

# DOUT activation with conditions

## Introduction

The DOUT activation with conditions function allows the user to configure various conditions under which DOUTs will be activated, making the DOUTs much more flexible for a variety of tasks.

Feature in the following FM devices with the latest firmware and configurator:

- FM-Tco4 HCV series devices;
- FM-Tco4 LCV series devices;
- FM-Pro4 series devices;
- FM-Eco4 series devices.

You can get the latest firmware and configurator from our documentation website: [doc.ruptela.lt](http://doc.ruptela.lt)

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## 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 "immobilizer" functionality.
2017-12-18	1.3	New DOUT activation condition "GSM jamming"

## Description

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:

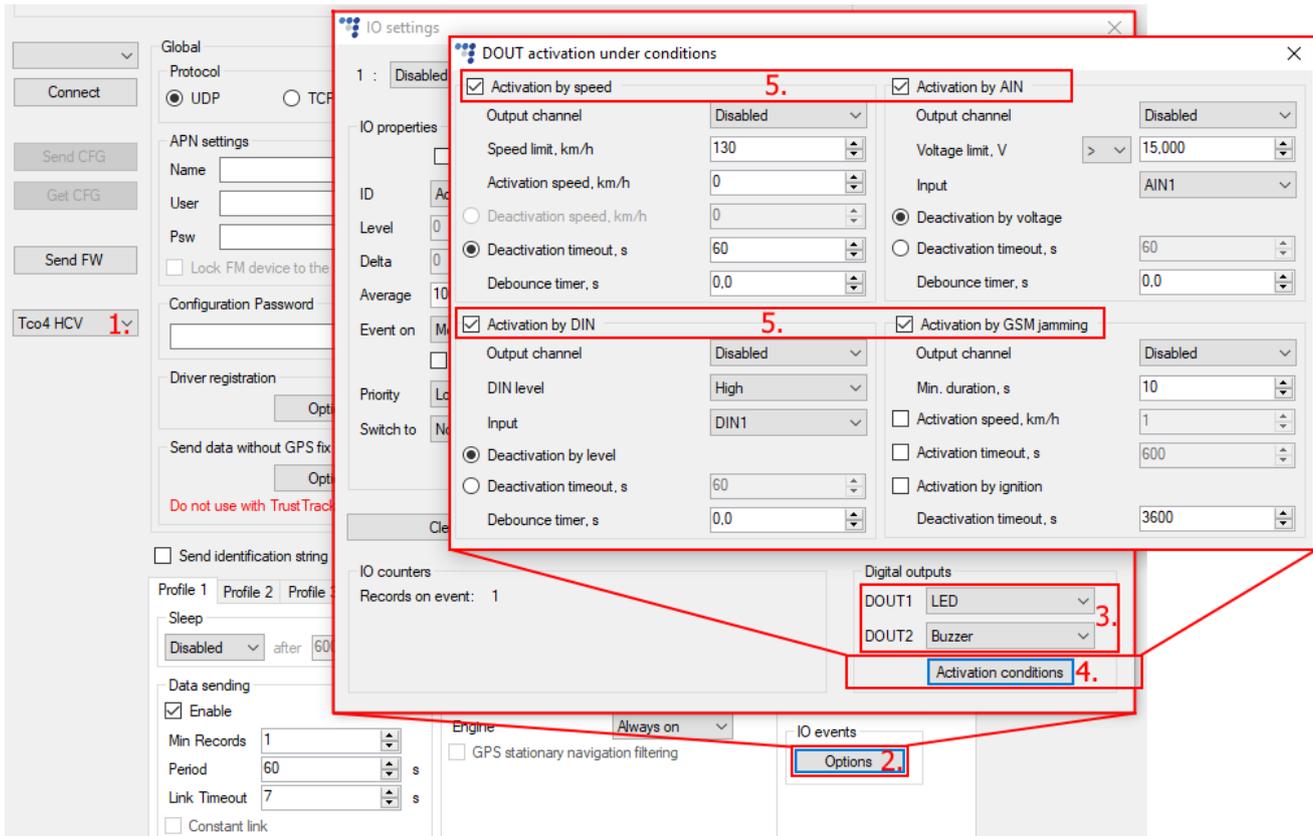
- LED;
- Buzzer;
- Blocking;
- Custom DOUT – custom DOUTs are described in “Configurable DOUTs patterns” document, which is available at the documentation website. “Immobilizer” custom DOUT is described further in the document.

Peripheral connection descriptions are located on every page for each FM device model at [doc.ruptela.lt](http://doc.ruptela.lt). The peripheral section is located at the bottom of the web page.

## General configuration

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

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, the user must 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 by conditions**”
5. In the settings window the user can select by 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.



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

## Configuring DOUT activation by speed

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

1. To enable DOUT **activation by speed**, the user must put a tick in the checkbox;
2. Next the user must select an **output channel** (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. Next the user must set a **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. **Speed limit cannot be lower than 1 km/h.**
4. After setting the speed limit, the user must configure the **activation speed**. As mentioned earlier, this speed defines when the DOUT is actually activated (Activation speed is required mostly for the blocking functionality to avoid any potential dangers with its use. In cases when output channel is set to LED or Buzzer, activation speed can be set close to the speed limit); **Activation speed cannot be set higher than the speed limit.**
5. Next the user must configure how or when the DOUT will be deactivated. The first choice is using the "**Deactivation speed**" where the user can set at which speed the DOUT is deactivated, this option can be selected only if activation speed is larger than 1 km/h.

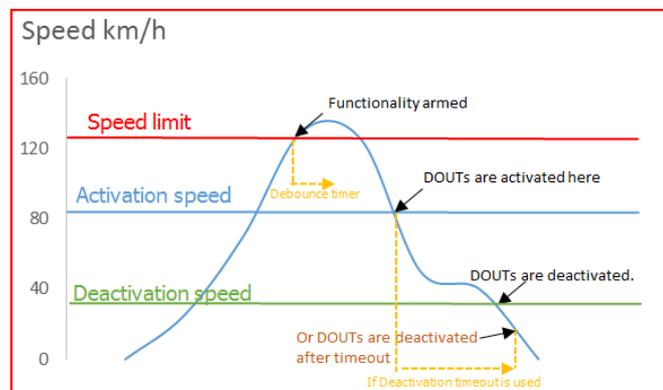
Alternatively, the user can set the “**Deactivation timer**”, after it runs out, the DOUT state is reset and monitoring of the vehicles speed continues.

6. Lastly, the user can configure the “**Debounce timer**”. This step is not mandatory, but is recommended. 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 to a couple of seconds to avoid possible speed spikes.

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

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:



## Configuring DOUT activation by AIN

To configure DOUT activation by AIN, the user must follow the instruction provided further:

1. To enable DOUT **activation by AIN**, the user must put a tick in the checkbox;
2. Next the user must select an **output channel** (Peripheral connected to the FM device and configured on a DOUT as described previously), this will be the DOUT activated by the selected condition.

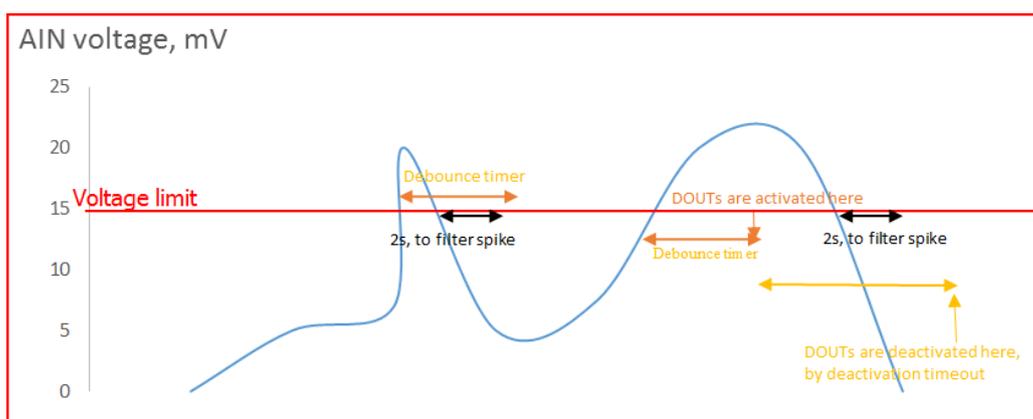
- Next, the user must set the **Voltage limit** at which the DOUT will **be activated**, after the debounce timer has run out (if configured). The voltage limit can be set to be either "**Lower than <**" or "**Larger than >**" the set value. The voltage is set in **Volts**, resolution is 0,005V.
- Next, the user must select the **analog input**, from which the voltage readings are received, this must be configured individually depending on the actual connections of to the FM device.
- Next the user must 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 vehicles voltage continues.
- Lastly, the user can configure the "**Debounce timer**". This step is not mandatory, but is recommended. 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 changes out of the activation scope, the DOUT will not be activated. It is recommended to set the debounce to a couple of seconds to avoid possible speed spikes.

The screenshot shows a configuration window for DOUT activation. It includes the following elements:

- 1.** A checked checkbox labeled "Activation by AIN".
- 2.** A dropdown menu for "Output channel" set to "LED".
- 3.** A dropdown menu for "Voltage limit, V" set to ">" and a numeric input field set to "15,000".
- 4.** A dropdown menu for "Input" set to "AIN1".
- 5.** A radio button selected for "Deactivation by voltage".
- A radio button for "Deactivation timeout, s" with a value of "60".
- 6.** A numeric input field for "Debounce timer, s" set to "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:



## Configuring DOUT activation by DIN

To configure DOUT activation by DIN, the user must follow the instruction provided further:

1. To enable DOUT **activation by DIN**, the user must put a tick in the checkbox;
2. Next the user must select an **output channel** (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. Next, the user must 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. Next, the user must select the **digital input**, from which the DIN state will be received, this must be configured individually depending on the actual connections of to the FM device.
5. Next, the user must 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. Lastly, the user can configure the **"Debounce timer"**. This step is not mandatory, but is recommended. 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 previous state, the DOUT will not be activated. It is recommended to set the debounce to a couple of seconds to avoid possible spikes.

<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.

## Configuring DOUT activation by GSM jamming

To configure DOUT activation by GSM jamming, the user must follow the instruction provided further:

1. To enable DOUT **activation by GSM jamming**, the user must put a tick in the checkbox;
2. Next the user must select an **output channel** (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. Next, the user must 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 activation goes to the **"Armed"** state;
4. Next, the user can 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 (device first checks CAN line, then OBD). For other conditions there is no priority, and the DOUT will be activated by the condition that fulfills 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, DOUT is Armed. 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. Lastly, the user must set a **Deactivation timeout**. This parameter defines after what time period the DOUT will be deactivated after the DOUT is Activated. If value is set to 0, the DOUT will not be deactivated automatically, and it will be possible to deactivate it only by "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.

## DOUT activation in sleep mode and other 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 the 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**, 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**, device wakes up;

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- 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 set configurations 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. Geofencing;
4. Activation by speed;
5. Activation by AIN;
6. 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.*

## I/O list

ID	Name	Name in the configurator	Size, B	Range	Event on	Description
627	DOUT_activation_by_speed	DOUT activation by speed	1	0-5	Monitoring On change Hysteresis	0 – DOUT activation mechanism is disabled; 1 – DOUT activation mechanism is enabled 2 – DOUT activation mechanism is armed (Speed limit is exceeded); 3 – DOUTs are activated; 4 – DOUT mechanism is deactivated after timeout; 5 – DOUT mechanism is deactivated after speed dropped below configured. This I/O state is valid till the generation of next record.

628	DOUT_activation_by_AIN	DOUT activation by AIN	1	0-4	Monitoring On change Hysteresis	0 – DOUT activation mechanism is disabled; 1 – DOUT activation mechanism is enabled 2 – DOUT activation mechanism is activated (Voltage limit is exceeded or voltage dropped below); 3 – DOUT mechanism is deactivated after timeout. This I/O state is valid till the generation of next record.; 4 – DOUT mechanism is deactivated after voltage has dropped or raises above the limit. This I/O state is valid till the generation of next record.
629	DOUT_activation_by_DIN	DOUT activation by DIN	1	0-4	Monitoring On change Hysteresis	0 – DOUT activation mechanism is disabled; 1 – DOUT activation mechanism is enabled 2 – DOUTs are activated; 3 – DOUT mechanism is deactivated after timeout; 4 – DOUT mechanism is deactivated after DIN status change. This I/O state is valid till the generation of next record.
637	DOUT_activation_by_GSM_jamming	DOUT activation by GSM jamming	1	0-4	Monitoring On change Hysteresis	0 – DOUT activation mechanism is disabled; 1 – DOUT activation mechanism is enabled 2 – DOUTs activation mechanism is armed 3 – DOUT is activated 4 – DOUT mechanism is deactivated after timeout

## New custom DOUT mode “Immobilizer”

Along with the “DOUT activation with conditions”, a new DOUT mode is introduced. This DOUT follows special conditions, **it can only be activated and deactivated only by a SMS command**. Configuration of this DOUT is also managed via SMS commands. This functionality can be enabled only on one of the DOUTs. To configure this mode, the user must 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**” documented located in the documentation [website](#).

Digital outputs

DOUT1  Pattern

DOUT2

The “Immobilizer” DOUT mode works similarly to the “Blocking” mode. In cases if the vehicle has stopped (speed = 0) or the ignition is off and the “Immobilizer” is activated, the device will output a

continuous signal (same as blocking). **“Immobilizer” configuration via SMS is described in the next section.**

## SMS commands

DOUT activation with conditions supports two new 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 by the 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***

## Work logic

The immobilizer functionality has some special conditions and cases that should be taken into account.

One of the cases is sending the “immobilizer” SMS command to a 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 60 km/h limit (*pass immobilizer 60*). 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.

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, GPS or CAN speed is 80 km/h and "*pass immobilizer 60*" command is sent, still it will not activate the immobilizer until first the vehicle speed drops below the set limit. If during the reset, ignition was of, the state of the immobilizer will change.