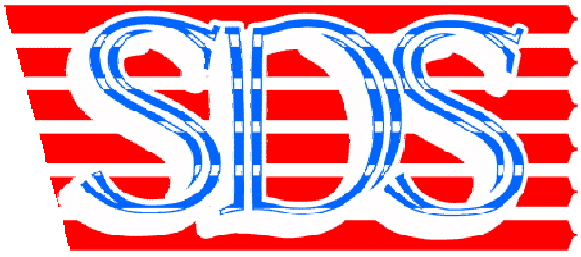
Emulator MAF and Oxygen Sensor
SK-04a v5

User Guide



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Content

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2. The principle of operation and purpose

Emulator SK-04 is designed to recreate the signal of oxygen sensor and any analog signal in the range 0 ... 5V. It is possible to correct the mixture to separate modes of operation of the motor by means of a computer.

Recreating zirconium oxygen sensor signal is carried by analyzing signals from the air flow sensor (MAF) and the fuel injector and then comparing them to the table. The base table is written by the manufacturer or in the process of self-emulation. If your car is equipped with only the absolute pressure sensor (MAP), the emulator will calculate the amount of air required for the formation of an oxygen sensor signal.

It is possible to switch the tables of emulation with an external switch. This is necessary, for example, when you go to maximum or economy mode, propane or gasoline (for natural gas equipment).

Recreating the analog signal is performed in accordance with a three-dimensional map. The table (map) prescribed voltage at the output of the emulator, which are tied to the speed, injection time or the air flow.

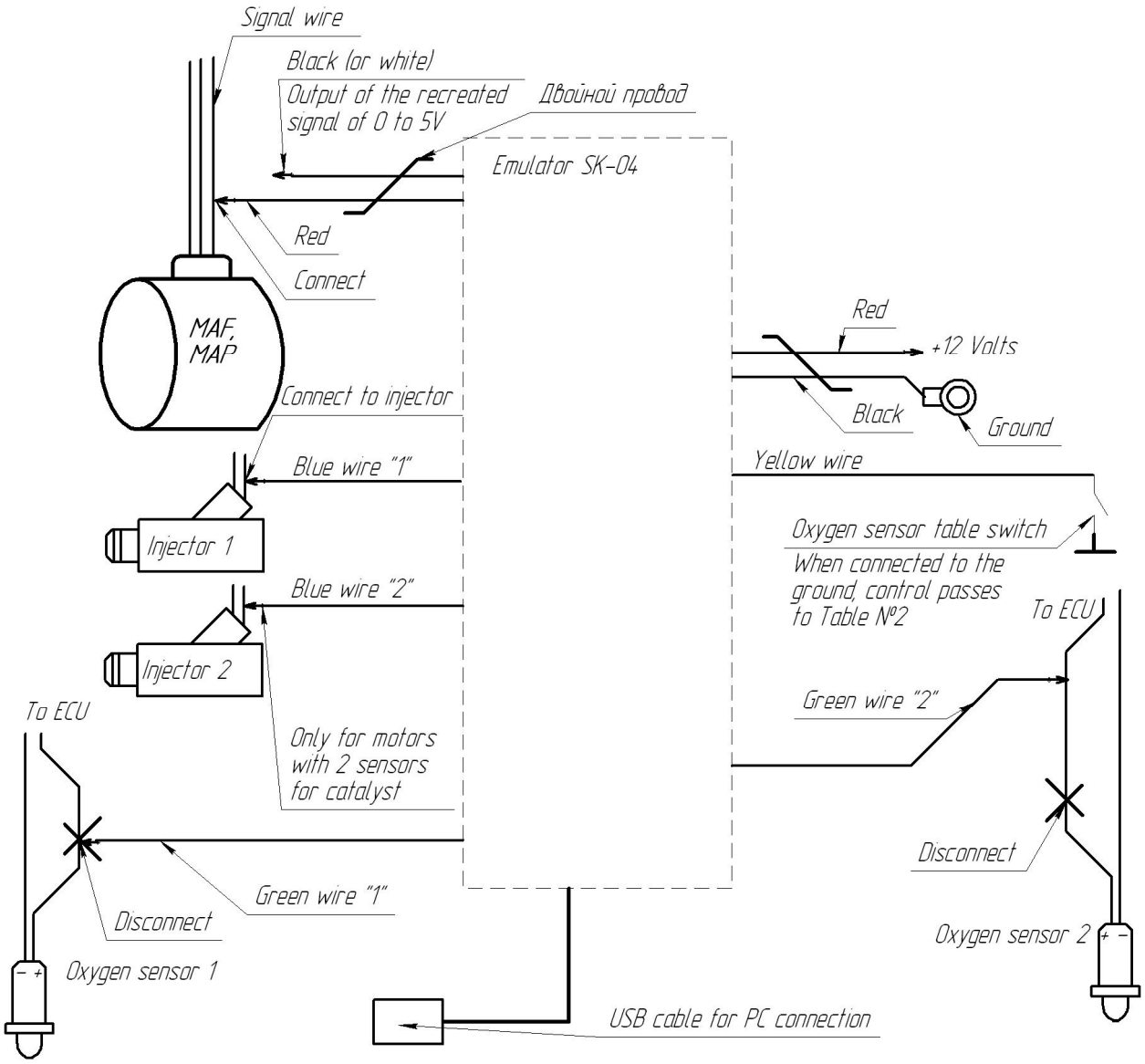
Emulator SK-04 is equipped with software that allows you to connect it to your computer, read and write all parameters in real time, to read the fuel, produce setting without stopping the engine. It provides output to the chart. You can save and record the tables of emulation signal. The device can work with MAF with both analog and pulse outputs.

3. Emulator Installation

Emulator must be installed in a place protected from excessive heat and moisture.

Complete wiring schematic is shown in Fig. 3.1.

Figure 3.1. Emulator wiring schematic SK-04



Connect the power supply to the system. Black wire **is required** to be connected to the ECU **body** (control unit) or to the vehicle body near the computer. 12 Volt power supply can be taken from the car fuse box or power supply wire of the injector. When you connect from the fuse holder you are to find such type of a fuse, which voltage is only present while the ignition and then connect the red wire to the fuse. The blue wire “1” is connected to a control (negative) wire Injector.

The blue wire “2” is connected only if necessary to emulate 2 oxygen sensors located before the catalytic converter. This wire must be connected to the control wire injector, relating to the 2nd oxygen sensor.

3.1. Connecting to the oxygen sensor.

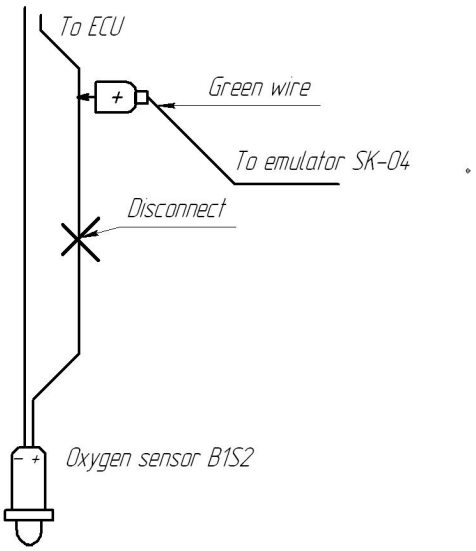
Connecting to the oxygen sensor is made after the procedure of emulator self-instruction (if necessary)

To do this, we must find two signal wires of the oxygen sensor by measuring the voltage on the wires connected to the sensor with a fully warmed up and running engine. For zirconium sensor the positive signal is the one, when the wire tension which varies from about 0.1V to 0.9V (sometimes from 0.5 to 1.5V) with respect to the vehicle body with an interval 0.5 – which constitutes 2 seconds with the engine at idle. As a rule, the blue wire (+) and white color (-) refer to the signal wire. The voltage at the negative signal wire is typically 0 volts. In some cases, the voltage on this wire up to 0.5 volts. The two wires of the same color are used to power the heater of the oxygen sensor. The absence of voltage with the above parameters indicates a possible malfunction of the zirconium oxygen sensor.

The emulator is connected to the two signal wires of the oxygen sensor.

Wiring according to Fig. 3.2. If your car is equipped with single-wire of the oxygen sensor, so the white wire from the emulator should be left free. During training, it is desirable that the oxygen sensor has been connected according to the standard scheme, and the emulator disconnected.

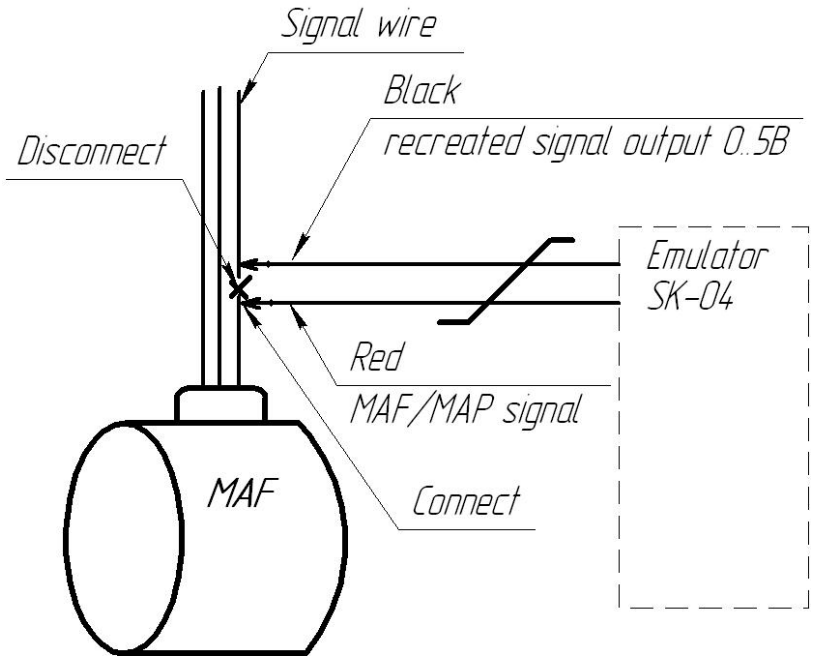
If your car is the oxygen sensor downstream of the catalytic converter, you can use the emulator catalyst for the oxygen sensor №2, while noting this in the emulator program. Figure 3.2. Wiring zirconium oxygen sensor, located behind the catalytic converter or emulator mode.



3.2. Connecting to MAS (MAF, MAP)

You must connect the air flow sensor (MAS, MAF) to emulator or manifold pressure sensor. Wiring MAS to the signal wire is shown in Fig. 3.1. in case of only the sensor emulation. If you need MAS correction of the signal or pressure sensor, it should be connected as shown in Fig. 3.3. MAS basing diagram may differ from the one shown above. The signal wire is determined by proportion of the voltage to the weight of the car. With ignition on and the engine stopped, the voltage on this wire should be approximately 1V. When the engine is running, the voltage should increase by pressing the gas pedal. In some models of the engines it can be used MAS with frequency output – the voltage on the signal wire of the sensor does not change. If you have a MAS, in the settings of the emulator you must select the type of "Digital" mode.

Figure 3.3. Connection for signal correction of air flow sensor (the sensor may have different pinout).



If you have a mass airflow sensor with pulse output, connect the emulator to start the engine and measure the frequency of the pulses from the mass airflow sensor at idle and under heavy throttling (the measurement function of frequency is present in many digital multimeter instruments). If the frequency to any modes exceeded the value of 1000 Hz, it should be noted to set "Frequency range of a mass airflow sensor equals to more than 1kHz."

You can connect to the absolute pressure sensor (MAP), which is necessary to specify in the program for proper work of the emulator.

If it is necessary to emulate mass airflow sensor - connect the red wire to the signal of the pressure sensor. On the black wire there will be the result of emulation of mass airflow sensor.

Do not forget to specify the type of sensor connected in the program!

When using the MAP sensor, a temperature correction is provided to correctly calculate the mass flow rate of the air. Therefore, turn on the function "take into account the temperature" in the settings. (Note, in some old "spade" flowmeters, the temperature is not taken into account).
The temperature sensor must be located in the intake air flow. We recommend to install it after the throttle.
** The temperature sensor is delivered starting with the software version v5.*

3.3. Switching the tables of the oxygen sensor

The emulator contains 2 tables of the oxygen sensor, which can be switched by changing the voltage at the yellow wire.
If the yellow wire is not connected anywhere – it is used the table №1 of the oxygen sensor.
With the closure of the wire on the body (or the supply of voltage falls below 2 volts) - the table №2 is used.

4. Connecting to a computer, software

The emulator has a connector for connecting to the USB port of a PC. After the first connection, install the drivers for the emulator that are on the CD-ROM in the folder “FTDI”.

Emulator is a standalone device, and the computer is necessary only for fine-tuning the device. Self-training can be done without a computer.

The device allows you to store, view and record all data on the computer. For this there is a number of special buttons:

 - if you click on this button you will read the data from the emulator in a table or chart. The old data will be replaced with the new one.

 - if you click on this button, the data in the table will be recorded in the emulator.

 - opens a previously saved on your computer table or chart. Afterwards, it can be recorded in the emulator.

 - saves the table on your computer. Afterwards, it can then be recorded in the other device.

If instead of text ?????????????
You must install the support for Cyrillic

1. **In Control Panel, click on "Regional and Language Options"**
2. **Select the "Advanced"**
3. **In the "language programs that do not support Unicode," select "Russian", and click "apply"**

4.1. Introduction to software

Software supplied with the emulator. The software allows to read and save the parameters of the signals from the sensors in real time, make the setting of the emulator. It is possible to visualize the parameters in the form of diagrams and charts. You can read, edit and write an emulator table correction, save them on your computer, create templates of the tables.

Table 4.1. The list of editable parameters and functions.

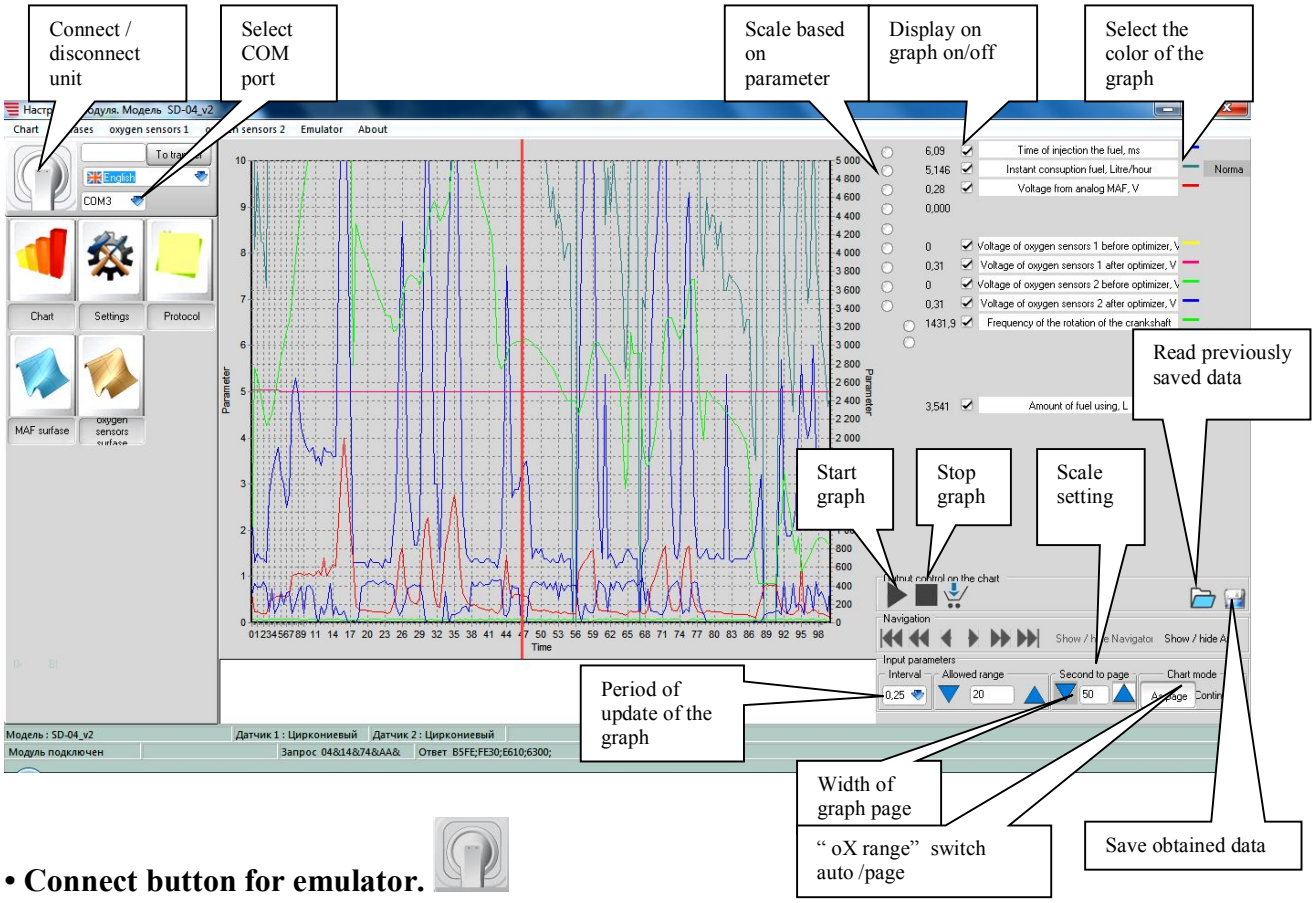
№№	Parameter Title	Notes
1	The coefficient for calculating fuel consumption	The coefficient is necessary for calculating fuel consumption
2	Number of fuel injectors	The coefficient is necessary for calculating fuel consumption
3	Engine volume, l	The coefficient is necessary for calculating fuel consumption
4	The coefficient for calculating rotation frequency of the crankshaft	The coefficient is necessary for calculating the rotation frequency of the crankshaft
5	The maximum extent possible for the lean * (air / fuel ratio)	Only for the broadband oxygen sensor
6	Type of mass air flow sensor, analog / digital (pulse)	
7	Frequency range of mass air flow sensor of less than 1kHz / 1kHz	Only for digital (pulse) mass air flow sensor
8	Load of mass air flow sensor load, on / off	Load output for mass air flow sensor by load impedance of 1k
9	Delay time, seconds	After turning on the ignition, during this time, the sensor signal is not reproduced
10	Select application of sensor channel №2 - for the first sensor or for the second (as an emulator of the catalyst)	Allows the use of the channel of 2nd oxygen sensor for emulation catalyst.

4.1.1. Output of the current data on the chart

To illustrate what is happening, it is possible to have the output of the motor parameters on the chart, received from the connected sensors, and then to save them on the computer.

Separating the desired area by the left mouse button, you can zoom in and out the chart. To scroll through the chart - drag the right mouse button.

Figure 4.1. Output on the chart.



• **Connect button for emulator.**

• **COM port selection window** 

shows the program that the computer port of the emulator is connected. Before you start, it is necessary to specify the COM port number, otherwise, the program can not communicate with the emulator.

 "Start / pause" the graph — is to start and temporary stop the graph. If key pause is pressed, an expanded view of the graph is not available. Further clicking on the key "start" continues the recording of the graph from the place of pause.

 "Stop graph" — the graph is stopped for further viewing and saving. If you click this key, then you will be able to start the graph again only after you clean it.

 "clean the graph" — cleans the graph. After cleaning the graph, key "start" becomes available.

The key “Continue graph” ▷ — becomes active when the key “Pause” was pressed. Its purpose is to continue the display on graph after pause.

The switch “continuously/page”. Its purpose is to choose the method of graphing. “Auto” - the entire graph is fitted within the window, as new values are added, the graph is compressed. “Pages” - the graph displays by fragments - pages.
The length of one page may be configured by the key. At the time when the page is already recorded, the recording of a new page starts.

“Width of graph page, sec”. Its purpose is to choose an interval of one page from 5 to 120 sec at a page-oriented output. Information on the selected width of the page is saved until the next session.

The parameter “range of permitted deviations” affects filtering of data received from the optimizer to minimize the display of possible false emissions on the graph. The degree of noise filtering is a percentage of the maximum allowable emission on the graph for one period of the survey of the optimizer. This means that the smaller the value of the allowed deviation is, the higher the degree of filtering is. That is, if it is necessary to get a smoother graph, decrease of the range value is needed. Information on the selected range is saved until the next session.

🖫 — the purpose of this key is to save data obtained from the optimizer on your computer for later viewing.
🗁 — the purpose of this key is to view previously saved data as a graph.

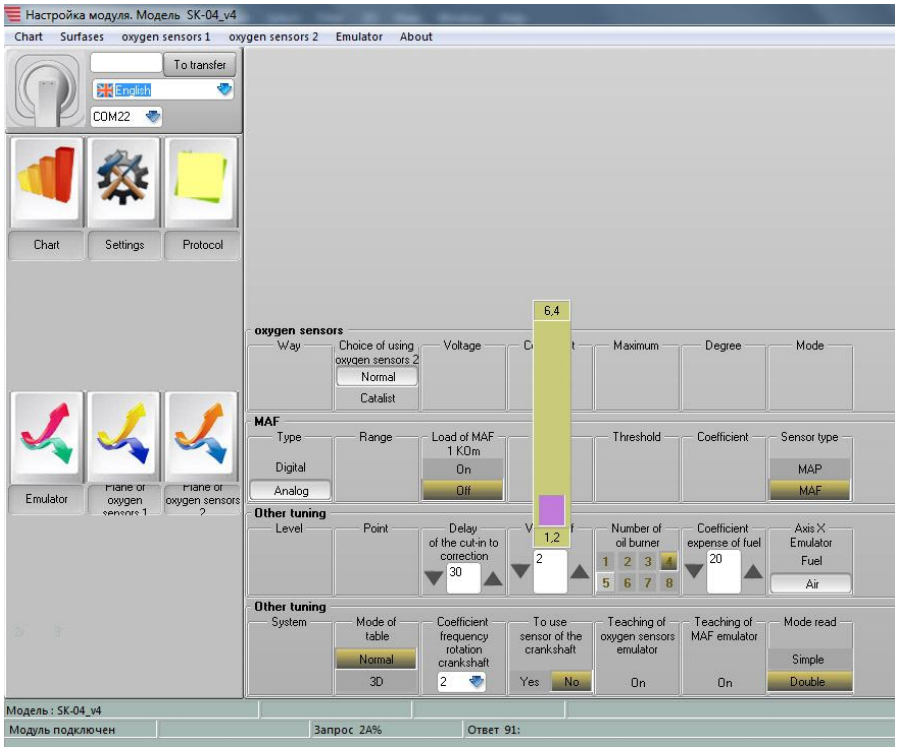
For convenience of your data research, the possibility is given to set limits on each of the two vertical scales of values in your sole discretion.

There are three methods of vertical scaling:

I. **“Auto”** — the limits are automatically extended when values that do not fit into the current range occur (for access, click “show scale”);
II. “Select limit” — the scale range is set by the user. The upper limit of the scale is set at the top of the panel, the lower limit is set at the bottom (to access, click “show scale”);
III. The range of the graph may be configured according to any of the options. To do this, click on the white box next to the desired setting.

4.1.2. Settings

Figure 4.2. Emulator settings



The panel called via the “Settings”.

- This displays the settings of the emulator. They are read out of it by pressing the button  . The switch on the panel, you can configure the emulator. Record of the new settings made in the unit immediately. In accordance with the new settings there displayed or hidden the appropriate parameters on the “Options”.
- *The coefficient for calculating the rotation speed of the crankshaft.* Depending on the injection scheme that is used on the vehicle, the fuel injection nozzle can perform separately or in pairs. This affects the formula for calculating the speed in which this ratio is entered. If the speed displayed is not correct – you must correct this ratio.

• The coefficient for calculating fuel consumption. The emulator does not know the exact parameters of the fuel injectors. Therefore, to properly calculate fuel consumption you need to enter this factor. **Setting:** Before starting the tuning factor, make sure that the account ratio is equal to 100, otherwise, it is necessary to set 100. Fill the tank of a certain amount of fuel, use all the fuel in the course of driving. Adjust the coefficient for fuel. This value can be calculated:

$$\text{Account\_ ratio} = \frac{100 \bullet \text{Proper consumption}}{\text{Consumption indications on the flow SK - 04}}$$

• *Number of injectors.* Here you must specify the number of fuel injectors. This setting affects the calculation of fuel consumption.

• *The volume of the engine.* Specify the engine size in liters. This parameter is used to calculate the fuel consumption.

• *Channel application of oxygen sensor №2.* It allows you to use the channel of the 2nd oxygen sensor for emulation of the catalyst through the 2nd oxygen sensor - to use this function, select the "catalyst". If you need to adjust the parameters of the two oxygen sensors located in front of the catalyst, select "normal".

• *The correction time delay after ignition.* Time after switching on the ignition, during which the emulator does not change the corrected signals.

• *Switch on/ off* allows you to enable or disable the emulator.

• *Type of analog / digital mass air flow sensor.* It is necessary to specify which mass air flow sensor attached to the vehicle. The analogue mass air flow sensor considered to be the one, which voltage varies with the air flow. The digital (pulse) mass air flow sensor is considered the one, the signal at the output of which has a pulsed character, i.e., when changing the air flow rate - pulse frequency changed by mass air flow sensor.

• Frequency range of mass air flow sensor below 1kHz / above 1kHz. It indicates the frequency range of digital (pulse) of the mass air flow sensor. This is necessary to obtain the desired accuracy of repetition frequency at the output of mass air flow sensor. Changing this setting changes the way the correction signal. If the frequency of the output signal is less than 1kHz on the mass air flow sensor in any mode of operation of the motor - you need to select a range of "below 1kHz".

• *Load of mass air flow sensor 1kOhm/ Off.* In some cars (e.g. Mitsubishi Galant, Outlender) the load of the mass air flow sensor is critical (this is typical for ECU). We connect the emulator instead of ECU. For normal operation of the sensor in the emulator, there provided the circuits to ensure the normal operation of the mass air flow sensor. In the "switch on" mode, the mass air flow sensor loaded is on the output resistor of 1kOhm. The necessity of switching on the mass air flow sensor load defined when connecting the emulator (See P. 3).

• *MAP / MAF Sensor Type*. Switches the type of connected air flow sensor or absolute pressure. If you selected the absolute pressure sensor (MAP), the emulator calculates the amount of air in the engine by pressure in the reservoir and by the rotation frequency of the crankshaft.

5. Emulator Settings

If your vehicle has no mass air flow sensor, then you can use the signal from the absolute pressure sensor and the emulator itself will calculate the amount of air. To do this, you need only specify the type of sensor in the program.

After installation, you need to install the emulator initial parameters. For this:

• After the first connection, install the drivers for the emulator that are on the CD-ROM in the "FTDI" folder

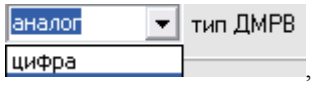
• Start the emulator program;

• Select the port (for example 

), which is connected to the emulator;

• Switch on the ignition;

• Press the "module connect"  - in this case, the emulator will read the current settings;

• Set the "mass air flow sensor type", 

, "frequency range of mass air flow sensor type";

• Start the engine;

• Set the "number of injectors", "engine volume".

5.1. Training

Before using, the device must be trained or tested, written in the emulator table. Training is conducted with a connected oxygen sensor. To start training, click the appropriate button in the program, or the button located inside the body of the emulator (push it with a thin object). A sign of the training process on is a flickering display of "work". During training, the emulator must be disconnected from the regular oxygen sensor. The duration of the training process is about 3 hours, during this period try to use all the possible modes of operation of the motor. On finishing, the emulator itself goes into operation.

In the training mode, the device generates a voltage table of the mass air flow sensor, depending on (amount of air) of the fuel injection amount. After training, the table becomes editable and you can adjust the composition of the fuel mixture.

To recreate (emulation) of the signal, it is used the number of air entering the engine (e.g. mass air flow sensor), the amount of fuel injected and the data obtained in the training process. For a given composition of the mixture, these data are processed and output as a signal of the oxygen sensor.

After completion of the training, it is necessary to disconnect the oxygen sensor and connect the emulator (see. Fig. 3.1.).

If necessary, adjust the mixture, connect the computer to the emulator, consider the sensor table obtained in the training process.

To get this, on the page “sensor binding” click the button “Read data”  , after which you see blue dots on the display that determine the voltage dependence of the mass air flow sensor (the amount of air) on the fuel. If you want to view the numeric values, open the tab “Sensor Table”, See Fig. 5.1.

If you want to change the composition of the fuel-air mixture, drag the dot up or down, See Fig. 5.2. Moving a dot up will cause the lean, moving a dot down - enrichment. ***Warning: do not change the position of a dot more than 0.8V (vertical scale), it can cause a shift of the engine into the emergency mode (indicator lights “Check engine”).***

For convenience, the colour of the displaced dots changes to green. Previous plot position is displayed as a blue curve.

After carrying out the necessary correction, a table with the values obtained should be written back to the emulator. To do this, click the button  See Fig. 5.1.

If you want to compare the actual performance curve with the engine, press the “dots”. The yellow dots will appear and disappear on the screen according to the present mode of operation. To stop the output of yellow dots, click “stop dots”.

The sign of the proper setting is the fluctuations of the recreated voltage of the sensor.

Picture. 5.1. Approximate chart view as a result of training.

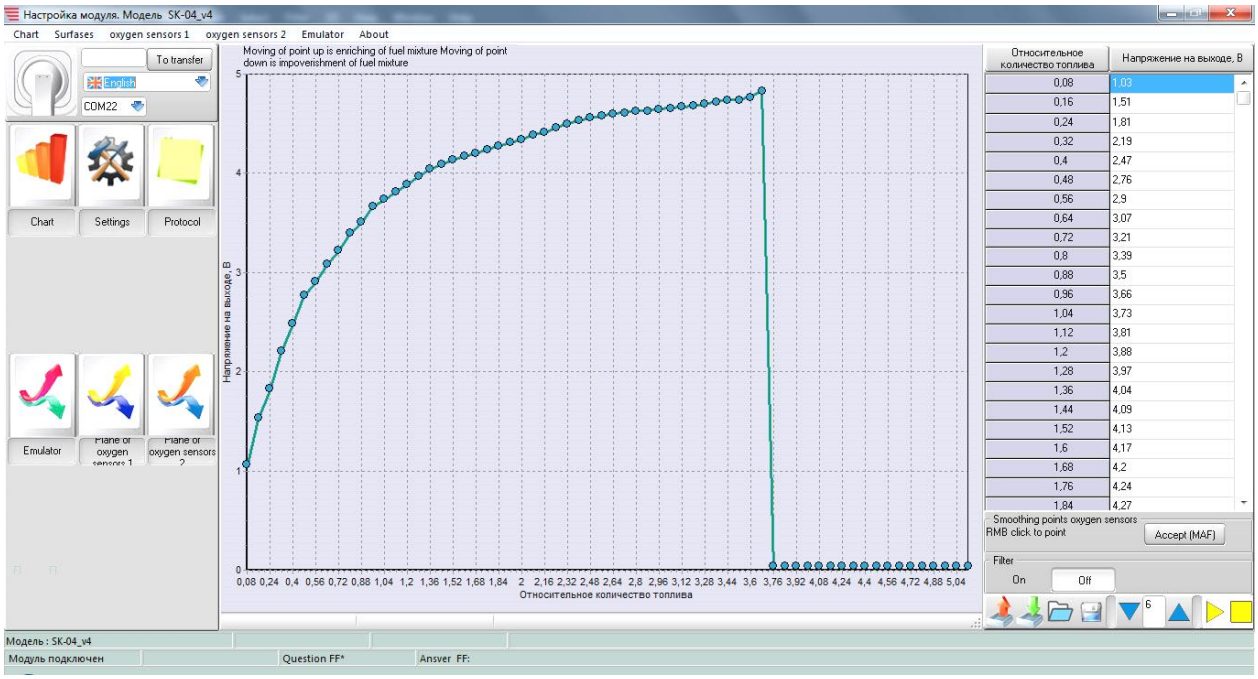
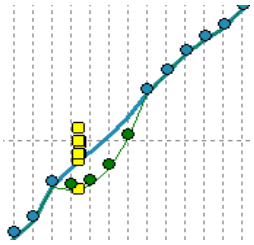


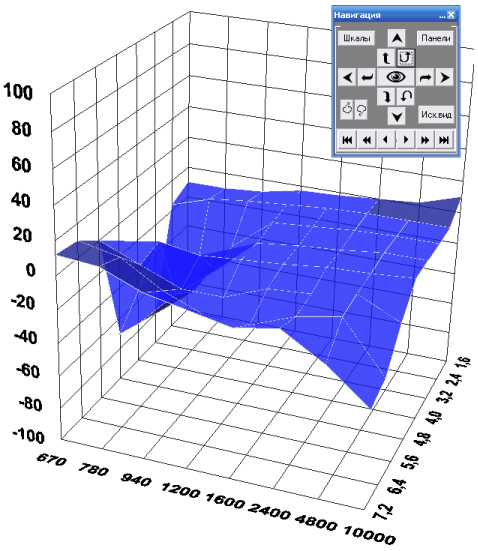
Fig. 5.2. Dots and curves displayed on the emulator chart: *the yellow ones - the current data; the blue - recorded in the emulator in the training process; the green - edited by the user.*



5.2. Emulation (formation) of the analog signal

The level of the signal generated is defined by three-dimensional (Fig. 5.3., 5.4.) or flat two-dimensional table (same as for sensor), and may be from 0 to 5 volts. Selecting the table to form the analog signal is made through the menu “mode tables”, “3D” and “simple”. **three-dimensional table** contains the fixed values of the rotation frequency of the crankshaft and the fuel injection time or voltage from mass air flow sensor – by choice (See Fig. 5.4.). Thus, the user can bind mode operation of the engine (rotation frequency, injection time, air flow) to a particular value of the signal at the output of the emulator.

Figure 5.3. Graphical view of the tables in the program window.

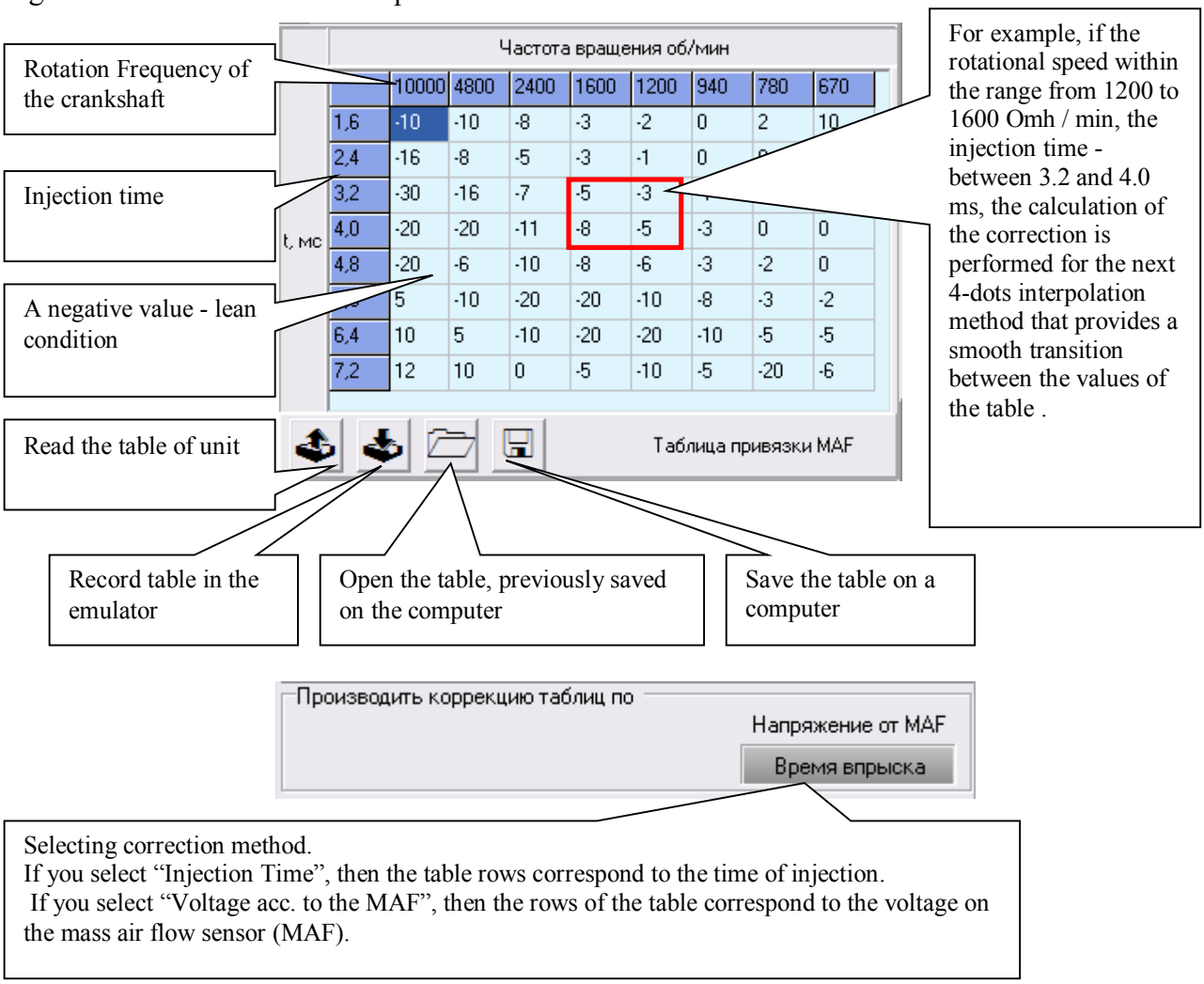


Шкалы - Scales Панели - Panels Исх. вид – Initial view

It is possible to produce a reproduction signal depending on the rotational speed, the injection time, the flow of air. Table correction built in a form of 8x8 matrix. The columns are always consistent to the speed. The rows of the matrix correspond to the time of injection of fuel or air flow (voltage from the MAF (mass air flow sensor)). Selecting lines made with a switch (See Fig. 5.4.).

The program of the emulator averages the correction level of neighboring dots in the table, if the injection time and the rotational speed do not coincide exactly with the table. Thus, there appears a “soft” conversion of correction, if the rotational speed and the time of injection are between tabulated values.

Fig. 5.4. Table of the correction parameters.



Частота вращения, об/мин – Rotational speed, Ohm/min

Таблица привязки MAF – Binding table MAF

Производить коррекцию таблиц по - Correct the tables by -

Напряжение от MAF - Voltage acc. to the MAF Время впрыска – Injection Time

Graphically displaying tabular information is in a three-dimensional model, which is shown in Fig. 5.3.

Three -dimensional panel can be rotated with the mouse or cursor control.

- Zoom button (left mouse button – zoom in, right mouse button – zoom out).

For turning and rotating surfaces it is necessary to apply buttons .

The buttons and designed for storing and restoring the spatial orientation of the surfaces.

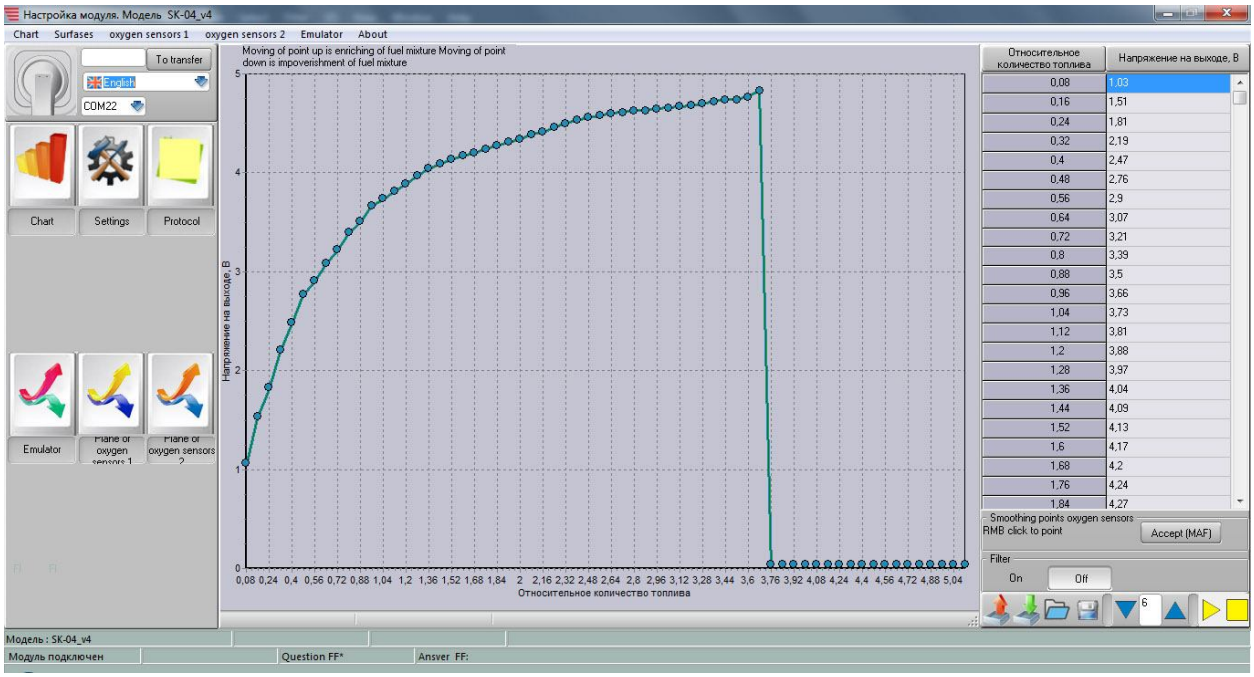
Restore the default of the surface types is with the button “Initial view”.

5.2.1. Two-dimensional table and MAF emulation

Two-dimensional table binds the value of the output voltage to the amount of air or the amount of fuel (Select using the button “Axis of the X emulator fuel / air”). If you want **to replace your MAF to MAP**, it is necessary to use the scale on the “air” X axis, specify the type of sensor as “MAP”. In the “simple” table mode, it is possible the MAF training (automatic completion of the table) based on the reference of the air flow sensor and differential pressure sensor (See Fig.5.6.). If the reference flow sensor is defective or missing, the setting should be made with disconnected oxygen sensor and mixture control of the broadband oxygen sensor, selecting the position of dots on the chart.

Attention! During the MAF training, the voltage data of the mass air flow sensor on the chart can be false.

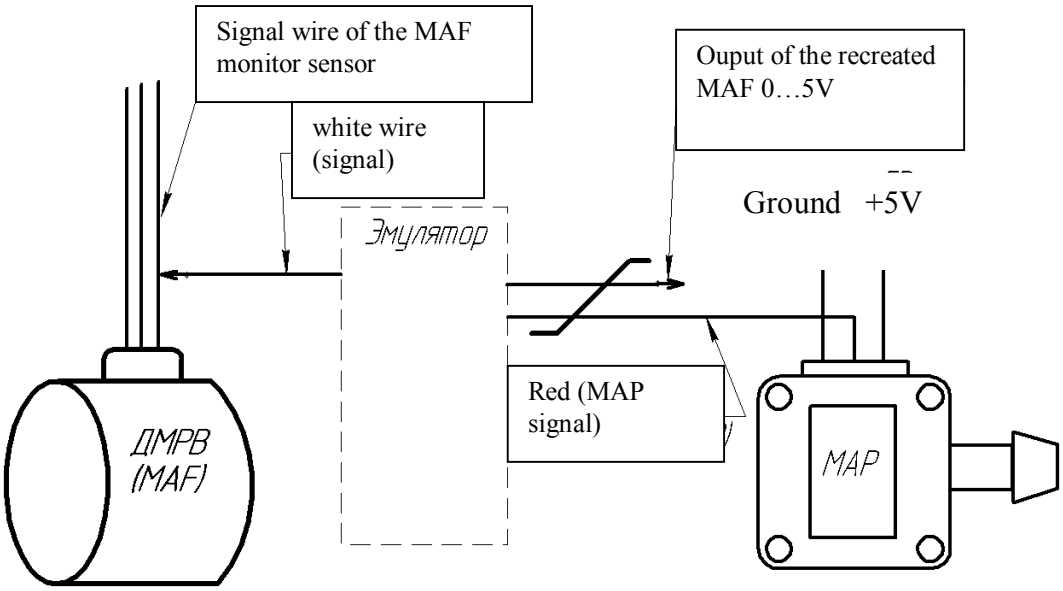
Picture. 5.5. The program of MAF emulation. Emulation is based on the MAP data, calculated acc. to the airflow.



MAF Emulation table is constructed on the basis of the amount of air (the value in arbitrary units). For each dot of the amount of air flow that is bound in correspondence to the MAF voltage.

Pressing the yellow button “Play” will be display the yellow dots, which are based on evidence of the real MAF sensor (if connected the monitor MAF sensor). Thus, one can compare the actual sensor data with a table of emulation.

Picture. 5.6. Wiring scheme in the MAF emulation training. After MAF training the sensor is disconnected.

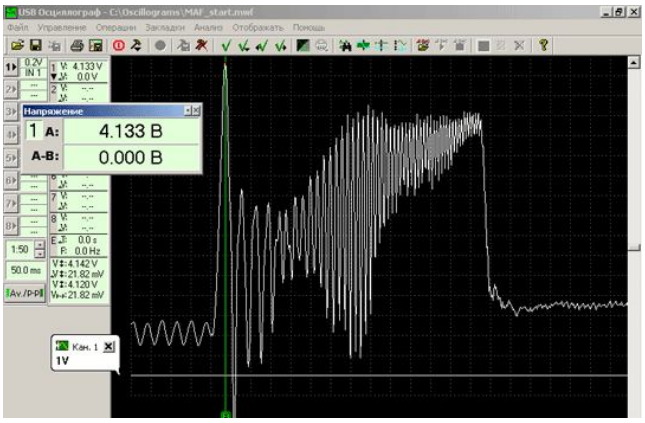


Power +5 volts for MAP sensor can be taken from the emulator. In order to find out how to do this, please refer to our dealers.

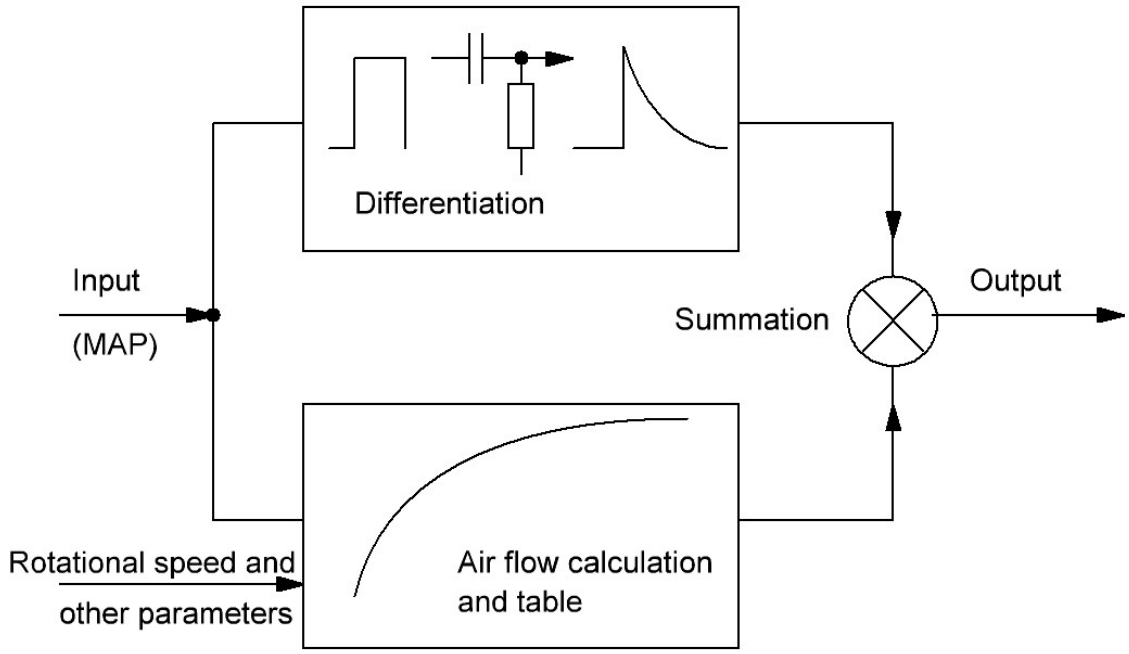
5.2.2. Response to the sudden depressing of the accelerator

When the throttle is opened sharply, the air is sucked into the intake manifold, because the pressure in it is much less than the atmospheric pressure when the damper is closed. This causes a sharp jump in MAF readings for a short time. In this connection, the function *'reaction to depressing of the accelerator'* is added in the device. The principle of operation is similar to the differentiating CR chain.

Picture 5.7 *Example: Reaction to a sudden opening of the throttle of a serviceable MAF.* The peak amplitude reaches 4.13 volts (The norm is about 3.5 V).



Picture 5.8 *Structural Scheme for the formation of a reaction to the depressing of the accelerator*



Picture 5.9 *Example of reaction to different input signals. The table is configured to pass the signal unchanged*

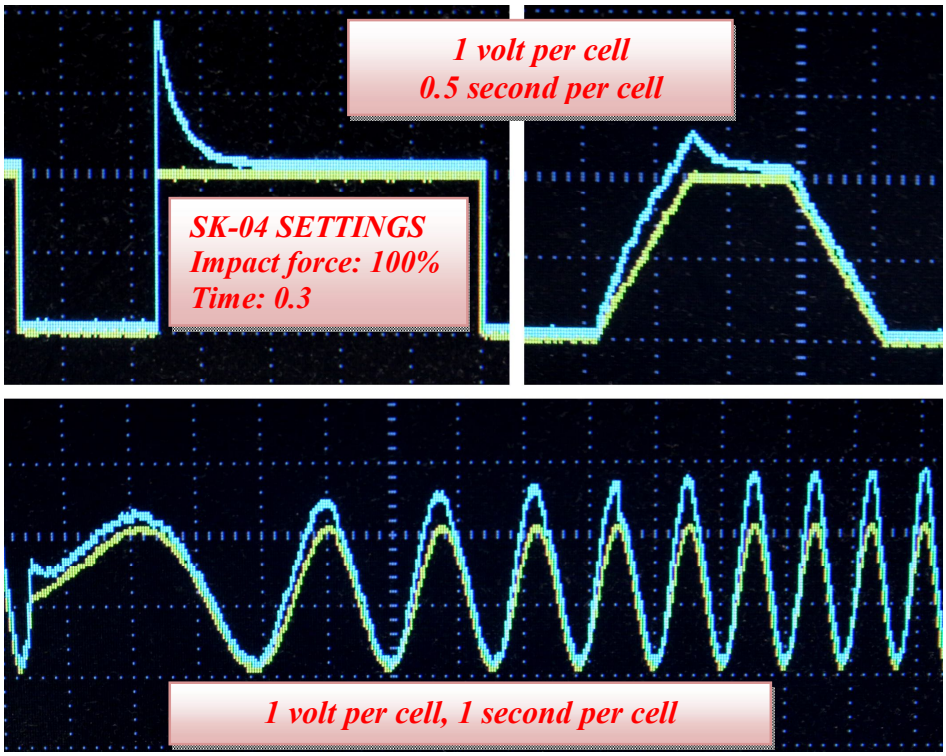


Figure 5.9 shows the response of the instrument to various input signals. The table is configured to pass the signal unchanged.

Adjustment: 'Force of influence' = 100%, 'Exposure time' = 0.3.

Just as in the differentiating chain, the amplitude depends on the steepness of the rise of the input signal. As it can be seen in the figure, with a sharp increase in the input signal by 2 volts and with a force of 100%, another 2 volts will be added to the output signal. A lower voltage will be added at smoother fronts.

Using the parameter **'Exposure time'** you can adjust the peak duration (differentiation time). The exposure time is indicated in terms of the rectangular input pulse. If you select 0, this function is disabled.

Using the parameter **'Impact force'** you can adjust the amplitude of the peak. If 100% is selected, the output signal will be added up to 100% of the input signal (with a sharp increase in the input signal).

Note! As it can be seen from the figures, differentiation in this device works to increase the voltage only.

5.3. Setting the correct display of fuel consumption

The emulator does not know the exact parameters of the fuel injectors. Therefore, to properly calculate fuel consumption you need to enter **the coefficient for calculating the fuel consumption on the computer.**

The calculation of fuel consumption also affects some input parameters: *the number of fuel injectors, engine volume.*

Setting: Before starting the tuning factor, make sure that the account ratio is equal to the 100, otherwise, set 100. Fill the tank of a certain amount of fuel, use all the fuel in the course of driving. Adjust the factor for fuel. This value can be calculated:

$$\text{Account\_ ratio} = \frac{100 \bullet \text{Proper consumption}}{\text{Consumption indications on the flow SK - 04}}$$

Near the counter there is a button with which you can reset the counter of fuel consumption.

6. Possible malfunctions and their solutions

The main cause of problems during installation and setup of the emulator is incorrect understanding of the material presented in this manual or improper understanding of the injection motor. The eventual causes and corrective actions are listed in Table 6.1.

Table 6.1. The eventual malfunctions and their solutions.

Malfunction	Cause	Correction
Settings are not set by default, chart is not written	Emulator is not connected with the computer	1. If you use an adapter, check that you have the drivers for it. Run must be done only after you connect the adapter. 2. Emulator is not powered on or the ignition is off. 3. Make sure you pressed the button  . 4. If the connection with the computer installed, then at the top of the program you should see the model title of the emulator, for example: SK-04_v1. 5. Incorrect COM port is selected in the relevant window (See Fig. 4.2). 6. It is not advisable to power a laptop by the car in the process of setting up. **Remember, if there is a connection at the moment of your changing the settings on the computer or writing the chart - the emulator has an indicator that blinks "PC connection"**
Connected mass air flow sensor (MAP, MAF), the engine stalls or operates intermittently.	Incorrect type of mass air flow sensor	Determine the type of mass air flow sensor and set the desired values in the program
the injection time and rotational speed not displayed	The blue wire not properly connected	Reconnect blue wire to the other wire injector.
Rotational speed is not displayed correctly	The coefficient set incorrectly	Set the parameter “coefficient of rotation frequency of crankshaft”.
Fuel consumption not displayed	The chart not written	Fuel consumption is only updated when running the chart.
Incorrect fonts with Windows operating system which displays absence of Russian language or the program functions incorrectly	Russian fonts not installed	Open Control Panel (Control Panel) ->
Regional and Language Options (Regional and language Options) ->
Advanced (Advanced).
Set “Language programs for non-Unicode” (“Language for non-Unicode Programs”) to “Russian” (“Russian”)

7. Warranty

The manufacturer guarantees the performance of products subject to the rules of operation set forth in the instruction manual.

The warranty period of the emulator constitutes 12 months from the date of implementation. During the warranty period the owner, in the case of system failure, is eligible for a free repair. During the warranty period the repair is carried out at the expense of the owner if he exploits the emulator not in accordance with this instruction manual, or does not comply with the manufacturer's recommendations.

The system is removed from the guarantee in the following cases:

• When opening the device;

• If there is mechanical damage;

• If the operation is not carried out in accordance with this manual.

Emulator SK-04 meets the technical conditions and found fit for use.

Release Date _____ 2017.

Seller: _____ Official seal

The trade brand a/m (for which the equipment is installed): _____

Installed by: _____ / _____ /

Installation date: _____