



DOUT activation with conditions User Manual

2019/05

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1 Introduction

The DOUT activation with conditions functionality allows the user to configure various conditions under which DOUTs will be activated, making the DOUTs much more flexible for a variety of tasks. DOUTs can be used for vehicle control, for instance – engine blocking by set conditions.

1.1 Compatibility

This functionality is compatible with the following FM devices with the latest firmware version:

- FM-Tco4 HCV
- FM-Tco4 LCV
- FM-Pro4
- FM-Eco4
- FM-Eco4 S

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

1.2 Legal notice

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1.3 Document change log

Date	Version	Change details
2017-06-26	1.0	Initial draft.
2017-08-11	1.1	Functionality is now supported by Eco4 series devices.
2017-09-01	1.2	Added work logic for the "Immobilizer" functionality.
2017-12-18	1.3	New DOUT activation condition "GSM jamming"
2018-07-30	1.4	"Immobilizer" work logic clarified.
2018-11-19	1.5	Added note about DOUT inversion in "Configuration".
2019-04-18	1.6	Immobilizer operation principle updated.
2019-05-10	1.7	Added description of DOUT activation by rollover.

2 Functionality description

2.1 About

DOUT activation by conditions is used to inform the driver about various events in progress, such as over speeding or GSM jamming. For this functionality to work, a peripheral must be connected to the FM device in order for it to be activated by the set conditions. This functionality works with the following peripherals:

- LED
- Buzzer
- Blocking
- Custom DOUT – custom DOUTs are described in the “Configurable DOUTs patterns” document, which is available on the documentation website. “Immobilizer” custom DOUT is described further in the document.

Peripheral connection descriptions are located on every page for each FM device model at doc.ruptela.it. The peripheral section is located at the bottom of the web page.

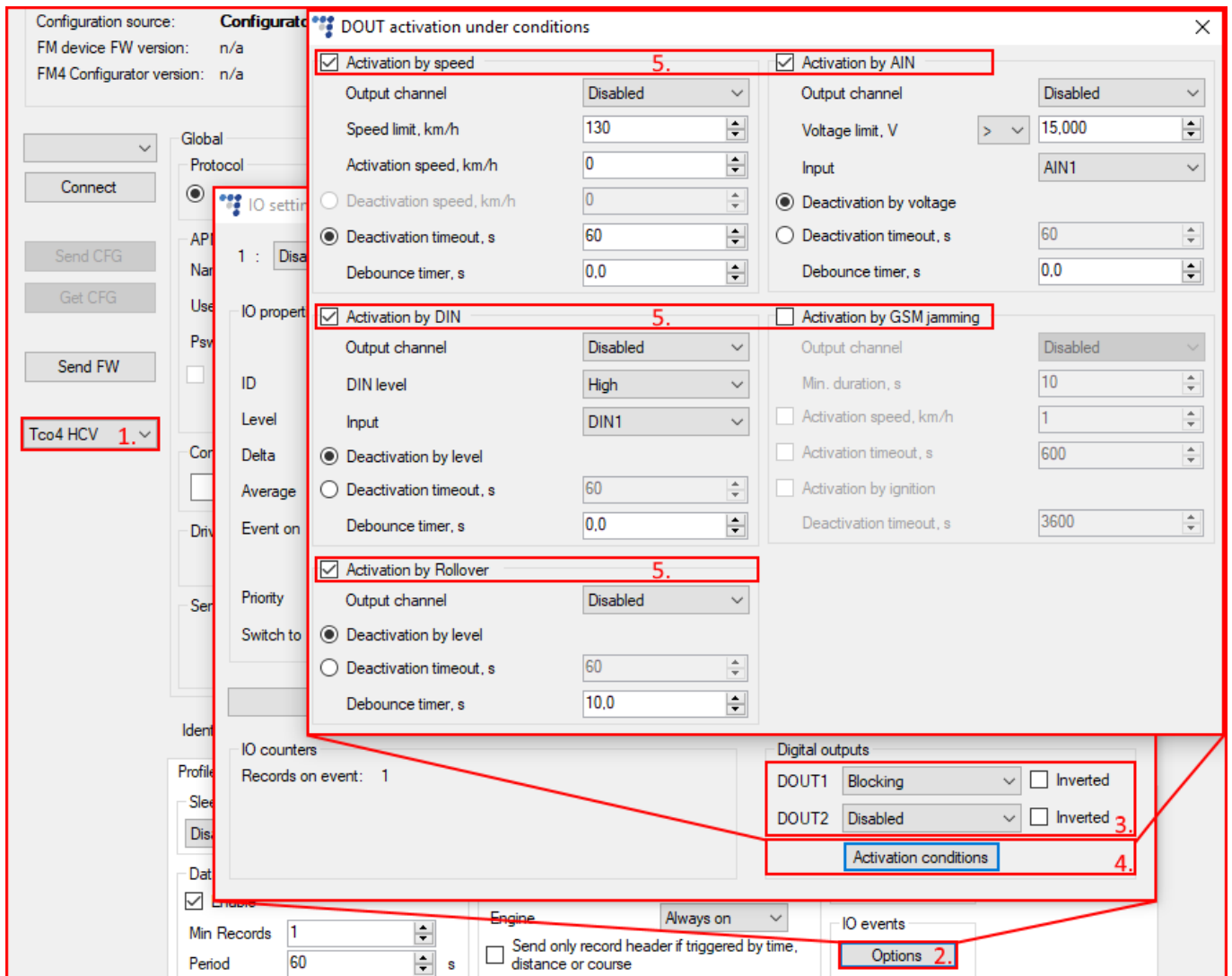
2.2 General configuration

Assuming that the peripherals were connected correctly, the user can start configuring the DOUT activation by conditions.

Note

The **Inverted** checkbox inverts the logic of the selected DOUT. Keep this in mind before configuring DOUTs.

1. In the FM device configurator, please select your FM device model;
2. In the **IO events** section click the **Options** button, this will open the **IO settings** window;
3. In the **IO settings** window, select a peripheral device in the DOUT drop-down list. There is no priority on which DOUT a peripheral is selected (if a peripheral is selected on one DOUT it will be unavailable for selection in the other). Selecting a peripheral on a DOUT will enable the **Activation conditions** button;
4. Click the **Activation conditions** button, this will open the settings for **DOUT activation under conditions**.
5. In the settings window the user can select under what condition the DOUTs will be activated, the following options are available:
 - Activation by speed
 - Activation by AIN
 - Activation by DIN
 - Activation by GSM jamming
 - Activation by rollover



This covers the general process of the configuration. The configuration for each condition is described further on separately.

3 Configuration

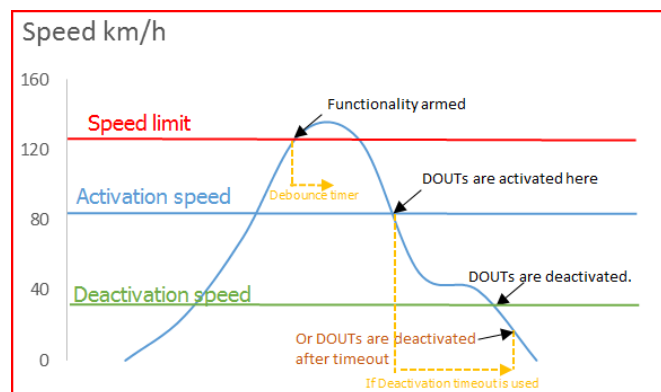
3.1 Configuring DOUT activation by speed

To configure DOUT activation by speed, the user must follow the instruction provided below:

1. To enable DOUT **activation by speed**, the user must tick the checkbox;
2. Select an **output channel** (the peripheral connected to the FM device and configured on a DOUT as described previously), this will be the DOUT activated by the selected condition.
3. Set the **speed limit** at which the DOUT will be **armed, but not activated**. This means that once the speed limit is reached and the debounce timer has run out (if configured) the device will only prepare to activate and wait until the **activation speed** (configured further) is reached to actually activate the DOUT. **The speed limit cannot be lower than 1 km/h.**
4. Set the **activation speed**. Speed defines when the DOUT is actually activated (the activation speed is required mostly for the blocking functionality to avoid any potential dangers with its use. In cases when the output channel is set to LED or Buzzer, the activation speed can be set close to the speed limit); **The activation speed cannot be set higher than the speed limit.**
5. Configure how or when the DOUT will be deactivated. First option, use **deactivation speed** where the user can set at which speed the DOUT is deactivated, this option can be selected only if the activation speed is greater than 1 km/h. Alternatively, the user can set the **deactivation timer**, after it runs out, the DOUT state is reset and the monitoring of the vehicle's speed continues.
6. *Optional recommended step.* Set the **debounce timer**. This timer defines how much time the device will wait after the speed limit is reached to arm the DOUT, if within this time period the speed lowers below the configured speed limit, the DOUT will not be armed. It is recommended to set the debounce timer to a couple of seconds to avoid possible speed spikes.

<input checked="" type="checkbox"/> Activation by speed	1.	
Output channel	LED	2. ✓
Speed limit, km/h	130	3. ↓
Activation speed, km/h	12	4. ↓
<input type="radio"/> Deactivation speed, km/h	0	5. ↓
<input checked="" type="radio"/> Deactivation timeout, s	60	↓
Debounce timer, s	0.0	6. ↓

After the configuration is complete, the user can close the window and send the configuration to the FM device. DOUT activation by speed working principle:



3.2 Configuring DOUT activation by AIN

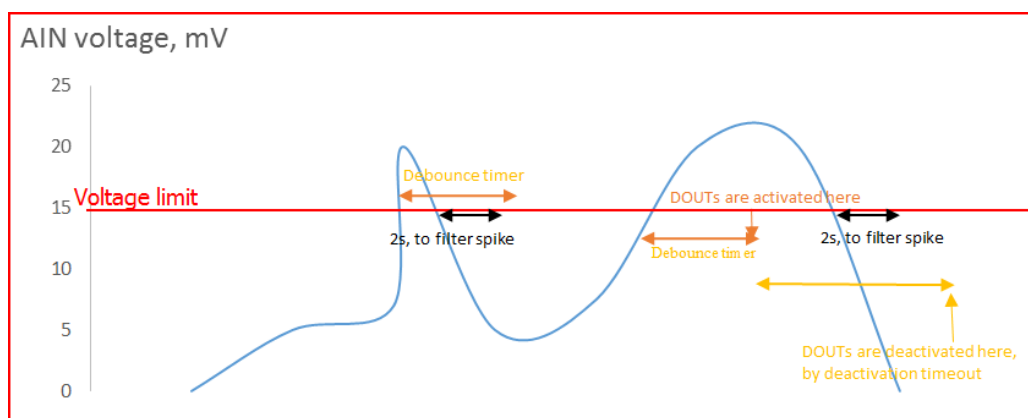
To configure DOUT activation by AIN, the user must follow the instructions provided below:

1. To enable DOUT **activation by AIN**, the user must tick the checkbox;
2. Select an **output channel** (the peripheral connected to the FM device and configured on a DOUT as described previously), this will be the DOUT activated by the selected condition.
3. Set the **voltage limit** at which the DOUT will **be activated**, after the debounce timer has run out (if configured). The voltage limit can be set to be either "**Lower than <**" or "**Larger than >**" the set value. The voltage is set in **volts**, the resolution is 0,005 V.
4. Select the **analog input**, from which the voltage readings are received, this must be configured individually depending on the actual connection to the FM device.
5. Configure how or when the DOUT will be deactivated. The first choice is using the **deactivation by voltage**, which means that the DOUT state will be reset after the voltage has dropped below the set limit, **AND 2 seconds have passed**. The 2 second timer is a hard-coded spike filter that cannot be edited or disabled. Alternatively, the user can set the **deactivation timer**, after it runs out, the DOUT state is reset and monitoring of the vehicle's voltage continues.
6. *Optional recommended step.* The user can configure the **debounce timer**. This timer defines how much time the device will wait after the set voltage limit is reached, before activating the DOUT. If within this time period the voltage level no longer satisfies the activation condition, the DOUT will not be activated. It is recommended to set the debounce to a couple of seconds to avoid possible voltage spikes.

The screenshot shows a configuration window for DOUT activation by AIN. The settings are as follows:

- 1. Activation by AIN
- 2. Output channel: LED
- 3. Voltage limit, V: > 15.000
- 4. Input: AIN1
- 5. Deactivation by voltage
- 6. Deactivation timeout, s: 60
- Debounce timer, s: 2.0

After the configuration is complete, the user can close the window and send the configuration to the FM device. DOUT activation by AIN working principle:



3.3 Configuring DOUT activation by DIN

To configure DOUT activation by DIN, the user must follow the instructions provided below:

1. To enable DOUT **activation by DIN**, the user must tick the checkbox;
2. Select an **output channel** (the peripheral connected to the FM device and configured on a DOUT as described previously), this will be the DOUT activated by the selected condition.
3. Set the **DIN level**, at which the DOUT will **be activated**, after the debounce timer has run out (if configured). The DIN level can be set to either **high** (changes from 0 to 1), or **low** (Changes from 1 to 0).
4. Select the **digital input**, from which the DIN state will be received, this must be configured individually depending on the actual connection to the FM device.
5. Configure how or when the DOUT will be deactivated. The first choice is using the **deactivation by level**, which means that the DOUT state will be reset after the DIN state reverts to previous state, **after the 2 second hard coded spike filter has passed**. Alternatively, the user can set the **deactivation timer**, after it runs out, the DOUT state is reset and monitoring of the DIN level continues.
6. *Optional recommended step*. The user can configure the **debounce timer**. This timer defines how much time the device will wait after the DIN level is activated, before activating the DOUT. If within this time period the DIN level reverts to the previous state, the DOUT will not be activated. It is recommended to set the debounce to a couple of seconds to avoid possible spikes.

The screenshot shows a configuration window for DOUT activation by DIN. The settings are as follows:

<input checked="" type="checkbox"/> Activation by DIN	1.
Output channel	LED 2. v
DIN level	High 3. v
Input	DIN1 4. v
<input checked="" type="radio"/> Deactivation by level	5.
<input type="radio"/> Deactivation timeout, s	60
Debounce timer, s	6. 0.0

After the configuration is complete, the user can close the window and send the configuration to the FM device.

3.4 Configuring DOUT activation by GSM jamming

To configure DOUT activation by GSM jamming, the user must follow the instructions provided below:

1. To enable DOUT **activation by GSM jamming**, the user must tick the checkbox;
2. Select an **output channel** (the peripheral connected to the FM device and configured on a DOUT as described previously), this will be the DOUT activated by the selected condition.
3. Set the **minimal duration in seconds**. Once GSM jamming is detected, this parameter defines for how long it must be registered (continuously), for the DOUT to actually be armed. If the timer was not reached, and the jamming is no longer being detected, the timer will reset. If the timer passes, the DOUT goes to the "armed" state;
4. Select one or several of the activation conditions. If several conditions are enabled, the highest priority goes to the **activation speed**. If activation speed is enabled, other enabled conditions are not checked, unless speed data is not received or is not valid from the CAN line or OBD line (the device first checks the CAN line, then the OBD line). For other conditions there is no priority, and the DOUT will be activated by the condition that is fulfilled first. Activation conditions description:
 - a. **Activation speed, km/h** – this activation method defines the speed at which the DOUT will be activated. For example: activation speed is set to 30 km/h, the DOUT is armed. The vehicle is going at 60 km/h, the DOUT will not activate, until the vehicle slows down to 30 km/h. The FM device will receive speed information from various sources, but in the event, if no data is available, the system will check for a different activation condition. (**This activation method is available only for the PRO series devices**).
 - b. **Activation timeout, s** – this activation method will simply activate the DOUT once the timeout has passed, after the DOUT has entered the "armed" state;
 - c. **Activation by ignition** – if this activation method is selected, the DOUT will activate if it was "armed" and afterwards the **ignition was turned OFF**, or if the ignition was OFF to begin with, the DOUT will activate immediately. **For this condition it is recommended to set engine state detection to DIN4.**
5. Set the **deactivation timeout**. This parameter defines after what time period the DOUT will be deactivated after the DOUT is activated. If the value is set to 0, the DOUT will not be deactivated automatically, and it will be possible to deactivate it only with a "doutreset" SMS command. In order to avoid a constant DOUT activation state in areas with constant GSM jamming, it is highly recommended to set a deactivation timeout above 0s.

The screenshot shows a configuration window for DOUT activation. The settings are as follows:

<input checked="" type="checkbox"/> Activation by GSM jamming 1.	
Output channel	2. Disabled
Min. duration, s	3. 10
<input checked="" type="checkbox"/> Activation speed, km/h	4a. 1
<input checked="" type="checkbox"/> Activation timeout, s	4b. 600
<input checked="" type="checkbox"/> Activation by ignition 4c.	
Deactivation timeout, s	5. 3600

After the configuration is complete, the user can close the window and send the configuration to the FM device.

3.5 Configuring DOUT activation by rollover

There are some initial conditions needed for the functionality to work:

Initial conditions:

1. Accelerometer has to be calibrated;
2. **Rollover detection** has to be enabled in the **Impact detection** settings.
3. *Recommended.* Enable the **Roll over alarm** functionality in the **IO settings** window.

To configure DOUT activation by rollover follow the instructions:

1. Tick the **Activation by Rollover** checkbox to enable the functionality.
2. Select an **Output channel** from the drop-down list. It is the configured DOUT mode. If *Disabled* is selected, the functionality will not work.
3. Enable one of the deactivation conditions:
 - **Deactivation by level** – the DOUT is deactivated once the rollover is not detected anymore.
 - **Deactivation timeout** – the DOUT is deactivated after an entered period of time passes. The default value is 60 seconds, input range – from 0 to 80000 seconds. If the value is set to 0, then the DOUT will not deactivate automatically and can only be deactivated only by the *doutreset* SMS command.
4. *Optional recommended step.* Set the **Debounce timer** which defines how much time the device will wait before changing the status of activated DOUT. It is recommended to set the debounce timer in order to avoid spikes. The default value is 10 seconds, input range – from 0 to 60 seconds.

The screenshot shows a configuration window for DOUT activation. It features a checked checkbox for 'Activation by Rollover' (labeled 1.), a dropdown menu for 'Output channel' set to 'Disabled' (labeled 2.), a radio button selected for 'Deactivation by level', a spin box for 'Deactivation timeout, s' set to 60 (labeled 3.), and a spin box for 'Debounce timer, s' set to 10.0 (labeled 4.).

After configuring DOUT activation by rollover, close the windows and send the configuration to the device.

4 DOUT activation in sleep mode and special conditions

Several special conditions must be taken into account when using the DOUT activation with conditions:

- Once the DOUT is activated by a condition, it cannot be disabled by a transition to any sleep mode or by changing a profile;
- Once the FM device goes into sleep/deep sleep mode, activation by speed will not work;
- If DOUT activation by speed is **armed** or **activated**, the device cannot go to sleep/deep sleep/custom sleep mode. In custom sleep mode, if "**DOUT activation by speed**" changes status to **armed** or **activated**, the device wakes up;
- If DOUT activation by speed is **armed** or **activated**, the device cannot go to sleep/deep sleep/custom sleep mode. In custom sleep mode, if "**DOUT activation by GSM jamming**" changes status to **armed** or **activated**, the device wakes up;
- If DIN state is **HIGH**, the device cannot go to sleep mode, if DIN status is **LOW**, the device can go to sleep mode, but will wake up if the DIN state changes to **HIGH**;
- DOUT activation by conditions behavior in custom sleep mode depends fully on the configuration of the custom sleep mode;
- If the device goes to sleep mode or deep sleep mode, DOUT activation from GSM jamming will not work;

Since DOUTs can be activated by other functionalities apart from "DOUT activation with conditions", a hardcoded priority list of DOUT activations is implemented to set priorities for functionalities. If a DOUT is activated by a functionality or a condition, all other activation conditions, which are **lower in the priority list are temporarily deactivated** while the DOUT is active. The priority is set as follows:

1. Driver registration
2. Activation by GSM jamming
3. Activation by rollover
4. Geofencing
5. Activation by speed
6. Activation by AIN
7. Activation by DIN

Note

It is recommended to use one DOUT for "Activation with conditions" functionality, while leaving the other DOUT for functionalities such as "Driver registration" and "Geofencing" to avoid confusion.

Example: *DOUTs are activated by geofencing, while the DOUTs are active, activation by speed, AIN and DIN will be temporarily ineffective.*

5 I/O list

IO parameters can be configured in order to monitor the current DOUT activation state. The following IO parameters can be configured:

- DOUT activation by speed
- DOUT activation by AIN
- DOUT activation by DIN
- DOUT activation by GSM jamming
- DOUT activation by rollover

More detailed descriptions of the IO parameters can be found on our documentation [website](#).

6 Custom DOUT mode

6.1 "Immobilizer" mode

"Immobilizer" mode can only be activated and deactivated only via an SMS command. This functionality can be enabled only on one of the DOUTs. To configure this mode, select Immobilizer in the DOUT drop-down list. Additionally, the user can set a pattern for this DOUT. Custom DOUT patterns are described in the "Configurable DOUT patterns" document located in the documentation [website](#).

Digital outputs

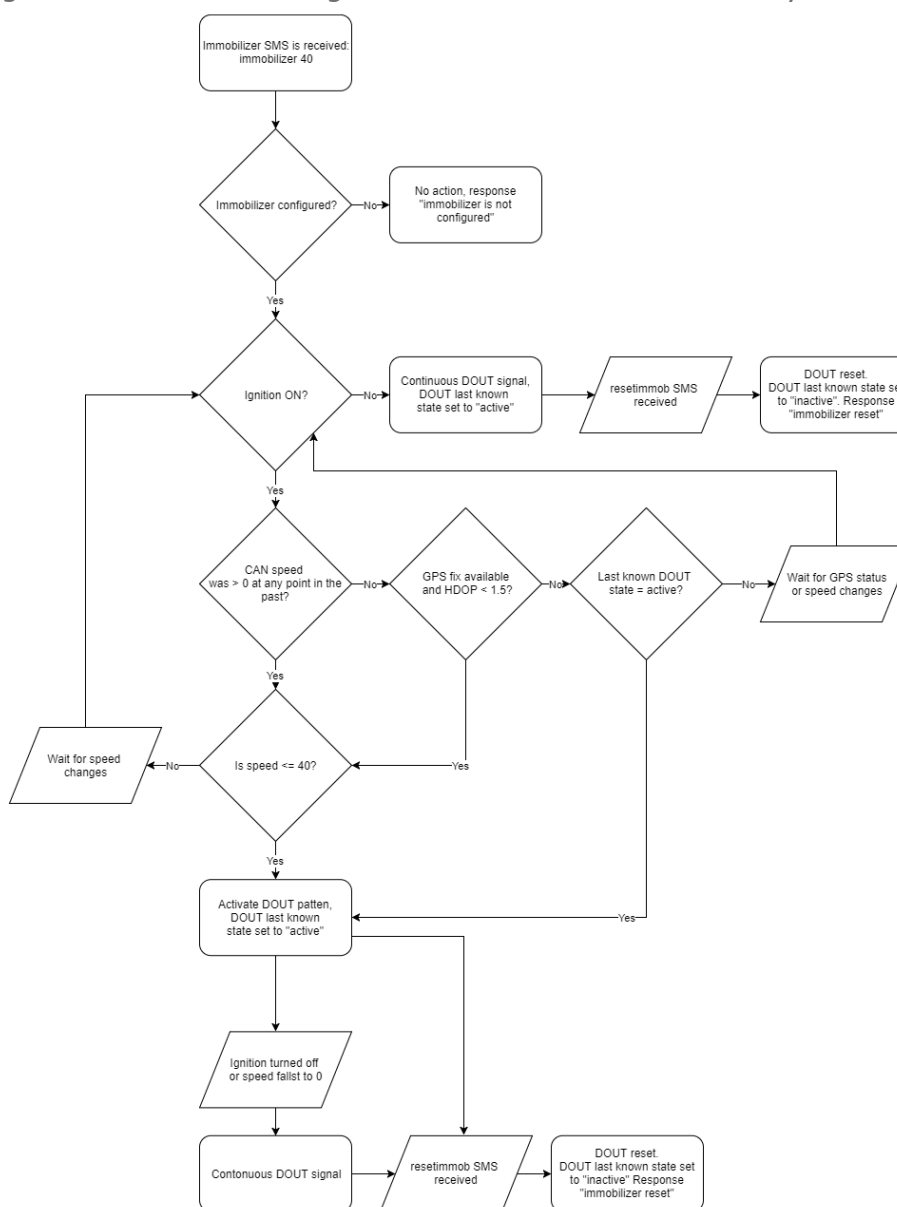
DOUT1: Immobilizer Pattern: 1 : 1 : 0 : 0 : 1 : H

DOUT2: Disabled

Activation conditions

Operating principle

In order to understand the full workflow of the immobilizer, please refer to the given workflow diagram. The following diagram covers the full and general workflow of the functionality.



Use-cases

There are some examples given which explain several possible use-cases. Refer to the workflow diagram above for the general operation principle of the functionality.

Case 1:

Initial conditions:

1. Immobilizer SMS is received;
2. Ignition is ON;
3. CAN speed is not available, the GPS fix available and GPS positional measurement precision is high enough (HDOP < 1.5);
4. GPS speed is 0.

If the conditions are complied, the device will output a continuous signal according to the set pattern.

Case 2:

One of the cases is sending the *immobilizer* SMS command to an FM device with a lower speed setting compared to the actual speed. For example, the actual speed is 80 km/h, the immobilizer command is sent with a 60 km/h limit (*pass immobilizer 60*). **If the ignition is on**, the immobilizer will not activate in any case until the GPS or CAN speed has first lowered below the set 60 km/h limit and afterwards reached the set limit.

Case 3:

Additionally, to the previous case, the *reset* SMS command (or any other case when the device resets) should be also described. The *reset* command resets the FM device. The *reset* command has no effect on the *immobilizer* command and functionality, unless at that moment the ignition is off. If the immobilizer is active, the reset command will not disable it. If the case of the first example is in effect (and the Ignition is ON), GPS or CAN speed is 80 km/h and a *pass immobilizer 60* command is sent, it will still not activate the immobilizer until the vehicle speed first drops below the set limit.

Immobilizer status

Immobilizer status is important when the SMS reset command is received.

The device saves the last known "Immobilizer" status and if the speed parameter is not available, the device checks the last known immobilizer status:

- If status was *disabled* – the device keeps the DOUT inactive and waits for the speed parameter.
- If status was *enabled* – the device activates the DOUT. If there is an activated pattern, it is restarted.
- If the last known status is not available, the device keeps the DOUT inactive and waits until GPS fix and speed parameter are acquired.

7 SMS commands

DOUT activation with conditions supports two SMS commands. The first SMS command is *doutreset* which can reset the state of the activated DOUTs remotely. The DOUTs will be reset even if DOUT activation conditions are fulfilled.

Note

If the DOUT state is reset via an SMS command, they can only be reactivated after the deactivation conditions are met.

SMS command structure:

pass doutreset

The following responses can be received:

- ***DOUT activation mechanism was reset***
- ***DOUT activation mechanism is inactive***
- ***DOUT activation is not configured***

The second SMS command is for the **"Immobilizer" DOUT mode**. SMS command structure:

pass immobilizer <speed>

<speed> - describes the vehicle speed at which the progressive DOUTs must be toggled.

If no custom DOUTs are configured, the device will respond with the following message:

immobilizer is not configured

To reset the custom DOUT patterns the user must send the following message:

pass resetimmob

The device will respond with the following message:

immobilizer reset