

# Geofencing

User Manual

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# 1 Introduction

## 1.1 Purpose of This Document

The purpose of this user manual is to provide information about the geofencing functionality. Geofencing allows you to control the vehicle using predefined areas – geofences. You can alert the driver, immobilize the vehicle if it is leaving a geofence or simply monitor vehicle inputs within a geofence.

Detailed descriptions of tracking devices and functionalities can be found on our documentation website: [doc.ruptela.it](http://doc.ruptela.it).

## 1.2 Legal Information

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## 1.3 Document Application

Geofencing is compatible with the following devices with the newest firmware version:

- Trace5
- FM-Tco4 HCV
- FM-Tco4 LCV
- FM-Pro4
- FM-Eco4 (geofencing only)
- FM-Eco4 S
- FM-Eco4 T

## 1.4 Contact Information

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## 1.5 Document Changelog

Version	Date	Modification
1.0	2014-12-04	Initial draft.
1.1	2016-06-08	Added: Multipoint geozones.
1.2	2016-07-11	Added: Radius for multipoint geozones.
1.3	2016-08-02	Added: Configuring geozones with a DIFF configuration file.
1.4	2016-08-29	Added: DOUT delay for geofences.
2.0	2019-11-08	Added: Auto-geofencing. Updated: User manual structure and design.
2.1	2020-04-03	Updated: Compatible device list.
2.2	2020-04-27	Updated: Geofence settings.

## 1.6 Notations

The following notations are used in this document to highlight important information:

### **Bold text**

Used to indicate user interface elements or for emphasis.

### *Italic text*

Used to indicate items that belong to a list and can be selected.

### **Note**










Used to highlight important information or special conditions.

### **Caution**



Used to mark actions that require caution when handling the product.

## Availability table

Trace5	Tco4 HCV	Tco4 LCV	Pro4	Eco4	Eco4 S/T	Plug4
						

Used to mark which devices support a given functionality. Device names are written without the FM prefix.

## 1.7 Acronyms and Abbreviations

AIN – Analog Input

DIFF – Comparison of differences between two files

DIN – Digital Input

DOUT – Digital Output

## 1.8 References

Advanced configurator user manual:

<https://doc.ruptela.lt/pages/viewpage.action?pageId=884778&preview=/884778/28967177/EN%20Advanced%20Configurator%20User%20Manual.pdf>

Device user manuals: <https://doc.ruptela.lt/display/AB/Tracking+devices>

Digital output user manual:

<https://doc.ruptela.lt/pages/viewpage.action?pageId=884778&preview=/884778/26771685/EN%20Digital%20Output%20User%20Manual.pdf>

Configurable navigation filtering:

<https://doc.ruptela.lt/pages/viewpage.action?pageId=884778&preview=/884778/19726562/EN%20Configurable%20navigation%20filtering.pdf>

## 2 Geofence Basics

Geofences consist of points and areas defined by these points. Geofence points are defined by their position – longitude and latitude in decimal degrees. A total of 250 geofences can be defined, with a total maximum of 600 points.

**i** FM-Eco4 and FM-Eco4 S devices support only up to 100 circular geofences.

Each geofence has its unique ID that allows you to identify the geofence if an event was triggered within it. Geofences can also be grouped, allowing you to set different conditions and alerts for different geofence groups.

**i** Geofences can overlap. If the vehicle is within a few geofences at the same time, it is considered to be within the smaller geofence (by area). Geofences have a 20 m border buffer zone.

Geofences allow you to receive you the following information about the vehicle:

- If the vehicle has entered or left a geofence
- Analog and/or digital input values within or outside the geofence
- Speed within or outside the geofence

Specific conditions can be set for these parameters. If the conditions are met, alerts can be indicated using digital outputs.

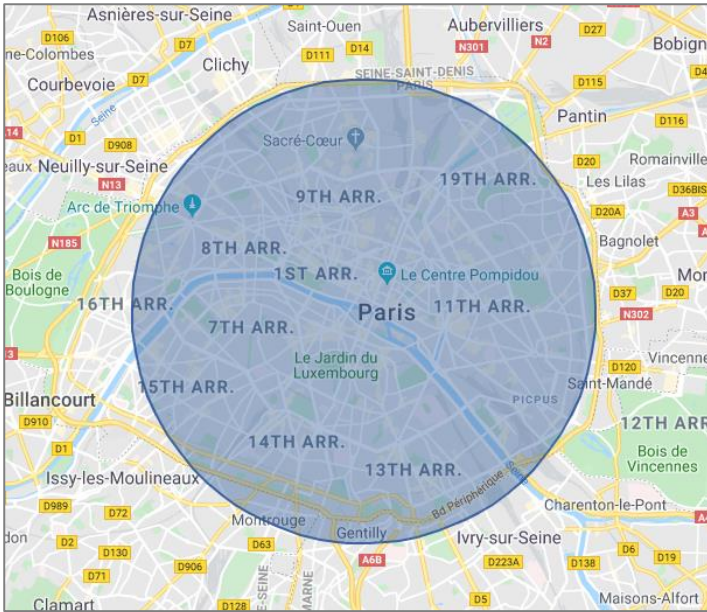
### 2.1 Geofence Types

#### 2.1.1 Circular

Trace5	Tco4 HCV	Tco4 LCV	Pro4	Eco4	Eco4 S/T	Plug4
✓	✓	✓	✓	✓	✓	⊘

Circular geofences cover an area (circle) of a defined radius. Once a point is placed, the area of the defined radius around the point becomes a circular geofence. This allows you to quickly and simply mark an area if you do not need a lot of precision.

The radius of circular geofences can range from 25 m to 250000 m.



## 2.1.2 Multipoint

Trace5	Tco4 HCV	Tco4 LCV	Pro4	Eco4	Eco4 S/T	Plug4
✓	✓	✓	✓	⊘	⊘	⊘

Multipoint geofences cover an area, bounded by several placed points. This allows you to define an area of a specific shape – for example a parking lot, a city, a country, etc.

Multipoint geofences can have from 3 to 20 points.



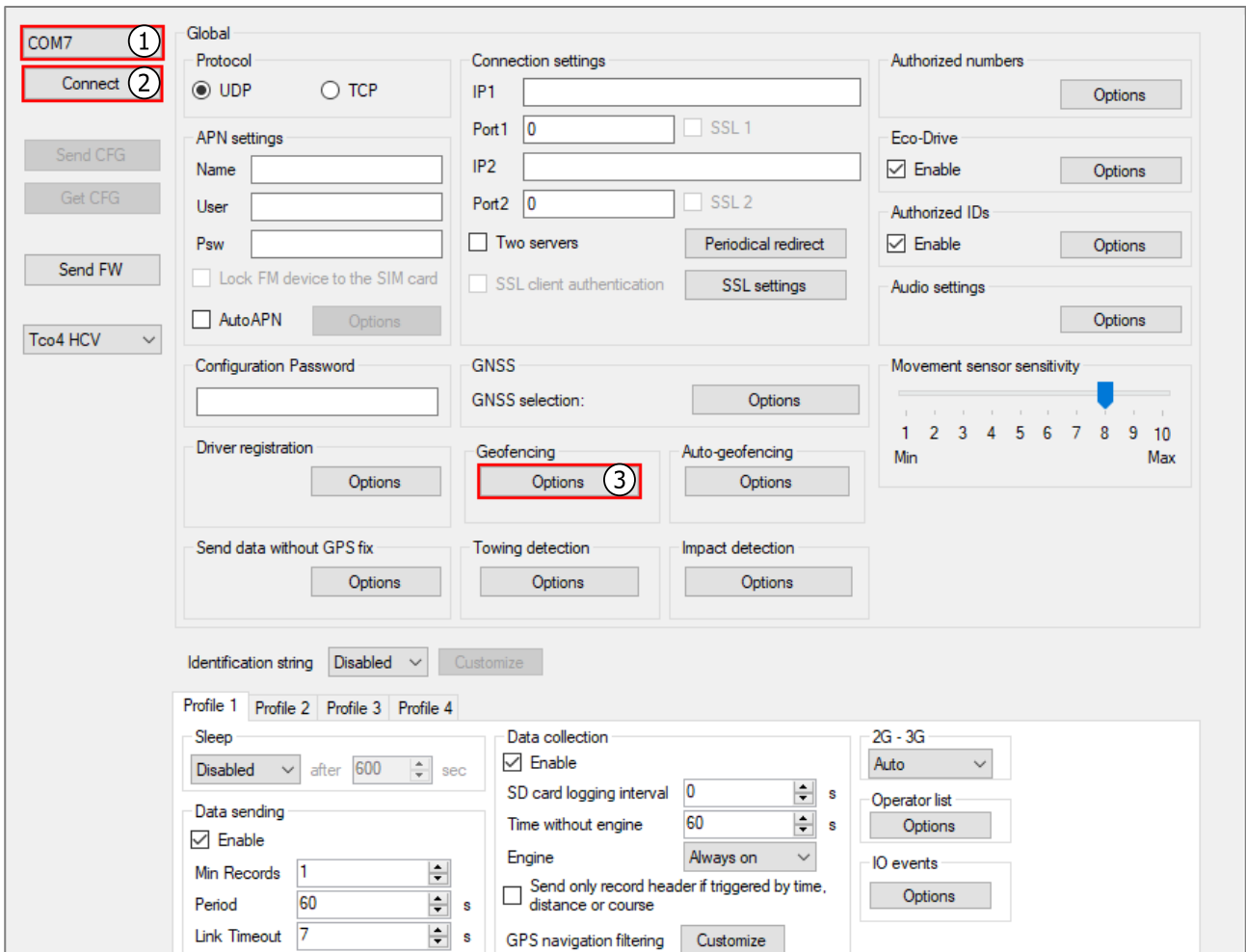
# 3 Configuration

**i** This functionality requires the use of the advanced configurator.

## 3.1 Starting the Configuration

To start the configuration, follow these steps:

1. Open the advanced configurator. Select the COM port to which your device is connected.
2. Click **Connect**.
3. Click the **Options** button in the **Geofencing** section to open the **Settings of Geozones** window.





## 3.2 Adding Geofences

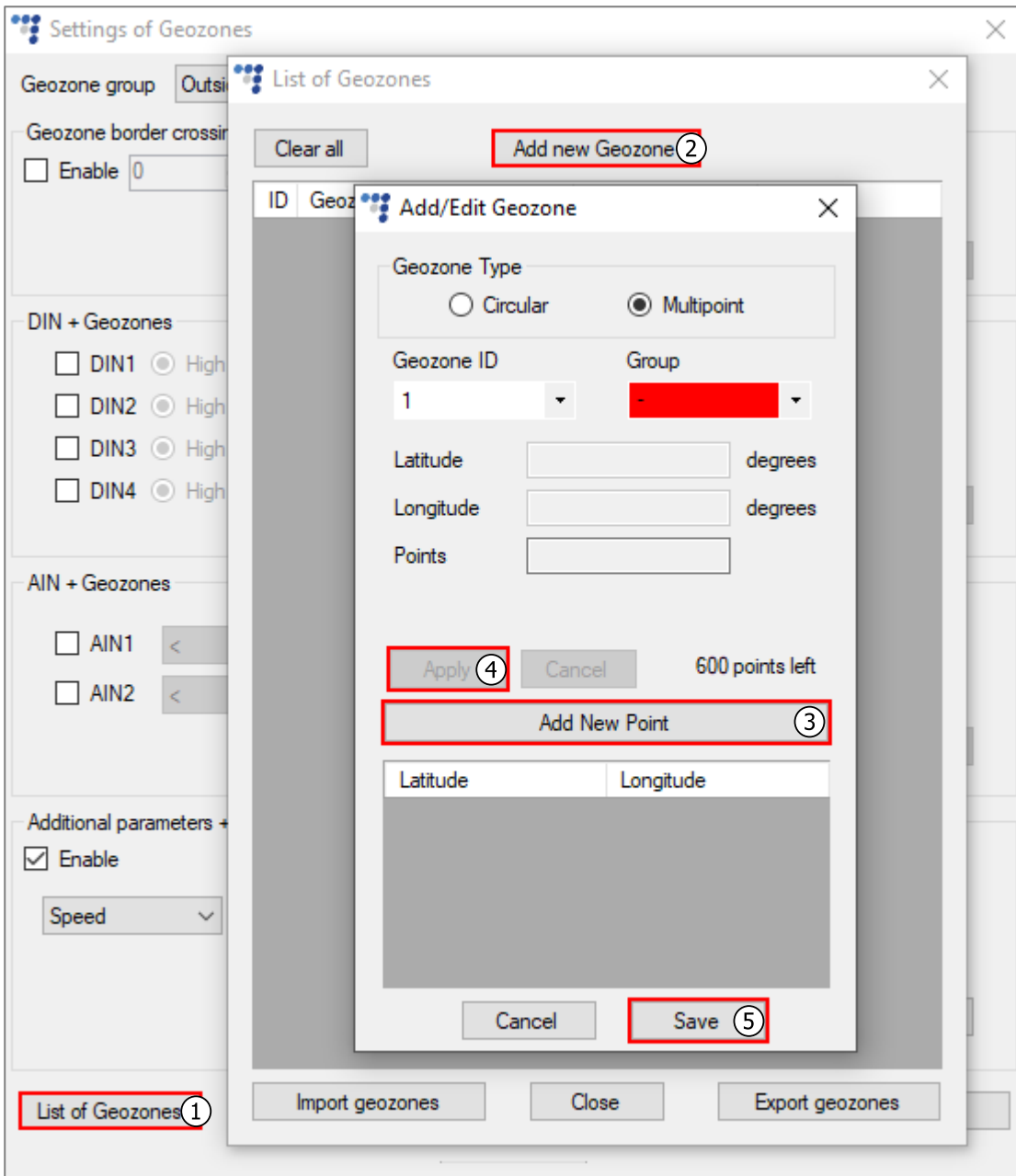
To add new geofences, click **List of Geozones** at the bottom of the **Settings of Geozones** window. A new **List of Geozones** window will appear. Click **Add new Geozone** to open the geofence creation window and configure the parameters described below.

<b>Geozone Type</b>	Which type of geofence you wish to create. Possible values: <ul style="list-style-type: none"><li>• <i>Circular</i> – for circular geofences, a single center point is defined</li><li>• <i>Multipoint</i> – for multipoint geofences, each point is defined separately</li></ul> Default value: <i>Circular</i>
<b>Geozone ID</b>	Which ID you wish to assign to the geofence. You cannot select the ID of an already existing geofence. Default value: Next available lowest value
<b>Group</b>	Which group you wish to assign the geofence to. Group selection is mandatory. Default value: None (cannot be used)
<b>Latitude</b>	The latitude of the point in decimal degrees. Default value: None
<b>Longitude</b>	The longitude of the point in decimal degrees. Default value: None
<b>Radius</b>	[Circular geofences only] The radius of the geofence in meters. Default value: None
<b>Points</b>	[Multipoint geofences only] Shows how many points the geofence currently consists of.
<b>Add new point</b>	[Multipoint geofences only] Click to enable the <b>Latitude</b> and <b>Longitude</b> fields. Click <b>Apply</b> to save the point or <b>Cancel</b> to discard it.

If a field is red, its value is not allowed and must be modified.

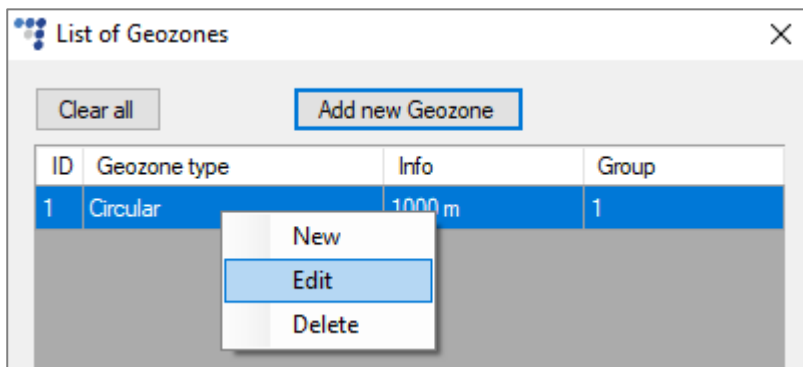
For multipoint geofences, new points can be added next to existing points by right clicking on a point and clicking **Add Above/Add Below**.

Click **Save** to save the geofence and return to the geofence list or click **Cancel** to discard it.

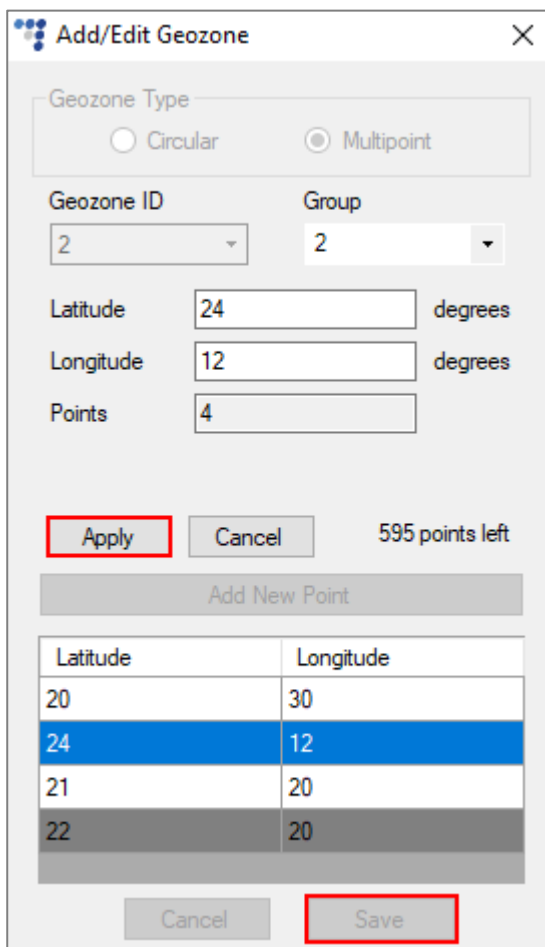


### 3.3 Editing Geofences

To edit a geofence, right click on an existing geofence and click **Edit**.



The edit process for circular geofences is straightforward and is similar to creating them. For multipoint geofences, double click on a point to edit it and click **Apply** to save it. You can also right click on a point to edit/delete it. Click **Save** to change your changes to the geofence.



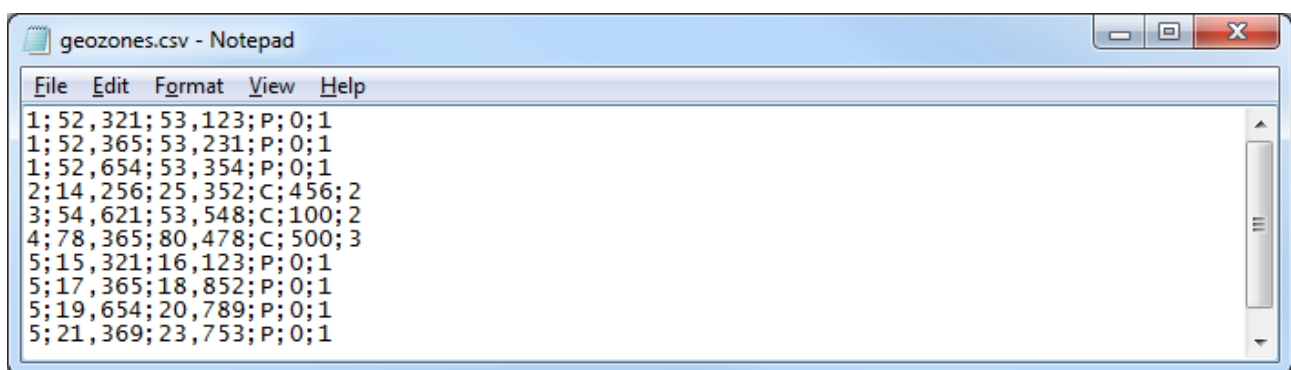
You can click **Clear all** to delete all entered geofences.

## 3.4 Importing/Exporting Geofences

Entering all geofence data by hand can be a time-consuming process, especially if there are many points. Geofence data can be imported from a .csv file that already contains the geofences and their points. Each point is entered in a new line in the following format:

*Geofence ID;Latitude;Longitude;Type;Radius;Group*

<b>Geozone ID</b>	The ID of the geofence in the geofence list. For multipoint geofences, make sure that the ID is the same for all points. Example: <b>1</b> ;52,321;53,123;P;0;1
<b>Latitude</b>	The latitude of the point in decimal degrees. A comma is used as a delimiter for decimal points. Example: 1; <b>52,321</b> ;53,123;P;0;1
<b>Longitude</b>	The longitude of the point in decimal degrees. A comma is used as a delimiter for decimal points. Example: 1;52,321; <b>53,123</b> ;P;0;1
<b>Type</b>	The type of the geofence. Possible values: <ul style="list-style-type: none"><li>• C – circular</li><li>• P – multipoint</li></ul> Example: 1;52,321;53,123; <b>P</b> ;0;1
<b>Radius</b>	The radius of the circular geofence in meters. For multipoint geofences, enter 0. Example: 1;52,321;53,123;P; <b>0</b> ;1
<b>Group</b>	The group the geofence belongs to. Example: 1;52,321;53,123;P;0; <b>1</b>



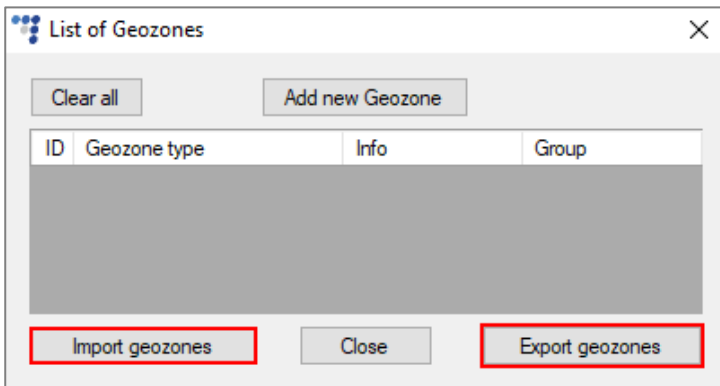
```
1; 52, 321; 53, 123; P; 0; 1
1; 52, 365; 53, 231; P; 0; 1
1; 52, 654; 53, 354; P; 0; 1
2; 14, 256; 25, 352; C; 456; 2
3; 54, 621; 53, 548; C; 100; 2
4; 78, 365; 80, 478; C; 500; 3
5; 15, 321; 16, 123; P; 0; 1
5; 17, 365; 18, 852; P; 0; 1
5; 19, 654; 20, 789; P; 0; 1
5; 21, 369; 23, 753; P; 0; 1
```

To import geofences, open the **List of Geozones** window and click **Import geozones**. All existing geofences will be overwritten.



When importing geofences from a .csv file, only limited validation is performed. Only the geofence ID, group, point latitude and longitude are verified. If they are entered incorrectly, an error message is displayed. Other parameters are not verified, and you must ensure that they are entered correctly.

To export geofences, click **Export geozones** and choose, where you wish to save the .csv file.



A DIFF configuration file can also be used to import geofences. Like with .csv file import, using a DIFF configuration file will overwrite all existing geofences.

## 3.5 Geofence Settings

Configure, how the device should behave within/outside of geofence groups. The settings apply for each group separately.

<b>Geozone group</b>	To which geofence group the settings apply for. Selecting <i>Outside</i> will apply the settings for when the vehicle is not in any geofence. Default value: <i>Outside</i>
<b>Geozone border crossing</b>	Enable to generate entering/leaving geofence events. Entering events are generated when the vehicle enters any geofence from the outside or enters a geofence in a different group. Leaving events are generated when the vehicle leaves any geofence group and is outside. No events are generated when the vehicle enters a geofence in the same group. Default value: Disabled
<b>Delay timer in seconds</b>	How much time must pass to generate an entering/leaving geofence event after crossing geofence borders. Default value: Disabled, 0 s
<b>Output channel</b>	Which DOUT mode will be used to activate DOUTs to alert the driver when an event is generated. The DOUTs must already be in configured in the desired modes in <b>IO settings</b> . More info: <a href="#">Digital Output User Manual</a> Default value: Disabled
<b>Inputs+Geozones</b>	Allows receiving alerts of input state changes within/outside a geofence group. Select which input status you want to monitor by ticking the corresponding checkbox. Choose which state to monitor - <i>High</i> or <i>Low</i> for DIN and <i>On</i> or <i>Off</i> for Ignition. If you select <i>Ignition</i> , you can enable the following conditions: <ul style="list-style-type: none"><li>• <i>Enable DOUT activation delay</i> - delays the activation of the required DOUT by the set amount of time.</li><li>• <i>Enable DOUT duration</i> - sets the duration for the DOUT to be active.</li><li>• <i>Trigger only once</i> - if enabled, the DOUT will be triggered only once after entering a geozone.</li></ul> Value of these conditions by default: Disabled If you have previously configured DOUTs, you can select an output channel through which this alert information will be provided to the driver. If <i>Ignition</i> is ticked, only the Blocking DOUT output channel can be selected. Default value: Disabled
<b>AIN+Geozones</b>	Allows receiving alerts of AIN input voltage changes within/outside a geofence group. Select which AIN you want to monitor by ticking the corresponding checkbox. Set the threshold value and the condition. If you have previously configured DOUTs, you can select an output channel through which this alert information will be provided to the driver. Default value: Disabled
<b>Additional param.+Geozones</b>	Allows receiving alerts of speed changes within/outside a geofence group. Enable the condition by ticking the checkbox. Set the threshold value and the condition. If you have previously configured DOUTs, you can select an output channel through which this alert information will be provided to the driver.

CANbus speed data is prioritized. If CANbus speed data is unavailable, GNSS speed data is used.

Default value: Disabled

### Enable IO

Enables the *Geofencing IO* parameter, used to receive alert info to the server.



Any configured alert will be activated only after entering/leaving a geofence group. If the vehicle enters a geofence in the same group, there will be no alert.



If the engine is set as *Always On*, you will not be able to tick the *Ignition* input.



The *Ignition* input cannot be selected outside of the geozone group.

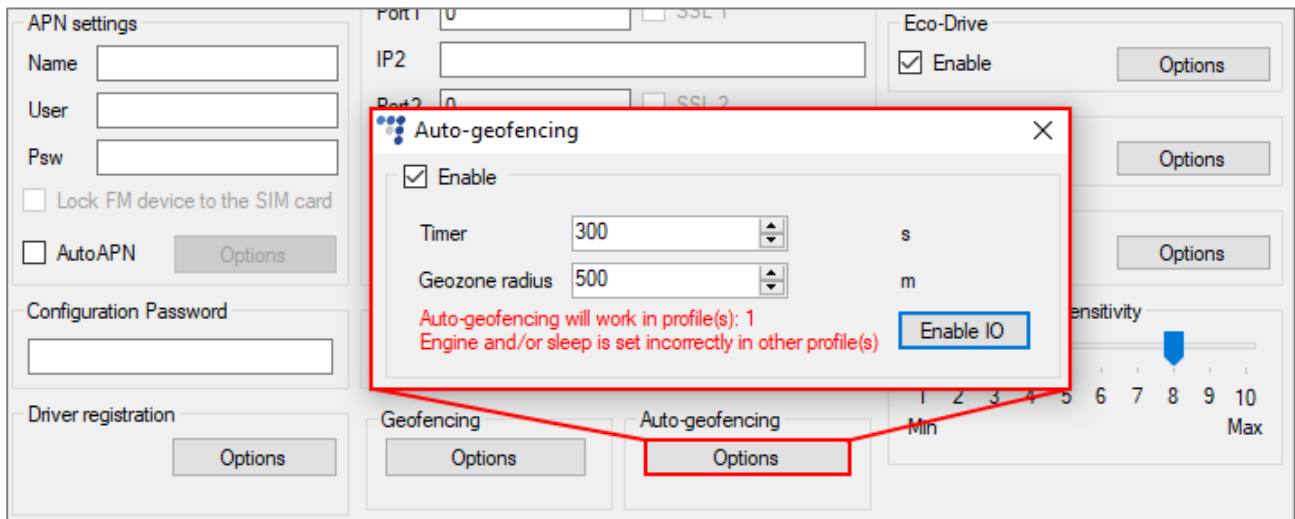
## 3.6 Auto-Geofencing

Trace5	Tco4 HCV	Tco4 LCV	Pro4	Eco4	Eco4 S/T	Plug4
✓	✓	✓	✓	⊘	✓	⊘

Auto-geofencing creates a circular geofence of a defined radius around the vehicle after the engine is off for a defined time. This can be used to receive alerts when the vehicle leaves the geofence while the engine is off and can be used for theft prevention.

Click the **Options** button in the **Auto-geofencing** section in the main menu to open the auto-geofencing settings window.

<b>Enable</b>	Tick this checkbox to enable the auto-geofencing functionality. Default value: Disabled
<b>Timer</b>	How much time must pass to create the geofence. Range: 60 to 65535 s Default value: 300 s
<b>Geozone radius</b>	The radius of the created geofence. We recommend making the geofence big enough to avoid jumps in position due to low GNSS signal accuracy. Otherwise, you may receive false alerts. Range: 100 to 10000 m Default value: 500 m
<b>Enable IO</b>	Enables the <i>Autogeofence alert</i> IO parameter, used to receive alert info to the server. Protocol v1.1 must be enabled.



The use of stationary navigation filtering may delay auto-geofencing alert detection.



### 3.6.1 Auto-Geofencing Conditions

Auto-geofencing is configured for each profile separately. Auto-geofencing cannot be enabled if *Sleep*, *Deep Sleep* or *Custom* (with GNSS disabled) mode is active.

Auto-geofencing is dependent on the engine state and cannot be enabled if the following engine detection methods are used:

- *Always on*
- *MovSensor*
- *Custom* with the following configuration:
  - No conditions
  - Only *Mov Sensor* is selected
  - Only *GPS speed* is selected
  - Any combination with *MovSensor* and the condition *OR*
  - Any combination with *GPS speed* and the condition *OR*

The methods listed above will detect that the engine is on if the vehicle starts moving. Because of this, there is no way to tell whether the vehicle is being driven or taken away.

We recommend using *Ignition(DIN4)* for engine state detection.

### 3.6.2 GNSS Filtering Effects on Auto-Geofencing

If [stationary navigation filtering](#) is enabled, it will keep the same coordinates until the engine is switched on or until the conditions to disable the filter are fulfilled. Depending on the configuration, the vehicle may need to travel at a higher speed (40 km/h by default) in order to disable the filter. Because of this, there might be a delay between the alert and the actual event of the vehicle leaving the geofence. In some cases, the alert might never trigger. It depends on the configuration of the filter.

If no filtering is used, jumps in position due to an inaccurate GNSS signal may cause false alerts. You can use a larger geofence radius (over 1000 m) to prevent this.

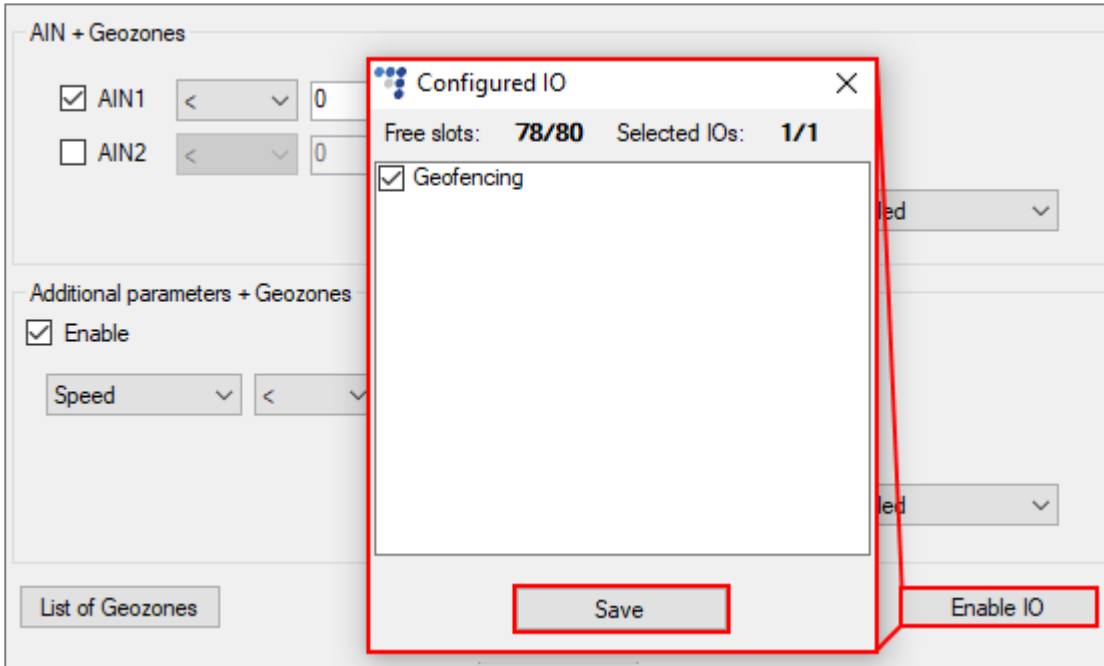
We recommend not using auto-geofencing together with stationary navigation filtering, unless late alerts will cause you more issues than false alerts.

## 3.7 IO Parameters

### 3.7.1 Geofencing

All geofence related events are registered in the *Geofencing* IO parameter. Therefore, it must be enabled if you wish to see geofence related events in your fleet management platform.

Enable the *Geofencing* IO parameter by clicking **Enable IO** in the **Settings of Geozones** menu. Click **Save**.



The corresponding bits in the 4 byte status register represent geofence related states and events.

Geofence ID				Geofence group ID				Reserved				Geofence data unreliable	Speed event	AIN2 event	AIN1 event	DIN4 HIGH event	DIN3 HIGH event	DIN2 HIGH event	DIN1 HIGH event	DIN4 LOW event	DIN1 HIGH event	DIN2 LOW event	DIN1 LOW event	Leaving geofence event	Entering geofence event	Geofence status					
b <sub>31</sub>	b <sub>30</sub>	b <sub>29</sub>	b <sub>28</sub>	b <sub>27</sub>	b <sub>26</sub>	b <sub>25</sub>	b <sub>24</sub>	b <sub>23</sub>	b <sub>22</sub>	b <sub>21</sub>	b <sub>20</sub>	b <sub>19</sub>	b <sub>18</sub>	b <sub>17</sub>	b <sub>16</sub>	b <sub>15</sub>	b <sub>14</sub>	b <sub>13</sub>	b <sub>12</sub>	b <sub>11</sub>	b <sub>10</sub>	b <sub>9</sub>	b <sub>8</sub>	b <sub>7</sub>	b <sub>6</sub>	b <sub>5</sub>	b <sub>4</sub>	b <sub>3</sub>	b <sub>2</sub>	b <sub>1</sub>	b <sub>0</sub>
4 <sup>th</sup> Byte				3 <sup>rd</sup> Byte								2 <sup>nd</sup> Byte				1 <sup>st</sup> Byte															

Bit	Description
0	Geofence status. 1 – inside geofence 0 – outside geofence
1	Entering geofence event. 1 – event occurred 0 – no event

Bit	Description
<b>2</b>	Leaving geofence event. 1 – event occurred 0 – no event
<b>3</b>	DIN1 low state event 1 – event occurred 0 – no event
<b>4</b>	DIN2 low state event 1 – event occurred 0 – no event
<b>5</b>	DIN3 low state event 1 – event occurred 0 – no event
<b>6</b>	DIN4 low state event 1 – event occurred 0 – no event
<b>7</b>	DIN1 high state event 1 – event occurred 0 – no event
<b>8</b>	DIN2 high state event 1 – event occurred 0 – no event
<b>9</b>	DIN3 high state event 1 – event occurred 0 – no event
<b>10</b>	DIN4 high state event 1 – event occurred 0 – no event
<b>11</b>	AIN1 event 1 – event occurred 0 – no event
<b>12</b>	AIN2 event 1 – event occurred 0 – no event
<b>13</b>	Speed event. 1 – event occurred 0 – no event
<b>14</b>	Geofence data unreliable. Geofences can be temporary switched off. This is done to prevent geofence event triggering if the GNSS signal is weak. 1 – geofencing turned off 0 – geofencing turned on
<b>15-19</b>	Reserved
<b>20-23</b>	Geofence group ID
<b>24-31</b>	Geofence ID

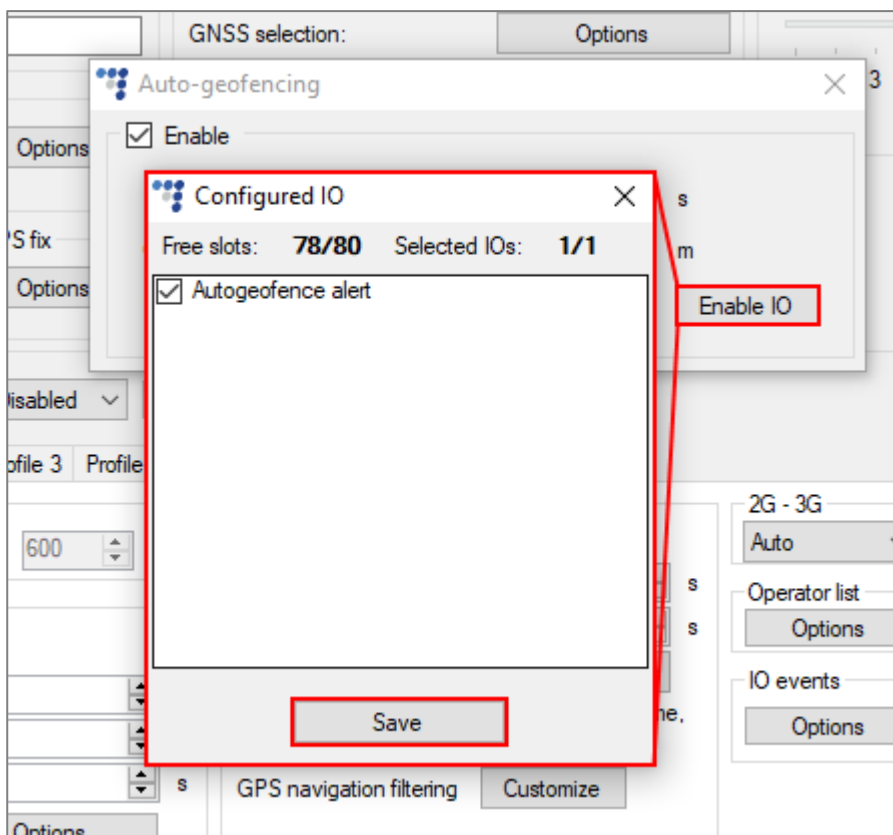
### 3.7.2 Auto-Geofencing

Use the *Autogeofence alert* IO parameter to be notified when the vehicle leaves the automatically generated geofence.

Enable the *Autogeofence alert* parameter by clicking the **Enable IO** button in **Auto-geofencing**. Click **Save**. Protocol v1.1 must be enabled.

The *Autogeofence alert* IO parameter can have the following values:

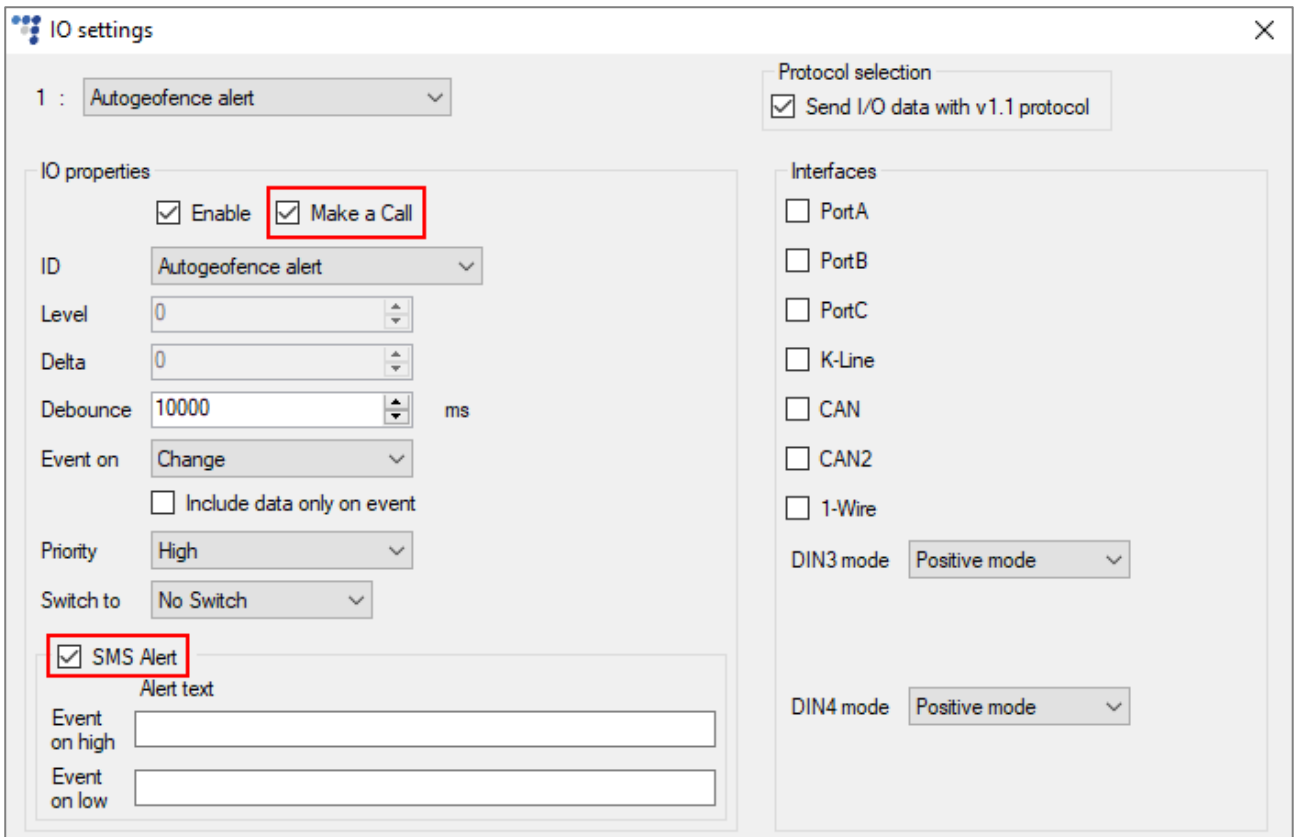
- 0 – no alert
- 1 – alert



Click **Options** in **IO events** to open the **IO Settings** window. Tick the **Make a Call** checkbox to receive a call alert when the vehicle leaves/enters the geofence. Tick the **SMS Alert** checkbox to receive an SMS alert with customizable text when the vehicle leaves (Event on high)/enters (Event on low) the geofence.



For alerts to work, specific SMS and call alert numbers must be configured in **Authorized numbers**.



### 3.8 Finishing the Configuration

To finish the configuration, close the **Settings of Geozones** and **Auto-geofencing** windows. Click **Send CFG** to send the configuration to the device.

