NAVTELECOM
TELEMATICS SYSTEMS

CAN Spy
User Manual

Version 1.0

Moscow
2022

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1. HISTORY OF CHANGES

Version 1.0 from 05/16/2022:

- The first version of the document.

2. WORK WITH THE PROGRAM

CAN SPY program allows you to:

- determine data availability in the CAN bus, exchange rate and type of identifiers;
- analyze CAN messages to decode numerical parameters or state of discrete sensors;
- display parameter values when parsing CAN data from decoding files;
- record and playback logs from vehicle CAN bus or equipment with CAN interface.

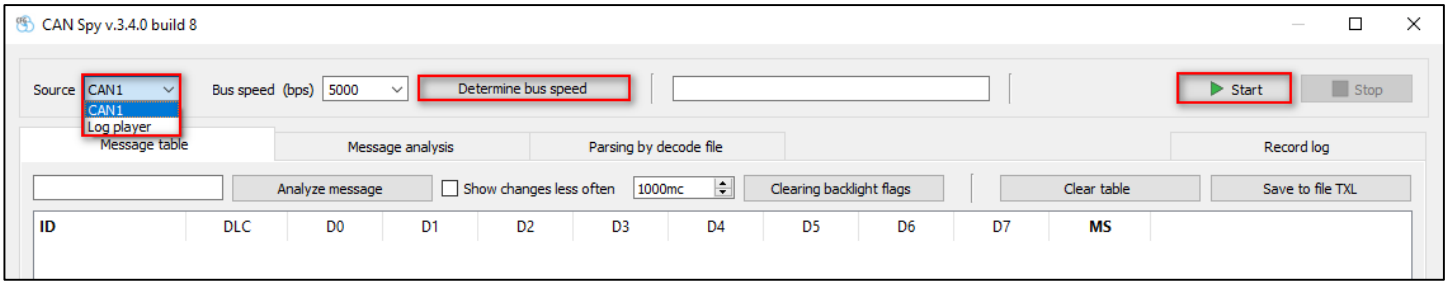
To start working with CAN data in the CAN Spy window you need to select a data source. It can be CAN interface of the GPS tracker or player of previously recorded logs.

When choosing the data source CAN interface, CAN1 or CAN2 (for devices with 2 CAN), it is necessary to correctly connect CAN interface of the device to the CAN bus. Connection points to the CAN bus wires depend on the specific type of vehicle or equipment.
For safe connection to CAN bus without damaging the wire insulation, it is recommended to use a contactless reader of the CAN-Crocodile type.

Operation in the CAN Spy window with getting data through CAN interface is only possible with direct connection to the device via USB. Remote data acquisition is not implemented in this window.
The low bandwidth of the wireless communication channel with the device (GPRS) does not allow to fully transfer the entire amount of CAN bus data necessary for full-fledged work with this data.

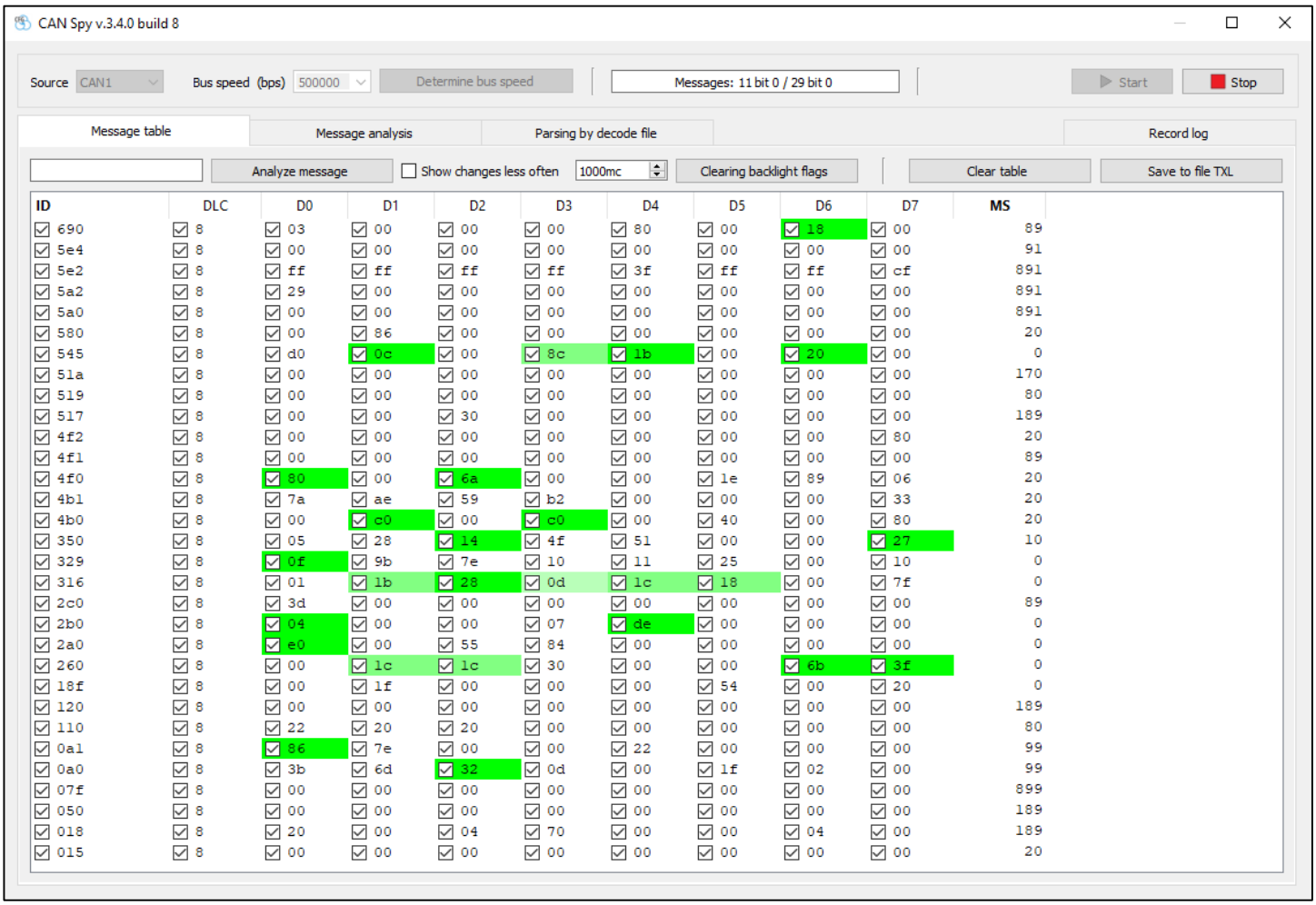
If data baud rate in the CAN bus is unknown, you can use automatic baud rate detection function, for this you need to click the ***Detect CAN bus baud rate*** button

In the *CAN bus baud rate (bps) field*, you can select the value of the exchange rate in the drop-down list, or enter the value manually in the field if it is known in advance.



2.1 Message table

If the bus baud rate is determined automatically, the messages transmitted via CAN will appear in the ***Message table*** window.

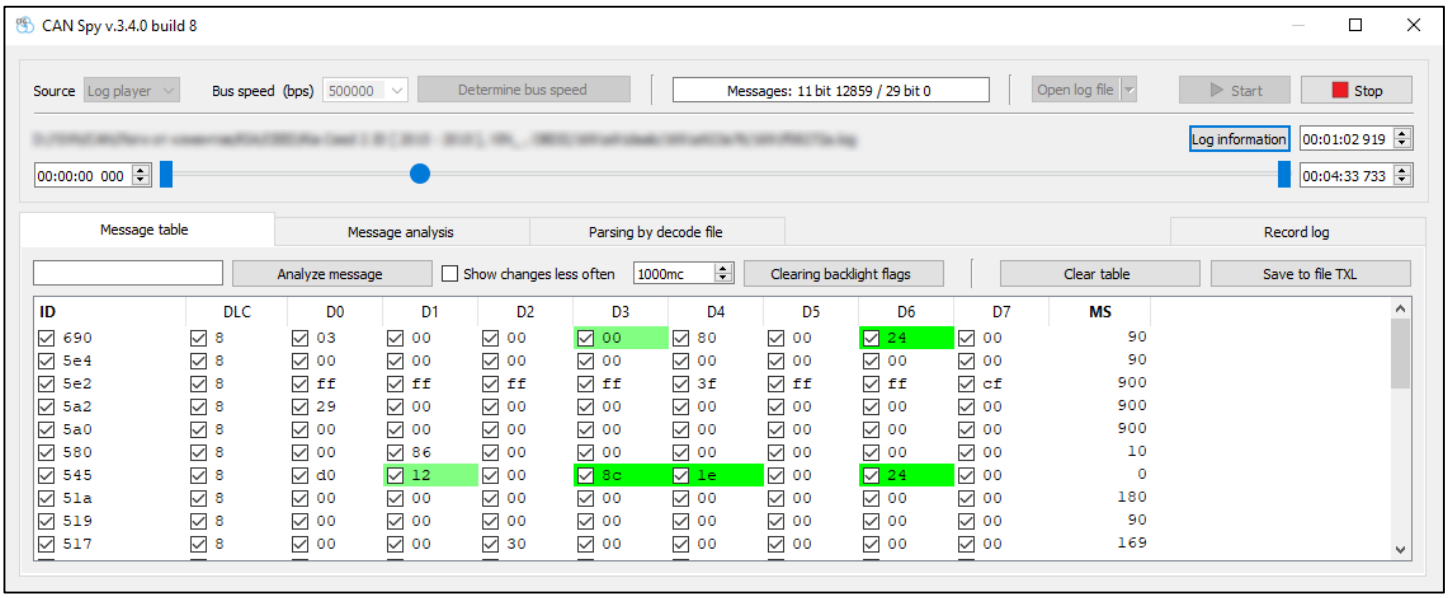


ID	DLC	D0	D1	D2	D3	D4	D5	D6	D7	MS
690	8	03	00	00	00	80	00	18	00	89
5e4	8	00	00	00	00	00	00	00	00	91
5e2	8	ff	ff	ff	ff	3f	ff	ff	cf	891
5a2	8	29	00	00	00	00	00	00	00	891
5a0	8	00	00	00	00	00	00	00	00	891
580	8	00	86	00	00	00	00	00	00	20
545	8	d0	0c	00	8c	1b	00	20	00	0
51a	8	00	00	00	00	00	00	00	00	170
519	8	00	00	00	00	00	00	00	00	80
517	8	00	00	30	00	00	00	00	00	189
4f2	8	00	00	00	00	00	00	00	80	20
4f1	8	00	00	00	00	00	00	00	00	89
4f0	8	80	00	6a	00	00	1e	89	06	20
4b1	8	7a	ae	59	b2	00	00	00	33	20
4b0	8	00	c0	00	c0	00	40	00	80	20
350	8	05	28	14	4f	51	00	00	27	10
329	8	0f	9b	7e	10	11	25	00	10	0
316	8	01	1b	28	0d	1c	18	00	7f	0
2c0	8	3d	00	00	00	00	00	00	00	89
2b0	8	04	00	00	07	de	00	00	00	0
2a0	8	e0	00	55	84	00	00	00	00	0
260	8	00	1c	1c	30	00	00	6b	3f	0
18f	8	00	1f	00	00	00	54	00	20	0
120	8	00	00	00	00	00	00	00	00	189
110	8	22	20	20	00	00	00	00	00	80
0a1	8	86	7e	00	00	22	00	00	00	99
0a0	8	3b	6d	32	0d	00	1f	02	00	99
07f	8	00	00	00	00	00	00	00	00	899
050	8	00	00	00	00	00	00	00	00	189
018	8	20	00	04	70	00	00	04	00	189
015	8	00	00	00	00	00	00	00	00	20

*If only one message is displayed in the **Message table** window, this means that this CAN bus does not have the second module or CAN data receiver device operating in active mode with message acknowledgment. In this case, it is necessary to look for another connection point to CAN , where a full-fledged data exchange of two or more modules takes place.*
*Device interface working in the CAN Spy window is in **passive** mode. In this mode, it only "listens" to the CAN bus without sending acknowledgments.*

When manually entering the baud rate value, to enable reception of CAN messages, you must first set the required rate in the field *CAN bus baud rate (bps)*, then click ***Start***.

If *Log player* is set as the source, it is possible to select a CAN log file previously recorded using the ***Record log*** tab. After selecting the file, you must click ***Start*** to playback the data from the CAN log.
When playing the CAN log, data is displayed in the same way as when directly connected to the CAN bus and viewing data via USB.

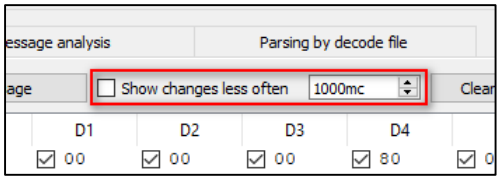


If the folder with previously recorded CAN logs is archived, it is necessary to unarchive the files with logs in advance.

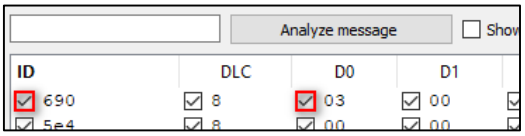
Message table tab allows you to see all messages running in CAN and show their meanings.

Description of the table columns:
ID - message identifier in HEX.
DLC - shows the length of the data in the message (in bytes).
Dx - shows message data in HEX. Byte numbering starts at "0", so the first byte is D0, the second byte is D1, and so on.
MS - approximate period of transmission of CAN message in the bus (in milliseconds).

The values in each byte are highlighted with each change. When searching for the required parameters, you can configure the highlighting of changing values in such a way that only those values that change less often than set in the *Show changes less often* fields are highlighted.



You can also disable and enable the highlighting of each of the changing bytes or the entire message, removing or unticking them next to the byte value, or next to the message identifier.

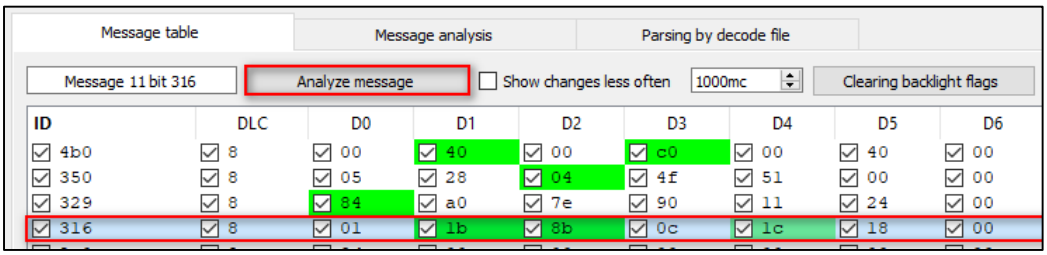


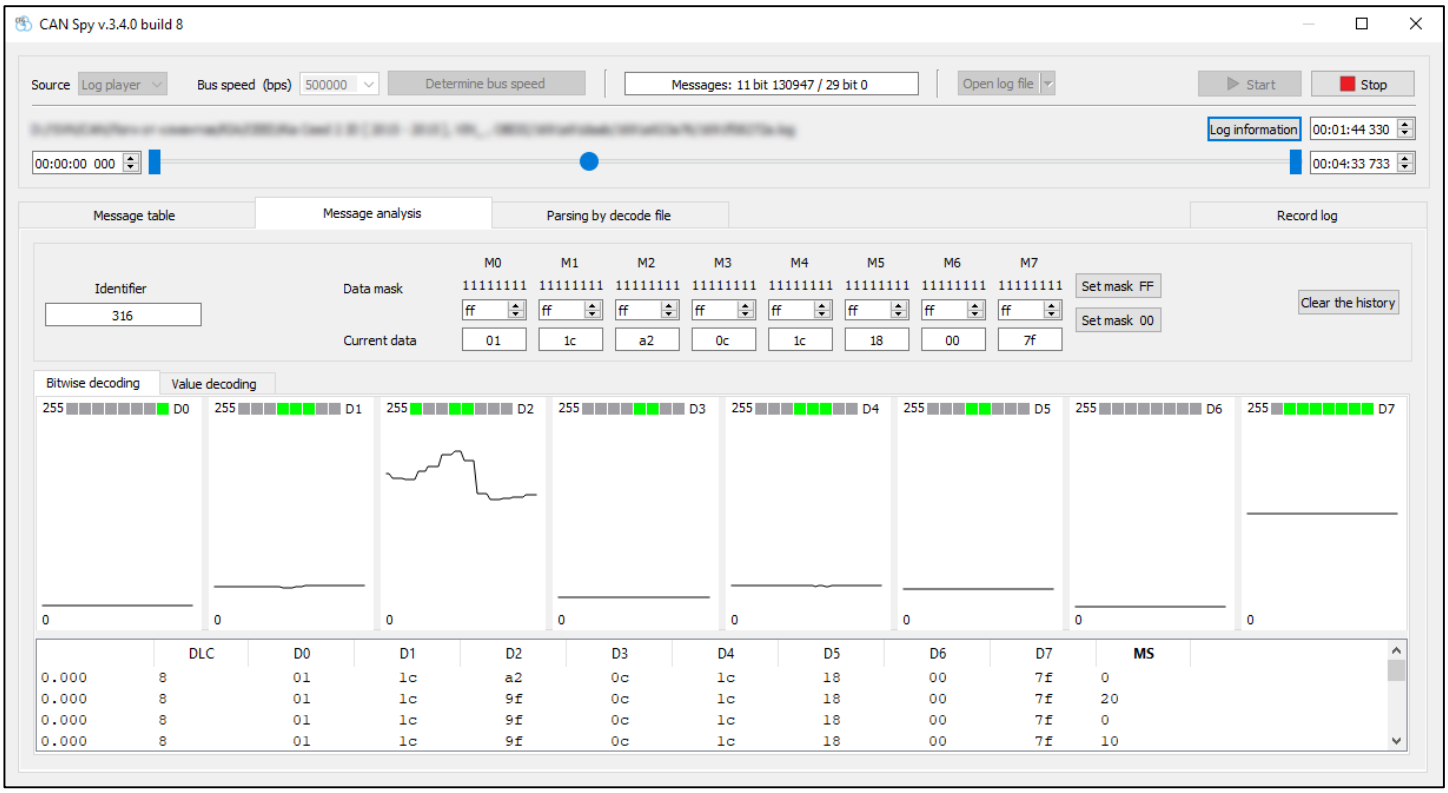
The ***Reset highlighting flags*** button sets all previously cleared ticks at once, including highlighting of all changing values.

If necessary, you can save a list of messages with data to a file in the ".txl" format by clicking ***Save to file TXL.***

2.2 Message analysis

In order to study in detail the data in a particular message, you need to select the string of this message and click the ***Analyze message*** button, this automatically switches to the ***Message analysis*** tab.





2.2.1 Bitwise decoding

Message analysis tab, in the ***Bitwise decoding*** section, can show change in the values of a single message.

In this section, it is convenient to determine the type of transmitted data in each byte (bit field or numeric value), it is convenient to search for discrete values for turning on/off sensors and mechanisms. It is also convenient to determine the size of the searched values in bytes, the byte order in the found value.

The ***Bitwise decoding*** section consists of two parts:

- Graphs block
- Table with message history

The graphs block consists of 8 windows, which graphically show the history of changes in the value of the corresponding data byte of this message for a short time interval. Above the graph there are indicators that reflect the state of the bit of the selected byte at a given time (if the bit is 1, then the indicator is green).

Changing the values of byte D4. 3rd and 4th bit = "1"

2.2.2 Value decoding

To search and analyze the values of numeric parameters, use the section ***Value decoding***.

First, with highlighting of the ***Message table*** tab, you need to find a message that has changes when the required parameter changes. Then, on the ***Message analysis*** tab, in the ***Bitwise decoding*** section, you need to determine the bytes in which the required numerical parameter changes in accordance with changes on the dashboard or on-board computer display of the vehicle. Having determined the required bytes, you need to set a mask for parsing them.

The value of the entire byte is parsed by the mask "FF", the value is not parsed by the mask "00". Clicking ***Set mask FF*** or ***Set mask 00*** enables/disables data parsing of all 8 bytes.

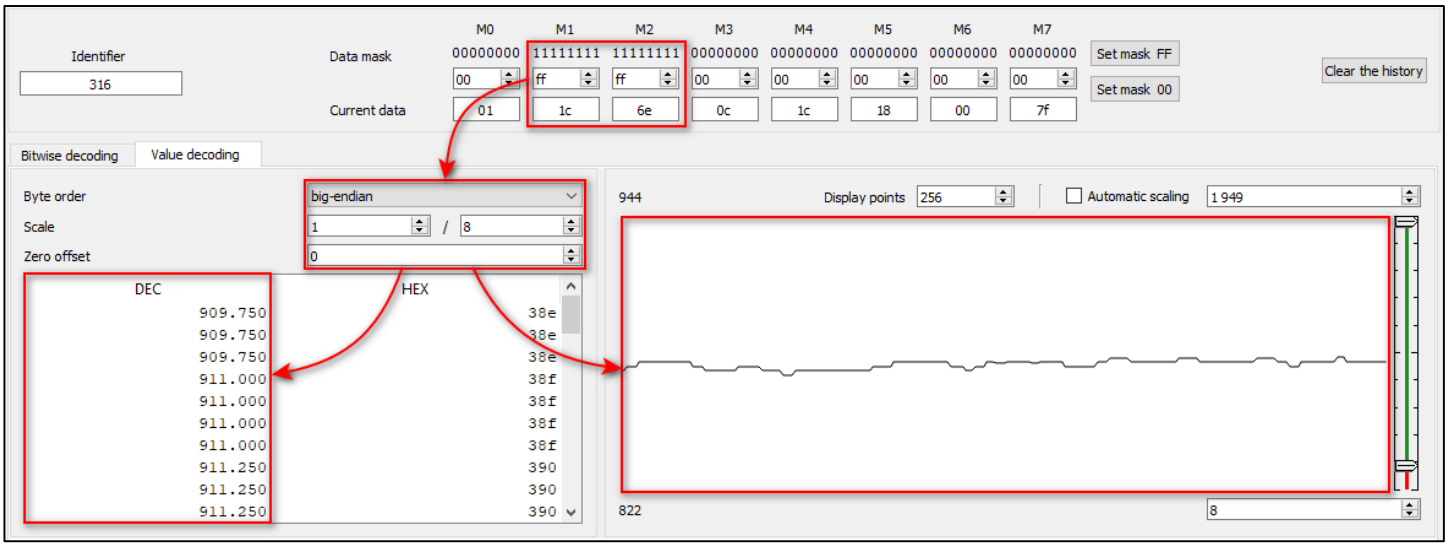
After setting the mask, go to the ***Value decoding*** section.

The value selected by the mask can be changed:

Byte order - sets the direct (Big-endian) or reverse (Little-endian) byte order, if 2 or more bytes are selected by the mask.

Scale – coefficient selection and zero offset so that the value obtained in the DEC column corresponds to the required value of the numerical parameter displayed on the dashboard or on-board computer display of the vehicle.

For convenience, you can observe the change in the required value on the graph by setting the required graph scale manually or using automatic scaling.



Parsing the value for the parameter "Engine speed"

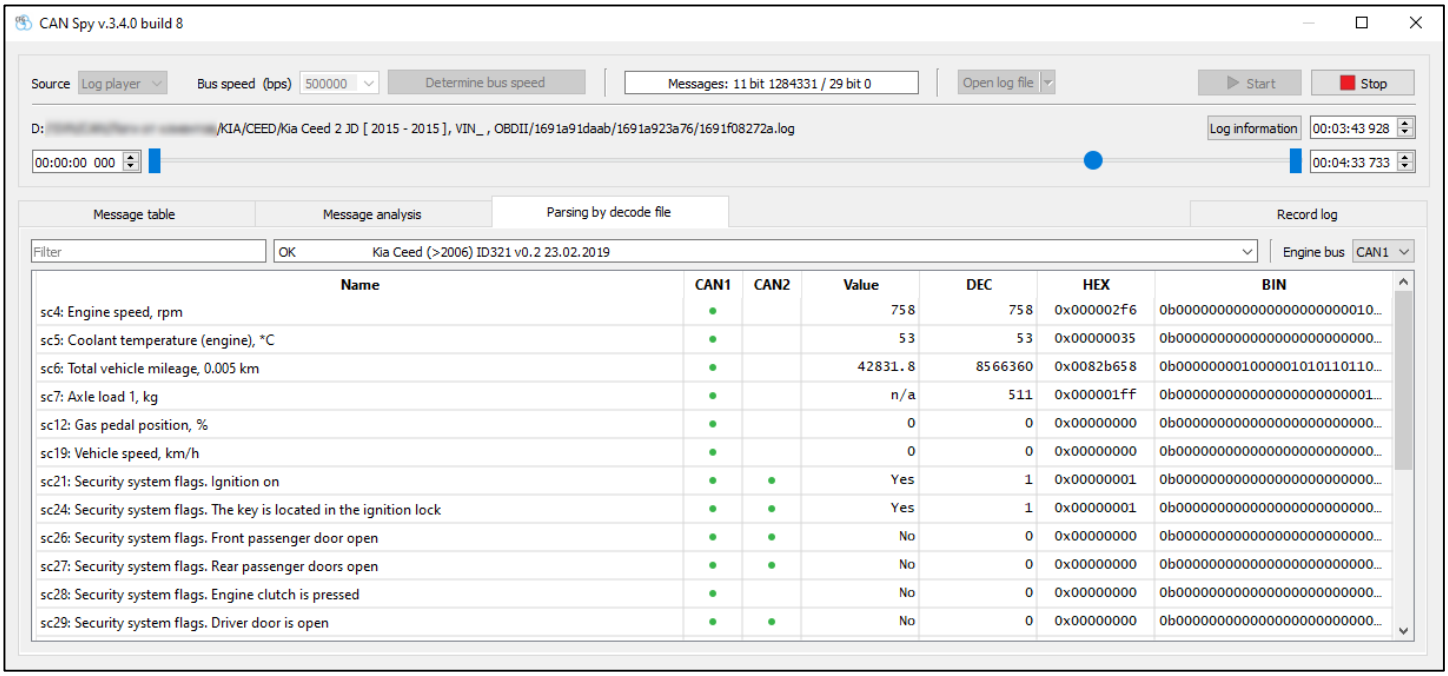
2.3 Parsing by decoding file

Parsing by decoding file tab allows you to see the values of those parameters that can be parsed from the vehicle CAN bus using ready-made decoding files. Analysis of parameter values by decoding files in the CAN Spy window corresponds to the parsing of CAN data in the device when these files are loaded into it. This tab allows you to quickly evaluate the possibility of using a particular decoding file on a car to which the device is connected via CAN, while the decoding file may not be loaded into the device (CAN Spy itself interprets the data based on the decode file).

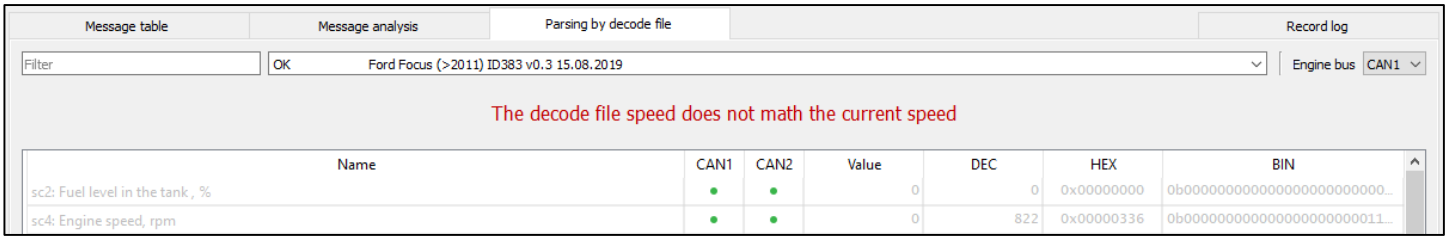
Decoding files are created by technical team of Navtelecom LLC. The contents of the files and information about the decoding of a particular parameter are the property of Navtelecom LLC and are not disclosed.

When you select one or another decoding file, strings with parameters appear in the table, which can be parsed using this file.

Parameters marked in gray are not present in CAN messages.



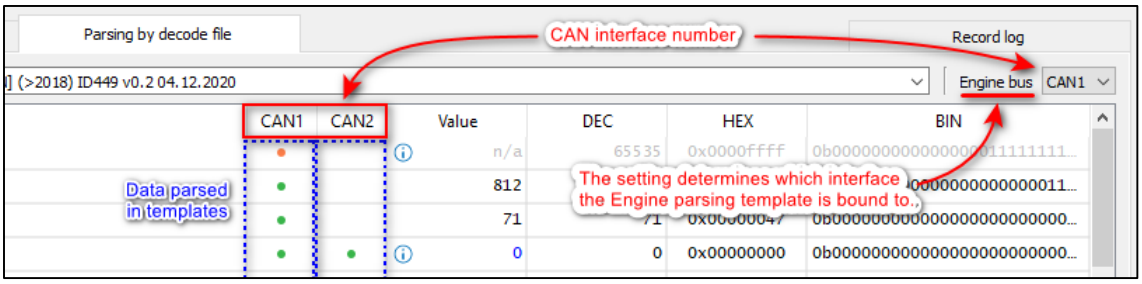
If the baud rate set in the decoding file differs from the baud rate of the connected CAN bus or the bus from which the log was recorded, then decoding will not be performed and a corresponding warning will appear.

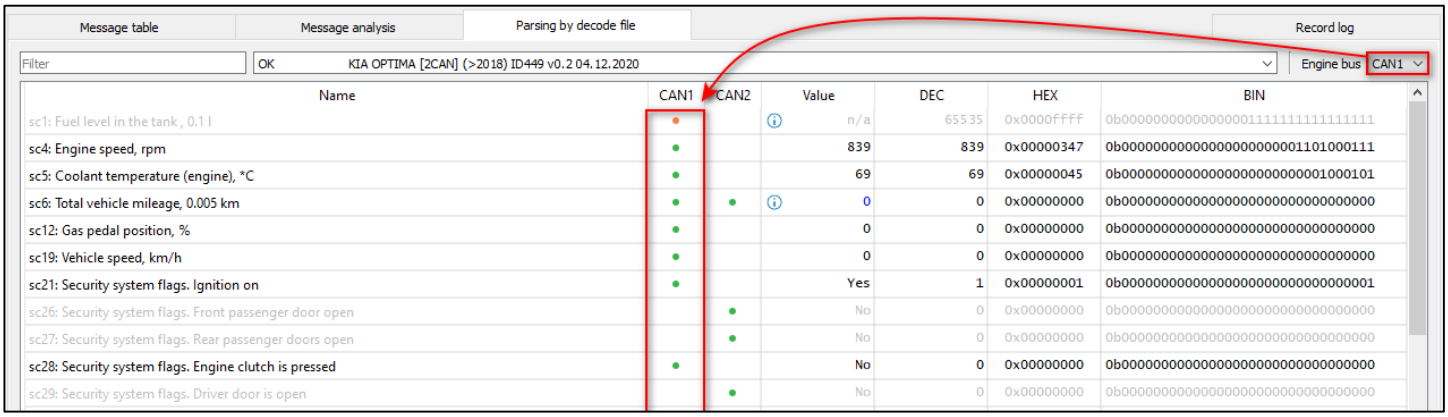


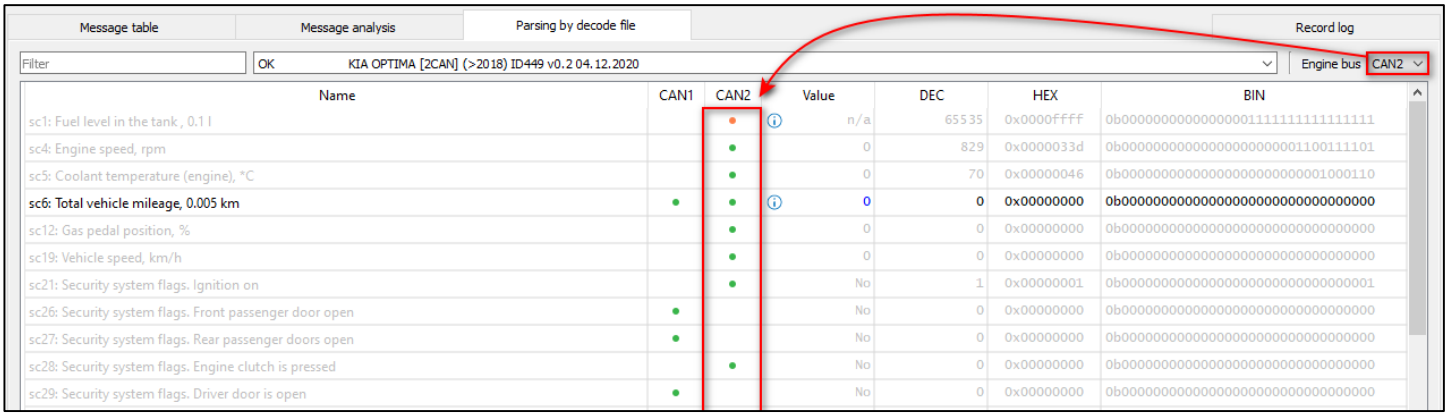
Parameters, the values of which are displayed in blue, are calculated ones. Their values are not transmitted in the CAN bus, but are calculated based on the values of other parameters present in the bus. When hovering over the sign ⓘ information about the features of the parameter calculation appears.

With vehicles for which decoding files with the mark **[2 CAN]** have been created, it is desirable to use devices with two CAN interfaces *(S-2653, S-2437)*. Connection must be made to both CAN buses in order to obtain the maximum set of parameters**.**

When working with two CAN buses, by setting the ***Engine bus*** you can programmatically change the data parsing template for each bus without physically reconnecting the interfaces. Those, the device programmatically perceives CAN1 as CAN2 and vice versa.





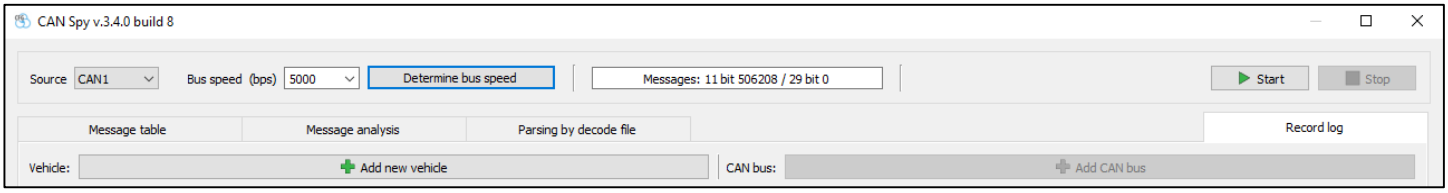


After finding the necessary data, it should be noted that if the Engine template was selected for the CAN2 interface, then the same software substitution must be made in the device configuration when configuring the CAN interface to work with this decoding file and with this vehicle.

2.4 Recording CAN bus logs

Record log tab allows you to save CAN messages in the form in which they were transmitted in the bus at the time the logs were taken. This is convenient for further analysis of the received data if the vehicle is available to work with CAN for a limited time.

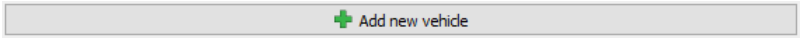
Also CAN logs must be sent to the technical support service of Navtelecom LLC if parsing of the vehicle CAN bus data to which the device needs to be connected has not yet been implemented in the decoding files, or is performed with an error according to the finished decoding file.



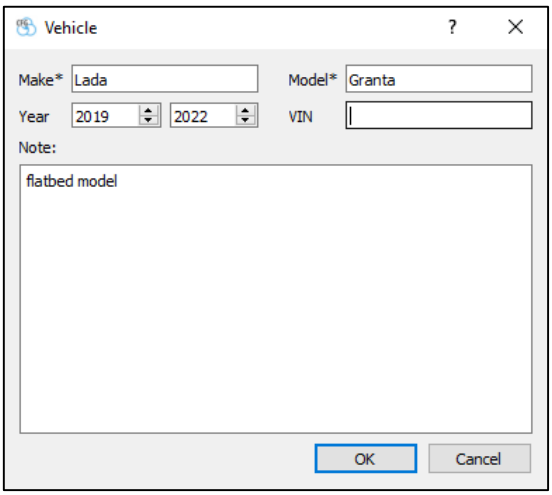
To record logs, you must first select the *Source* - CAN1 or CAN2 (for devices with two CAN interfaces), set *CAN bus baud rate (bps)* and click ***Start***. Or, if the rate is unknown, after selecting the source, click ***Automatic rate detection***.

After selecting the source and rate or after automatically detecting the rate, it is recommended to check that the device is receiving any CAN messages on the ***Message table*** tab.

On the ***Record log*** tab you first need to create a "Vehicle" by clicking the button:



In the window that appears, you need to specify the *Make* and *Model* of the vehicle (required), *Year* of manufacture and *VIN* (if known).



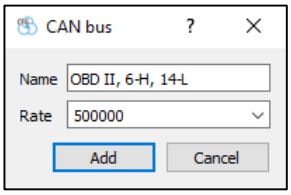
After clicking ***Add*** button, the created vehicle appears in the drop-down list.

In the future, you can edit the data with the button , you can delete the vehicle with the button , and create another new vehicle with the button .

Next, you need to add a CAN bus by clicking the button:

In the window that appears, in the *Name* field, you need to specify the connection point to the CAN bus in the vehicle (name of the control unit or connector, wire colors or pin numbers for connecting CAN_H and CAN_L lines).

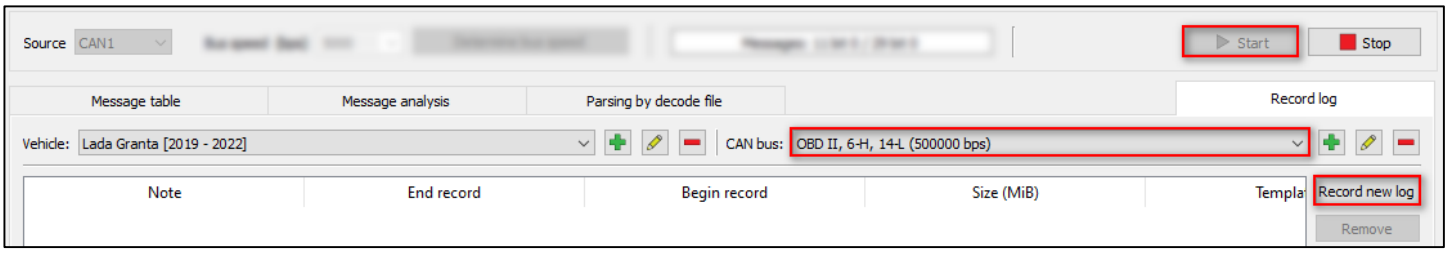
The *rate* is set automatically if the CAN Spy is enabled to receive CAN messages.



After adding the CAN bus, it appears in the drop-down list.

If you need to record logs from several CAN buses on one vehicle, then you need to add each of them to the list and also indicate the connection point of the CAN interface of the device.

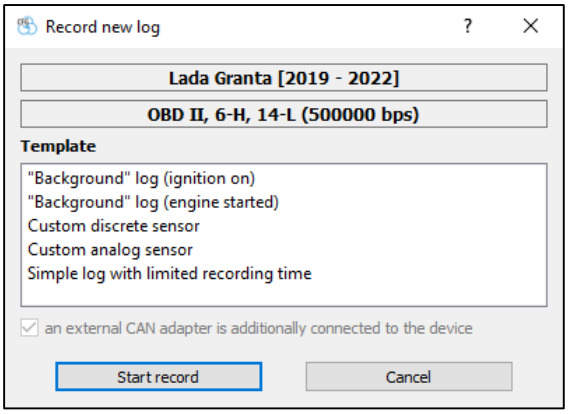
After selecting the CAN bus to which the device is connected, you can start logging.



When you click the ***Record new log*** button, a logging window appears, in which the vehicle data and the connection point to the CAN bus are indicated. In the list of templates, you need to select the type of log that you want to record.

2.4.1 Background log template

In most cases, it is enough to record two logs, *Background log (ignition on)* and *Background log (engine running)*, with the ignition on in one case and with the engine running in the other case accordingly.



After choosing a template, you need to click ***Start record*** and follow the instructions in the log recording wizard window. If necessary, you can change the *log recording duration* and add a *note* for the recorded log.

At the top of the wizard window, the status of receiving CAN data during recording is displayed, the description of possible notifications is given below:

Data reception from CAN bus is disabled - no logging is performed.

No data from CAN bus - no CAN data during logging.

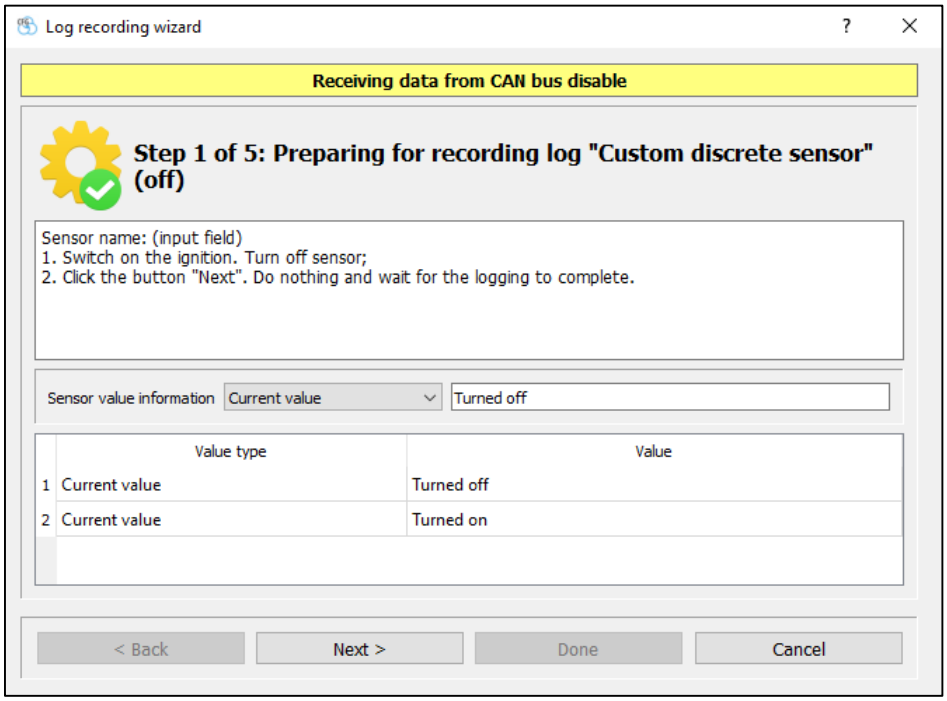
Receiving data from CAN bus - logging in progress, data from the CAN bus is visible.

After a successful logging, you need to click ***Done*** to save the log on your computer.

2.4.2 Template "Custom discrete sensor"

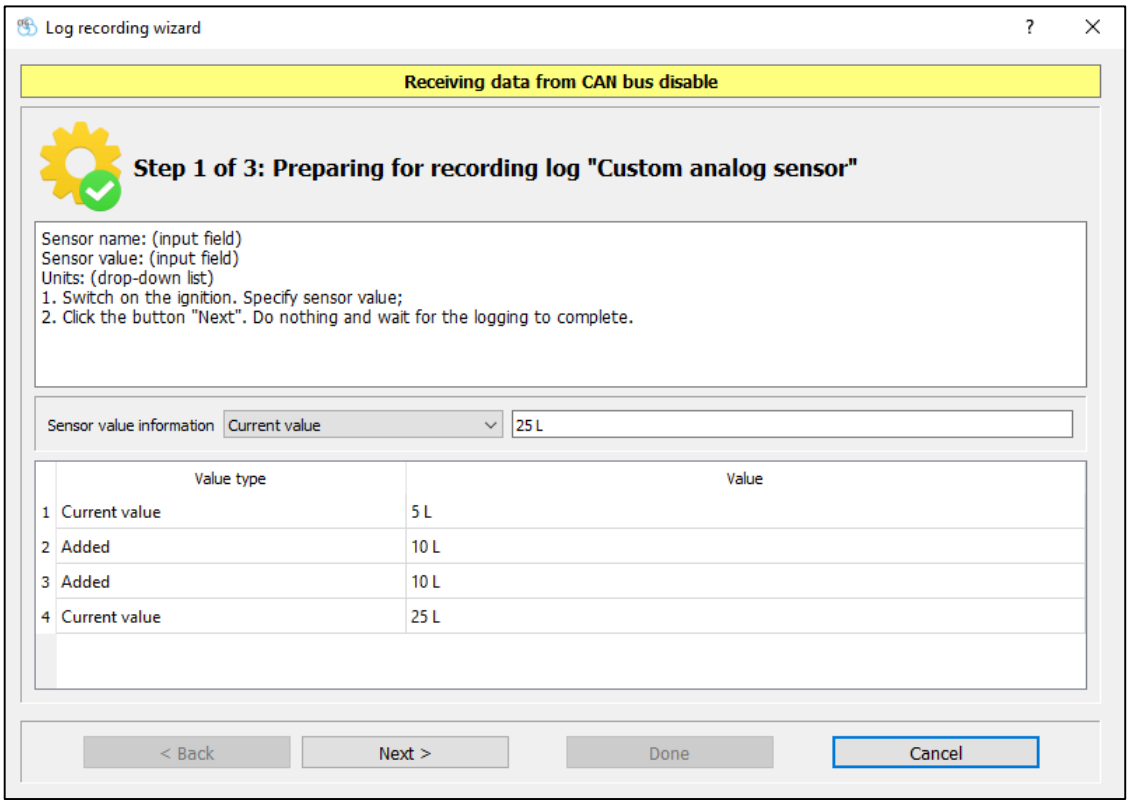
To find the changes when one or another discrete sensor is triggered, select the *Custom discrete sensor* template.

When recording a log using this template, you will need to follow the instructions in the log recording wizard and turn on/off the sensor while changing the information about the sensor readings in the wizard interface.



2.4.3 Template “Custom analog sensor”

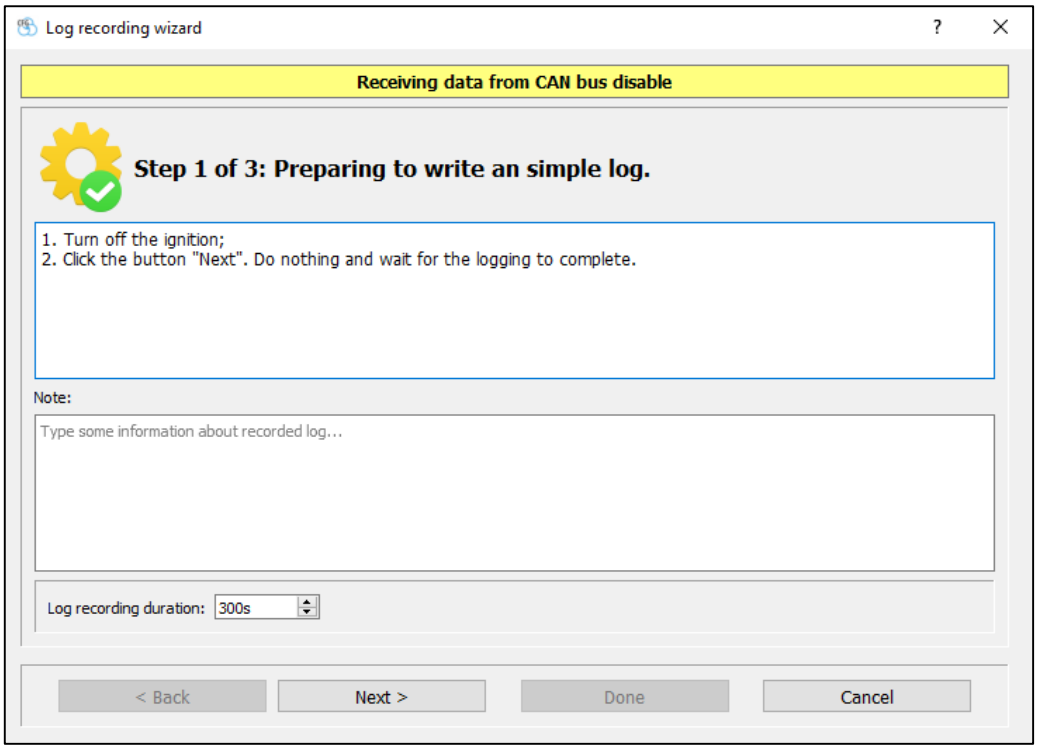
To find the CAN bus data for analog sensor values, you record a log using the *Custom analog sensor* template. Following the instructions of the log recording wizard, you need to specify in the *Value type* field the known current value of the sensor (“Current value”) or the change in value relative to the previous record (“Added”).



2.4.4 Template "Custom log with limited recording time"

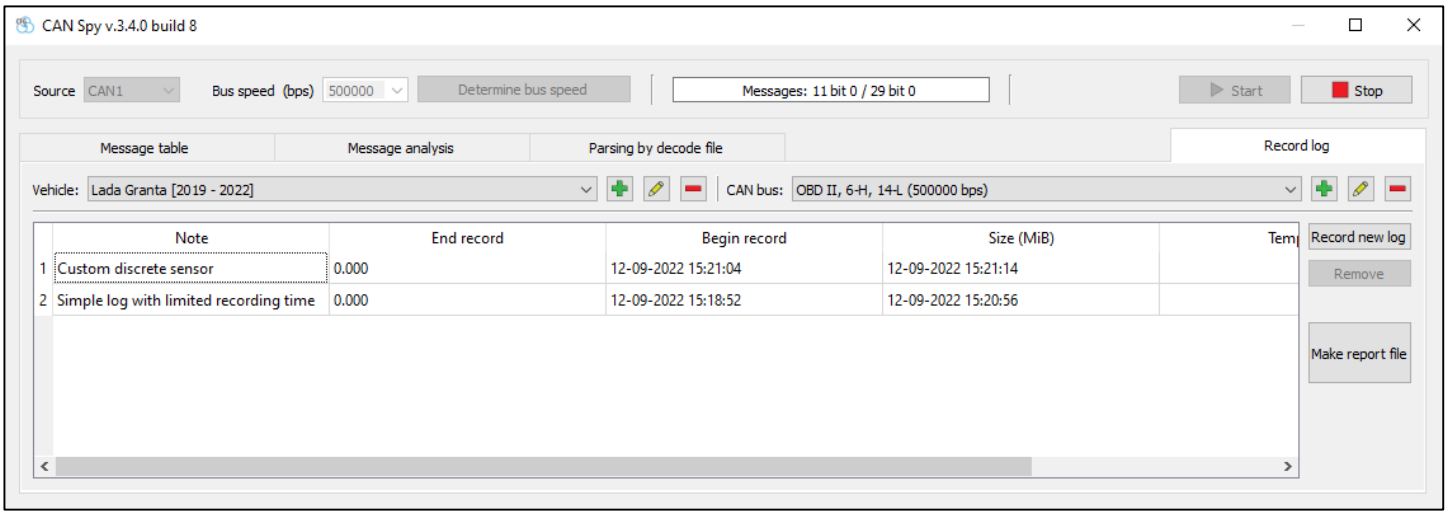
This template is recommended for logging with long-term value changes.

By default, the log for this template is written for 5 minutes. If necessary, you can change the duration with the *Log recording duration* parameter. You can also add a description of the conditions and features when writing a log in the *Note* field.

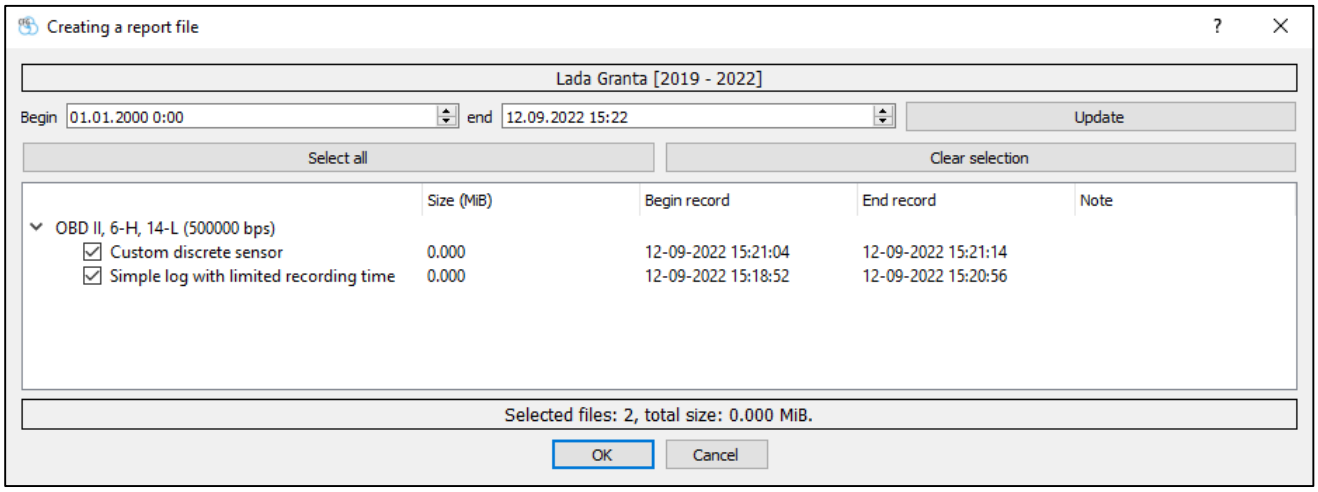


2.4.5 Saving CAN bus logs

When sending CAN bus logs to the technical support service of Navtelecom LLC, it is necessary to create an archive with the necessary logs for the selected vehicle. This archive is generated automatically when you click the ***Generate report file*** button.



In the window that appears, you can select the log files that will be included in the archive.



Logs and archives of report files are saved by default on the computer in the folder can-logger C:\Users\Public\NAVTELECOM\NTC Configurator v3\ Data \ can-logger

Archives of report files must be sent to support@navtelecom.ru
The subject of the email, for example, *"CAN logs. Lada Granta 2022.*
The content of the email should describe the reason for sending the log:

- error parsing parameters *(which parameters?)*;
- required parameters are not available in the existing decoding file *(what parameters are needed?)*;
- there is no decoding file for the required vehicle;

The more useful information there is in the description of the log, the easier it is to return to its re-analysis later.