DAI. Discrete Analog Sensors Connection

User Manual
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Necessary Tools, Devices, Materials

To connect a Galileosky tracking device (hereinafter – tracking device) you should have:

1. Electrical tools.
2. A multimeter.
3. A set of connecting wires with fuses.
Possible Options of Discrete Analog Sensors

Galileosky devices can process readings of discrete analog sensors, such as: buttons, end switches, switches, and tumblers (hereinafter – discrete sensors). Processing of discrete sensors signals is performed according to the configured in the tracking device algorithms.

Signals from discrete sensors are given to the discrete analog inputs (hereinafter - DAI) of the tracking device. The number of DAI may be different and depends on Galileosky device type. Regardless of the type of device, DAI marking is the same and has the following form: IN0, IN1, etc.

The following devices can be used as discrete sensors:

1. **Emergency button** (Pic. 1) – a “logical 1/0” signal supply device, which is identified by the tracking device as a trigger signal processing algorithm of the event;

2. **End switches** (Pic. 2) – end switches, “open/closed” signal feeders, which can be identified by the tracking device as a trigger signal processing algorithm of the event;

3. **Ignition lock** (Pic. 3) – “on/off” signal feeder, which is identified by the tracking device as a signal “switch starting”.

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Pic. 1
Emergency buttons

Pic. 2
End switches
4. A sensor with transistor output (Pic.4) – a sensor transmitting signal by “yes/no” principle, depending on transistor state on the output “closed-opened”.

Pic. 3
Ignition lock

Pic. 4
Sensor with transistor output
Emergency Button Connection

To accept and process a signal from an emergency button, it is necessary to connect it to Galileosky device in accordance with one of the following schemes:

1. **Emergency button with positive voltage** (Pic. 5) – pressing the emergency button results in applying of positive voltage of power supply to one of the DAI of the tracking device;

2. **Emergency button with ground switching** – a positive power supply voltage is applied to one of the DAI of the tracking device through 20kOhm resistor. Pressing of the emergency button results in ground switching of this DAI.

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**Pic. 5**
Emergency button with positive voltage applying. Connection scheme

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**Pic. 6**
Emergency button with ground switching. Connection scheme
DAI. Discrete Analog Sensors Connection 
(version 5 dated from July 2, 2018)

To configure DAI of the tracking device to operate with an emergency button, it is necessary to connect the device to Configurator, go to the “Settings” tab -> “Inputs/outputs” and perform the following activities for every custom input:

1. set the filter type as “middle value”;
2. set the filter length as “1”, further you may increase the length in order to exclude false responses on the input;
3. use sliders to set discrete signal limits (in millivolts). Maximum discrete signal value must correspond to maximum operating voltage value, which can be applied to the analog input. You may also set the discrete signal limits by adding digital values into fields “Operating zone” and “Non-operating zone”;
4. click “Apply” button.

Picture 7 shows the example of settings of Input 0 (IN0) and Input 2 (IN2) for connection schemes of Pictures 5 and 6.

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Tracking device input state is transmitted to the monitoring server in field “Device status” (№ 17, tag 0x46 of Galileosky protocol) in form of logical 0/1 value, where 0_— signal of normal condition of input, and 1_— DAI activation signal. For connection schemes illustrated by the example:

IN0 input
- normal condition is from 0 to 7000 mV, logical 0 is transmitted;
- activation condition is from 8000 to 33000 mV, logical 1 is transmitted;

IN2 input
- normal condition is from 8000 to 33000 mV, logical 0 is transmitted;
- activation condition is from 0 to 7000 mV, logical 1 is transmitted;

Inputs state in indifference zone from 7000 to 8000 mV will correspond to the previous input state.

State of tracking device DAI, which are set to operate with an emergency button, is displayed in field “Analog inputs” in the “Device” tab of Configurator:
- inputs in the normal state show the current input voltage in black (in millivolts) (Pic. 8);
- inputs in response state show the current input voltage in red (in millivolts) (Pic. 9).
After the setting of analog inputs to operate with the emergency button is completed, you should configure the monitoring software.

Connection of the emergency button ends with checking emergency signal transmission to the monitoring server.
End Switches Connection

In most cars on-board end switches (hereinafter – end switches), when you press them close their general operation to the ground of the vehicle. In this case, connection of end switches to Galileosky device should be carried out in accordance with Picture 10 of the manual in the following order:

1. use a multimeter to measure the voltage at the junction of end switches before and after opening the doors, make sure the signal is transmitted;
2. connect one of the DAI of Galileosky device to the end switches;
3. configure Galileosky device as it was done above with the emergency button.

End switches connection ends with checking the transmission of opening door signal to the monitoring server.
Ignition Sensor Connection

Connection of an ignition sensor should be performed according to the scheme of Picture 11 of this manual. Ignition voltage is taken from the correspondent output of a car ignition lock and is applied to one of the analog inputs of Galileosky device.

Parameter setting of DAI to operate with the ignition sensor is similar to setting of DAI to operate with the emergency button, described above.

To exclude false coordinates at stops, filtering of coordinates according to ignition sensor signal should be configured – in field “Ignition sensor” of the “Track” tab of Configurator you should indicate the analog input to which the ignition sensor is connected (Pic. 12). In the absence of voltage on this input the coordinates will not be updated.

Ignition sensor connection ends with checking the ignition signal transmission to the monitoring server.
Sensor with Transistor Output Connection

Let us consider a sensor that has a transistor serving as an executive element, which opens or closes if a control signal is present. According to activation principle, sensors are divided into inductive and capacitive (proximity), optical (photocell), etc.

A sensor has different modifications depending on transistor type at the output:
- PNP normally open (hereinafter – NO)
- PNP normally closed (hereinafter – NC)
- NPN NO
- NPN NC

1. To connect a sensor with PNP transistor at the output to DAI, connect sensor loading to a negative side of the tracking device (GND). Connect the output to one of the inputs IN0-IN7 (Pic. 13).

   - in case of NO transistor, when the sensor activates, transistor opens, voltage (+V) is brought to the tracking device’s input, and it activates (logical 1).
   - in case of NC transistor, voltage is brought to the tracking device’s input in a standard mode. When the sensor activates, transistor closes and logical 0 is given to the input.

In the scheme with NPN transistor at the output of the sensor, connect sensor loading to the positive side of the tracking device (VCC). Connect the output to one of the inputs IN0-IN7. Connect minus to GND of the tracking device (Pic. 17). DAI resistance to the ground of Galileosky tracking device ($R_{ter}$) for versions 5.0 and 2.0 is 14 kOhm, for Base Block is 30 kOhm. Internal resistance of the sensor ($R_{sensor}$) should be 10 times less than $R_{ter}$. Otherwise,
you should add an additional resistor \( R_{\text{add}} \) parallel to \( R_{\text{sensor}} \) to the scheme, its resistance is usually about 1 kOhm.

Now, when the sensor is not active, voltage is brought to tracking device’s input (discrete “1”). When the sensor is active – discrete “0” is at tracking device’s input.

Parameters configuration of DAI in Configurator is similar to settings in “Emergency button connection” section (p. 6-8).

Connection of sensor with transistor output ends with checking the transistor activation signal transmission to the monitoring server.

Connection of digital analog sensors is completed; the tracking device is ready for use.

RSA “Galileosky”, LLC produces satellite monitoring equipment for GPS and GLONASS real time vehicles monitoring. The tracking devices determine the mobile object location recording the time and route as points with geographical coordinates and send the data to the server to be further processed and sent to the traffic controller panel.

In addition, a number of other vehicle parameters are recorded: the state of analog and discrete inputs of the tracking device and the state of digital interfaces.

The tracking devices can be used in any vehicle.