



ACCELERATION SENSOR SMART-AS0101

USER MANUAL



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INTRODUCTION

This manual is designated for Vega Smart-AS0101 acceleration sensor (hereinafter – device, sensor) manufactured by Vega-Absolute OOO and provides information on powering and activation procedure, control commands and functions of the device.

This manual is targeted at specialists familiar with installation work fundamentals for electronic and electrical equipment.

Vega-Absolute OOO reserves the right to make changes to the manual related to the improvement of equipment and software, as well as to eliminate typos and inaccuracies, without prior notice.

1 DEVICE PURPOSE AND OPERATION PRINCIPAL

DEVICE PURPOSE

Vega Smart-AS0101 can be used to protect premises, buildings, and structures, as well as in Smart Home systems, built on LoRaWAN® technology.

The sensor is triggered by shaking or moving due to the built-in accelerometer with three levels of sensitivity and sends an alarm signal to the LoRaWAN® network.

It can be installed on any movable parts, such as doors, drawers and windows as motion or shake indicator. Can be used as a sensor for breaking windowpanes.

The sensor is produced in four color variants: black, brown, white and grey.

The sensor is powered by a CR123A 1400 mAh battery.

The sensor configuring via USB with special software «Vega LoRaWAN Configurator».

OPERATION ALGORITHM

Vega Smart-AS0101 operates in modes listed below:

"Storage" – is a mode for storing and transporting. In this mode the device does not communicate regularly with the network.

"Active" – is a main mode of device operation.

Initially, the device is not connected to power, because a plastic plug is installed between the battery contact and the device contact, which must be removed before putting the sensor into operation.

Vega Smart-AS0101 supports two activation methods in the LoRaWAN® network - ABP and OTAA. Select one of the methods via the "Vega LoRaWAN Configurator" application (see "User Manual" on the program).

ABP method. After pressing the start button, the device immediately starts working in the "Active" mode.

OTAA method. After pressing the start button, the device makes three attempts to connect to the network within the set frequency plan. After the activation in the LoRaWAN® network is confirmed, the device sends a signal (LED flashing for 5 seconds) and switches to the "Active" mode. If all attempts fail, the counter will continue to accumulate data and will attempt to connect to the network every 6 hours.

Hold the start button pressed (min. 5 seconds) to switch the device from the "Active" mode back to the "Storage" mode.

The readings store in the device memory with a configurable period from 5 minutes to 24 hours. The stored readings transmit during the next communication session with the LoRaWAN® network.

The adjustable data transfer period can be from 5 minutes to 24 hours. Data transferring in random point in time during set period. At the next communication session, the device starts sending accumulated packets with readings, from the earliest to the latest.

With the "Confirmed uplinks" option turned on, the device will send the next packet only after receiving a confirmation of the delivery of the previous one. If such confirmation have not received after the fulfilled in the settings uplink number of transmission, device completes the communication session until the next one according to the schedule. In this case, the device continues to collect data according to the data collection period and store it in memory. Non-transmitted packets remain in the device memory until the next communication session.

With the "Confirmed uplinks" option turned off, the device just sends all accumulated packets to the network in order from the earliest to the latest. There are no checks of package delivery in this mode. There are no non-transmitted messages in the device memory.

The internal clock is set automatically when device connected to the "Vega LoRaWAN Configurator" via USB, also adjustable via LoRaWAN®.

FUNCTIONAL

Vega Smart-AS0101 acceleration sensor is class A device (LoRaWAN® classification) and has the following features:

- ◉ Frequency plans RU868, EU868, KZ865 supported
- ◉ The ability to set custom frequency plan
- ◉ ADR support (Adaptive Data Rate)
- ◉ Sending of confirmed packets (configurable)
- ◉ OTAA or ABP activation (configurable)
- ◉ Communication period - every 5, 15, 30 minutes, 1, 6, 12, 24 hours (configurable)
- ◉ Extra communication in case of alarm event
- ◉ Temperature measurement by the internal temperature sensor
- ◉ Battery charge measurement (%)

MARKING

Device marked with sticker that contain the following information:

- ⦿ Device model;
- ⦿ DevEUI;
- ⦿ Month and year of manufacture;
- ⦿ Certification marks.

Sticker located in three places – on device case, in factory certificate and on the packing box.

Besides, there is an additional sticker located on the packing box and contains:

- ⦿ Information about firmware version;
- ⦿ QR code containing device activation keys in the LoRaWAN® network, production date and other identifiers.

2 SPECIFICATION

DEVICE SPECIFICATION

MAIN	
USB-port	micro-USB, type B
Operating temperatures	-40...+85 °C
Built-in temperature sensor	yes
LoRaWAN®	
LoRaWAN® class	A
Quantity of LoRa channels	16
Frequency plans supported by default	RU868, EU868, KZ865, custom (EU868 based)
Frequency plans available as order option	IN865, AS923, AU915, KR920, US915
Activation type	ABP or OTAA
Communication period	5, 15, 30 minutes, 1, 6, 12 or 24 hours
Data collection period	5, 15, 30 minutes, 1, 6, 12 or 24 hours
Memory amount for storing packets	200 packets
Antenna	internal
Sensitivity	-138 dBm
Radio coverage in restrained urban conditions	max 5 km
Radio coverage within line of sight	max 15 km
Transmitter power by default	25 mW (configurable)
POWER	
Replaceable battery	CR123A 3V, 1400 mAh
Warranty number of packets sent by the device with default settings, not less	15 000
CASE	
Housing dimensions	63 x 36 x 21 mm
Ingress protection rating	IP20
PACKAGE	
Dimensions	80 x 40 x 25
Weight	0,045

DEFAULT DEVICE SETTINGS

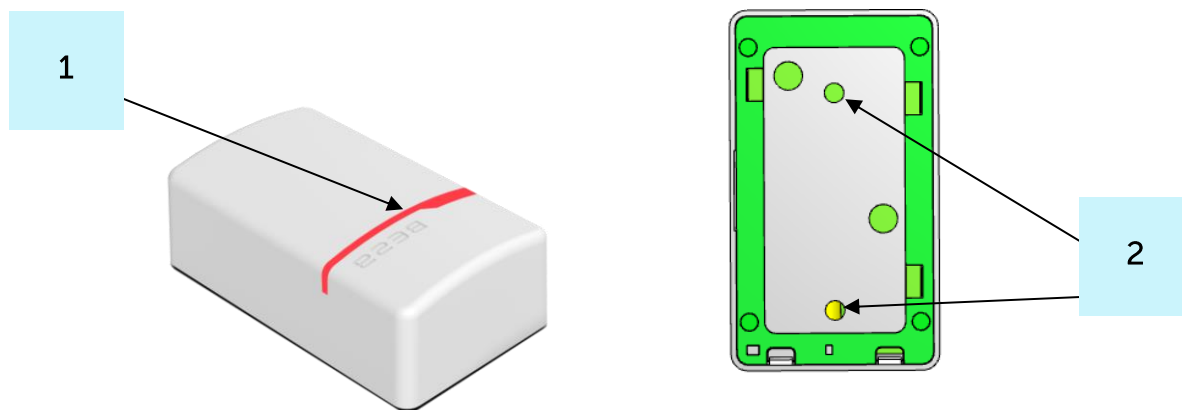
PARAMETER	VALUE
Frequency plan	RU868
Activation type	OTAA
Adaptive Data Rate	ON
Confirmed Uplinks	OFF
Rx 1 Delay	1 second
Join Accept Delay	5 seconds
Uplink number of transmissions	1
Data rate	DR0
Power	14 dBm
Communication period	24 hours
Data collection period	24 hours
Time zone	UTC +00:00

For changing the device settings, you need to connect to it with “Vega LoRaWAN Configurator” application. You can download app on the iotvega.com site in SOFT section as well as User Manual for configurator. [Go to the app page.](#)

3 OPERATION

DEVICE APPEARANCE

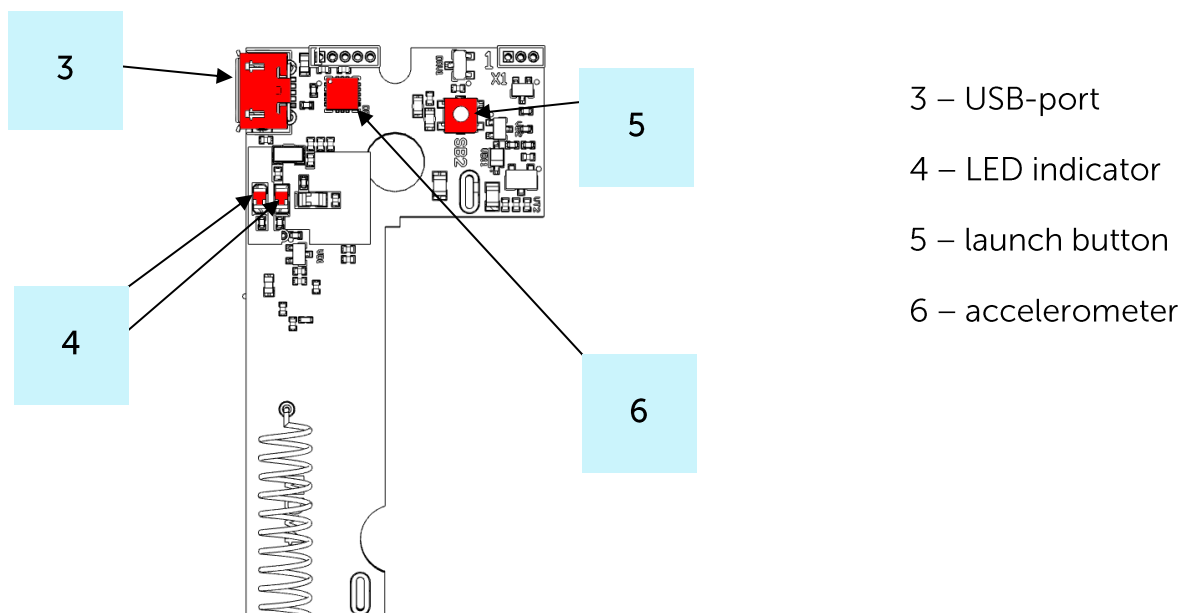
Vega Smart-AS0101 is represented in a compact package with a double color LED indicator on the front side.



1 – LED indicator

2 – holes for screws

Service elements are located inside the case on the board: an USB interface and a start button.



3 – USB-port

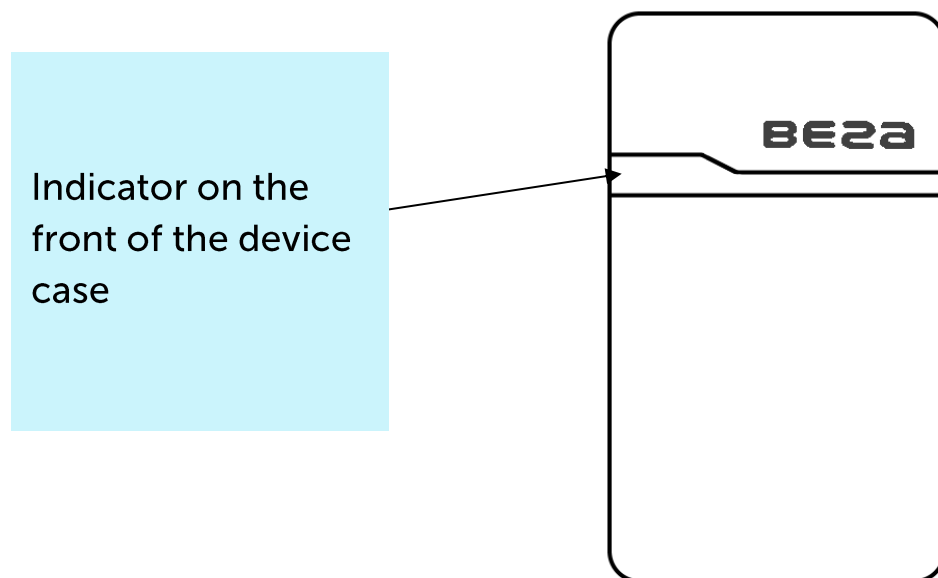
4 – LED indicator







5 – launch button

6 – accelerometer

INDICATION

A double color indicator is located on the front of the sensor case and it informs a user about the device state.



INDICATOR SIGNAL		MEANING
	A series of short green flashes	Linking to the network in progress
	One long green flash	The device connected to the network and is in «Active» mode
	One long red flash	Linking to the network is unsuccessful or the device switched to the «Storage» mode
	One short red flash	Every sensor triggering
	One green flash every 10 seconds	Device in «Active» mode and the battery charge is more than 10%
	One red flash every 10 seconds	Battery charge is lower than 10 %



In case of connection attempt fail, the device will continue to accumulate data and will attempt to connect to the network every 6 hours

MOUNTING RECOMMENDATIONS

To provide the stable radio between the gateway and the end device it is recommended avoiding the device installation in the places which are barriers for the radio signal getting through like a reinforced floors and walls, a basement, an underground facilities and wells, a metal case etc.

The necessary stage for the network deploying including a big quantity of end devices is a radio planning work with nature experiments.



Before starting mounting work, you must make sure that the latest firmware version is installed on the equipment

For mounting you will need:

- double sided tape;
- screwdriver;
- laptop.

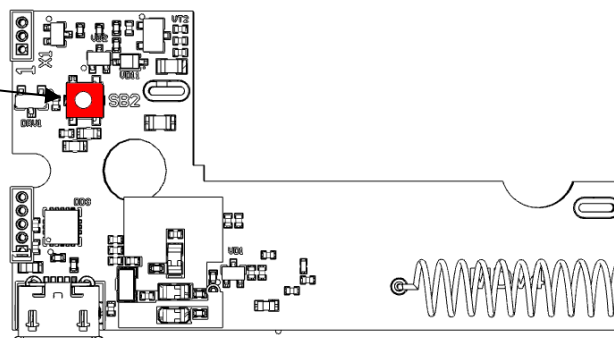


Initially, the device is not connected to power, because a plastic plug installed between the battery contact and the device contact must be removed before commissioning.

Step by step mounting guide:

1. Setting the devices and connecting them to the network are usually carried out in the office (see Network Deployment Manual).
2. Determination of suitable places for mounting at the object with a network tester.
3. Remove the plastic plug between the battery and the device contact, if present, or install the battery if it has not been installed.
4. Device launching – switching to the “Active” mode and registration in the network.

The location of the start button on the board



5. By the laptop you can make sure that the device successfully sends the data.
6. Assembling the device.
7. Fixing the device on the object. It can be fixed with self-tapping screws or double-sided tape.

4 COMMUNICATION PROTOCOL

This part describes the Smart-AS0101 communication protocol with LoRaWAN® network.



In fields consisting of several bytes, the little-endian byte order is used

SMART-AS0101 TRANSMITS THE FOLLOWING TYPES OF PACKETS

1. Packet with current readings, sent regularly to LoRaWAN® port 2

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 1	uint8
1 byte	Battery charge, %	uint8
1 byte	Sensor deviation angle from vertical 0-90	uint8
2 bytes	Temperature in °C, multiplied by 10	int16_t
1 byte	Sending reason (0 – by the time, 1 – sensor triggered)	uint8
1 byte	Inputs state (byte field)	uint8
4 bytes	Reading time for values in this packet (unixtime UTC)	uint32

"Inputs state" bit field decoding

Bits	Field description	
0 bit	Accelerometer state (1 – move, 0 – not move)	
1-7 bit	Reserved	

2. Packet with time correction request, sent every seven days on LoRaWAN® port 4

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 255	uint8
4 bytes	Time of the modem at a moment of the packet transmission (unixtime UTC)	uint32

After receiving this type of package, the application can send to modem the packet with time correction.

3. Settings packet – transmitting on LoRaWAN® port 3 when settings request command received, or device connected to the network

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 0	uint8
2 bytes	ID of parameter	uint16
1 byte	Data length (len)	uint8
len bytes	Parameter value	-----
2 bytes	ID of parameter	uint16
1 byte	Data length (len)	uint8
len bytes	Parameter value	-----
...
2 bytes	ID of parameter	uint16
1 byte	Data length (len)	uint8
len bytes	Parameter value	-----

SMART-AS0101 RECEIVES THE FOLLOWING TYPES OF PACKETS

1. Real-time clock adjustment – sent by application on LoRaWAN® port 4

Size in bytes	Field description	Data type
1 byte	Packet type, this packet = 255	uint8
8 bytes	The value in seconds for which you need to adjust the time. Can be positive or negative	int64

When receiving the packet, the pulse counter sets its internal clock and calendar in compliance with the received packet.

2. Packet with request of settings – sent by application on LoRaWAN® port 3

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 1	uint8

Answering that packet, the device sent the packet with settings.

3. Packet with settings is identical to such packet from device

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 0	uint8
2 bytes	ID of parameter	uint16
1 byte	Data length (len)	uint8
len bytes	Parameter value	-----
2 bytes	ID of parameter	uint16
1 byte	Data length (len)	uint8
len bytes	Parameter value	-----
...
2 bytes	ID of parameter	uint16
1 byte	Data length (len)	uint8
len bytes	Parameter value	-----

The package with settings sent to the device may not contain all the settings supported by the device, but only the part that needs to be changed.

Table of ID of Smart-AS0101 parameters and these possible values



The table contains values in DEC, when sending, these values must be converted to HEX

ID of parameter	Description	Data length	Possible values
4	Confirmed uplinks	1 byte	1 – confirmed 2 – unconfirmed
16	Communication period	1 byte	1 – 1 hour 2 – 6 hours 3 – 12 hours 4 – 24 hours 5 – 5 minutes 6 – 15 minutes 7 – 30 minutes
44	Accelerometer sensitivity	1 byte	1 – low 2 – mid 3 – high
49	Data collection period	1 byte	1 – 1 hour 2 – 6 hours 3 – 12 hours 4 – 24 hours 5 – 5 minutes 6 – 15 minutes 7 – 30 minutes

5 STORAGE AND TRANSPORTATION REQUIREMENTS

The Smart-AS0101 sensor shall be stored in the original packaging in heated room at temperatures $+5^{\circ}\text{C}$ to $+40^{\circ}\text{C}$ and relative humidity less than 85%.

The sensor shall be transported in covered freight compartments of all types at any distance at temperatures -40°C to $+85^{\circ}\text{C}$.

6 CONTENT OF THE PACKAGE

The sensor is delivered complete with:

Acceleration sensor Vega Smart-AS0101 – 1 pc.

CR123A battery – 1 pc.

Factory certificate – 1 pc.

7 WARRANTY

The manufacturer guarantees that the product complies with the current technical documentation, subject to the storage, transportation and operation conditions specified in the "User Manual".

The warranty period is 36 months. The warranty does not cover batteries.

The warranty period of operation is calculated from the date of sale marked in the product factory certificate, and from the release date when such a mark is absent. During the warranty period, the manufacturer is obliged to provide repair services or replace a failed device or its components.

The manufacturer does not bear warranty obligations in the event of a product failure if:

- ⊙ the product does not have a factory certificate;
- ⊙ the factory certificate does not have an TCD stamp and / or there is no sticker with information about the device;
- ⊙ the serial number (DevEUI, EMEI) printed on the product differs from the serial number (DevEUI, EMEI) specified in the factory certificate;
- ⊙ the product has been subject to alterations in the design and / or software which are not provided for in the operational documentation;
- ⊙ the product has mechanical, electrical and / or other damage and defects arising from violation of the conditions of transportation, storage and operation;
- ⊙ the product has traces of repair outside the manufacturer's service center;
- ⊙ the components of the product have internal damage caused by the ingress of foreign objects / liquids and / or natural disasters (flood, fire, etc.).

The average service life of the product is 7 years.

In the event of a warranty claim, contact the service center:

119A, Bol'shevistskaya Str., Novosibirsk, 630009, Russia.

Tel.: +7 (383) 206-41-35.

e-mail: remont@vega-absolute.ru

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02	22.01.2019	KEV	Communication protocol changed, setting via 'air' described, indication changed. Frequency plans added, specification changed, blackbox described, warranty changed, configurator updated. "Marking" part added.
03	24.01.2019		Исправлена неточность в протоколе обмена – тип пакета с запросом настроек и с настройками
04	03.07.2020	KEV	Scheduled revision of the document, minor changes
05	30.03.2022	KMA	Planned revision



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