# Internal Geozones for FM 4<sup>th</sup> generation devices

## Introduction

Internal geozones allow you to get information and alerts about vehicle conditions in/out of geozones. Feature was expanded to include multipoint geozones. Now two types of geozones are available:

- Circular
- Multipoint

Feature with multipoint geozones for different FM devices is available starting with these firmware versions:

- FM-Tco4 HCV - 00.02.14.04
- FM-Tco4 LCV - 00.02.14.04
- FM-Pro4 - 00.02.14.04

You can get the latest firmware and configurator from our documentation web site: doc.ruptela.lt

## Legal information

## Document change log

| Date | Version | Change details |
|---|---|---|
| 2014-12-04 | 1.0 | Initial draft |
| 2016-06-08 | 1.1 | Multipoint geozones added |
| 2016-07-11 | 1.2 | Radius for multipoint geozones |
| 2016-08-02 | 1.3 | Configuring geozones with a DIFF configuration file. |
| 2016-08-29 | 1.4 | Added description for "DOUT delay for geofences" feature. |

# Circular and Multipoint geozones

Circular geozones are available for all FM 4th generation devices.
Multipoint (polygonal) geozones are available for the FM-Pro4, FM-Tco4 LCV, FM-Tco4 HCV devices.

**Geozone points**
- Geozone points are defined by Longitude and Latitude in decimal degrees.
- Each geozone has its unique ID number. If geozone related event occurs, geozone ID used to identify in which geozone event was triggered.
- FM devices support up to 600 points. From these 600 points it is possible to form up to 250 geozones. These points can be used either for defining circular or multipoint (polygonal) geozones (Eco family devices support only 100 circular geozones).
- For circular geozones radius can have values ranging from 25 m to 250000 m.
- Minimum number of points per multipoint (polygonal) geozone is 3 and maximum number is 20.

**Event detection accuracy and stability**

Default jitter eliminating hysteresis is used to increase event detection accuracy and stability.
- For border crossing detection stability 20 m border hysteresis is used.
- For DINx input state detection stability, 100 ms time hysteresis is used.
- For AINx input value detection stability, 100 mV hysteresis is used.
- For speed related event detection stability, 5 km/h hysteresis is used.

**Function notes**
- If object is within few geozones, then ID of smaller geozone is assigned by comparing cross-section area of the geozone.
- Geozones are configured internally and offer DOUTs control functionality. All geozone related events work for multipoint (polygonal) geozones in a same way as they worked before for the circular geozones.

**Alerts and information**

Geozones allow you to get the following information and alerts about vehicle conditions:
- Entering or leaving geozone
- DINs values in or out of the geozone
- AINs values in or out of the geozone
- Aditional parameter condition in or out of geozone
- Geozone list

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# Geofencing IO

All geozone related events are registered in a single IO ID 151 - Geofencing. You must enable it in order to see geozone related events in the tracking system.

1. In the **IO events** section click on the "Options" button. It opens up a new "IO settings" window, here you can enable or disable IO parameters.
2. Select a slot that you want to enable.
3. In the **IO properties** section tick the **Enable** check box, otherwise the slot will remain empty.
4. **ID** contains the parameter list. Choose a parameter you want to enable for the selected slot. For geozone functionality to function properly choose *Geofencing* IO.

   More details about this parameter available below.
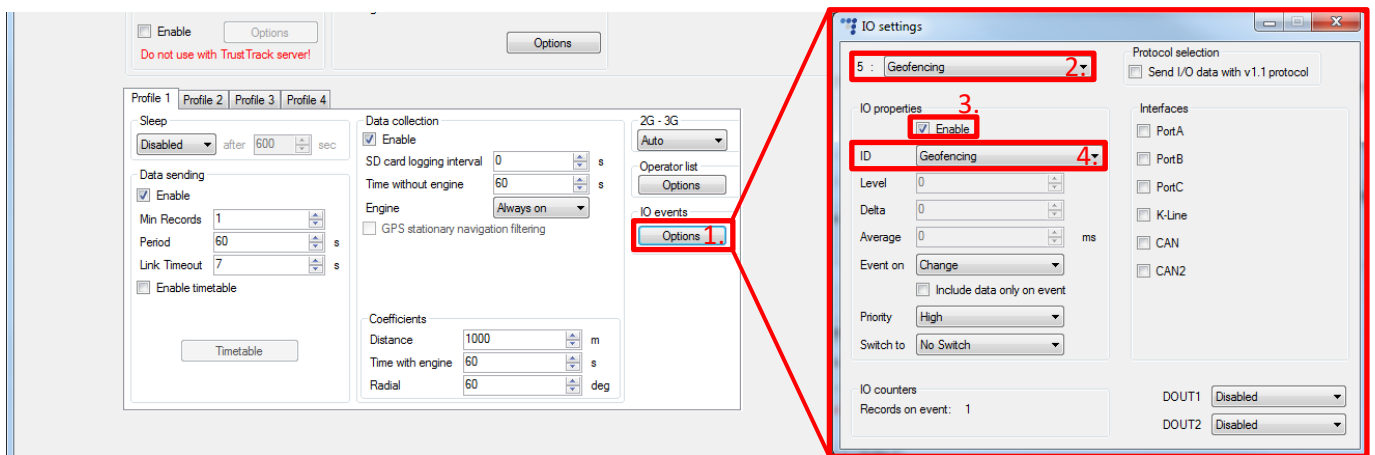


Corresponding bits in 4 byte status register represents geozone related states and events.
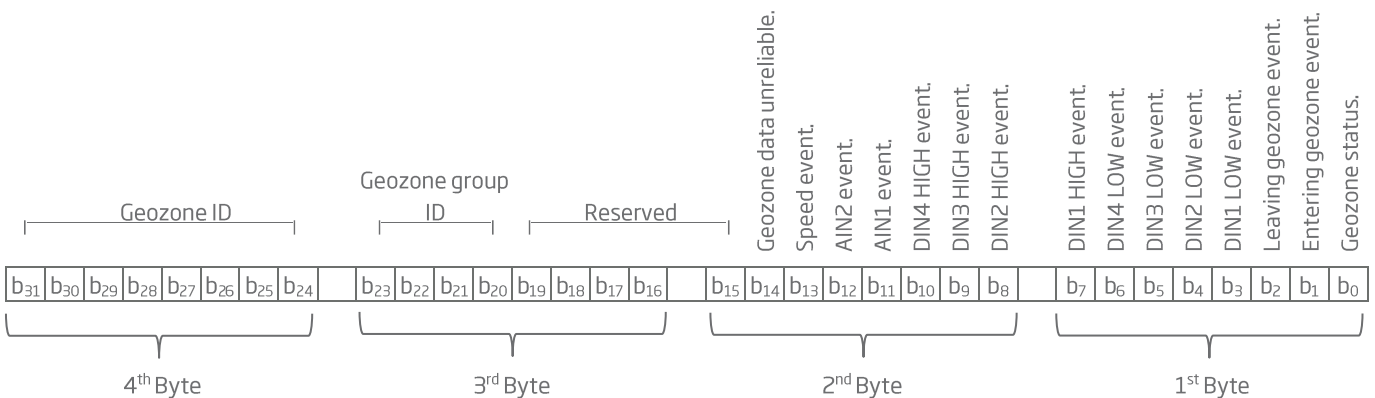


| Bit | Description |
|-----|-------------|
| 0 | Geozone status. Inside geozone – 1, outside geozone – 0 |
| 1 | Entering geozone event. 1 – only when event occurs, 0 – the rest of time |
| 2 | Leaving geozone event. 1 – only when event occurs, 0 – the rest of time |

| Bit | Description |
|---|---|
| 3 | DIN1 LOW event. 1 – only when event occurs, 0 – the rest of time |
| 4 | DIN2 LOW event. 1 – only when event occurs, 0 – the rest of time |
| 5 | DIN3 LOW event. 1 – only when event occurs, 0 – the rest of time |
| 6 | DIN4 LOW event. 1 – only when event occurs, 0 – the rest of time |
| 7 | DIN1 HIGH event. 1 – only when event occurs, 0 – the rest of time |
| 8 | DIN2 HIGH event. 1 – only when event occurs, 0 – the rest of time |
| 9 | DIN3 HIGH event. 1 – only when event occurs, 0 – the rest of time |
| 10 | DIN4 HIGH event. 1 – only when event occurs, 0 – the rest of time |
| 11 | AIN1 event. 1 – only when event occurs, 0 – the rest of time |
| 12 | AIN2 event. 1 – only when event occurs, 0 – the rest of time |
| 13 | Speed event. 1 – only when event occurs, 0 – the rest of time |
| 14 | Geozone data unreliable. Geozone functionality sometimes can be temporary switched off. This is done to prevent geozone event triggering on bad GPS signal, lack of GPS parameters. 1 – Geozones turned off, 0 – Geozones turned on. |
| [15...19] | Reserved |
| [20...23] | Geozone group ID |
| [24...31] | Geozone ID |

## DOUTs control

If you need sound (buzzer) or light (LED) alert in vehicle on various conditions regarding geozones, you need to configure digital outputs first. If you do not need alerts, skip this section and go to **Geozone settings**.

## Note
If you use Driver registration, please take extra precautions before proceeding. Geozones and Driver registration use the same peripherals for the indication. If you change peripherals connected to the DOUTS, changes will be applied to Driver registration as well and you might need to reconfigure it.

To configure DOUTs go to the **IO events** settings. DOUTs are configured independently. They can control peripheral units and/or block (e.g. ignition blocking) something that is connected to the DOUT. You have 5 options from drop down menu:
- Disabled
- LED
- Buzzer
- Blocking
- GSM jamming block

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If you select one option on the DOUT1, then it becomes unavailable on the DOUT2 and vice versa.
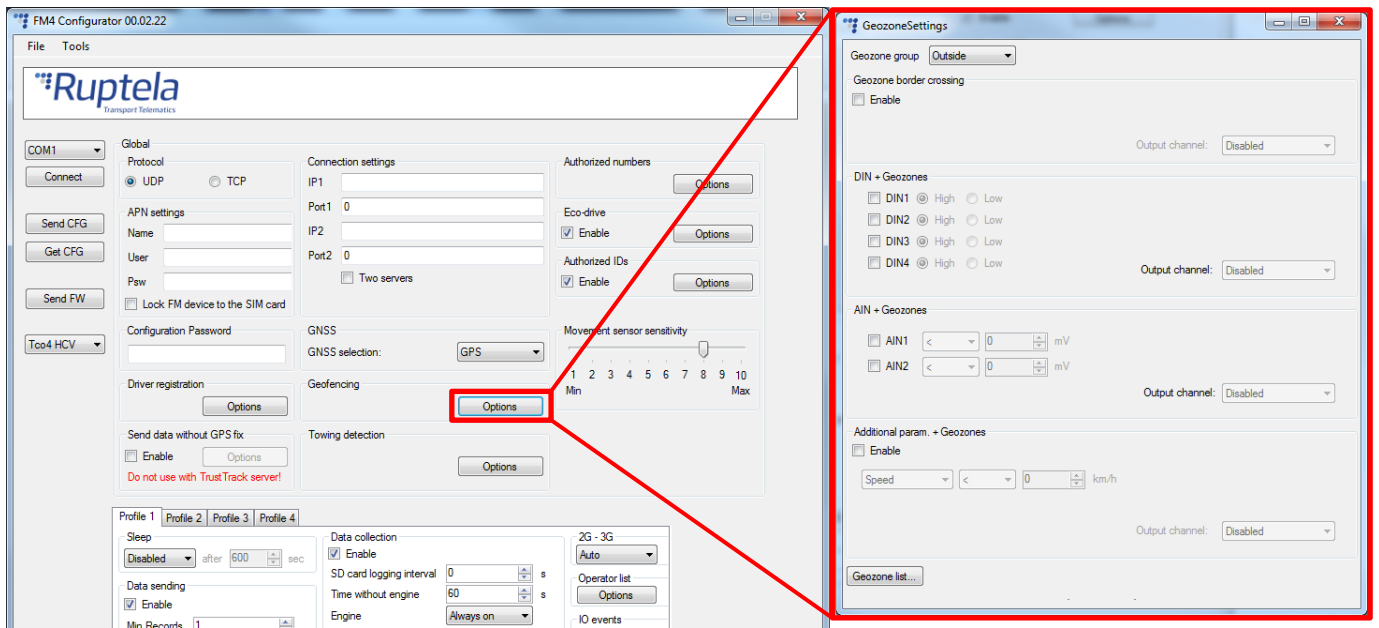
**Note**
When connecting peripheral device to the DOUT you must also configure it on the same output. E.g. if you have connected Buzzer to the DOUT1, then in the configurator, select Buzzer in the DOUT1 menu.
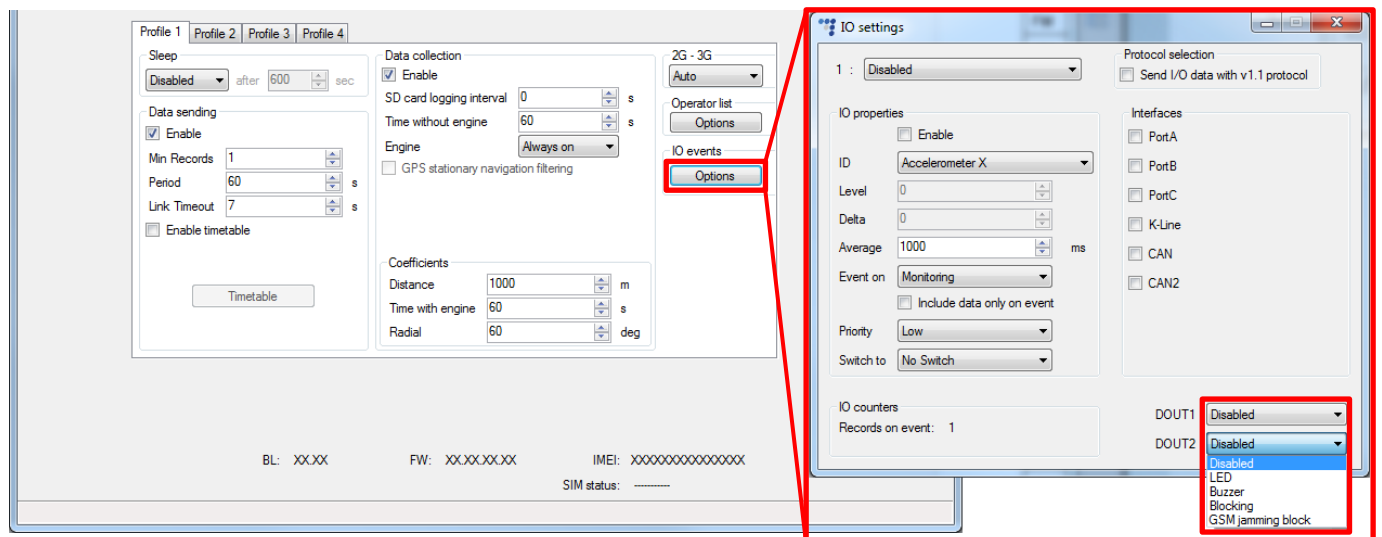


## Geozone settings

In the main configurator window locate **Geofencing** section and click on the Options button. New Geozone Settings window will be displayed. It has these sections:
- Geozone group drop down meniu
- Geozone border crossing
- DIN + Geozones
- AIN + Geozones
- Additional param. + Geozones
- Geozones list button for geozone file importing

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## Geozone group

Geozone grouping allows you to set different parameters for each geozone group. There can be up to 8 geozone groups. *Outside* group is considered as outbound geozone - territory that is not assigned to any geozone and geozone group.



- There is no Entering/Leaving event when crossing between geozones of the same group (just a change of geozone ID).
- When device is turned on, Entering event is generated when device is in one of the 1-8 groups, Geozone ID – current ID.
- When device is turned on, Leaving event is generated when device is in Outside geozone, Geozone ID – 0 ID.
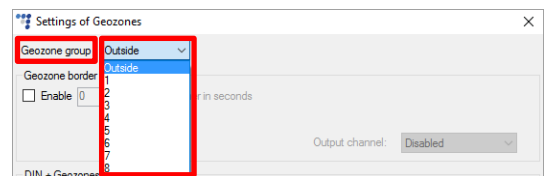
## Geozone border crossing

This section controls what happens during the geozone border crossing event. If you enable it, both conditions will be taken into account, while entering and leaving geozone.
If object moves from one geozone to another, no output is activated. This is considered a case, when geozones overlap, so there is no event for entering or leaving a geozone.



Entering geozone is identified in these cases:
- Entering from Outside geozone to 1-8 group geozones.
- Entering from one geozone group to another group.

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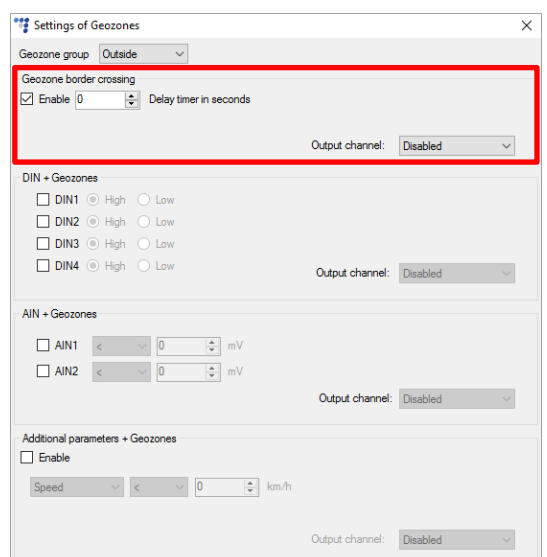
Leaving geozone is identified in those cases:
- Entering from geozone of group 1-8 to Outside geozone.

## Note
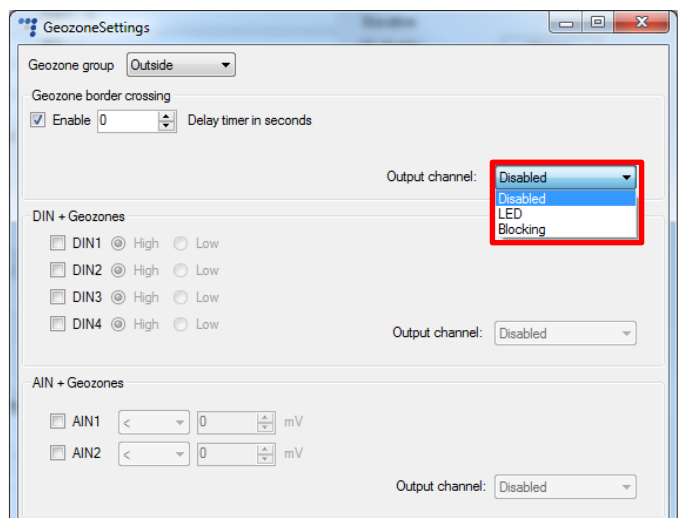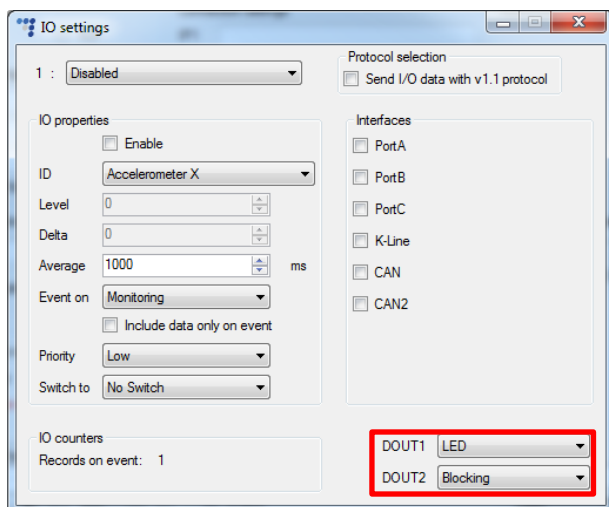Geozone border buffer zone is 20 m.

It is possible to set a delay for geozone border crossing event. Use **Delay timer in seconds** field. Values from 0s up to 65536s can be used. Default value is 0s. Entered value applies to each geozone group separately. If Geozone border crossing is disabled, then delay timer field is disabled for that geozone group.

Operation examples:
- When vehicle enters geozone and stays there for a longer period than preset value, then selected DOUT is activated and geofencing event is triggered.
- If vehicle drives out of the geofence while device output is active, DOUT is deactivated.
- If vehicle leaves geozone earlier, than preset timer runs out, nothing should happen and timer resets.
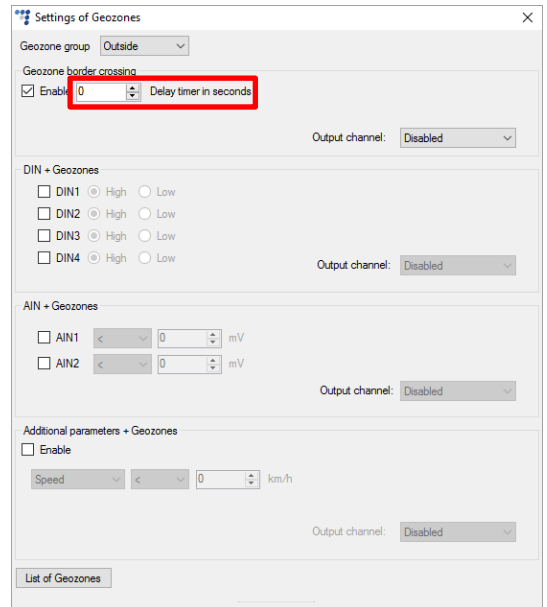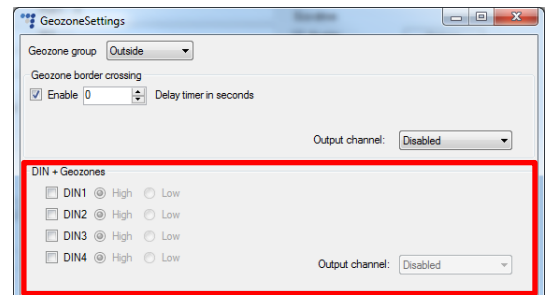


If you have previously configured DOUTs, you can select an **Output channel** through which this alert information will be provided to the driver. Alert will be given when the condition is met - geozone border is crossed. An example with one possible DOUT1 and DOUT2 configuration is given below. Different configurations allows you to choose a desired Output channel.

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## DIN + Geozones

DIN + Geozone allows to get alerts of digital input state changes in or out of the geozone. You can select which DIN status you want to monitor by enabling the corresponding check box. Also you can choose which state to indicate - High or Low. If you have previously configured DOUTs, you can select an **Output channel** through which this alert information will be provided to the driver.

## AIN + Geozones

AIN + Geozones allows to get alerts of analogue input voltage in or out of geozone. You can select which AIN you want to monitor. You can also set edge value for the alert - more (>) or less (<) than entered value. If you have previously configured DOUTs, you can select an **Output channel** through which this alert information will be provided to the driver.
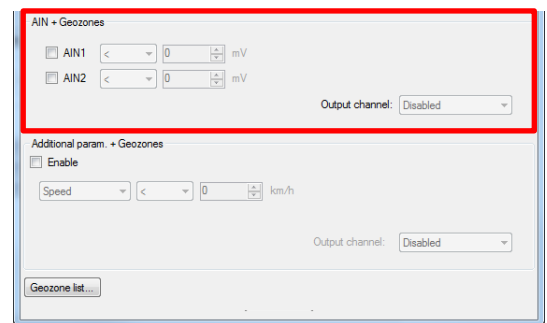
## Additional param. + Geozones

Additional parameters + Geozones gives you an ability to set an alert depending on the status of that parameter. E.g. over speeding while moving in or out of the geozone. Select the parameter, condition (more or less) and value. If you have previously configured DOUTs, you can select an **Output channel** through which this alert information will be provided to the driver.
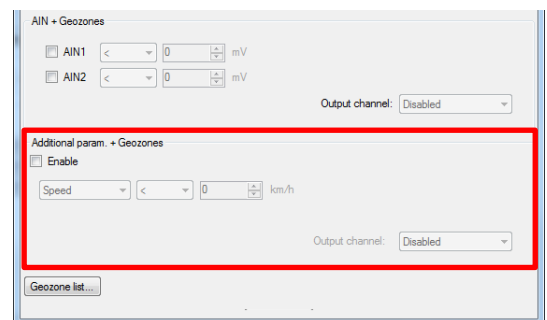
When event is continuous (for example speed >100 km/h), event is not generated again when crossing between geozones in the same group.

For geozone over speeding events, information from CANbus (wheel based speed from FMS or LCV CAN) is used first. If it is not available or data is not valid, then device takes speed data from the GNSS.

### Note
Any configured alert will become active only after leaving one geozone group and entering another one. If vehicle leaves one geozone and enters another which is in the same geozone group, then there will be no alert.

# Geozones list

To add, delete, import or export geozones click the "Geozone list" button in the Geozones Settings window.

New pop up window will be displayed, it contains a list with currently configured geozones. Depending on configuration, this list could be empty or not.

- "Clear all" button will clear all entries from the list.
- "Add new Geozone" button will open geozone creation menu.
- "Import geozones" button allow to import CSV file with the geozones.
- "Export geozones" button allow to export CSV file with the geozones.
- "Close" button to exit this window.
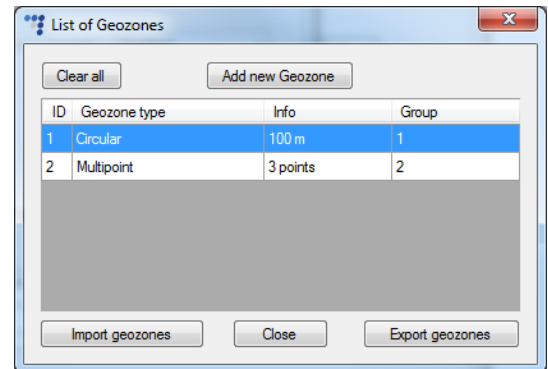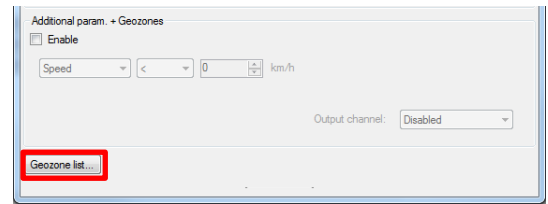




**Modifying circular and multipoint geozones**

All created or imported geozones that are displayed in the "List of Geozones" window can be modified. Choose a geozone that you want to edit and double click on it. Or right click on a selected row and choose "Edit". You can also use other available options:

- "New" – Functions the same as "Add new Geozone" button. Descriprion available below.
- "Edit" – Used to edit a specific geozone. Geozone type and its ID cannot be changed. Other fields can be modified freely.
  Editing circular geozones is very straight forward. Once you are done click "Save" button to apply changes. Multipoint geozone editing can be more complicated. More on that will be available in "Creating multipoint geozones" section.
- "Delete" – Delete selected geozone.
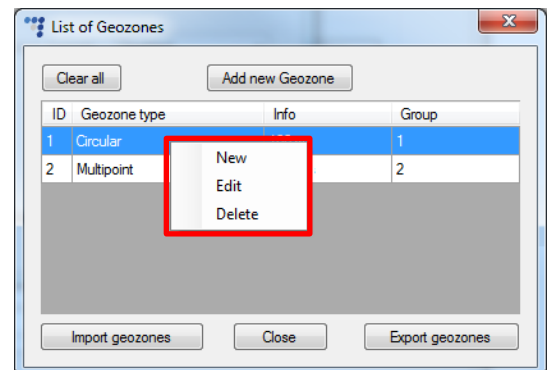
**Creating circular geozones**

Click "Add new Geozone" button to access geozone creation menu. Follow these steps to add a new Circular geozone:

1. In **"Geozone Type"** section at the top choose *Circular.*
2. In a dropdown menu choose a **"Geozone ID"** number for this new geozone. Only available ID's will be shown.
3. Choose a **"Group"**. It is a necessary step.
4. Enter **"Latitude"**, **"Longitude"** and **"Radius"** values for this new geozone. Radius can have values from 25 m to 250000 m.
5. You can "Save" this geozone or reject it by clicking "Cancel"



**Creating multipoint geozones**

Click "Add new Geozone" button to access geozone creation menu. Follow these steps to add a new Multipoint geozone:

1. In **"Geozone Type"** section at the top choose *Multipoint.*
2. In a dropdown menu choose a **"Geozone ID"** number for this new geozone. Only available ID's will be shown.
3. Choose a **"Group"**. It is a necessary step.
4. Click the "Add New Point" button.

"Add New Point" button includes a new row in the table below. It also enables **"Latitude"** and **"Longitude"** fields.
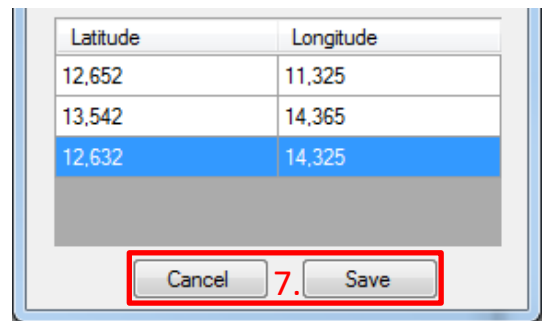
5. Enter **"Latitude"** and **"Longitude"** values for this new geozone.
6. Click "Apply" button.



Entered values will be added to the table. You need at least 3 points to create a single multipoint geozone. Maximum number of points for one geozone is 20. To add additional points repeat steps 4, 5 and 6.

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7. You can "Save" this geozone or reject it by clicking "Cancel".



Multipoint geozone points in the table can be edited. Choose a point that you want to edit and double click on it. Or right click on a selected row and choose "Edit".

You can also use other available options:
- "Add Above" – Basically it functions the same as "Add new Point" button. Description available above. This allows you to choose where this new point will be inserted.
- "Add Below" – Basically it functions the same as "Add new Point" button. Description available above. This allows you to choose where this new point will be inserted.
- "Edit" – Used to edit a specific point. Geozone type and its ID cannot be changed. Other fields can be modified freely. Once you are done click "Apply" button to save changes.
- "Delete" - Delete selected point.
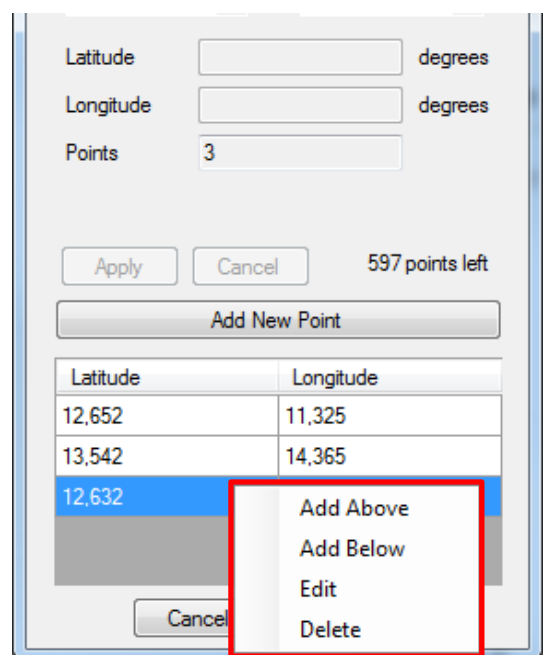


## Configuring geozones with a DIFF CFG file
User can choose to configure geozones list with a DIFF configuration file. However, he must remember that this works only when changing an entire geozones list. With a DIFF CFG file it is not possible to change only one or just a few points in the list. Doing so will delete all other geozones. In summary, with DIFF CFG modify an entire geozoens list at once.

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# Geozone CSV file import/export

Geozone importing functionality is meant for advanced users only. Geozones are imported from a CSV file, which is filed with geozone data.

> ## Note
> Geozones are imported from a CSV file and only limited validation is performed. Configurator only checks and verifies geozone ID, geozone group, longitude and latitude data. If mistakes are found, it displays an error message. Other parameters are not verified. User himself must ensure that file contains only valid data.

Geozone CSV file format for geozone information importing and after exporting:
Geozone ID;Latitude;Longitude;Point type;Geozone radius;Geozone group ID CRLF
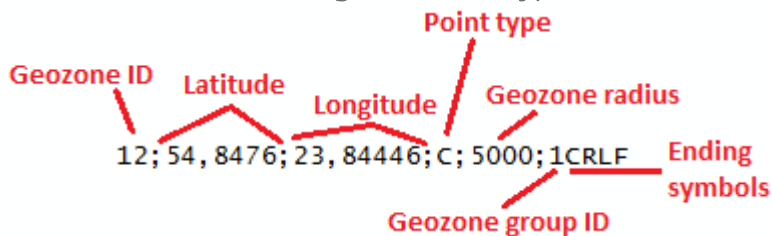


CSV file example with 10 geozones:



Explanation:
- Geozone ID - Id corresponding ID in list (1-250).
- Latitude - Latitude coordinate. Comma symbol " , " is used to separate decimal points.
- Longitude - Longitude coordinate. Comma symbol " , " is used to separate decimal points.
- Point type. This must be a symbol:
  - C – Circular.
  - P – Multipoint (polygonal).
- Radius - Enter radius in meters. For multipoint (polygonal) geozones enter 0.
- Geozone group ID - number 1 - 8.
- CRLF - line ending symbols.
- Semicolon ";" is used as parameter separator (delimiter).

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**Importing/exporting geozones**

1. Click "Import geozones button" and choose a CSV. file with geozone data. This action will overwrite all existing geozones.
2. Click "Export geozones" to save them to the CSV file.