NAVTELECOM
TELEMATICS SYSTEMS

GPS/GLONASS TRACKING EQUIPMENT

SIGNAL S-2651

Operations manual

Installation and connection of the device

MOSCOW
2020

Dear customer!

This Operations manual provides information about main issues relating to the functioning, installation, and operation of the device.

Customers are strongly advised to study this document carefully before the installation and operation of the device.

Navtelecom LLC is interested in constantly improvement of the manufactured products quality.

Please, contact our technical support by email address: support@navtelecom.ru should you have any questions or problems with the device.

It is possible to download software, documentation and get detailed information on the manufacturer's website https://navtelecom.ru.en

We thank you for purchasing of our product! We are sure that if operation of the equipment is correct, it will reliably serve you for a long time.

CONTENTS

1. BASIC CHARACTERISTICS

1.1 Purpose of the system

The equipment is a GPS-GSM Based Vehicle Tracking System. It is allowed to use the following terms in relation to this device: "system", "product", "equipment", "device" "terminal", "tracker".

The system is designed for:

- vehicle monitoring: its location, track, mileage, fuel consumption, engine hours;
- driving style determination (EcoDriving);
- crush event fixation in accordance with acceleration thresholds or Addiction Severity Index (ASI);
- emergency informing about vehicle hijacking;
- emergency informing about attacks on the driver or passengers and other accidents;
- processing and transmitting of data to the server from devices such as tachograph, tire pressure monitoring system, CAN bus adapter, refrigerator controller, RFID tag reader;
- monitoring the temperature using temperature sensors;
- remote control of connected devices and vehicle systems, such as a siren, engine and door lock system, etc.

Recipients of information from the system can be:

- centralized dispatch centers;
- end-users (corporate and private car owners, proxy persons, etc.)

1.2 System tasks

The system operation consists of the following tasks:

- telemetering record of vehicle location, speed, direction and mileage according to the GPS/GLONASS satellite information;
- telemetering record from the contact, impulse, analog connected sensors and CAN bus; monitoring of vehicle battery voltage and device built-in battery voltage;
- fuel consumption, drains and fills monitoring; mileage monitoring; stoppage time and off-track monitoring; places of cargo loading/unloading monitoring;
- events data record to the nonvolatile memory, possibility of its remote reading and analyzing;
- sustained or specified time period transmission of information about current and past events on the vehicle via GPRS-channel to the telematics server for further analyzing, visualization and report formation;
- customer SMS informing on sensors activation;
- connected external devices control (for example, siren on/off) by SMS command or by preset settings in automatic mode;
- control of cargo safety by comprehensive measures; improving driver and passenger's safety.

1.3 Operational principles

The device during its operation continuously monitors the status of the connected sensors, vehicle battery voltage, built-in device battery voltage, GSM modem signal level, operational capability of navigational sensor (GPS/GLONASS), etc.

At power-up or USB connection to a computer the device automatically turns on. At power-off or USB disconnection the device continues its operation from built-in battery. The device turns off when the built-in battery is discharged to 3V.

Upon the occurrence of an event set by the device logic (set by the user or device manufacturer), the telematics information is recorded into nonvolatile memory and is sent to tracking platform as a message with a set of parameters. Events for messages formation can be change of direction, timer activation in motion or in stand, activation of input sensor, value changes of analog or digital sensor, etc. Each message is recorded with its sequence number and has its own code that determines the reason for its formation. When sending message packets after reconnecting to tracking platform, the earlier messages are sent first. Some messages generated by "alarm" events (pressing the panic button, impact sensor detection, etc.) are sent out of turn, immediately after the "alarm" event has happened. After message packet sending to the server, the device is waiting for server answering. If there is no answering from the server, the device will try to send message again until it receives answering about data transferred, in this case the next packets from the queue will not be sent. This algorithm set in the data transfer protocol ensures reliable sending of all messages to the server, even in case of data transmitting failure.

The device operation parameters are configured using proprietary software, the NTC Configurator program. For proper software operation there is a requirement for a computer with MS Windows 7 or higher operating system.

It is also possible to perform basic settings via Bluetooth, USB, GSM channels using the NTC Control program - a mobile application for smartphones and tablets running the Android operating system.

1.4 Basic technical characteristics

Tab 1

	S-2651(M)
GSM/GPRS/Bluetooth	
3G modem	no
GSM frequency bands	GSM 850, EGSM 900, DCS 1800, PCS 1900
IP-stack protocols	TCP, UDP
Transmitter power	Class 4 (2W) in GSM 850 and EGSM 900; Class 1 (1W) in DCS 1800 and PCS 1900
Maximum speed of data transfer/reception, kbit/s	85,6
SIM card holder 1	external with ejector (Molex), miniSIM
SIM card holder 2	internal, nanoSIM
SIM chip[1]	2
GSM-signal jammer detector	yes
Bluetooth	yes, v 4.0
GNSS	
Supported navigation systems	GLONASS/GPS/Beidou
Number of channels	tracking: 33, picking-up: 99
Sensitivity (in laboratory conditions)	tracking: -165 dBm cold start: -148 dBm
Time of first coordinates determination (for GPS and GLONASS systems with a signal of -130 dBm)	cold start: <35 sec warm start: 30 sec hot start: <1 sec
Coordinates error, (50% CEP, 24 hours in static mode, with signal levels -130 dBm), m	2.5 (in plan), 5 (in height)
Speed determination error is less than, m/s	0,1
Coordinate update rate, Hz	1
Power supply	
Operation supply voltage, V[2]	9,5…47
High voltage pulsation protection and prolonged overvoltage up to 200V	yes
Current consumption at 12 V voltage in operation mode on average[3], mA	80
Current consumption at 12 V voltage with turned off GLONASS and GSM modules is no more than, mA	30
Maximum current consumption at 12 V voltage in the operation with the charge of the battery is not more than, mA	200
Protection against polarity reversal with the connection to the exterior supply source	yes
Battery[4]	Li-Po 3,7 V, at least 800 mAh
Battery protection from recharge, full discharge, short circuit[5]	yes
Maximum operating time of the device from the fully charged battery (without external power) is at least, h	5
Time of full charge of the battery is not more than, h	6
Backup battery of the RTC clock and the navigation module	yes
Time of keeping of the RTC clock rate and ephemeris in a navigation module (with the power off and discharging of the battery) is at least, days	5
Battery charging from USB	yes
Inputs	
Inputs protection against power surges, V	Up to 200
Total number of universal (analog, discrete, pulse-frequency) inputs	6

Number of pulse-frequency inputs used for frequency fuel level sensors connection or for rectangular pulses calculation	Up to 6 (as a part of universal)
Working range with frequency fuel level sensors, Hz	1 – 3000
Number of analog inputs, configured as discrete	Up to 6 (as a part of universal)
Measuring range by inputs, set up as analog, V	0…31
Built-in pull-up resistor for discrete inputs	yes
Outputs	
Number of outputs of the "open collector" type for the external devices control	4
Maximum switching current by the control outputs, mA	500
Maximum switching voltage by the control outputs, V	48
Interfaces	
USB interface for configuartion, device control, data transfer and diagnostics	yes
Digital interface RS-485	yes
Digital interface RS-232	yes
CAN digital interface	1
1-Wire interface	yes
Device memory	
Volume of non-volatile memory, Mb	8
Number of records in non-volatile memory (by type of ring buffer) with telematics record package less 127 bytes	Up to 51700
Data recording period in the internal storage device, s	1 — 3600 And/or upon the event
MicroSD-card support with the memory up to 32 Gb	yes
Function of telemetry record to microSD-card	yes
Telemetry records number on microSD-card	no less than 2 000 000 per 1 Gb
Accelerometer	
Accelerometer with built-in configured shock sensors, displacement and tilt sensors	yes
Measured acceleration range, g	+/-24
Acceleration errors in the range of +/-24g less than %	0,5
Accelerometer calibration using information from the GLONASS/GPS module in normal vehicle motion	yes
Configuration and management	
USB interface for configuration, control and data transfer	yes
Device configuration with the NTC Configurator	yes
Firmware updating and settings changing by GPRS channel	yes
Automatic firmware update function	yes
Possibility to change settings by SMS	yes
Possibility of tone control and GPRS, SMS and DTMF control	yes
Data transfer	
Data transferring by GSM by SMS, GPRS	yes
Optional selection of transmitted parameters to save traffic	yes
Sending information in roaming about the current state of the specified timers in motion and in stand, with the subsequent unloading of all the accumulated data in the home network	yes
Configuration of the priority operators list in roaming	yes
Operator settings automatic detection based on SIM card registration in a GSM network	yes
EGTS protocol support	yes
FLEX and FLEX 2.0 protocols support	yes

FLEX 3.0 protocol support	yes
Number of servers (IP addresses) for synchronous receiving of telemetric data	3
Sending telemetry data to the server repeatedly by SMS or GPRS request for the period	yes
Output of user and debug logs from GSM modem, GPS receiver and interfaces	yes
Data transferring in TCP and UDP	yes
The number of subscribers for SMS-alert	5
Functionality	
EcoDriving function	yes
Vehicle evacuation tracking	yes
Crush event determination in accordance with acceleration thresholds or Addiction Severity Index (ASI)	yes
Formation and sending accident profile file to the server	yes
Immobilizer function using driver identification system by Proximity cards and 1-Wire interface	yes
Programmable power-saving mode with the ability to disable GLONASS/GPS and GSM-modules	yes
Device operation on the timer or by the calendar	yes
Security mode	yes
GSM-signal jammer detector	yes
GNSS jammer detector	yes
SMS sending according to speeding event	yes
Determination of engine operation and engine hours calculation by the voltage in the vehicle electrical system	yes
Sensors selection for engine hours calculation	yes
Tachometer function with engine speed calculation	yes
Providing LBS information from three nearest towers cell towers	yes
Data encryption according to the AES128 standard in data transfer	yes
Real mileage measurement algorithm with the terrain features	yes
Sensors selection for coordinate averaging	yes
Configuration of data averaging over all inputs for fuel level sensors	yes
Ability to stop operation of fuel sensors under specified conditions (lowering the supply voltage below the threshold, turning off the ignition, turning off the engine)	yes
Configuration of outputs operation (continuous, single, periodic)	yes
Digital fuel level sensors connection by RS-232 interface	yes
The maximum number of connected digital fuel level sensors by RS-485 interface	16
Ability to calibrate LLS fuel level sensors in the device	yes
Synchronic operation of fuel level sensors (LLS) and tachographs (Shtrih, Mercuriy, Atol) on RS-485	yes
MODBUS RTU protocol support	yes
Operation with RFID-tags readers "Escort" ("Radius"), "ADM20", "Mielta" and LLS-compatible	yes
NMEA string output from the navigation module by RS-485 interface	yes
CAN interface with J1939 standard	yes
Support of CAN protocols other than J1939 by decoding files	yes
Parsing CAN parameters by user settings	yes
Operation with CAN buses of J1708 standard via RS-485 interface	yes
CAN-LOG and CAN-FMS adapters support	yes
DTA-CAN CAN adapter support	yes
Connection a Bluetooth headset for two-way communication with the driver	yes

Bluetooth connection for up to 4 wireless fuel level sensor (ESCORT TD-BLE, TECHNOTON DUT-E, GL-TV)	yes
Bluetooth connection for up to 4 wireless temperature and humidity sensors (ADM31, ESCORT TL-BLE)	yes
Bluetooth connection for ADM32 wireless tilt angel sensors	yes
Bluetooth connection for TECHNOTON GNOM DDE wireless axle load sensors	yes
Bluetooth connection for TECHNOTON DFM wireless fuel level sensor	yes
Bluetooth connection for ELM327 diagnostic adapter	yes
Transparent mode[7]	yes
Unloading of ddd-files from «Shtrikh», «Mercuriy», «VDO Continental», «Atol»[8] tachographs	yes
Events sending on tachograph state change	yes
Driver display DV-01 support	yes
Text messages display received from the server or by SMS on DV-01 driver display	yes
Built-in "Autoinformer" function	yes
Support of route sign boards "ITLINE" and "Integral"	yes
Display of information about current route, current and next stop on the DV-01 driver display when the "Autoinformer" function is on	yes
Monitoring compliance with speed limits by geofences	yes
Display of information about set speed limit and overspeed warnings on the DV-01 driver display	yes
Display of information about the fuel level in liters from 4 LLS fuel level sensors on the DV-01 driver display	yes
Connection of passenger flow meters "PP-01" and "Avtokonduktor"	yes
Camera connection support, sending pictures to the server upon the request	yes
Using of information from tire pressure sensors "Pressure Pro", "TPMS 6-13" (from "Parkmaster"), "B-Tag" (from "Bridgestone"), TM508T22U and "TD 18, 20, 21"	yes
Operating with breathalyzer "Alcogran AM-525"	yes
Interface for connection of digital temperature sensors	1-Wire
The maximum number of connected digital temperature sensors by 1-Wire	8
Events formation about reduce/increase of temperature	yes
Reading TouchMemory key codes and drivers identifying by 1-Wire	yes
The maximum number of TouchMemory key codes stored in the device memory without SD-card	510
Connection of microphone and loudspeaker to establish a speakerphone with a driver and microphone listening	yes
Resistance and power of the connected loudspeaker	4 ohm – from 1,5 up to 5 watts 8 ohm – from 1,0 up to 3 watts
Connection to buzzer output line for notification of an incoming call	yes
Performance specifications	
Storage temperature with the battery[9], °C	0 … +40
Storage temperature without the battery[9], °C	-40 … +85
Operating temperature with the battery[10], °C	-20 … +60
Operating temperature without the battery[10], °C	-40 … +85
Temperature at which the battery is possible to charge, °C	0 … +50
Maximum allowable humidity level at 35 °C, %	95
Maximum allowable overload during impacts, g	24
Design features of the device	
External GLONASS/GPS and GSM antennas	yes
Plug for connection to the computer	miniUSB

Connectors for GLONASS /GPS and GSM antennas	SMA
Interface connectors	Microfit-14, Microfit-6, Microfit-4
Enclosure material	ABS plastic
Enclosure protection level	IP54
Intrusion detector	yes (only in S-2651M)
Device dimensions with connectors, mm	105x78x20,5
Device weight, kg	0,087

[1] - Optional.
[2] - If maximum operating voltage is exceeded the power protection is activated. The device continues to work, but is powered by the battery (if available).
[3] - If GPRS operates in poor communications, peak consumption (10 ms), consumption of the device can accede 500 mA.
[4] - Attention! Lithium polymer battery (Li-Po) is used in the device. The following rules must be observed during its operation: not to heat, keep away from sources of heat, not to throw the battery into the fire, not to expose to direct sunlight. The device, for power of which Li-Po battery is used, cannot be used in high humidity, high and low ambient temperatures. Operation is permitted under the conditions specified by the manufacturer. Not to hit, not to deform, not to disassemble, not to close contacts.
[5] - Protection against battery charge while it is overcooled or overheated.
[6] - Only when using the RS-232/RS-485 interface converter.
[7] - To connect the SIGNAL devices to the ATOL Drive 5 tachographs, an UART / RS-232 converter is additionally required.
[8] - A mode in which information received via the RS-232 and RS-485 interfaces is not processed by the device, but is buffered and transmitted to the server as is.
[9] - When the device is stored and used outside the specified temperatures, it is recommended to turn it off and remove the battery from the device to avoid damage to the battery and to the device.
[10] - If the device is operating outside the specified temperatures, irreversible change in the properties of the Li-Po battery, a decrease in capacity, current output can occur.

1.5 Appearance of the device

On the front part of the device unit (figure 1) is located:

- 14-pin connector of Microfit-14 type for connection of power supply, digital and analog sensors and control lines.
- 6-pin connector of Microfit-6 type with leads of CAN bus interface, RS-485 interface and RS-232 interface;
- 4-pin connector of Microfit-4 type for connection of 2-way speakerphone interface;
- SMA connector for connecting a GSM antenna (on the left);
- SMA connector for GLONASS / GPS antenna connection (on the right).

On the side of the device unit (figure 2) is located:

- MiniUSB connector for connection with a computer;
- SIM card holder slot with ejector (yellow button).

In the upper part of the device unit (figure 3) there are three indicators:

- system indicator (SYS)
- modem operation indicator (GSM);
- navigation receiver indicator (NAV).

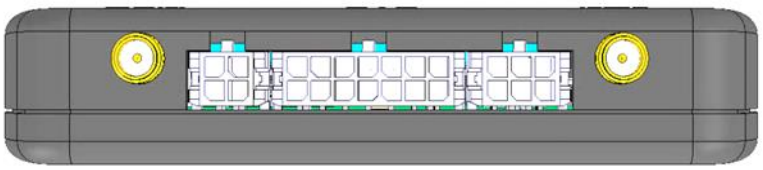

Figure 1. Device unit (front view).

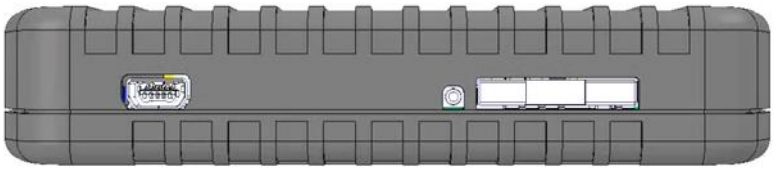

Figure 2. Device unit (side view).

Figure 3. Device unit (top view).

1.6 Standard equipment set

Tab. 2

№	Name	Number of pieces	Version of complete set	
			A	B
1	SIGNAL device unit	1	+	+
2	GLONASS/GPS-antenna	1	+	+
3	GSM-antenna	1	+	+
4	Fuse 1 A	2	+	+
5	Fuse holder	1	+	+
6	14-pin connector of Microfit-14 with two power wires	1	+	+
7	6-contact connector of Microfit-6 type	1	+	+
8	4-contact connector of Microfit-4 type	1	+	+
9	Cable set of 10 installation wires	1	+	+
10	Passport	1	+	+
11	Interface cable with MiniUSB connector	1	+	
12	Package	1	+	

Figure 4. GLONASS/GPS-antenna

Figure 5. GSM-antenna

Figure 6. Fuse and fuse holder

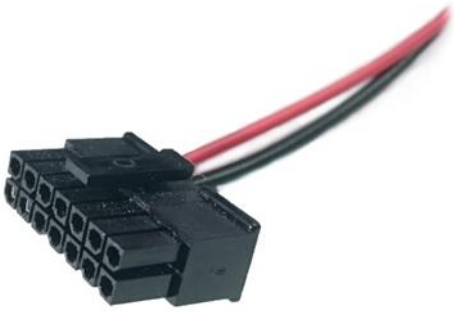

Figure 7. 14-pin connector of Microfit-14 type with power supply wires

Figure 8. 6-pin connector of Microfit-6 type

Figure 9. 4-pin connector of Microfit-4 type

Figure 10. Interface cable with MiniUSB connector

Some cases may require connection of additional equipment not included in the standard equipment set, for example:

- fuel level sensor;
- tachograph;
- external LED;
- temperature sensor;
- tangent G-2500
- TouchMemory contact key reader.

Figure 11. Fuel level sensor

Figure 12. Tachograph

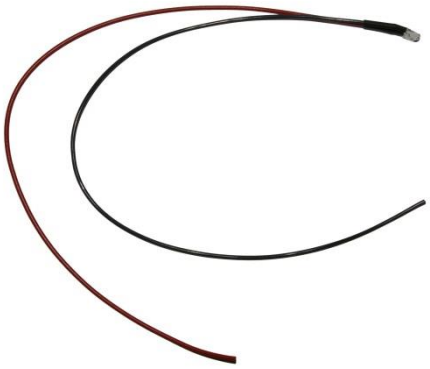

Figure 13. External LED

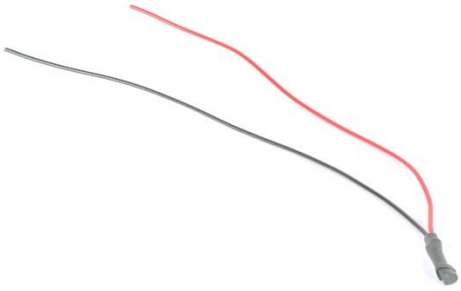

Figure 14. Temperature sensor

Figure 15. Tangent G-2500

Figure 16. TouchMemory contact key reader

The manufacturer reserves the right to complete the devices with equipment whose set, appearance and characteristics differ from those shown in the pictures.

1.7. Device components

The device consists of the following elements (see Figure 17-20):

1) front cover;
2) GSM LED indicator;
3) system LED indicator;
4) GLONASS / GPS LED indicator;
5) GSM antenna connector;
6) GLONASS/GPS antenna connector;
7) fixing hole;
8) 4-pin connector;
9) 14 pin connector;
10) 6-pin connector;
11) MiniUSB connector;
12) SIM-card 1 ejector holder;
13) SIM-card holder 1 (external);
14) back cover;
15) fixing screw of the back cover - 4 pcs.

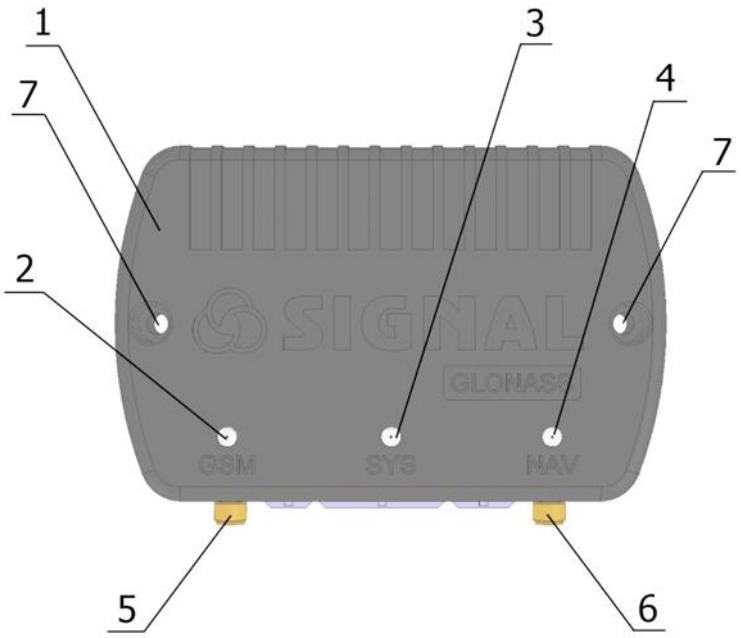

Figure 17

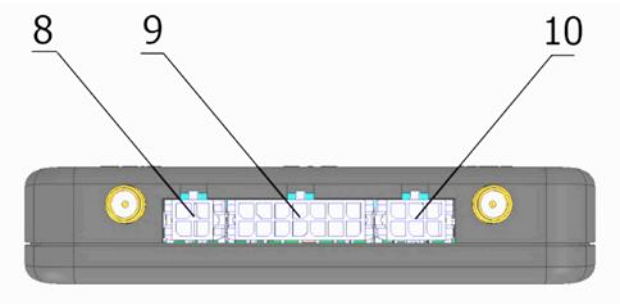

Figure 18

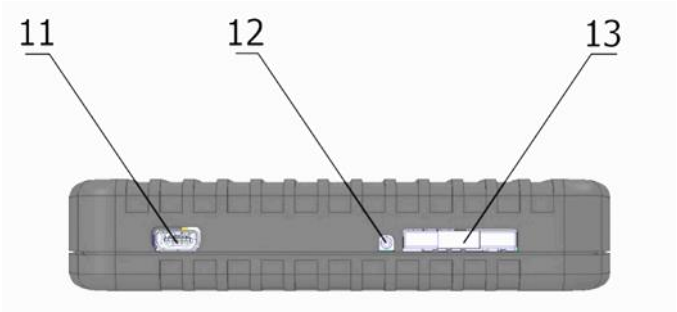

Figure 19

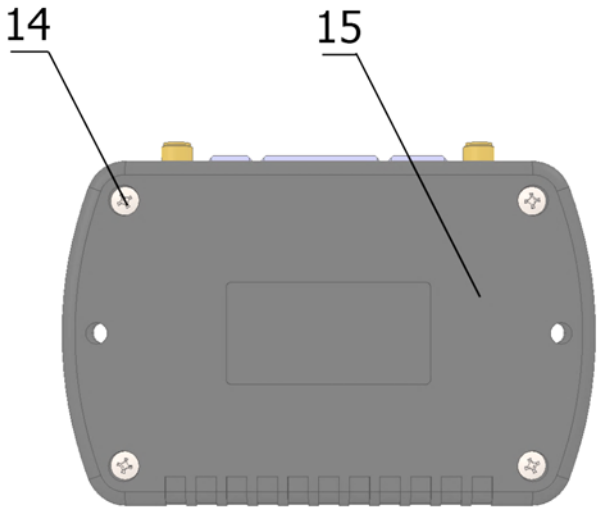

Figure 20

1.8 Device interface connector

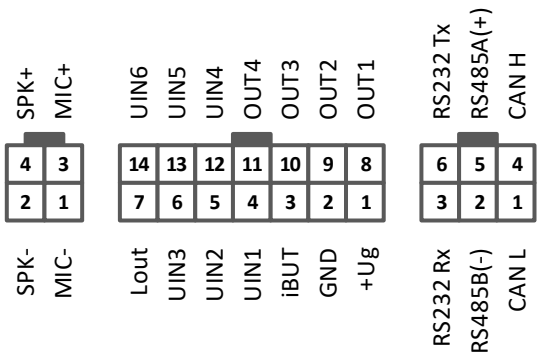

Figure 21. System connectors Microfit-14, Microfit-6, Microfit-4

Microfit-14 connector:
1 - Power "Plus" (+ U_G)
2 – "Ground" (GND)
3 - 1-Wire Interface Line (iBUT)
4 - Universal input 1 (UIN1)
5 - Universal input 2 (UIN2)
6 - Universal input 3 (UIN3)
7 – Linear audio signal output of the "Autoinformer" function (LOUT).
8 – Output 1 "open collector" (OUT1)
9 – Output 2 "open collector" (OUT2)
10 - Output 3 "open collector" (OUT3)
11 - Output 4 "open collector" (OUT4)
12 - Universal input 4 (UIN4)
13 - Universal input 5 (UIN5)
14 - Universal input 6 (UIN6)

"Plus" of the main power supple $+U_6$ should be connected via an external fuse.

"Ground" GND is connected to the "ground" of the car.

The universal inputs UIN1 - UIN6 can be set up as discrete, analog, counting or frequency. It allows to connect to them a wide range of different sensors, for example, frequency (frequency from 1 Hz to 2000 Hz) and analog (voltage from 0 V to 31 V) FLS, impulse fuel consumption sensors (DRL), buttons or switches.

Attention!
It is prohibited to apply a voltage more than 50 V to the device universal inputs, because it may lead to the failure of the device.

Linear audio signal output L_{OUT} is designed to connect a low-frequency amplifier with a minimum input voltage of 0.5 - 0.7V to implement the "Autoinformer" function.

Attention!
To avoid interference, the GSM antenna of the device should be located as far as possible from the input connector of the device, amplifier, speaker and from the wires connecting them.

Outputs OUT1-OUT4 «open collector» type are designed to control low-current loads up to 500 mA. When activated, a negative signal ("Ground") is formed on these lines. Connection of external executive devices with a load current higher than the maximum allowed should be made using additional switching relays. The relay type is selected based on the requirements for the value of the switched current, voltage, and also depending on the power of the connected device.

The interface line **1-Wire (iBUT)** is used to connect the contact pads of TouchMemory keys, Proximity-card readers and digital heat-sensing device.

Microfit-6 connector

1 - CAN interface line (CANL)
2 - RS-485 interface line (RS-485B (-))
3 - RS-232 Interface Line (RS-232RX)
4 - CAN interface line (CANL)
5 - RS-485 interface line (RS-485A (+))
6 - RS-232 Interface Line (RS-232TX)

The digital interface RS-232 is designed for a connection of various devices transmitting and receiving information on this interface for example, a fuel level sensor, CAN bus adapter, tachographs, RFID, MODBUS devices, etc.

The digital interface RS-485 is designed for connection of various devices transmitting and receiving information on this interface, for example, fuel level sensors (up to 16 pcs.), CAN bus adapter, tachographs, RFID, MODBUS devices, etc.

CAN interface is used for direct connection to CAN bus, tachograph or sensor.

Microfit-4 connector

1 - Microphone negative contact (MIC-)
2 - Negative speaker contact (SPK-)
3 - Microphone positive contact (MIC +)
4 - Positive contact of the speaker (SPK +)

Attention!

Observe the polarity when connecting the microphone.

2. DEVICE CONNECTION

2.1 Installation

Before the system installation, first of all, it is necessary to determine the type and number of the connecting sensors, the identification system and other additional equipment. It is also necessary to be sure that all the additional equipment connected to the terminal are operable.

Immediately before installing the system and connecting the equipment, also make sure that the cellular operator provides good communication quality in the intended location of the GSM antenna.

The navigation antenna should be installed in such a way as to ensure maximum "visibility" of navigation satellites in the upper hemisphere.

Attention!

In order to avoid overheating of the device and failure of the Li-Po battery, it is prohibited to install the tracker in places with an ambient temperature more than +60 ° C, for example, near heating systems, etc. It is also prohibited to place the device in a sealed container without heat dissipation.

It is prohibited to install tracker in places with high humidity and in places where there is a risk of possible ingress of liquid or large amount of dust into the case.

When the device is connected to the Microfit-14 connectors harnesses, the connectors themselves should not be connected to the device. Each pin of this connector has a numeric code. The purpose of each is shown in Figure 16

At the stage of checking the correctness of the connection and settings of the device, it is not recommended to directly include actuating devices in the output circuits. It is advisable to do this at the final stage of verification.

The power supply of digital and analogue fuel sensors must be connected through the fuses supplied with the sensors directly to the power supply.

The power supply "-" ("ground") of all connected external sensors must be combined with the power supply "-" (contact "G") of the device.

The interface lines of fuel sensors should be connected directly to the device without additional elements. Switches must be made with the power off.

Connection to the car CAN bus should be carried out with the car ignition off.

2.2 SIM-card installation and operation

The device supports using of two SIM-cards. The first SIM card (external) is the main by default, and its installation is carried out without the use of special tools. For installation of the second SIM-card (internal), it is necessary to remove the back panel of the device using a screwdriver.

After turning-on or rebooting, the device starts operation with the main SIM - card. In the settings, either an external or internal SIM card can be selected as the main one.

Switching to the second SIM-card occurs when registration on the first SIM-card is lost and there is no registration after the next GSM modem rebooting. Also switching to the second SIM-card occurs after a series of unsuccessful attempts to connect to the telematics server. When operating on a secondary SIM-card, a periodic availability check can be performed.

Figure 22. SIM-card installation to the device

Remove the SIM card holder from the device by pressing the yellow ejector button with a pen or a pencil. Place the SIM card in the holder with the gold contacts facing out. Carefully insert the holder along with the SIM card back into the device.

In order to install the second SIM card in the device, it is necessary to remove the back panel by unscrewing the four mounting screws

Attention!

If the SIM-card is locked with a PIN code, it is necessary to unlock it by inserting the SIM card into a mobile phone or specify the PIN-code of this card in the device settings in the "Data transmission" tab.

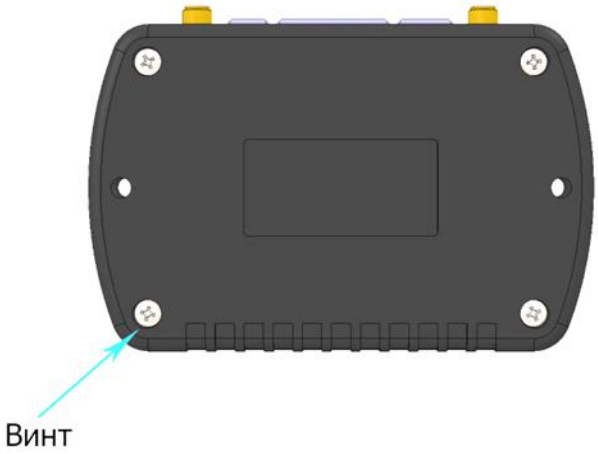

Figure 23. Removing the back panel of the device

The second slot is designed to install a nanoSIM type SIM-card. The SIM card is installed as shown in the picture, by the contacts on the board.

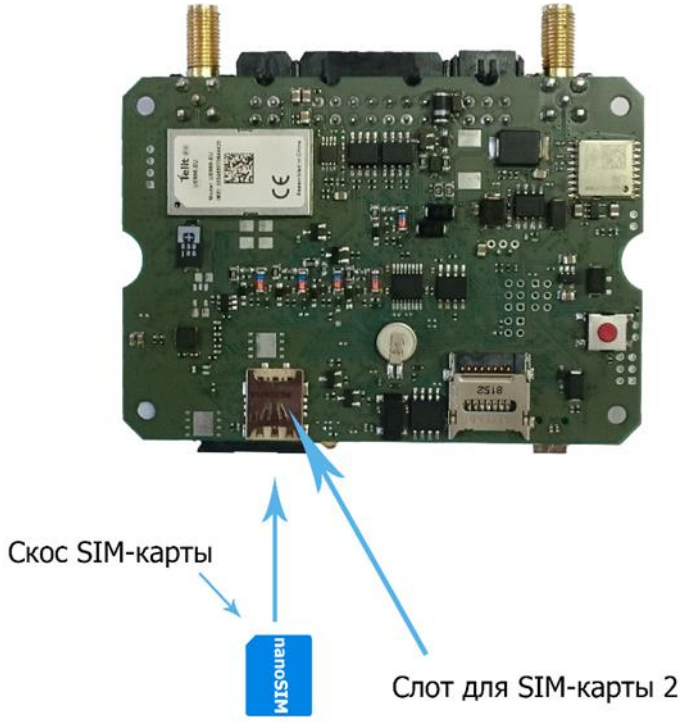

Figure 24. SIM-card installing in the second slot

Assemble the device body in reverse order.

The balance of funds on SIM-cards should be sufficient for the device to operate on GPRS.

2.3 GSM- and GLONASS/GPS antennas connection

Connect the GSM- and GLONASS/GPS antennas as shown in the figure. The GSM antenna connector is below the GSM LED and the GLONASS/GPS antenna connector is below the NAV LED.

Place the navigation antenna in a place that is most open for the view of the upper hemisphere (for the best "visibility" of satellites). GLONASS/GPS antenna has a magnet in its design. It should be installed on a flat metal base made of iron or steel. Additionally, after cleaning and degreasing the surface it is recommended to use double-sided tape. If it is impossible to install the GLONASS/GPS antenna on a metal surface, it can be mounted on a plastic one using double-sided tape.

The GSM antenna must be installed on a plastic surface in a place where reception of cellular signals is best ensured. The distance from the metal elements of the car structure must be at least 15 sm. To avoid interference during the speaker and autoinformer functions operation, the GSM antenna of the device must be located as far as possible from the input connector of the device, amplifier, speaker and from the wires connecting them.

The GSM antenna is fastened using an adhesive layer applied to one side of the antenna, on a flat cleaned and degreased surface, after removing the protective film.

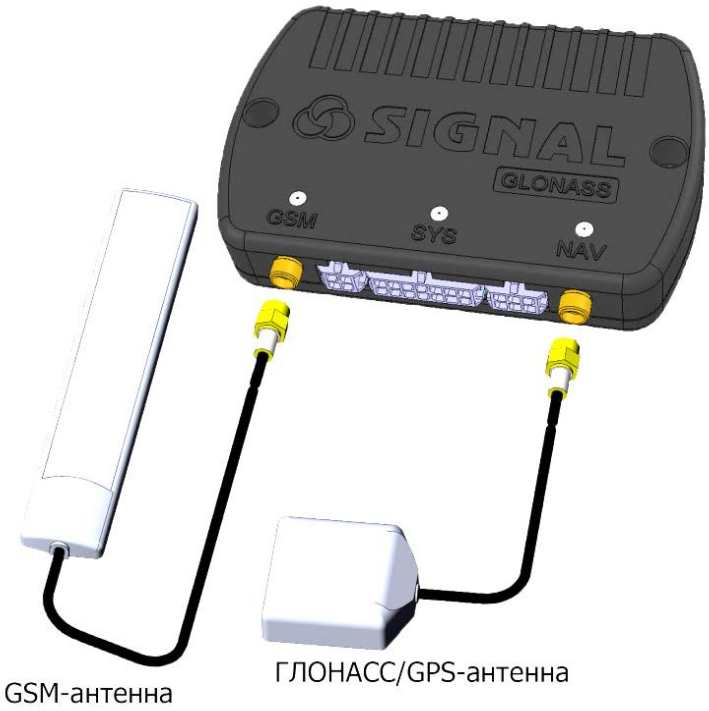

Figure 25. GSM- and GLONASS/GPS antennas connection

2.4 Power connection

The power supply of the system is carried out from the on-board network of the car, which should within the limits indicated in Table 1, in the section "Basic technical characteristics", or from the built-in rechargeable battery when the main power is disconnected.

When voltage surges, which is more than the specified ratings, occur, the built-in overvoltage protection system will operate in the device. It is strongly recommended to connect the device to the power supply through a 1 A fuse. During installation the power supply should be connected the last turn when all the other equipment is already connected. Connection of the power supply minus contact (GND) is carried out to the vehicle "ground".

Note:

On vehicles with disconnection of the "ground" in order to ensure uninterrupted operation, it is allowed to connect the device power supply to the "+" and "-" circuits of the vehicle battery. In this case, it is not allowed to connect any sensors, signal circuits or power supply circuits through which the device can be connected to the car body. Also, when the car is powered by the battery in which the "ground" is disconnected, sensors cannot be connected to the device, the "-" power supply of which is connected to the car body, without the use of galvanic isolation devices.

With an operation supply voltage and with the observance of the temperature mode of charging the built-in

battery (see the Table 1, in the section "Basic technical characteristics"), the built-in battery is constantly recharged through the circuit of the device.

When the system operates only from the built-in battery, the digital interfaces CAN and 1-Wire (IButton) do not function due to insufficient voltage. Power supply from the built-in battery is sufficient for operation of universal inputs, RS-232 and RS-485 interfaces, built-in accelerometer, GSM modem, GLONASS / GPS receiver and for the implementation of control outputs.

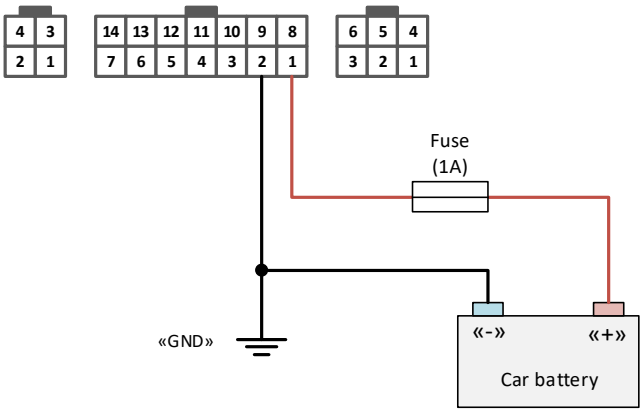

Figure 26. Power connection

2.5 Universal inputs connection

2.5.1 Analog sensors connection

The device allows to measure the voltage applied to the inputs in the range of 0 ... 31 V.

When connecting analog FLS or other sensors for which the output voltage has to be monitored, the voltage measurement profile must be set in the inputs setting. In this case, the function of adjustable averaging of measured values and the setting of the threshold level for fixing the voltage measurement event become available.

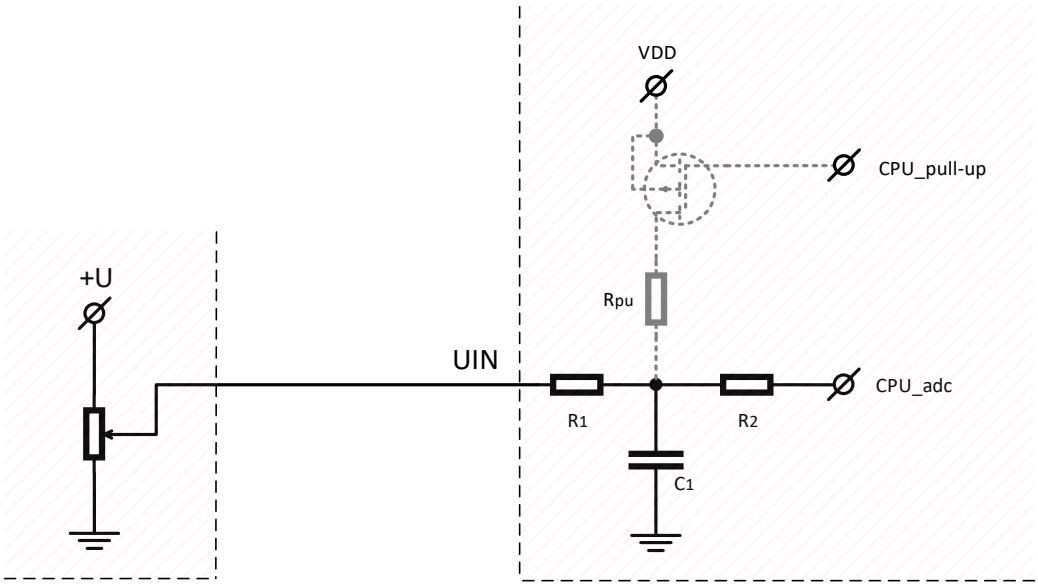

Figure 27. Connection of analog sensors

2.5.2 Discrete sensors connection

The device allows to connect any type of sensors that have two steady states: "on" ("activated") and "off" ("normal").

The voltage thresholds at which the device fixes the sensor on (activating) or off (switching to normal) depend on the line profile setting and the set levels on the voltage scale. In order to operate with discrete sensors, the

“Discrete NO +”, “Discrete NC +”, “Discrete NO-”, “Discrete NC-” profiles must be specified in the settings.

“Discrete N3 -”, “Discrete NO-” allow to operate with sensors which close the input to "ground" ("-" power) when they are turned on or off.

Note:

With these profiles voltage is applied to the input through the built-in pull-up resistor Rpu. This allows not to use an external "pull-up" resistor when operating with sensors which operates on "-" (by "ground").

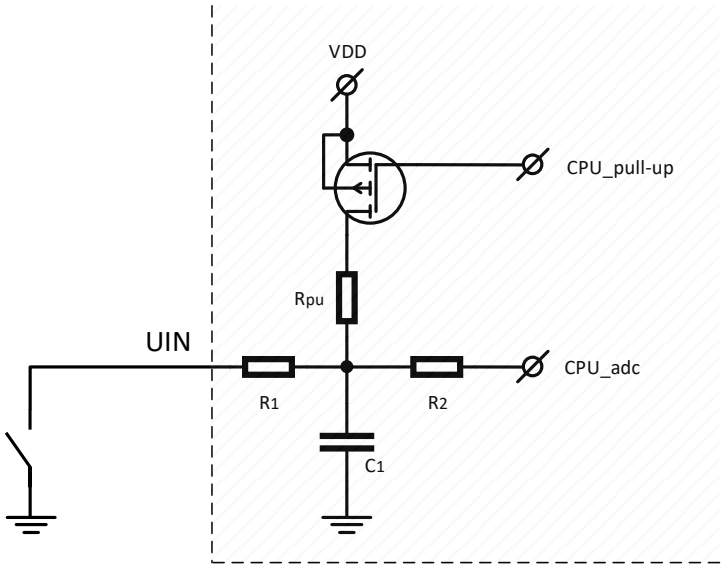

Figure 28. Connection of normally open (NO-) sensors

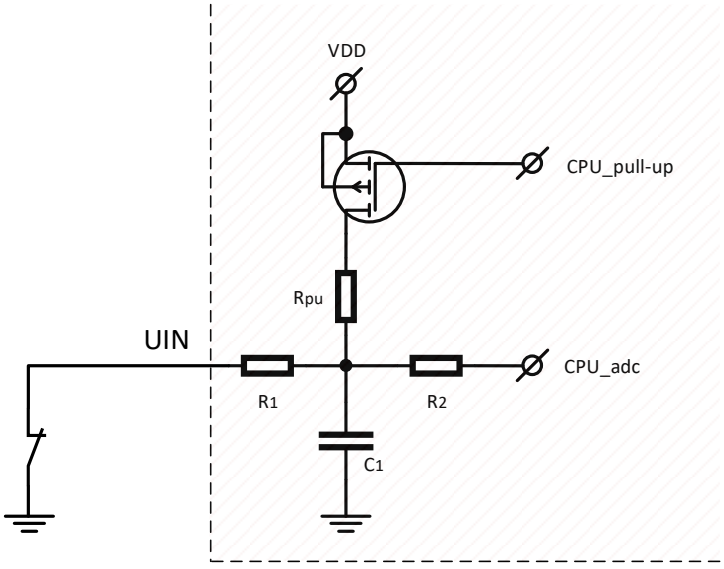

Figure 29. Connection of normally closed (NC-) sensors

Profiles "Discrete NC+" and "Discrete NO+" allow to work with sensors, which, when turned on or off, close the input to “+” supply voltage.

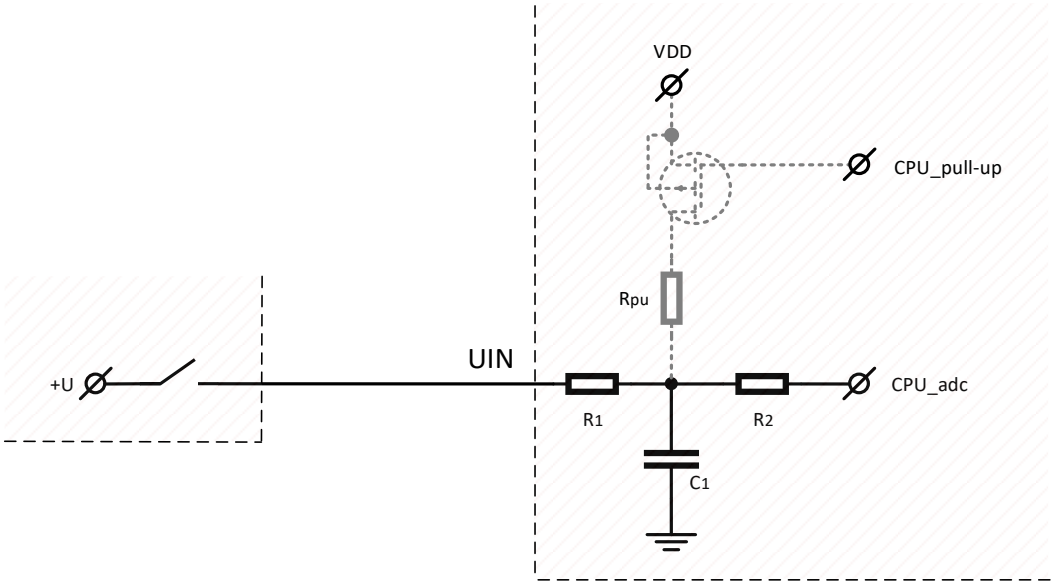

Figure 30. Connection of normally open (NO+) sensors

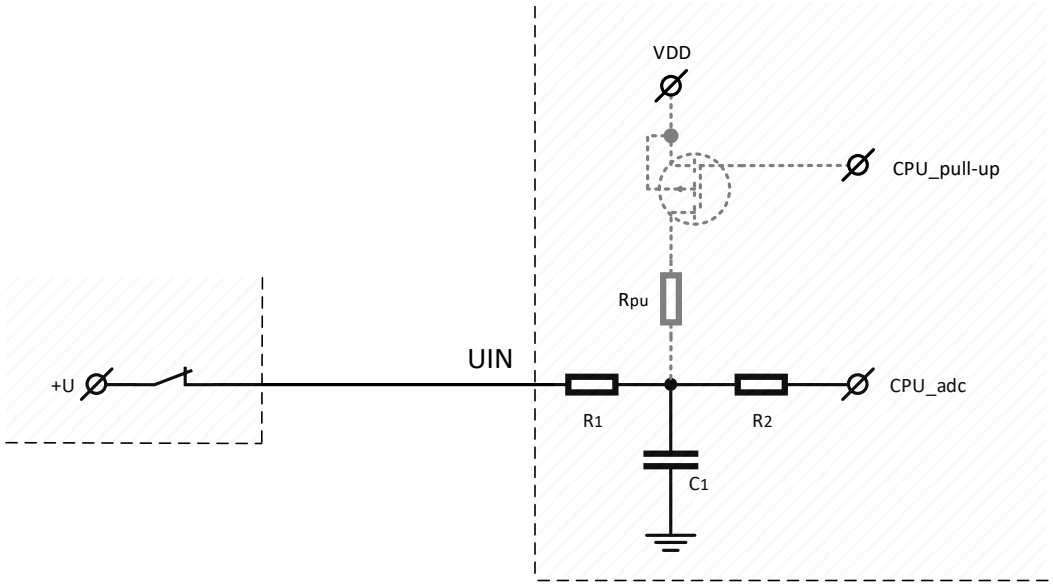

Figure 31. Connection of normally closed (NC+) sensors

Note:

*It is recommended to connect one of the universal input (usually **UIN1**) to the vehicle **ignition line** and make the appropriate setting in the configuration. However, such connection is not mandatory.*

In addition to the source of notifications about turning on and turning off events, the input is used in coordinate processing algorithms (for example, when they are averaged at parking lots), energy saving, when calculating engine hours and in some other device algorithms.

Any input which configured for operation with a discrete sensor can be used as an ignition.

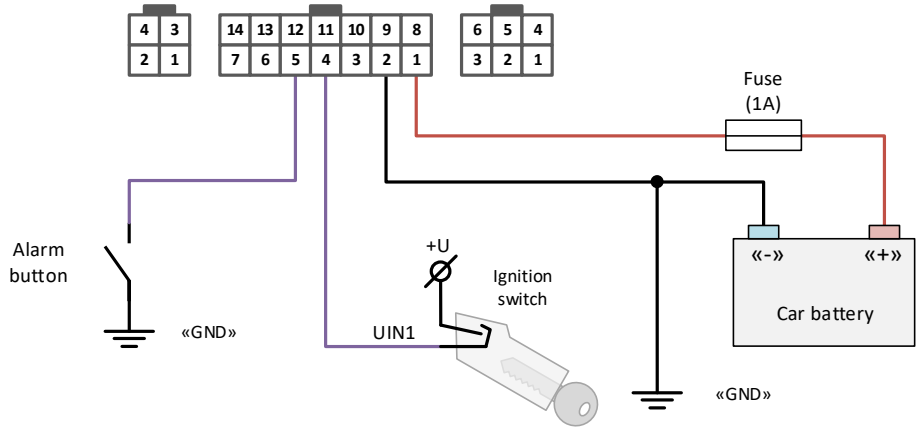

Figure 32. Connection of the ignition lock and alarm button

Digital inputs are configured in the "Input lines" tab of the NTC Configurator program.

2.5.3 Pulse frequency sensors connection

Connecting frequency or pulse sensors, it is necessary to consider how the output signal is generated in these sensors. Further setting of the input depends on this.

It is necessary to set the threshold level of fixation correctly, in order the device correctly determine the frequency or calculate the pulses.

Connecting pulse or frequency sensors, the output of which is implemented according to the "open collector" (OC) circuit with pull-up resistor, it is not necessary to turn on the Pull-UP circuit in the device by the setting.

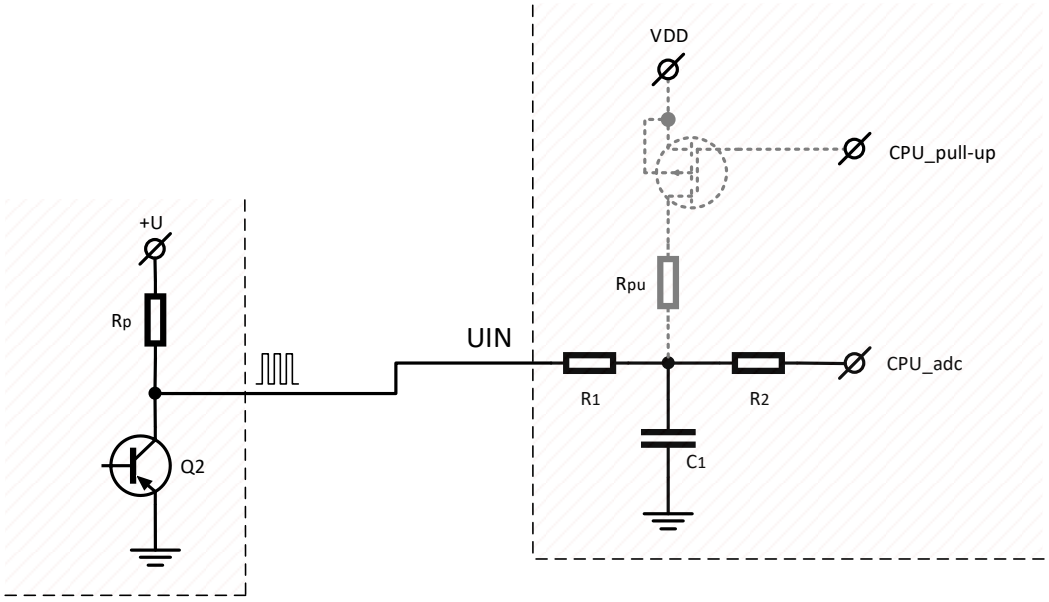

Figure 33. Connection of sensors with an "OC" type output circuit with a pull-up resistor in the sensor

When pulse flow meters with a reed sensor is connected, one contact of which is connected to the ground, it is necessary to include an internal pull-up resistor in the device setup.

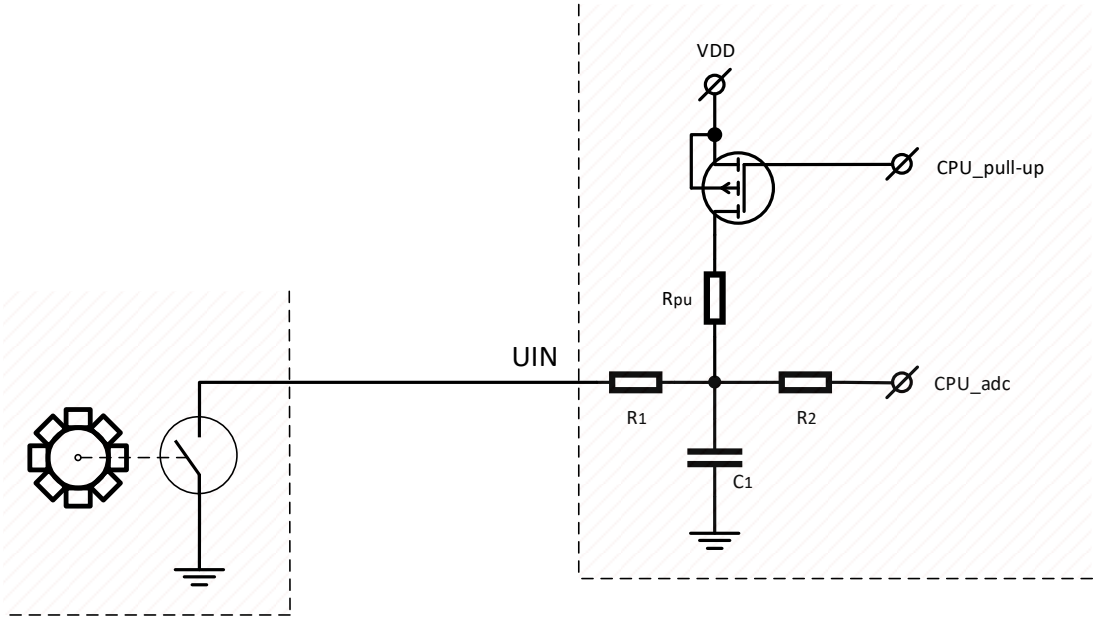

Figure 34. Connection of flow meters with a reed sensor

2.6 Built-in accelerometer

There are virtual sensors based on the built-in accelerometer (three-axis acceleration sensor): soft and strong impact sensors, displacement sensor and tilt sensor in the device. They can be used for alerts as well as external lines. Accelerometer is also involved in the coordinate averaging algorithm during stops, and the correct display of the track depends on its settings. In addition to virtual sensors, accelerometer is used for such functions as EcoDrivng and crush event fixation. For proper operation of these functions, the accelerometer must be calibrated after installing the device on the vehicle.

2.7 Control outputs connection

OUT1-OUT4 open collector outputs are designed to control low-current loads up to 500 mA. When the output is activated (turned on), it connects the external load to the "-" power supply (to the "ground").

The character of the controlling signal depending on the chosen mode can be permanent, signal or periodic.

Settings of the outputs are made in the "Output lines" tab of the NTC Configurator program.

One of the outputs can be used for control of sound signal emitting with help of the buzzer, for warning or EcoDriving function indication and for reminding about TM-key attaching (or RFID card).

Buzzers may be different in operating voltage, in the presence or absence of a built-in generator. A buzzer with a built-in generator can emit a sound signal independently when a constant supply voltage is applied.

In order buzzer operates without built-in generator, supply voltage modulation is required.

Buzzer without built-in generator can be connected only to OUT1, because only this line has opportunity to modulate the control signal for the buzzer.

Buzzer with built-in generator can be connected to any output. Connection diagrams for buzzer with build-in generator and for buzzer without build-in generator have no difference.

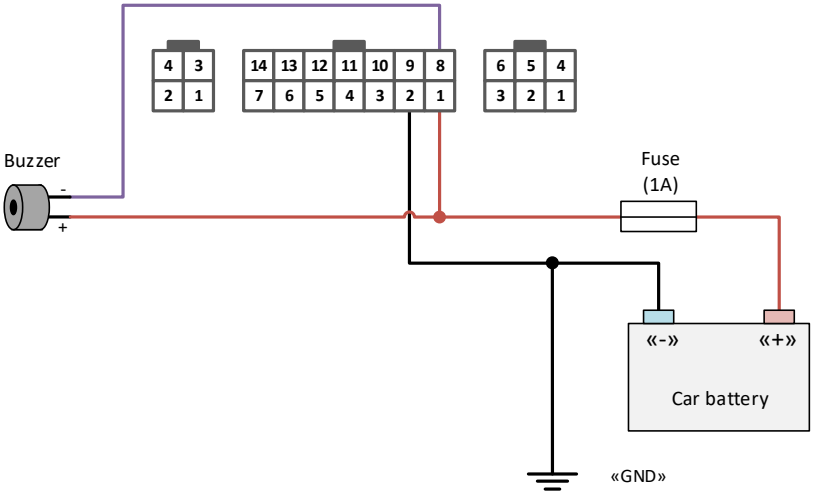

Figure 35. Connection diagram of buzzer

It is possible to connect LED for indication of device operation mode and security mode state.

If the power source is vehicle's on-board network, the LED must be connected through current-limiting resistor. Such resistor is already installed inside the lamp in the automotive LED lamps. It is only necessary to select the LED lamp under the desired voltage of the on-board vehicle network.

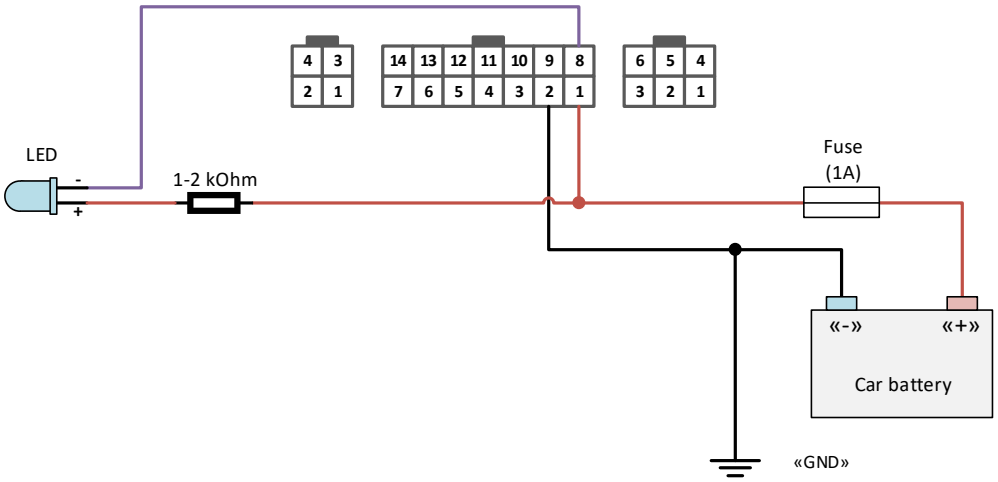

Figure 36. Connection diagram of LED

When security functions are used, it is possible to control the car siren. If the siren has a separate input, controlled by "-", then the output of the terminal can be connected to this input directly.

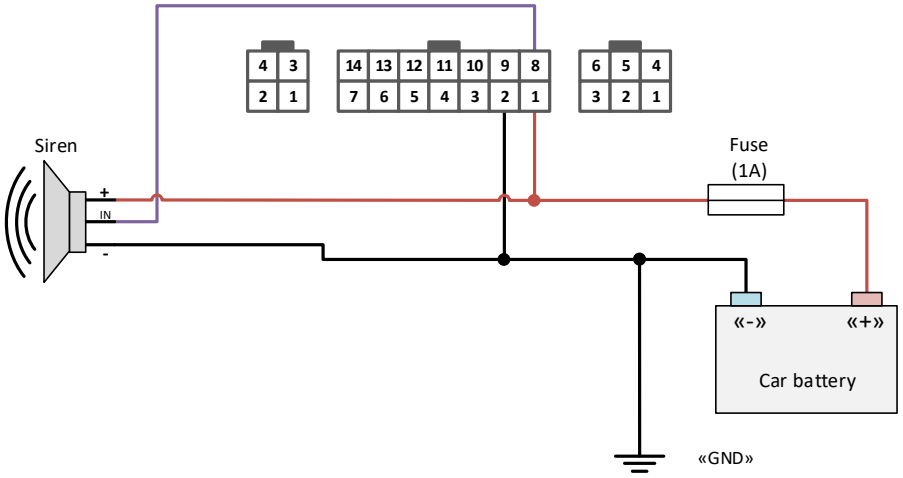

Figure 37. Connection diagram of car siren with input controlled by "-".

In order to connect car sirens without an additional control input, the inclusion of which is carried out by applying the supply voltage, it is necessary to use an additional relay, since the current consumed by such a siren may exceed the maximum allowable value for the output of the device.

The use of an additional relay is necessary for any load that can consume more than 500 mA.

There are relays with four and five contacts, but all relays have winding contacts (control contacts), these are 85 and 86 contacts (Figure 38). One of these contacts is connected to the "+" of the power supply, and the second to any negative control output of the device (contacts 8, 9, 10 and 11 of the Microfit-14 connector). All connections must be made through the fuse.

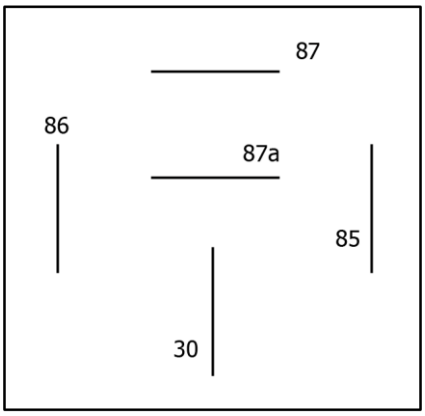

Figure 38. Designation of the external relay contacts

When voltage is applied to control contacts, relay is activated and closes or opens the electrical circuit with power contacts. Power contacts are always marked as 30, 87 and 87a. The 30th pin is always in the relay. Without applying voltage to the winding contacts, it is permanently closed to contact 87a. If a signal is applied to the winding, then the 30th contact is disconnected from 87a and connected to 87. 87a or 87 contacts may be absent, then the relay will only work to turn on or off (closing-opening) the power circuit.

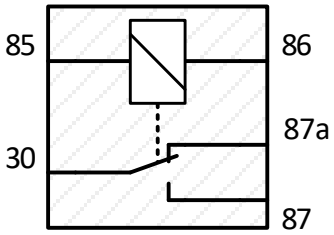

Figure 39. Five-contact relay diagram

Such relay can be used for example, when connecting an automotive electromechanical lock (Figure 40).

Attention!

When controlling the inductive load, which is the winding of the relay, reverse currents with a potential of more than 200 V can occur. Such a voltage can destroy the control transistor of the device output. To limit backflow emissions, it is necessary to connect an additional 1N4007 diode (1A, 1000V) in parallel to the relay coil, as indicated in figure 40

At the stage of correctness verification of the connection and settings of the device, it is not recommended to include actuators in the relay circuit directly. It is advisable to do this at the final stage of testing.

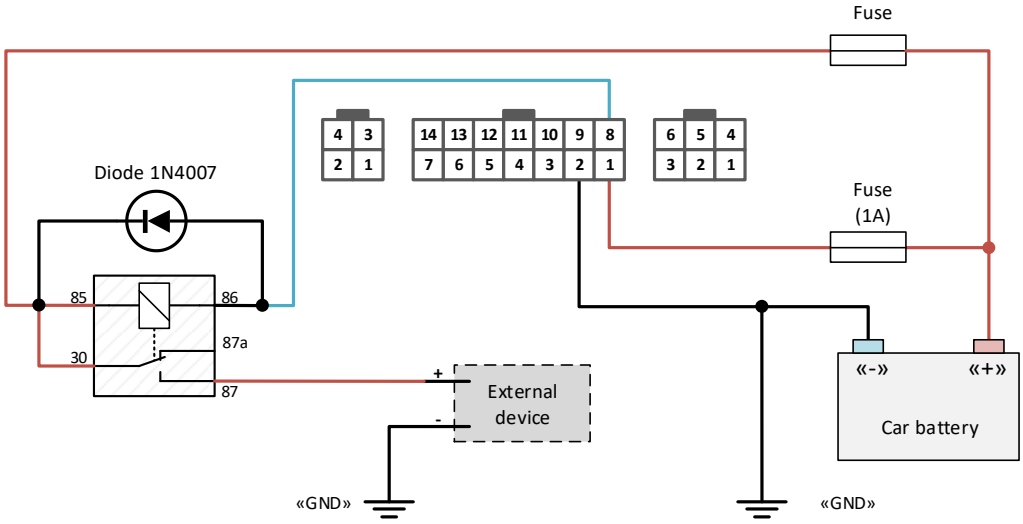

Figure 40. Connection diagram of the relay to the outputs of the device OUT1-OUT4

2.8 1-Wire informational interface (IButton) connection

1-Wire controller interface (IButton) allows to connect up to four digital sensors like DS18S20 (DS18B20) to the device, and it can also operate with DS1990 keys or key / card readers that emulate DS1990 keys via interface 1- Wire.

Each DS1990 key is a chip with a unique identification number stitched into it at the manufacturing plant by which the device identifies this sensor.

Saving the key codes in the device's memory allows to use identification when changing the security mode, activating the output with the profile set: "TM registered key indicator" and "TM key indicator", and also necessary for operation of the "Immobilizer" function.

The maximum number of stored keys - 510.

It is also allowed to connect external readers of contactless Proximity-cards and keyfobs that have TouchMemory DS1990A key emulation interface. However, such readers, as a rule, do not operate together with thermal sensors connected to the same physical interface.

Figure 41. TouchMemory System Key

Figure 42. TouchMemory key contact reader

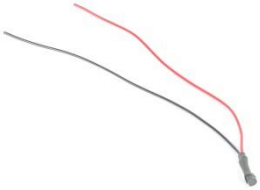

Figure 43. Temperature sensor based on DS18S20 chip

Figure 44. Appearance of Proximity-cards and keyfobs and possible variants of their readers

The terminal has the ability to connect temperature sensors to the 1-Wire interface using a two-wire circuit with "parasitic" power. Power is supplied through the same wire as the signal, therefore: the connection is made by two wires connected to the connector pins of the GND device ("ground") and IBUT 1-Wire (signal and power).

Note:

In order to ensure better immunity with a significant length of the line connected to the 1-Wire interface, temperature sensors based on the DS18S20 can be connected by a three-wire circuit with a separate stabilizer supply voltage of 3.5 - 5V sensors. There is no such stabilizer in the device.

In order the 1-Wire interface operates, the device must be powered up with the main power supply or connected by USB. When it is powered by the built-in battery, the 1-Wire interface does not work.

The red wire of the temperature sensor and the center pad contact TouchMemory are connected to the 1-Wire interface (pin 3, "1-Wire"). The black wire of the temperature sensor and the side contact of the TouchMemory pad is connected to the negative contact of the device (pin 2, "GND") or to the vehicle "Ground".

Connecting sensors and TouchMemory pads it is important to observe the topology of the common bus. This means that all sensors must be connected to one common two-wire cable (called as bus or trunk). It is important not to leave open the end of the bus that is opposite to the connected device, it should be closed by the last plug-in sensor.

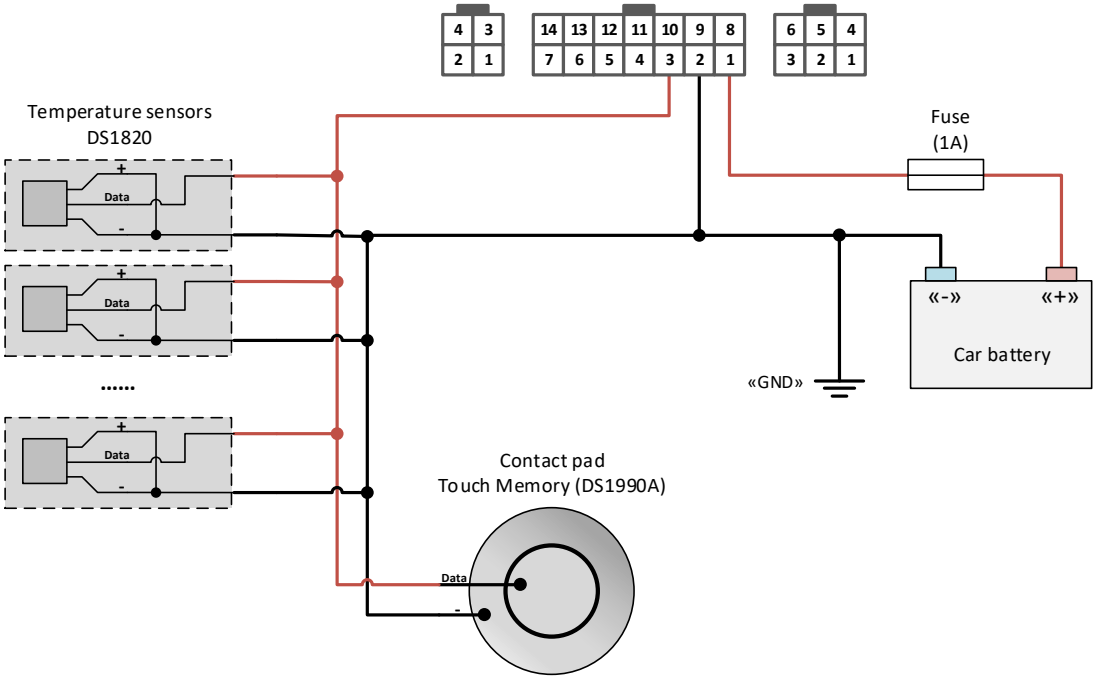

Figure 45. Connection of digital temperature sensors and TouchMemory pad

For networks sensors construction it is necessary to choose a "twisted pair" cable, as this drastically reduces the effect of interference beat. It is recommended to use standard unshielded telephone wire with twisted pairs of category 5. This cable is available with two or four pairs of wires. During sensors network laying it is possible to use any cable wires. Unused wires should be left free at both ends, as their grounding increases the capacitive load. Guaranteed sensor operation is provided with a tire length of not more than 15 meters. With a further increase in the length of the line on the signal parameters, the electrical characteristics of the cable may be affected. If it is necessary to use a contact reader for DS1990 keys, it is advisable to connect it on the bus in front of temperature sensors, that is, closer to the device connector.

When contacting a key to the contact pad or Proximity-cards or keyfobs to their readers connected to the device in operation mode, the information with the key code and the time it was contacted will be sent to the

telematics server (separate packet with this information).

Digital temperature sensor codes, keys, maps and keyfobs of the identification systems can be read in the NTC Configurator program in the "Telemetry" window with external power connected to the device.

2.9 Amplifier connection for voice information

The devices have the "Autoinformer" function designed to automatically inform passengers about stops.

To implement voice information, an external audio signal power amplifier must be connected to the device.

The amplifier should be selected based on the number and power of the speakers or acoustic systems connected to it. The power and the number of speakers are determined depending on the type of vehicle on which the automatic information system is installed. Also, when choosing an amplifier, you should take into account the range of permissible supply voltage, which must correspond to the voltage of the vehicle's on-board network.

The linear amplifier input should be connected to the linear audio signal output LOUT (pin 7 of the main device connector). The nominal input voltage of the audio signal at the device LOUT output is ~ 500 mV. If the amplifier has 2 channels, then to increase the power, you can connect both amplifier channels in parallel to one output.

To avoid interference with audio signal when informing, the connection should be made with a shielded cable. The GSM antenna of the device should be located as far as possible from the input connector of the device, amplifier, speaker and from the wires connecting them.

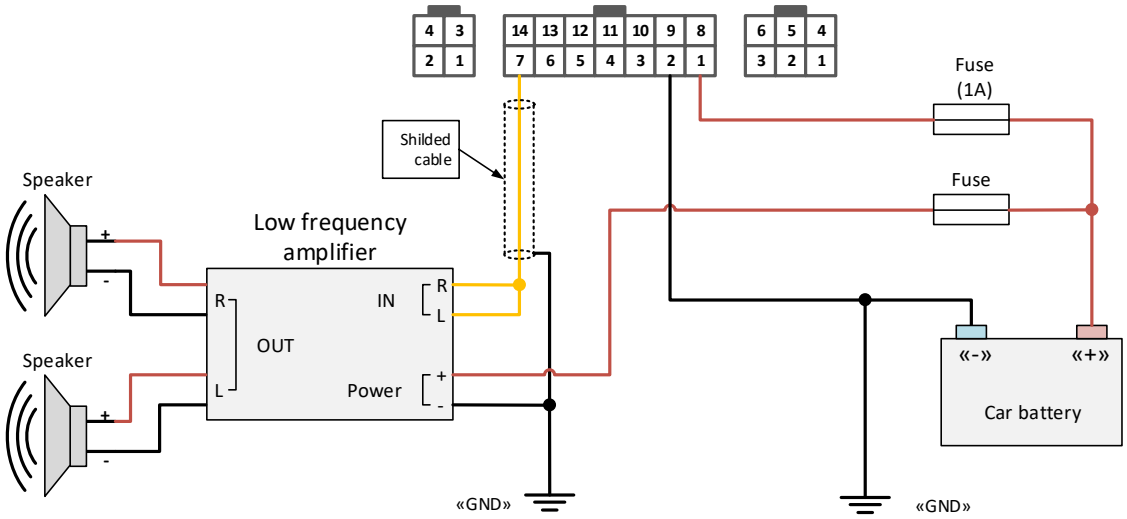

Figure 46. Amplifier connection for voice information

2.10 CAN interface connection

The device has its own CAN interface, which allows to connect to the vehicle CAN bus directly without additional adapters or decoders.

CAN bus is being connected using pins 1 and 4 of Microfit-6 connector. The CAN bus contact "CANL" is being connected to pin 4 of the connector, and the "CANH" bus to pin 4.

The connection location to the car CAN bus depends on vehicle's model and a year of its manufacture.

In some cars, all the necessary data from CAN bus can be obtained by connecting to the OBD-II diagnostic connector.

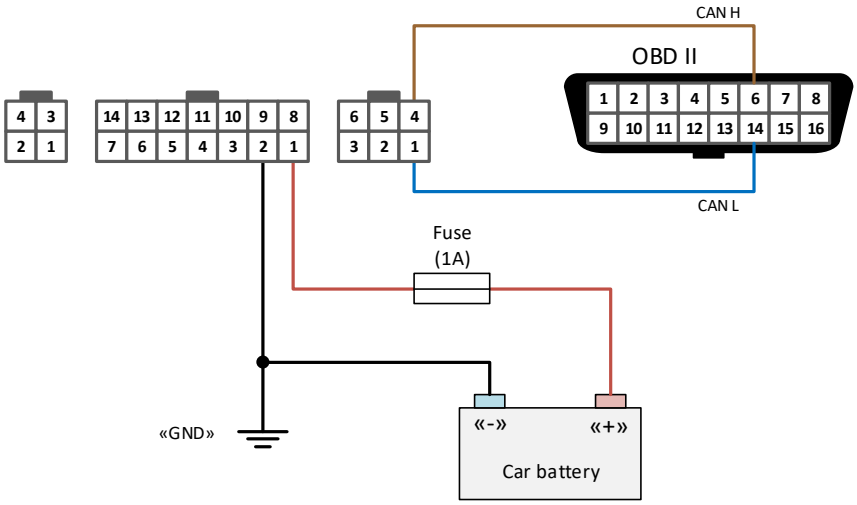

Figure 47. Connection diagram to OBD-II

In some vehicles it is necessary to search for the needed bus in the wiring which goes to the dashboard, to the control controller or in other places.

The safest way to connect to the CAN bus is to connect it through a contactless reader. Such a reader allows to receive data from the CAN bus of the car without physically connecting and breaking the insulation of the wires, thus avoiding problems with warranty service for new cars. The disadvantage of connecting through a contactless reader is the inability to receive data from the CAN bus on request from the device. As a result, some parameters become unavailable for receiving by the terminal on some cars

Figure 48. Connection to CAN through contactless reader

It is possible to receive data at request only if the vehicle CAN bus wires connection to the CAN interface of the device is direct.

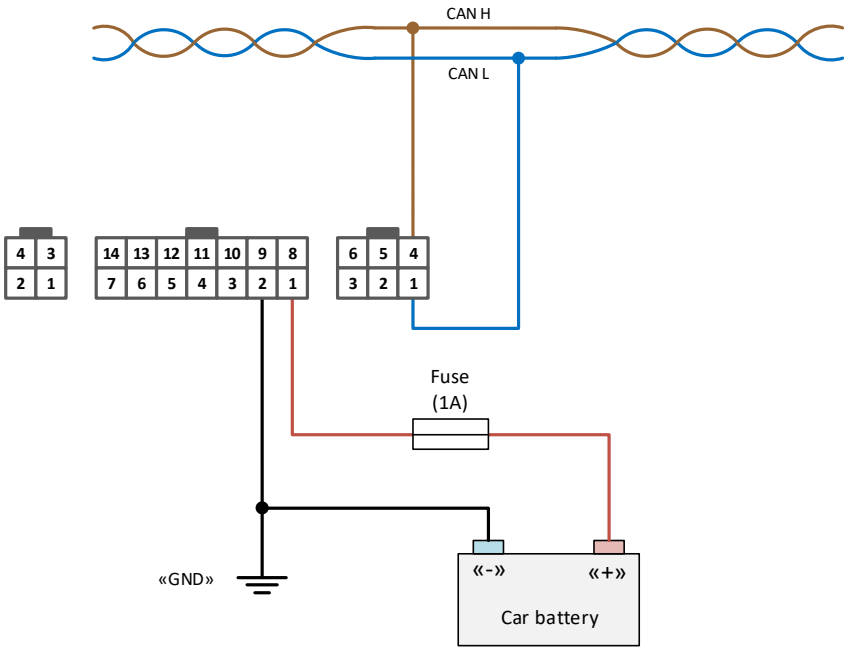

Figure 49. Direct connection to vehicle CAN-bus

Attention!

It is necessary to be careful when connection to the CAN bus is direct in order to avoid errors in the vehicle controller and disruption of its operation. Connection has to be made with the ignition turned off. Do not allow the CAN-H and CAN-L wires of the twisted pair to short circuit between each other, to earth, or to the "+" power of the on-board network. Do not connect CAN bus wires to any other pins in the terminal connector other than CAN-H and CAN-L pins.

The "-" terminal power supply (contact "G") must be connected to the vehicle "ground" before powering the device and connecting to the computer by USB.

If the connection to the CAN bus of a specific vehicle is made for the first time, then before connection the device must be configured to the ***passive*** *CAN mode.*

Note:

There can be several CAN buses in the vehicle, while information required to the user can be transmitted in different buses. Since the terminal has only one CAN interface, it is impossible to receive all required information simultaneously from both buses. It is necessary to choose the bus for connection in which there are the most important parameters for the customer, or use an external optional CAN bus adapter that has several CAN interfaces.

Attention!

"Navtelecom" LLC is not responsible for malfunctions connected with the vehicle equipment when the device was directly connected to the vehicle's CAN bus without using contactless readers, as well as when it is connected to the OBDII connector in active mode.

2.11 RS-232 interface connection

The digital interface RS-232rate is designed for connection of various devices that transmit and receive information on this interface, for example, FLS, CAN bus adapter, tachographs, RFID, MODBUS devices, etc.

The RS232TX interface line (pin 6) of the device should be connected to the RS-232RX line of the sensor, and the RS232RX line (pin 3) to the RS-232TX sensor.

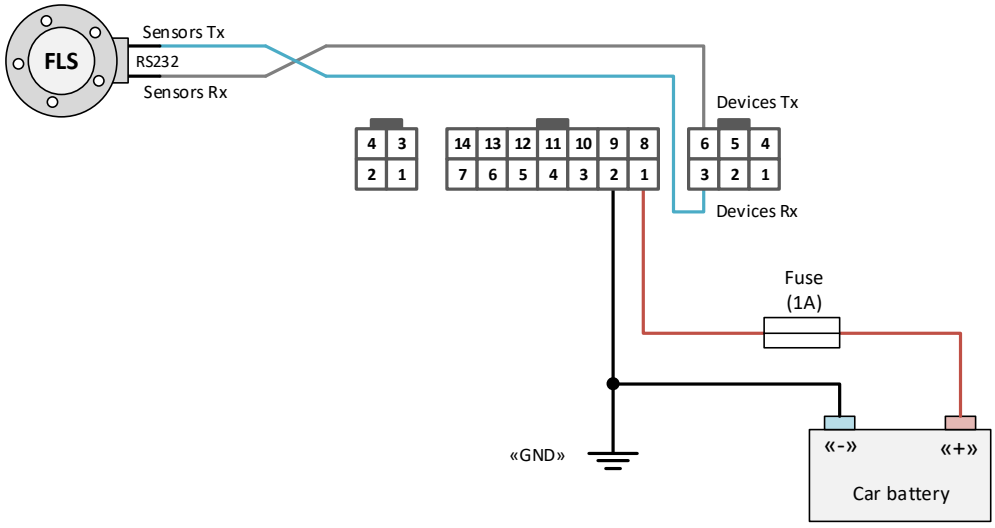

Figure 50. Connection diagram for fuel level sensor by RS-232 interface to the device

Periodic data output mode must be enabled in the sensor and the network address and data transfer rate must coincide with those which are programmed in the device itself.

Note:

Some manufacturers of additional devices (FLS, CAN bus adapters, etc.) connected by the RS-232 interface change the physical meaning of the designations of the TX and RX interface lines. That is why in this connection these devices do not function, and it is required to reconnect them by swapping the RX and TX contacts.

If there is any doubt which sensor line is Tx and which Rx , it is possible check this with a multimeter in the voltage measurement mode. The measured voltage on the sensor Tx line which is not connected to the terminal will be in the range from -5 to -12 V relative to the sensor supply "-". On the Rx line, the voltage will be close to "0".

2.12 RS-485 interface connection

The digital interface RS-485 is designed to connect devices transmitting and receiving information via this interface, for example, fuel level sensors, CAN bus adapter, tachographs, RFID, MODBUS-devices, etc.

As a rule, the interface is used to connect up to 16 digital fuel sensors. It is supposed to use digital LLS-compatible sensors.

The RS-485 + interface line of the device should be connected to the RS-485 + line of the sensor, usually designated as "A", and the RS-485 line of the device should be connected to the RS-485 line of the sensor, usually designated as "B". The RS-485 interface specifications practically do not limit the length of cables on a land vehicle (100m or more), since the interface is a differential bus and is well protected from the influence of external interference.

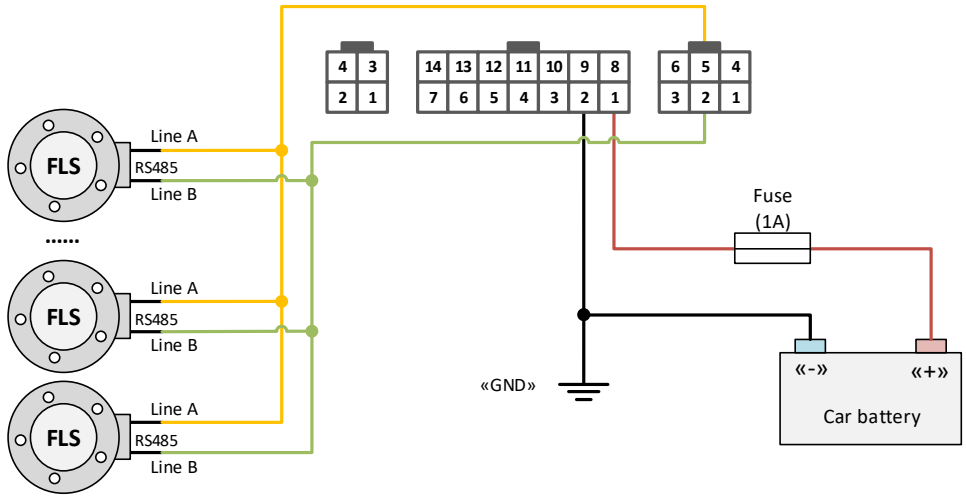

Figure 51. Connection diagram of fuel level sensors by RS-485 interface

In the fuel sensor, the periodic data output mode must be turned off, and the network address and data transfer rate must match the corresponding programmed parameters in the device itself.

2.13 Speaker and microphone connection

The speaker output is differential, but the polarity of its connection can be ignored, unless it is not specified by the speaker manufacturer.

In the fuel sensor, the periodic data output mode must be turned off, and the network address and data transfer rate must match the corresponding programmed parameters in the device itself. The speaker resistance should be 4 ohms or 8 ohms. The speaker of the device is only turned on when the speakerphone is established with the device.

An electret microphone capsule is connected to pins 1 (MIC +) and 3 (MIC-). This microphone capsule is used in computer microphones in a compact enclosure with lavalier. It can be used both for listening to the car interior and for establishing hands-free communication with the driver, paired with a speaker.

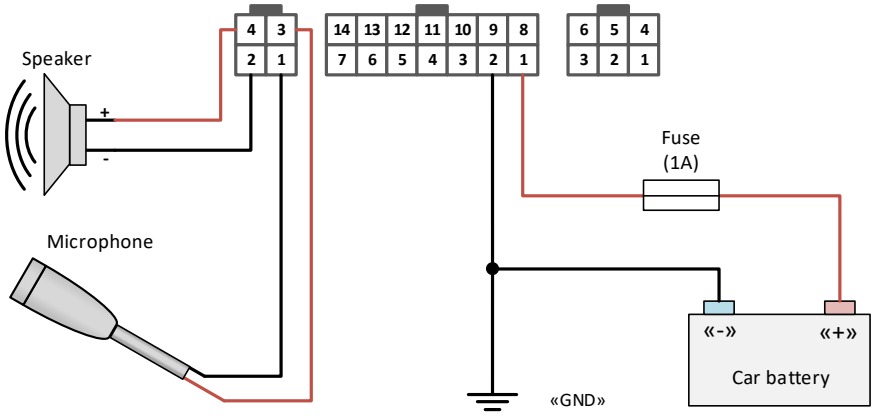

Figure 52. Speaker and microphone connection

Unlike a speaker, the microphone should be connected with strict polarity. To avoid interference with the sound, signal during voice connection, the microphone should be connected with a shielded cable. The GSM antenna of the device should be located as far as possible from the input connector of the device, the microphone and the cable connecting them.

3. LED INDICATION

In order to display the operation modes and the current state of the system, three LEDs on the device case are used: SYS, GSM and NAV.

The SYS system LED indicates the current status of the device. This LED indicates an alarm state if an alert is sent to subscribers by SMS, or an input is in the activated state. Also, the system LED can display the system operation in test mode (it is glowing for one second, is not glowing for one second).

Meaning of SYS LED indication

Tab. 3

Type of the signal light	Signal value
No indication	"Turn off " mode
1 flash в 4 seconds	"Energy saving" mode
2 flashes in 4 seconds	"Monitoring" mode
3 flashes 4 seconds	"Security" mode
Continuous frequent flashes	"Alarm" mode

Meaning of GSM LED indication

Tab. 4

Type of the signal light	Signal value
No indication	Built-in GSM-module is turned off.
1 sec is glowing, 1 is not glowing	Built-in GSM-module is turned on. No registration in the operator's network
1 short flash 1 second off	There is a registration in the cellular network of the operator. Weak signal
2 short flashes 1 second off	There is a registration in the cellular network of the operator. Medium quality signal
3 short flashes 1 second off	There is a registration in the cellular network of the operator. High quality signal
Permanent short flashes	Open GPRS session. Attempts to establish communication with the telematics server
Constant glowing	Connected either to the telematics server by GPRS or by voice channel

Meaning of NAV LED indication

Tab. 5

Type of the signal light	Signal value
No indication	Built-in GLONASS/GPS module is turned off
1 sec is glowing 1 is not glowing	Built-in GLONASS/GPS module is turned on Navigation coordinates is not identified
1 short flash 1 second off	Built-in GLONASS/GPS module is turned on Navigation coordinates is identified. Small number of satellites
2 short flashes 1 second off	Built-in GLONASS/GPS module is turned on Navigation coordinates is identified. Average number of satellites
3 short flashes 1 second off	Built-in GLONASS/GPS module is turned on Navigation coordinates is identified. A large number of satellites