



SMOKE SENSOR SMART-SS0102

USER MANUAL



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CONTENTS

INTRODUCTION.....	3
1 DEVICE PURPOSE AND OPERATION PRINCIPAL.....	4
Device purpose.....	4
OPERATION algorithm.....	4
Functional.....	5
Marking.....	6
2 SPECIFICATION.....	7
Device Specification.....	7
Default Device Settings.....	8
3 OPERATION.....	9
Device Appearance.....	9
Indication.....	10
Button.....	12
Mounting recommendations.....	13
Connecting devices in the line of solidarity work.....	17
4 COMMUNICATION PROTOCOL.....	19
SMART-SS0102 transmits the following types of packets.....	19
SMART-SS0102 receives the following types of packets.....	20
5 STORAGE AND TRANSPORTATION REQUIREMENTS.....	22
6 CONTENT OF THE PACKAGE.....	23
7 WARRANTY.....	24

INTRODUCTION

This manual is designated for Vega Smart-SS0102 Smoke 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-SS0102 smoke sensor is designed to detect fire in a protected area, accompanied by the emission of smoke. The sensor periodically (every ten seconds) is analyzing the environment and switch on an emergency warning via a light and sound indication when a smoke is detected. In addition, the sensor sends an alarm signal to the LoRaWAN® network.

Vega Smart-SS0102 can be used to protect rooms, buildings, and structures from fire and/or smoke.

The sensor powered by two replaceable batteries CR123A 3V of the common capacity 2800 mAh.



**The device is powered by a non-rechargeable lithium (Li) battery
Attempts to charge the battery may result in fire**

OPERATION ALGORITHM

The device has the next operation modes.

"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-SS0102 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 removing the plastic plug or exiting the "Storage" mode, the device immediately starts working in the "Active" mode.

OTAA method. After removing the plastic plug or exiting the "Storage" mode, 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 by the indicator (blue LED and sound indication). If all attempts fail, the sensor will continue attempts to connect to the network every 1 day. However, it will still function normally in the "Standby" mode.

Hold the start button pressed (min. 5 seconds) to switch the device from the "Active" mode back to the "Storage" mode. To exit the device from the "Storage" mode, you must press the start button.

In the "Active" mode, 3 submodes are possible.

"Standby" submode is a main submode of the device operation. When the device switches to "Standby" submode it stands to guard after 60 seconds and starts poll the smoke sensor every 10 seconds. If the calibration value of triggering threshold is exceeded, the device makes two more measurements every 2 seconds to confirm the fact of triggering. If all three measurements show that triggering threshold has been exceeded, the detector switches to the "Fire" submode. If the measurements after 2 seconds are below triggering threshold, the device does not register an alarm and continues to work in "Standby" submode.

"Fire" submode is an alarm mode. The device sends the alarm packet to LoRaWAN® network, switches on sound and light indication corresponding to alarm submode and stops smoke sensor measurements but still forms packets and transmits data according to the schedule. You can switch off the alarm only through device button pressing and the device will switch to the "Standby" mode.

"Test" submode is for checking device notification system without emission of smoke. The behavior of the detector in "Test" submode is fully consistent with behavior in the "Fire" submode. Transition to the "Test" submode is carried out by pressing button for 3 seconds. Transition back to "Standby" submode is carried out by short-term pressing of the button.

While operating in any submode the device forms data packet with configurable data collection period. Packet is formed at 00:00 if the collection period is 24 hours; at 00:00 and at 12:00 if the period is 12 hours etc. All packets are stored in the device memory until the next communication session. When beginning of communication session, the device starts sending packets from the earliest packet.

Transmission period can be equal to 5, 15, 30 minutes, 1, 6, 12 and 24 hours.

The time of data transmitting cannot be specified, it is defined in random way for every device in chosen period of transmission from the moment of connection to the network. For example, transmission period is 30 minutes, and device was started at 16:40 by the internal device clock. In random way the device calculate data transmitting time and set it at 16:41 in the half-hour period from 16:40 to 17:10. Thus, packets from this device will transmit at 16:41, at 17:11, at 17:41, at 18:11 and so on every 30 minutes by the internal device clock.

Time zone is specified for collection period setting which is equal to device time (UTC) plus time zone. Data transmission is always by UTC regardless of specified time zone.

FUNCTIONAL

Vega Smart-SS0102 smoke sensor is class A device (LoRaWAN® classification) and has the following features:

- ⦿ determination of smoke particles concentration in the room (smoke detector)
- ⦿ sound (siren) and light (LED) indication of smoke emission
- ⦿ detecting of the removing sensor from the mounting platform (removal sensor)
- ⦿ ADR support (Adaptive Data Rate)
- ⦿ sending of confirmed packets (configurable)
- ⦿ extra communication in case of alarm event – smoke sensor, removal sensor
- ⦿ temperature measurement
- ⦿ approximate main and reserve batteries charge measurement (%)
- ⦿ notification in case of low battery charge (one of it or both)

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	
Sensitivity	0,05...0,2 dB/m
The volume of the sound signal while a distance from the detector is 1 m	no less 85 dB
Operating temperatures	-10...+55 °C
Relative air humidity at a temperature of +40 °C	no more 93 %
Maximum illumination level	12000 lx
USB-port	micro-USB, type B
Built-in temperature sensor	yes
Mean time between failures	no less 60000 h
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
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	
Main battery	CR123A 3V, 1400 mAh
Reserve battery	CR123A 3V, 1400 mAh
Calculated number of packets sent by the device in "Standby" mode while default settings	15, 000
CASE	
Housing dimensions	ø117 x 44 mm
Ingress protection rating	IP20
PACKAGE	
Dimensions	130 x 115 x 58 mm
Weight	0,242 kg

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	25mW (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

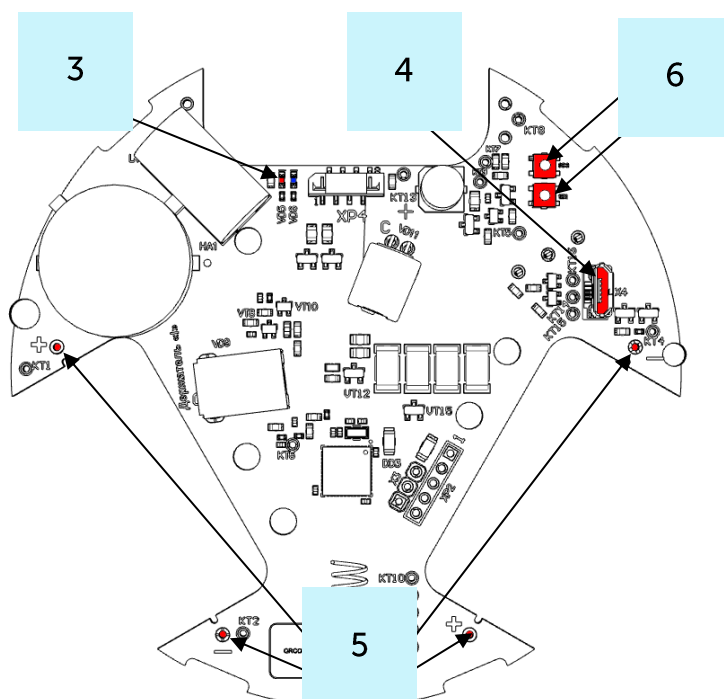
DEVICE APPEARANCE

The Vega Smart-SS0102 device is presented in a round case with a two-color indicator on the front.

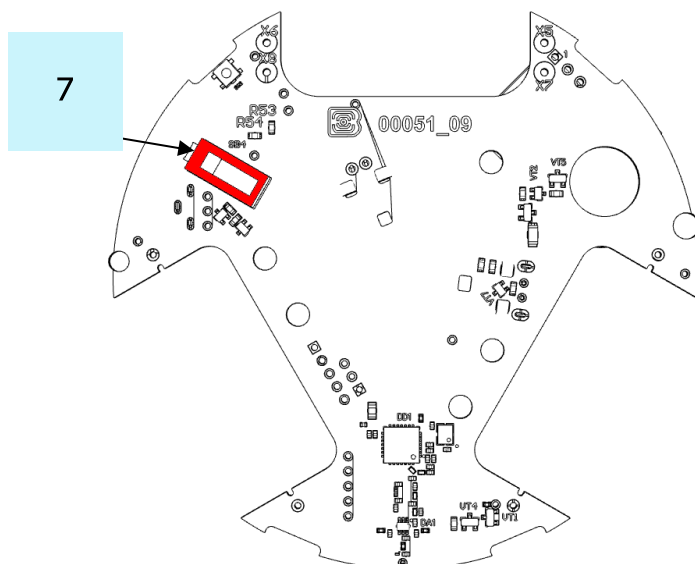


- 1- LED indicator
- 2- Launch button 1

Duplicate control and indication elements, as well as contacts for connection, are located inside the case on the board.

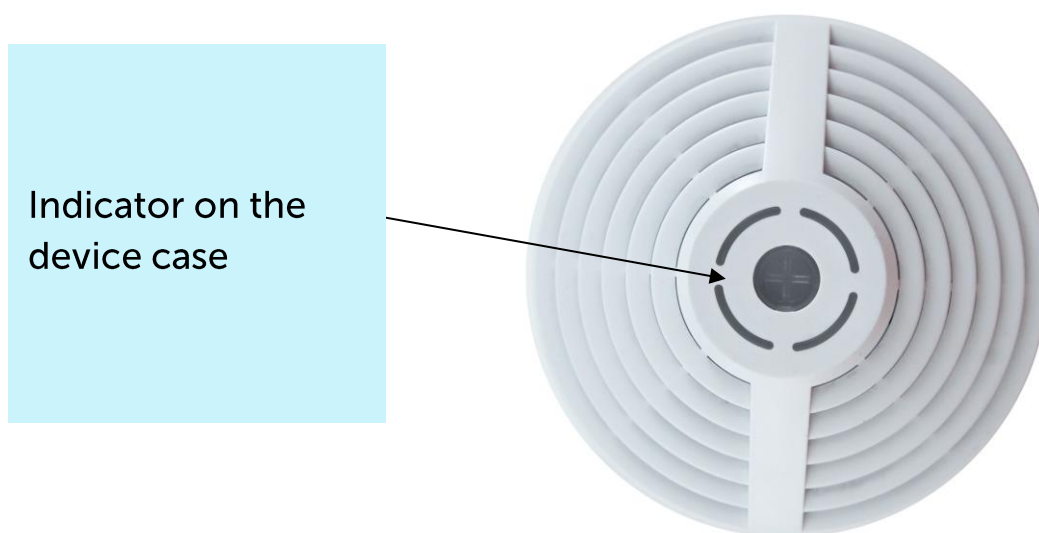


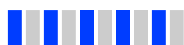

- 3 – LED indicators
- 4 – USB-port
- 5 – battery contacts
- 6 – launch buttons 2 and 3
- 7 – tamper



INDICATION

A double color indicator is located on the front of the sensor housing which informs user about device state. The sensor also has a sound indication.



LED indication		Sound	Meaning
	A short blue flash once per second	No sound	The process of network connection is in progress
	A long blue flash with duration is 2 seconds	No sound	Device has successfully connected to the network

	Three long blue flash with duration is 2 seconds each	No sound	Attempt to connect is failed
	Continuous red flashing	Tone-modulated sound signal lasting 10 minutes, followed by short beeps once per minute	"Test" submode "Fire" submode
	A short red flash once per second	A short beep once per minute	Battery malfunction (missing or discharged)
	Two short red flashes once per second	A double short beep once per minute	Sensor malfunction
	Three short red flashes once per second	A triple short beep once per minute	Dustiness of the sensor
	Four short red flashes	A short tone-modulated sound signal	Removal sensor triggered
	A short red flash once at every 10 seconds	No sound	The sensor is fine, in "Standby" submode
	No indication	A short tone-modulated sound signal	Transition to the "Standby" submode
	No indication	Tone-modulated sound signal lasting 10 minutes, followed by short beeps once per minute	Signal on the line of solidarity work
	No indication	A short beep	Button pressing

BUTTON

The button is located on the front side of the housing and allows you to manage the device.



The button on the
front side of
housing

The table of transitions between submodes and the logic of the button operation depending on the operating submode of the device.

Operating submode	Single press on the button	Pressing for more than 3 seconds
Standby	The device generates a packet and initializes an out-of-order communication session	Transition to the "Test" submode
Fire	Transition to the "Standby" submode	
Test	Transition to the "Standby" submode	

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 or screws;
- screwdriver;
- USB cable;
- laptop.

The sensor should not be installed in places where there are intense air currents (near fans, ventilation grids and air conditioners, heat sources), in rooms with a high level of dust, cigarette smoke, steam, in wet and kitchen areas, in places of insects.

The coverage area of one sensor depends on the height of ceilings.

Height of the protected room, m	The average area controlled by a single sensor, m ²	Distance, m	
		Between sensors	From a wall to sensor
up to 3,5	up to 85	9,0	4,5
from 3,5 to 6,0	up to 70	8,5	4,0
from 6,0 to 10,0	up to 65	8,0	4,0
from 10,0 to 12,0	up to 55	7,5	3,5

Step by step mounting guide:

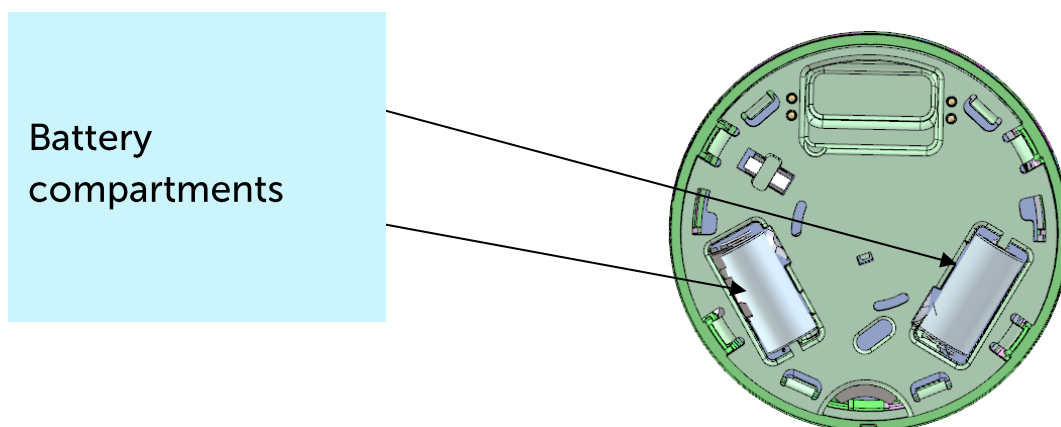
1. Setting the devices and connecting them to the network are usually carried out in the office (see Network Deployment Manual).
2. Determination of suitable places for mounting at the object with a network tester.

Smoke sensor is powered by two CR123A 3V 1400 mAh replaceable batteries. You must remove the plastic plug between the battery and the contact of the device, if there is a battery, or install the battery if it was not installed.

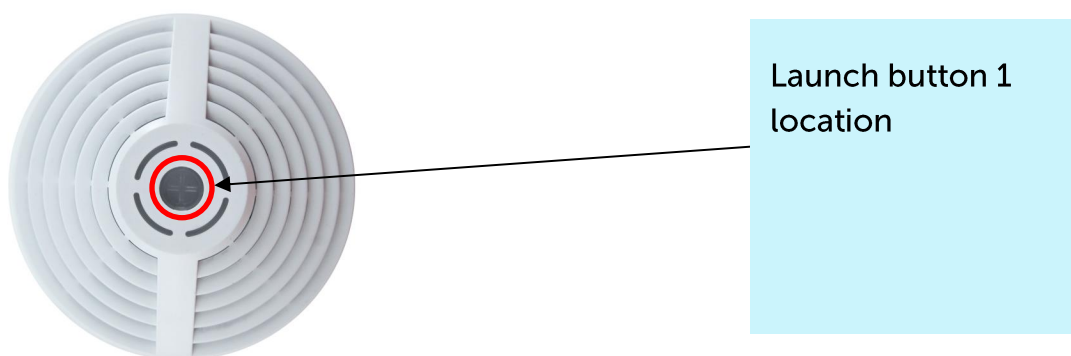
The reserve battery is installed first, then the main one. When the main battery is connected, the device automatically switches to the "Standby" submode within a minute.

After 60 seconds after inserting the batteries, the sensor starts working in the "Standby" submode and performs its functions to detect smoke, regardless of the presence of registration in the LoRaWAN® network.

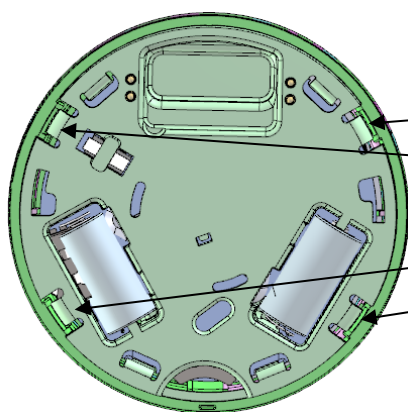
While operating the device tests the batteries every half an hour. As a result of test the device determinates operability and availability of batteries. If both batteries are fine the device every time changes operation from the main battery (2 hours) and operation from the reserve battery (1 hour).



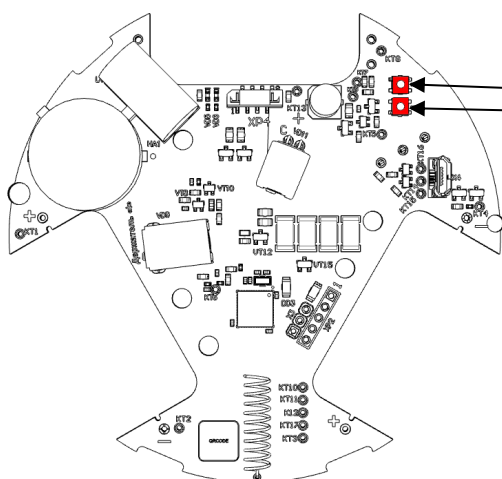
3. Starting the device - switching to the "Active" mode and registering on the network. If the device is turned on for the first time, then the transition to the "Active" mode will occur automatically after the power is connected. If the device was switched to the "Storage" mode, then it is necessary to initiate the start of the device using the start button 1 located on the device case, or the start buttons 2 or 3 located inside the device case on the board.



In order to use the button located on the board, it is necessary to remove the top cover of the device by pressing 4 fasteners of the case cover.



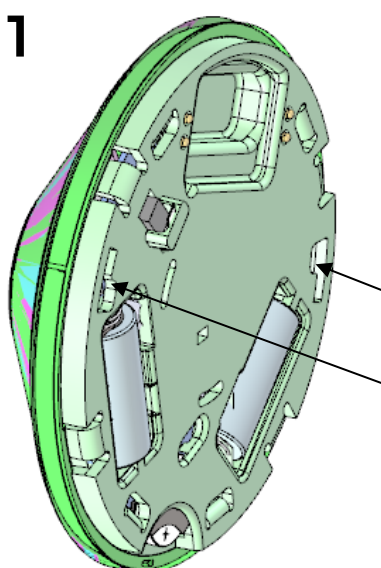
Fasteners of the case cover



Launch button 2 and 3 location

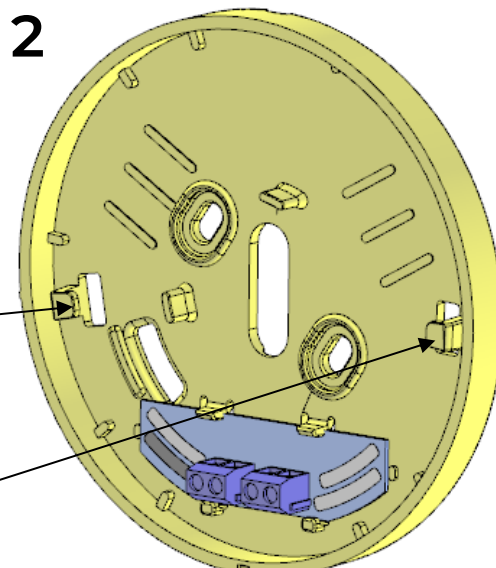
4. By the laptop you can make sure that the device successfully sends the data.
5. Assembling the device.
6. Mounting the device on the object. Smart-SS0102 structurally consists of two parts: the device itself in an individual case (1) and a mounting platform (2).

1



Platform fasteners and corresponding holes on the sensor housing

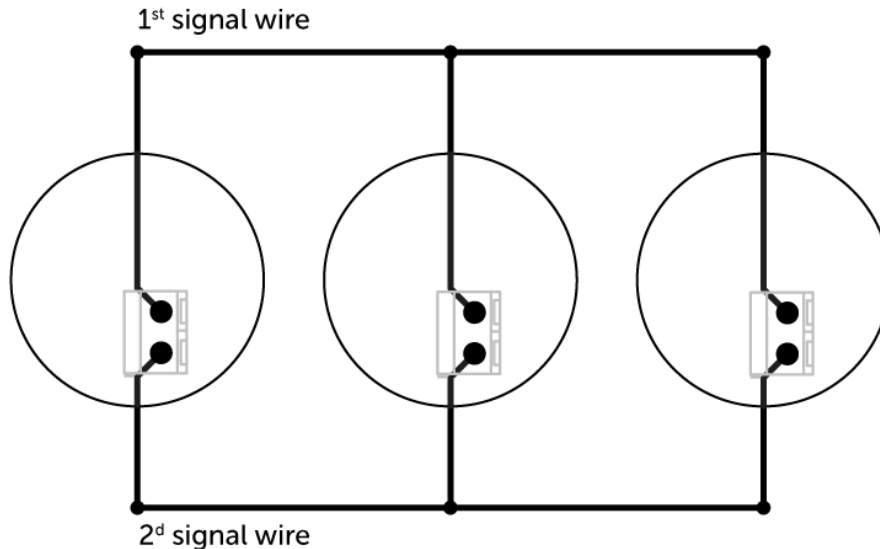
2



During installation, the platform is first installed, all the necessary wires are connected to it, if necessary. After that, it is necessary to align the mounting holes on the sensor housing and the fasteners on the platform and turn the sensor clockwise until it clicks firmly.

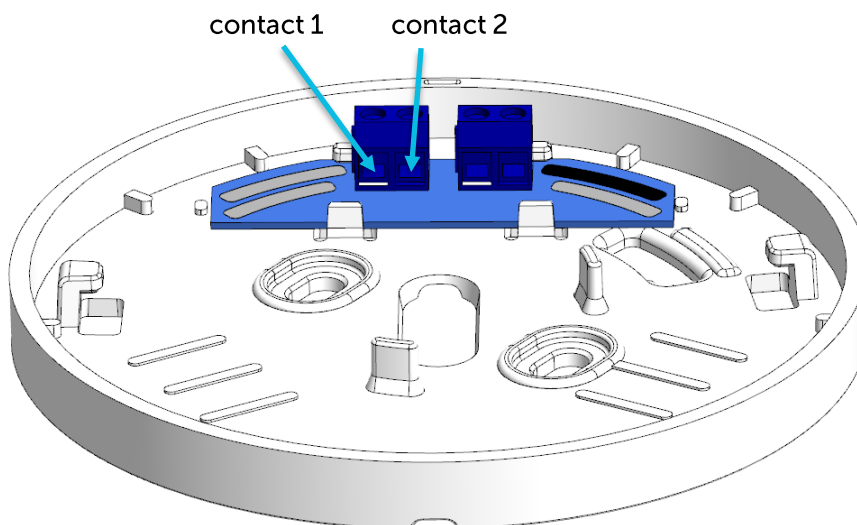
CONNECTING DEVICES IN THE LINE OF SOLIDARITY WORK

Vega Smart-SS0102 sensors can be connected to a solidarity line. To do this, they must be connected in series with a signal wire in one circuit.



It is recommended to connect no more than 10 sensors in one line with a wire length of no more than 50 meters.

The contacts for connection are located on the terminals of the mounting platform. The contacts are connected one to one, that is, contacts under number 1 must be connected to each other with a common wire, and contacts 2 must be connected to each other with another wire.



The modes of operation and the algorithm for collecting and transmitting data in the solidarity work line function as in individual work. Only additional indication of response to smoke is added.

When smoke is detected, the first detector that detected it sets the alarm flag in the solidarity line and switches to the "Fire" submode. All other detectors in the line remain in the "Standby" submode and are armed, continuing to analyze the smoke in the room, but at the same time they sound like in the "Fire" submode, the light indication of the "Fire" submode is not initiated. The alarm in the line can be disabled only by pressing the button on the first detector or by disconnecting the signal wire.

4 COMMUNICATION PROTOCOL

This part describes the Smart-SS0102 data exchange protocol with LoRaWAN® network.



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

SMART-SS0102 TRANSMITS THE FOLLOWING TYPES OF PACKETS

1. Packet with current state, sent by event on LoRaWAN® port 2.

Size in bytes	Field description	Data type
1 byte	Packet type == event ID: 5 – Alarm because of fire detection 6 – Test 7 – Alarm because of line of solidarity work 8 – Removal from mounting platform 9 – Alarm reset 10 – Low battery charge 11 – Start of the device guard 12 – Stop of the device guard 13 – Reserve 14 – Sensor malfunction 15 – Dustiness of the sensor chamber 16 – By the schedule	uint8
4 bytes	This packet time (unixtime UTC)	uint32
1 byte	Current state (bit field): 0 бит – Dustiness 1 бит – Fire 2 бит – Test 3 бит – Standby 4 бит – Malfunction 5 бит – Alarm 6 бит – Removal from mounting platform 7 бит – Signal through the line of solidarity work	uint8
2 bytes	Receiver voltage in mV	uint16
2 bytes	Transmitter current in mA	uint16
2 bytes	Thermistor temperature in °C	uint16
1 byte	Flag – battery 1 is used	bool
1 byte	Flag – battery 2 is used	bool
1 byte	Flag – battery 1 is available	bool
1 byte	Flag – battery 2 is available	bool
1 byte	Battery 1 charge in %	uint8

1 byte	Battery 2 charge in %	uint8
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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 is 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-SS0102 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

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 will send 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-SS0102 parameters and these possible values.

ID of parameter	Description	Data length	Possible values
4	Confirmed uplinks	1 byte	1 – confirmed 2 – unconfirmed
5	ADR (Adaptive Data Rate)	1 byte	1 – enabled 2 – disabled
8	Uplinks number of transmission	1 byte	from 1 to 15
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
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
55	Time zone, in minutes	2 bytes	from -720 to 840

5 STORAGE AND TRANSPORTATION REQUIREMENTS

The Smart-SS0102 sensor shall be stored in the original packaging in heated room at temperatures +5 °C to +40 °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 °C.

6 CONTENT OF THE PACKAGE

The sensor is delivered complete with:

Smoke sensor Vega Smart-SS0102 – 1 pc.

CR123A battery – 2 pcs.

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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Revision History

Revision	Date	Name	Comments
01	08.06.2020	KEV	Document creation date
02	12.12.2020	KEV	We add recommendation for using
03	16.04.2021	KEV	Functional is updated, operation modes are changed, indication is updated, communication protocol is changed
04	03.06.2021	KEV	Typos correction
05	05.08.2021	KEV	Addition of description the communication protocol
06	27.06.2022	KMA	Planned revision



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