CAN-bus.

Scanning of diagnostic trouble codes via OBD-II connector

2016

Contents

Necessary tools, devices, materials

To connect Galileosky terminal (hereinafter - terminal) to a CAN-bus of a vehicle, one should have:

1. Electrical tools.

Picture 1

2. Set of connecting wires, a cable of connection to OBD-II diagnostic connector.

Picture 2

3. Windows-based computer with the installed program of configuration of Galileosky terminals – "Configurator". It is recommended to install the latest version of the program from the site http://7gis.ru/en/podderzhka/programmyi.html

Picture 3

4. Galileosky terminal (hereinafter – terminal) of one of the modifications with CAN support. You can download a manual for connection of the terminal from our site http://7gis.ru/en/podderzhka/dokumentacziya.html

Picture 4

General information

OBD-II (On-Board Diagnostics) is an international standard of on-board diagnostics interface of a vehicle. Such interface provides access to data from different vehicle's systems, including Engine Control Unit (hereinafter – ECU) and is considered a valuable data source in case of troubles in a vehicle.

As a rule, the majority of vehicles have such connector. Appearance and contact pin assignments are shown in pic. 5:

Socket (vehicle side)

№	Signal	№	Signal
1	Manufacturer's option	9	Manufacturer's option
2	J1850 bus	10	J1850 bus
3	Manufacturer's option	11	Manufacturer's option
4	General (body)	12	Manufacturer's option
5	General (signal)	13	Manufacturer's option
6	CAN (J2234) High	14	CAN (J2234) Low
7	ISO 9141-2 K-Line	15	ISO 9141-2 K-Line
8	Manufacturer's option	16	Battery power

Picture 5. The scheme of OBD-II diagnostic connector

Some manufacturers use contacts "Manufacture's option" for diagnostics of low speed CAN-buses (CAN-buses of "Comfort" or command and data systems).

Operation of OBD-II is carried out in accordance with SAE J1979 protocol. Such protocol defines the way of requesting different diagnostic data and the list of parameters via PID (Parameter Identification). PID – identifiers of a parameter that can be available in ECU.

The list of main OBD-II PIDs, their definitions and formulas for output modification of meaningful diagnostic units is available on the Internet (see OBD-II Standard PIDs).

Car manufacturers are not obliged to use all PIDs listed in J1979. They can also add their own PIDs, thus, expanding a set of OBD-II codes with additional PIDs (see OBD-II Non-Standard PIDs).

10 main diagnostic modes are available in accordance with protocol J1979:

1. 0x01. Show current data – reading of current parameters of control system operation.
2. 0x02. Show freeze frame data – receiving of a saved copy of current parameters of control system operation at the time of trouble codes occurrence.
3. 0x03. Show stored Diagnostic Trouble Codes – reading and viewing of trouble codes (Mode 3 Read Diagnostic Trouble Codes (DTCs).
4. 0x04. Clear Diagnostic Trouble Codes and stored values – deletion of trouble codes, photographs of current parameters, results of oxygen sensors tests, results of test monitors.

5. 0x05. Test results, oxygen sensor monitoring (non CAN only) – reading and viewing of results of oxygen sensors tests (not for CAN-bus).
6. 0x06. Test results, other component/system monitoring (Test results, oxygen sensor monitoring for CAN only) – reading of tests results, that control operation of accelerator, systems of exhaust gas recirculation (ERG), systems of fuel tank ventilation. (Reading and viewing of results of oxygen sensors tests for CAN-bus only).
7. 0x07. Show pending Diagnostic Trouble Codes (detected during current or last driving cycle) – requesting of diagnostic results of non-stop tests, constantly being completed when all conditions for test holding are fulfilled. Such tests control composition of air-fuel mixture, misfire and other components influencing exhaust.
8. 0x08. Control operation of on-board component/system – control of on-board systems.
9. 0x09. Request vehicle information – requesting of data on a diagnosed car: VIN-code and calibration data.
10. 0x0A. Permanent DTC's (Cleared DTC's) – troubles that have been deleted.

In accordance with the standard manufacturers are not obliged to support all operation modes. They can add new operation modes with an index number higher than 09 (e.g. $22 mode, as it is defined by SAE J2190 standard for GM/Ford, $21 mode for Toyota).

Galileosky terminals support operation of 2 standard protocol modes:

- 0x01 Show current data - reading of current parameters of control system operation.
- 0x03 Show stored Diagnostic Trouble Codes - reading and viewing of trouble codes (Mode 3 Read Diagnostic Trouble Codes (DTCs).

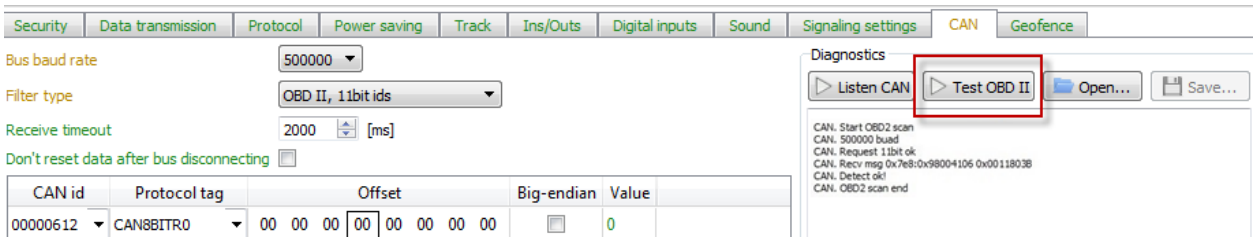
Connection of the terminal to a diagnostic connector

Connection of the terminal to a diagnostic connector is carried out in accordance with the manual "CAN-bus. Connection to the CAN-bus", you can download it from our site http://7gis.ru/en/podderzhka/dokumentacziya.html , see section "Connection of the terminal to CAN-bus" -> "Connection to the diagnostic OBD-II connector"

Setting of the terminal for operation via J1979 protocol

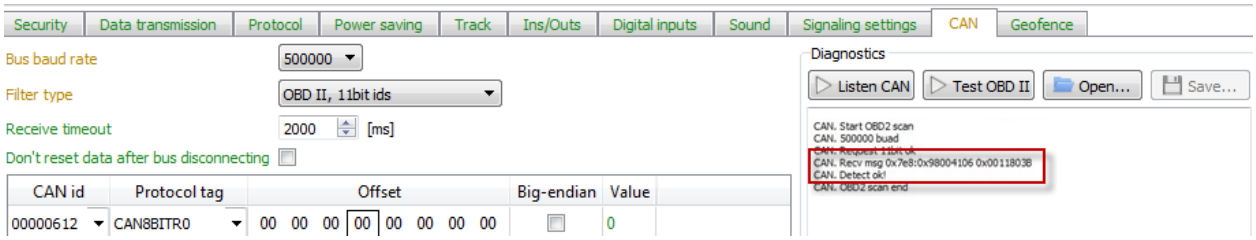
To set the terminal for operation via J1979 protocol run scanning bus mode Test OBD-II. Such mode is aimed at defining speed of data transmission in a bus and a type of identifiers via J1979 protocol in a CAN-bus of a vehicle. 250000 bit/s or 500000 bit/s speed values and operation with 11 and 29 bit identifiers are supported.

To start the mode in Configurator go to "Settings" -> "CAN" and click "Test OBD II" (pic. 6):



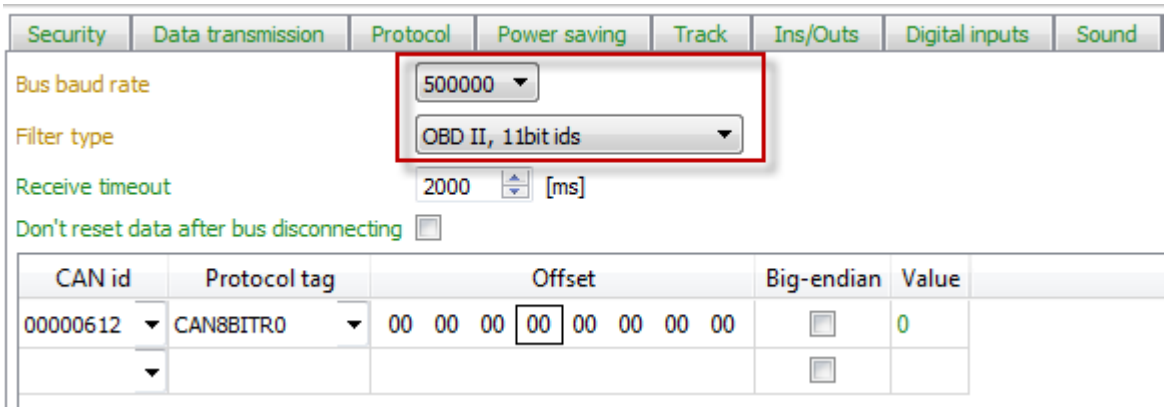
Picture 6. Operation mode via J1979 protocol

The terminal starts sending requests at different values of bus speed (pic. 7):



Picture 7. Receiving messages with 11 bit identifiers from the bus at the speed of 500 kbit/s

As a result, after response, in case CAN-bus supports J1979 , “Bus baud rate” parameters are set automatically: 250000 bit/s or 500000 bit/s, “Filter type” parameters are also set automatically: “OBD II, 11 bit ids” or “OBD II 29 bit ids” (pic. 8):



Picture 8. Automatic setting of bus speed and filter type

Go to tab “Troubleshooting”, tick parameters “CAN” and “CAN detailed” and make sure there are decrypted and derived messages being transmitted via J1979 protocol (pic.9):

- fuel level in a tank;
- coolant temperature;
- engine speed;
- trouble codes;
- readings of air-mass flow sensor;
- status of engine trouble sensor;
- OBD standard of the vehicle.

Engine speed
PID request 0x7DF 0x550C0102 0x55555555
0x7E8 = 04 41 0C 0E 08 AA AA AA
OBD response: 0x E0C4104 0xAAAAAA08
Engine speed 898

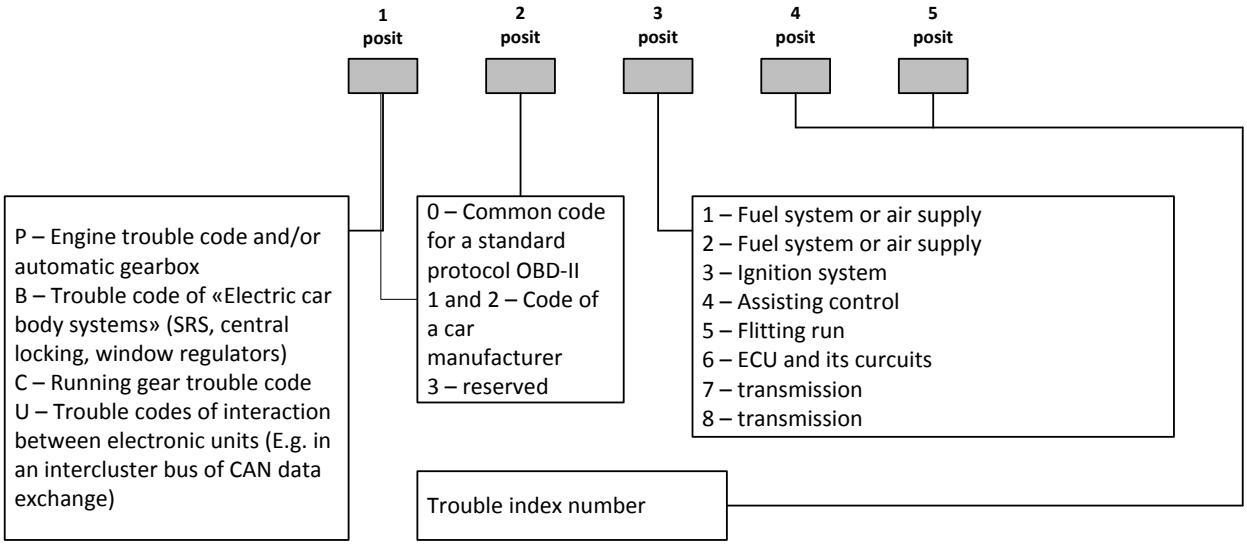
Engine coolant temperature
PID request 0x7DF 0x55050102 0x55555555
0x7E8 = 03 41 05 6A AA AA AA AA
OBD response: 0x6A054103 0xAAAAAAAA
Engine coolant temp 66

Picture 9. Parsing of data from CAN-bus via J1979 protocol

Let us consider receiving and deciphering of vehicle trouble codes.

Such messages are transmitted to the monitoring server in tags CAN16BITR0, CAN16BITR1, CAN16BITR2. The messages are transmitted in a hexadecimal form. See a detailed protocol description on our site http://7gis.ru/en/podderzhka/dokumentacziya.html

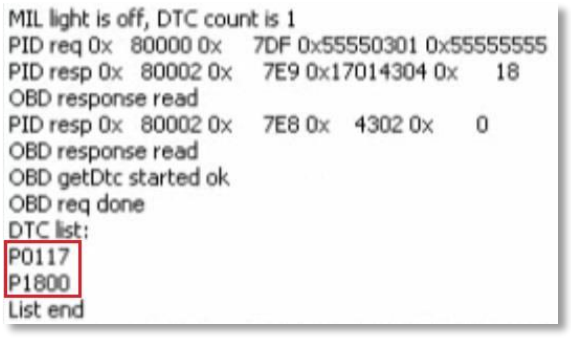
Trouble codes In a deciphered form have a special format consisting of 1 letter and 4 digits (some car manufacturers use a special vehicle troubles coding) (pic. 10):



Picture 10. Deciphering of a diagnostic trouble code

See a more detailed information on common trouble codes of a definite vehicle model in the description of SAE J1979 standard or in the Internet.

Here is the example of receiving, deciphering and transmission of vehicle trouble codes to the monitoring server (pic. 11):



Picture 11. Trouble codes display on “Troubleshooting” tab

According to trouble codes table for Subaru found in the Internet, P0117 trouble informs of fault to frame in a circuit of a coolant temperature sensor (ECT).

Setting of a monitoring software

Let us take parsing of trouble codes sent to Wialon Hosting monitoring software as an example.

Data transmission to Wialon is carried out in a hexadecimal form, at Wialon server data are recorded into corresponding variables can_r18, can_r19, can_r20 in a decimal form.

Thus, for the trouble code parsed above, value 279 will be displayed in variable can_r18, that corresponds to trouble 00117 (P0117) according to SAE J1979.

In order to monitor the occurrence of a specific trouble code, it is necessary to create a custom sensor and specify the following formula in parameter:

(can_r18 – <trouble code>)(can_r19 – < trouble code >)*(can_r20 – < trouble code >),*

where <trouble code> is a code value in a decimal format.

In case of recording of a preset trouble in messages by monitoring software, a sensor will receive 0 value and it will mean trouble occurrence.

Scanning of diagnostic trouble codes via OBD-II connector is completed, the terminal is ready to operate.