

# GUARDIAL Digital Tilt Sensor DTS3D

Tilt and shock sensor



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## 1. General

The integrated tilt and shock sensor was built based on a modern 3-axis acceleration sensor (accelerometer). The main advantage of the sensor is the detection of changes in each axis (3 axial sensor) and any position of the sensor assembly relative to the level. The sensor is characterized by reliability, resistance to interference and temperature changes. Configurable parameters allow universal use in vehicle security. The position sensor triggers an alarm when it detects a change in vehicle position relative to the starting position. Depending on the configuration and connection of the sensor, the initial position is remembered after power off or after the ignition switch off. The two-stage shock sensor distinguishes between light and strong shocks on the vehicle. A light hit triggers the pre-alarm function of the alarm system. A strong strike triggers an alarm.

## 2. Sensor configurable parameters

Sensor has 4 configurable parameters (default setting marked with **bold**). The method of parameter configuration is given in the description of the sensor's operation.

Parameter 1 – tilt sensor sensitivity

<b>Level 1</b>	<b>Tilt more than 1,5 degree from the initial vehicle position (default)</b>
Level 2	Tilt more than 0,7 degree from the initial vehicle position

Parameter 2 – shock sensor sensitivity (alarm trigger)

Level 1	312mg (low)
Level 2	250 mg
<b>Level 3</b>	<b>187 mg (default)</b>
Level 4	125 mg
Level 5	62 mg (high)

Parameter 3 – shock sensor sensitivity (pre-alarm)

Level 1	93 mg (low)
<b>Level 2</b>	<b>62 mg (default)</b>
Level 3	31 mg (high)

Parameter 4 – sensor operating mode and sensor output function (green and white wires)

<b>Level 1</b>	<b>Green wire</b>	<b>tilt and shock alarm output (default)</b>
	<b>White wire</b>	<b>pre-alarm output (default)</b>
Level 2	Green wire	tilt alarm output
	White wire	shock alarm output (no pre-alarm)
Level 3	Green wire	tilt and shock alarm output
	White wire	ignition input (to save initial vehicle position)
Level 4*	Green wire	tilt alarm output
	White wire	ignition input (to save initial vehicle position)

Level 4 is available only for special orders – disables shock sensor alarm and pre-alarm.



### 3. Algorithm of operation and sensor configuration

#### 3.1. Sensor operation

After turning the power on, the LED lights up for 10 seconds. Next it starts to blink evenly every 1 second. During the blinking of the LED, the shock sensor is active, the tilt sensor is not active yet. After about 60 seconds, the LED stops blinking - the sensor is fully armed (tilt sensor and shock sensor are active).

From now on:

- Changing the vehicle's position by an angle greater than the one set in the first parameter activates the alarm.
- A vehicle hit with a force exceeding the value set in parameter 2 activates the alarm.
- Striking a vehicle with a force exceeding the value set in parameter 3, but lower than the one set in parameter 2, activates the pre-alarm.

#### 3.2. Change of sensor configuration

To **change** the sensor configuration:

- Supply power to the sensor.
- After the power is turned on, the LED lights up 10 seconds.
- When the LED is on, tap the sensor slightly **5 times**. **Each tap is confirmed by short blink of Led**.
- The LED will turn off and blink **5 times**. The configuration programming will start.

From now on, the rule is:

- LED long blinks (from 1 to 4 times) indicate which parameter will be changed,
- LED short blinks (from 1 to the number of levels in the parameter) - indicates which level in this parameter we can choose at a given moment.

Tapping the sensor after the short flashes are displayed selects this level and proceeds to set the next parameter. Without tapping on the sensor, the next level of the given parameter is displayed with short flashes (if any) or moving to the next parameter.

After the last fourth parameter, the LED will turn off and after 3 seconds it will blink rapidly for approximately 3 seconds. After a moment, the LED will go off and it will display by blinking the set level for each of the 4 parameters:

- long blinks - show the parameter number,
- short blinks - show the set level in the parameter.

#### 3.3. Example configuration

Example 1 (setting level 1 in parameter 1):

LED 1x long blink, 3 seconds pause,  
LED 1x short blink – now tap the sensor to set level 1 in parameter 1,  
LED 1x short blink – confirmation of setting level 1, 3 seconds pause,  
LED 2x long blink – parameter 2 setting starts.

Example 2 (setting level 2 in parameter 1):

LED 1x long blink, 3 seconds pause,  
LED 1x short blink, pause,  
LED 2x short blink – now tap the sensor to set level 2 in parameter 1,  
LED 2x short blink – confirmation of setting level 2,  
LED 2x long blink – parameter 2 setting starts.

Example 3 (setting level 1 in parameter 2):

LED 1x long blink, 3 seconds pause,  
LED 1x short blink, pause,  
LED 2x short blink, 3 seconds pause,  
LED 2x long blink, 3 seconds pause (no change in parameter 1, parameter 2 setting starts),  
LED 1x short blink – now tap the sensor to set level 1 in parameter 2,



LED 1x short blink – confirmation of setting level 1,  
 LED 3x long blinks – parameter 3 setting starts.

### 3.4. Check of sensor configuration

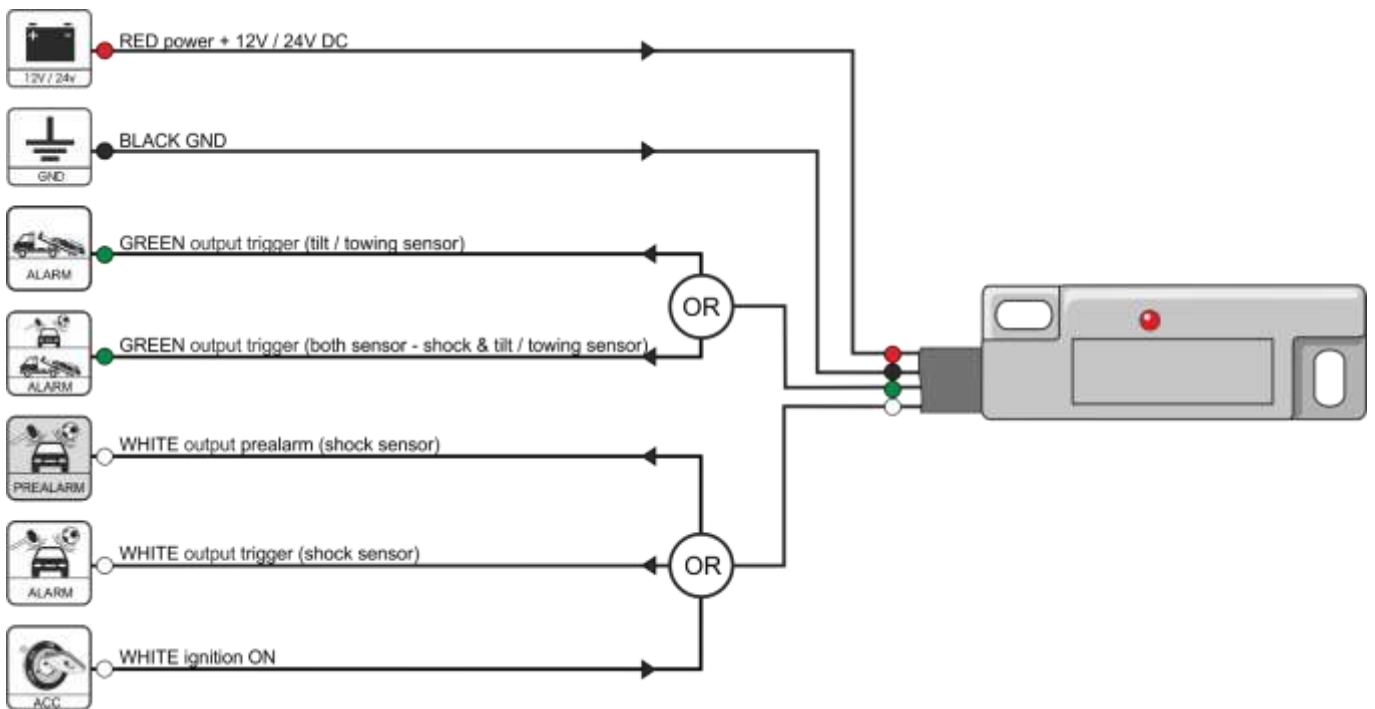
To **check** the sensor configuration:

- a. Supply power to the sensor.
- b. After the power is turned on, the LED lights up 10 seconds.
- c. When the LED is on, tap the sensor slightly **3 times**. Each tap is confirmed by short blink of Led.
- d. The LED will turn off and blink **3 times**. The configuration programming will start.

From now on, the rule is:

- LED long blinks indicates parameter number,
- LED short blinks indicates level of this parameter.

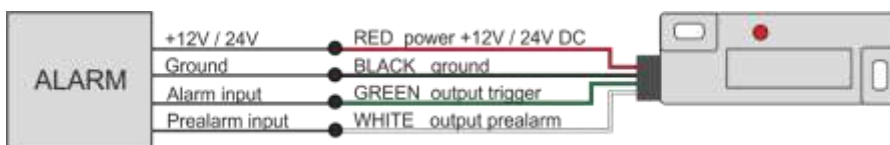
## 4. General schematic



## 5. Variants of sensor connection

### 5.1. Tilt and shock sensing.

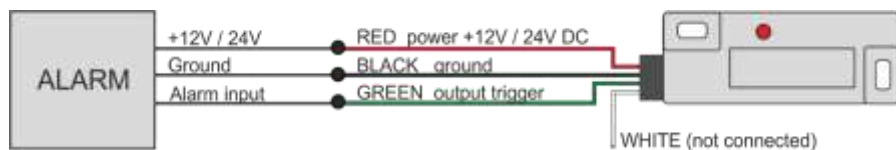
Connections to alarm system with single alarm input, pre-alarm input and sensor power supply.



- tilt and shock alarm trigger on single wire, green wire,
- shock pre-alarm on different white, white wire,
- set sensor parameter 4 – level 1 (default setting),
- sensor power supply (GND or +12V/+24V) must be off when alarm is disarmed.

## 5.2. Tilt and shock sensing

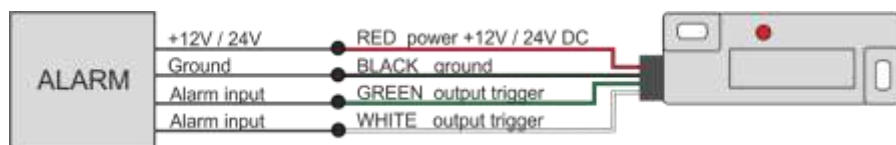
Connection to alarm system with single alarm input, without pre-alarm input and with sensor power supply.



- tilt and shock alarm trigger on single wire, green wire,
- white wire not connected,
- set sensor parameter 4 – level 1 (default setting),
- sensor power supply (GND or +12V/+24V) must be off when alarm is disarmed.

## 5.3. Tilt and shock sensing

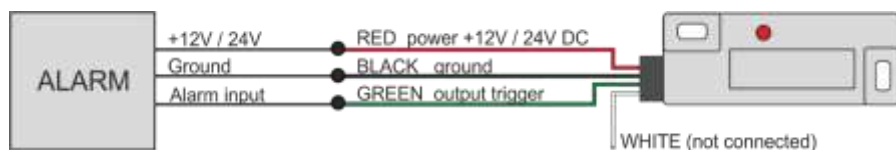
Connection to alarm system with two alarm inputs and sensor power supply.



- tilt alarm trigger on green wire,
- shock alarm trigger on white wire,
- set sensor parameter 4 – level 2,
- sensor power supply (GND or +12V/+24V) must be off when alarm is disarmed.

## 5.4. Only tilt sensing (no shock)

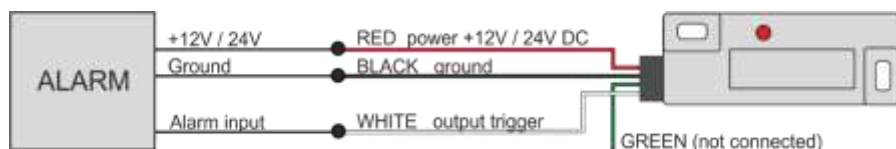
Connection to alarm system with one alarm input and sensor power supply.



- tilt alarm trigger on green wire,
- white wire not connected,
- set sensor parameter 4 – level 2,
- sensor power supply (GND or +12V/+24V) must be off when alarm is disarmed.

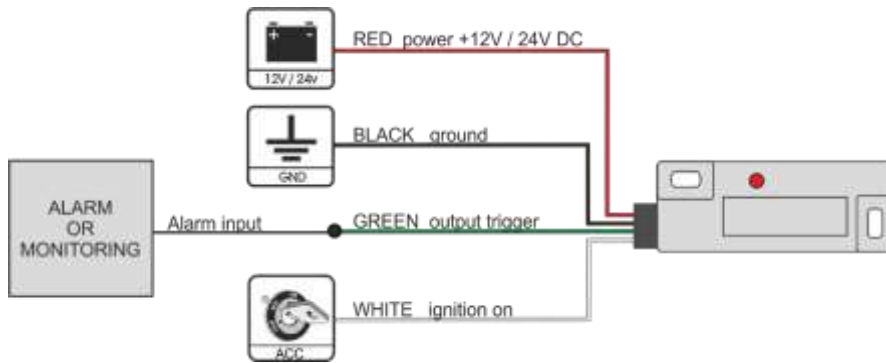
## 5.5. Only shock sensing (no tilt)

Connection to alarm system with one alarm input and sensor power supply.



- shock alarm trigger on white wire
- green wire not connected
- set sensor parameter 4 – level 2,
- sensor power supply (GND or +12V/+24V) must be off when alarm is disarmed.

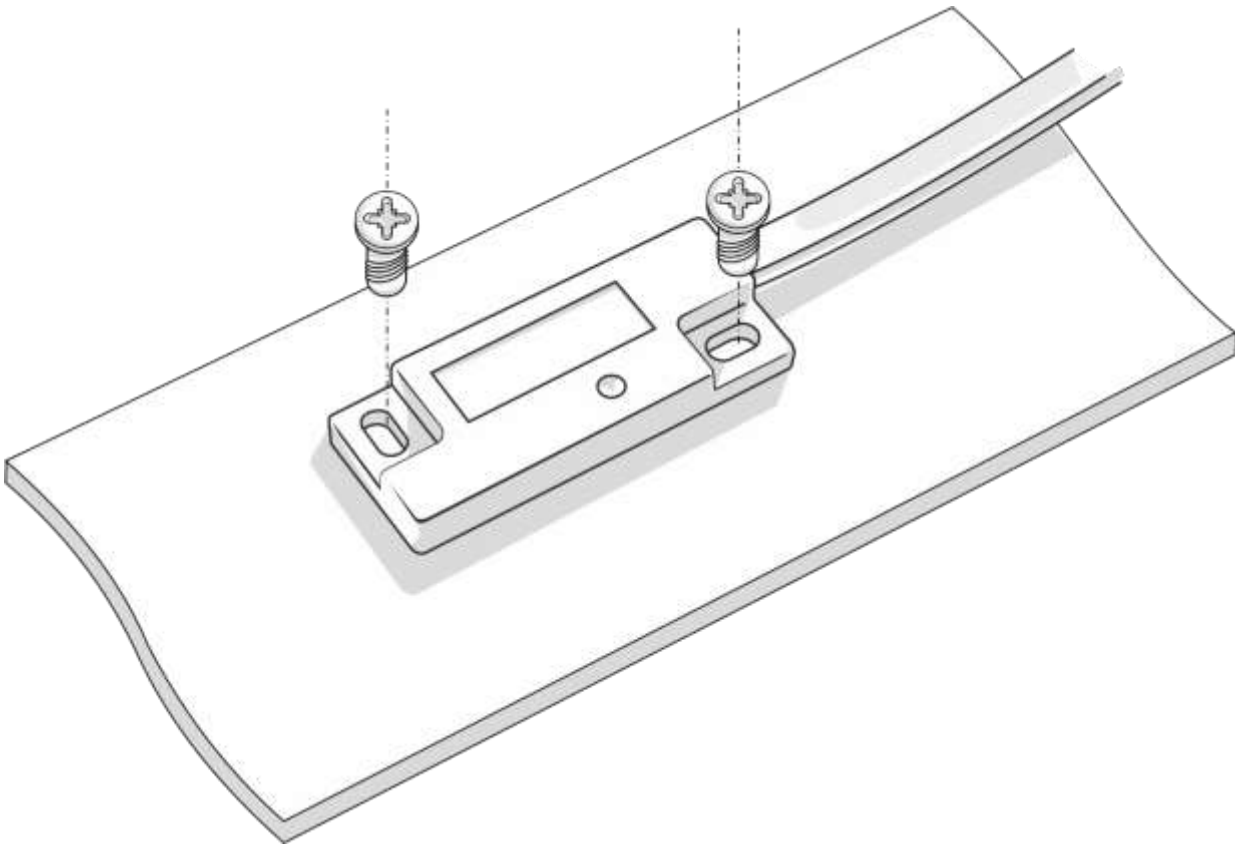
## 5.6. Tilt and shock sensing. Constant power supply (e.g. monitoring systems)



- tilt and shock alarm trigger on single wire, green wire,
- set sensor parameter 4 – level 3
- connect white wire to ignition circuit (sensor saves vehicle position after ignition is OFF)

## 6. Installation recommendations

The sensor should be permanently attached to a rigid base with screws or zip-ties or double-sided adhesive tape. Due to the built-in 3-axis accelerometer, the sensor can be mounted in any position relative to the vehicle's plane (horizontally, vertically, at an angle on any axis).



The element to which the sensor is attached should be rigidly connected to the body of the vehicle. Fastening to flexible, soft or deformable elements (e.g. to wire harnesses) will cause false alarms from the tilt sensor and will prevent the shock sensor from working.

Do not install the sensor on parts that rapidly change temperature (e.g. heating, ventilation and air conditioning housing), as false alarms may result.

## 7. Technical data

Power supply	9-30V
Power consumption when armed	< 1mA
Load capacity and outputs type	< 250mA, OC, ground active
tilt sensor setting time (LED stops blinking)	60 seconds
shock sensor setting time	12 seconds
Pulse length at the alarm output	1 second
Time between successive alarm pulses	2 seconds
Pulse length at the pre-alarm output	1 second
Time between successive pre-alarm pulses	4 seconds



## 8. Product code

Guardial DTS3D sensor will be shown on all documents with detailed product code that allows to identify its configuration. For example:

GUARDIAL DTS3D 0001-13210-10-01-01

GUARDIAL DTS3D **XXXX-ZZZZ-WW-CC-PP**

