gas. The program sets this value automatically during the first stage of calibration, and usually there is no need to change it. If it turns out that during the drive the car uses much more pressure, try to increase this value manually.