



SMOKE SENSOR

SMART-SS0101

User Manual

Smoke sensor Vega Smart-SS0101 is designed to detect smoke in the protected area. The sensor registers smoke particles by the electro optic method and provides light and sound alarm indication. The sensor also sends a status packet to the LoRaWAN™ network.

Document Information

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INTRODUCTION

This manual is designated for Vega Smart-SS0101 Smoke sensor (hereinafter – device, sensor) manufactured by Vega-Absolute LLC 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.



The device shall be installed and adjusted by qualified specialists in order to ensure proper operation of the device

1 DESCRIPTION AND OPERATION

Vega Smart-SS0101 smoke sensor is designed to detect fire in a protected area, accompanied by the emission of smoke. The sensor periodically (every three 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-SS0101 can be used to protect rooms, buildings and structures from fire and/or smoke.



The sensor is powered by a CR123A 1400 mAh replaceable battery.

The sensor is configured via USB with «Vega LoRaWAN configurator» application.

Information for registering of the device in the LoRaWAN™ network is available via «Vega LoRaWAN configurator» application.

2 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	yes
Built-in temperature sensor	yes
Mean time between failures	no less 60000 h

LoRaWAN™

LoRaWAN™ class	A
Quantity of LoRa channels	16
Frequency band	EU-868, RU-868, custom
Activation type	ABP or OTAA
Communication period	1, 6, 12 or 24 hours
Antenna	internal
Sensitivity	-138 dBm
Radio coverage in restrained urban conditions	max 5 km
Radio coverage within line of sight	max 15 km
Power output	up to 100 mW (configurable)

Power

Replaceable battery	CR123A 3V, 1400 mAh
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Case

Housing dimensions	ø105 x 45 mm
Ingress protection rating	IP40

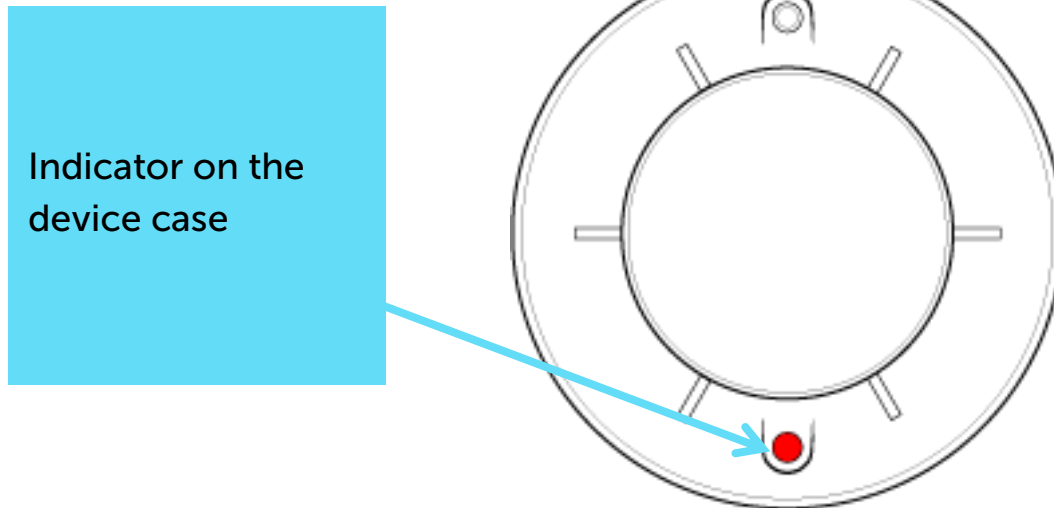
Vega Smart-SS0101 smoke sensor is class A device (LoRaWAN™ classification) and has the following features:






- ADR support (Adaptive Data Rate)
- Sending of confirmed packets (configurable)
- Extra communication in case of alarm event
- Temperature measurement by the internal temperature sensor
- Battery charge measurement (%)

3 OPERATION

INDICATION

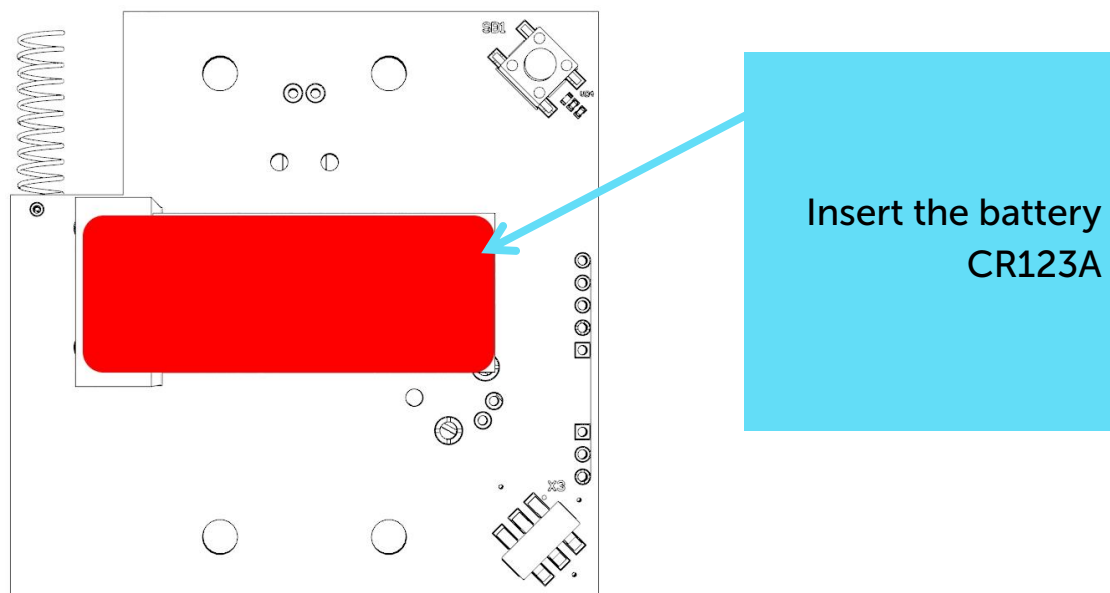
A double color indicator is located on the front of the sensor case there are the red and the blue. The sensor also has a sound indication.



Indicator signal	Sound signal	Meaning
 One blue flash every 10 seconds	No sound	Sensor is serviceable and working in «Active» mode
 Permanent red light	Tone-modulated sound signal with 4.5 minutes duration, after which short-time signal every minute	«Test» mode «Fire» mode
 One red flash every 5 seconds	Short-time signal every minute	Low power, replace the battery
 A series of short red flashes	No sound	Linking to the network
 One long red flash	No sound	The device is linking to the network successfully

INITIAL STARTUP

Smoke sensor is powered by the CR123A 3V 1400 mAh replaceable battery. You need to insert the battery observing the polarity before start.



After inserting the battery, the sensor immediately starts working in the «Active» mode and performs its functions to detect smoke, regardless of the presence of registration in the LoRaWAN™ network. The sensor supports two activation methods in the LoRaWAN™ network - ABP and OTAA. Select one of the methods using "Vega LoRaWAN Configurator" application (See part 4).

1. ABP. After inserting the battery, the device immediately starts working in the "Active" mode.

2. OTAA. After inserting the battery, the device makes three attempts to connect to the network within the set frequency band. After the activation request is confirmed by LoRaWAN™ network, the device indicates it by the one long red flash. If all attempts fail, the sensor will keep trying to connect to the network every day. Meanwhile the sensor will functions normally in the «Active» mode.

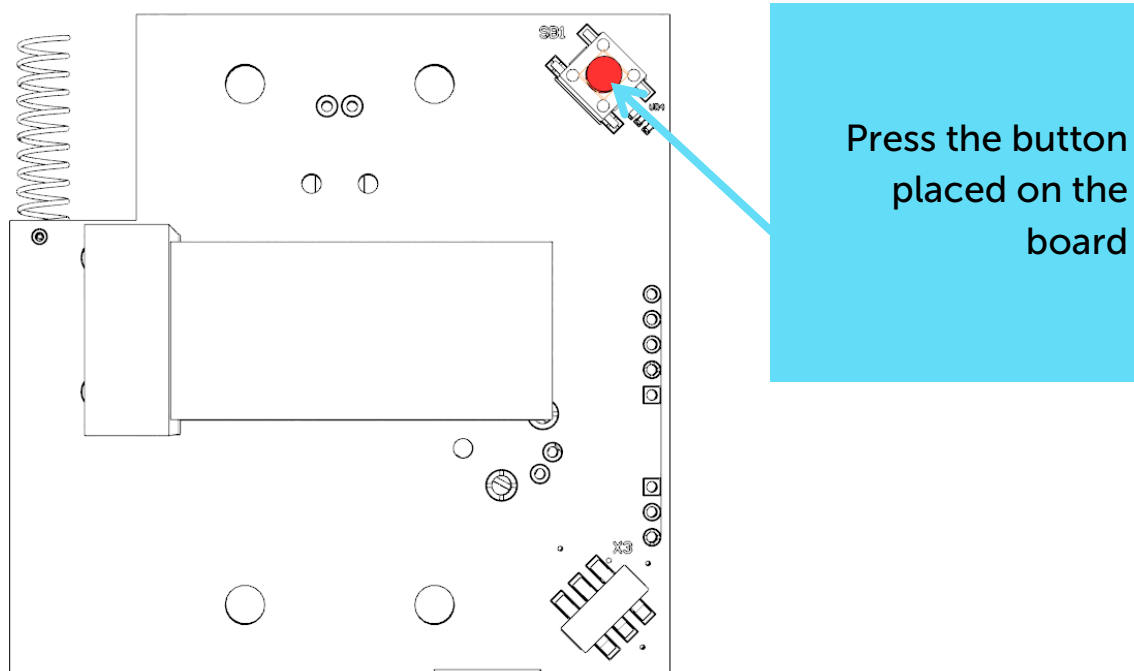


Before connecting the device, make sure that its registration data is entered in the network - Device EUI, Application EUI and Application Key for OTAA, or Device address, Application session key and Network session key for ABP

«TEST» MODE

The sensor supports the ability to test the alarm system in the absence of smoke particles and another substance.

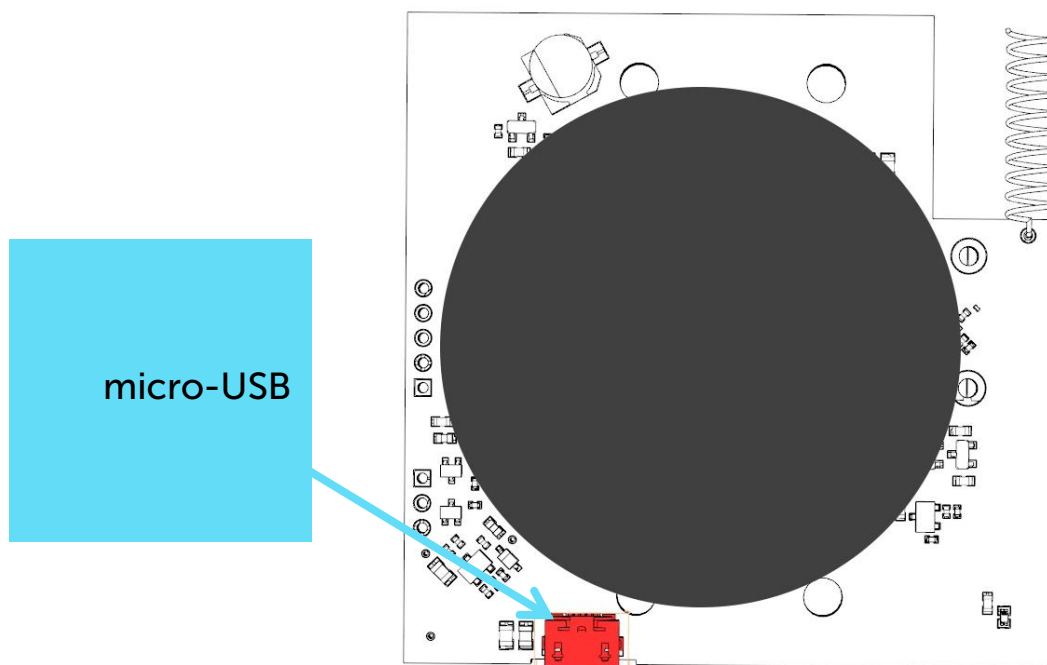
You may switch sensor to the «Test» mode by the pressing the button on the board during 5 seconds. Switching back to the «Active» mode is carried out by the same pressing the button on the board.



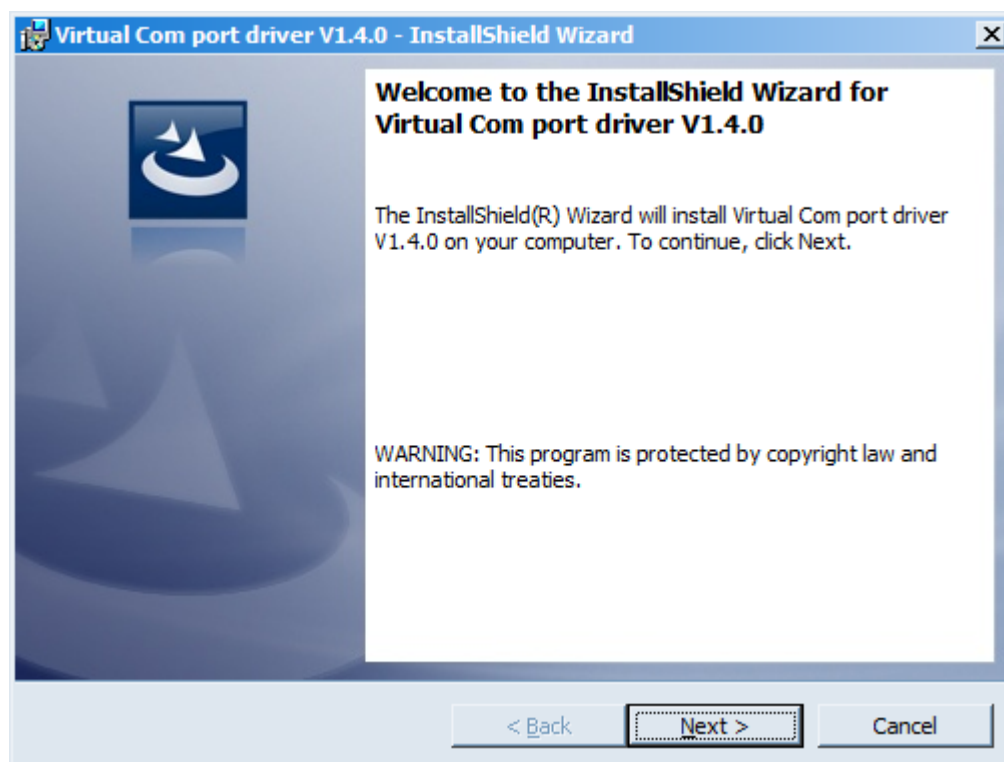
After pressing the button the sensor will switch to the «Test» mode and will give a tone-modulated sound signal with 4.5 minutes duration, after which short-time signal every minute. Light and sound indication in the «Test» mode totally coincides to the «Fire» mode indication.

CONNECTING VIA USB

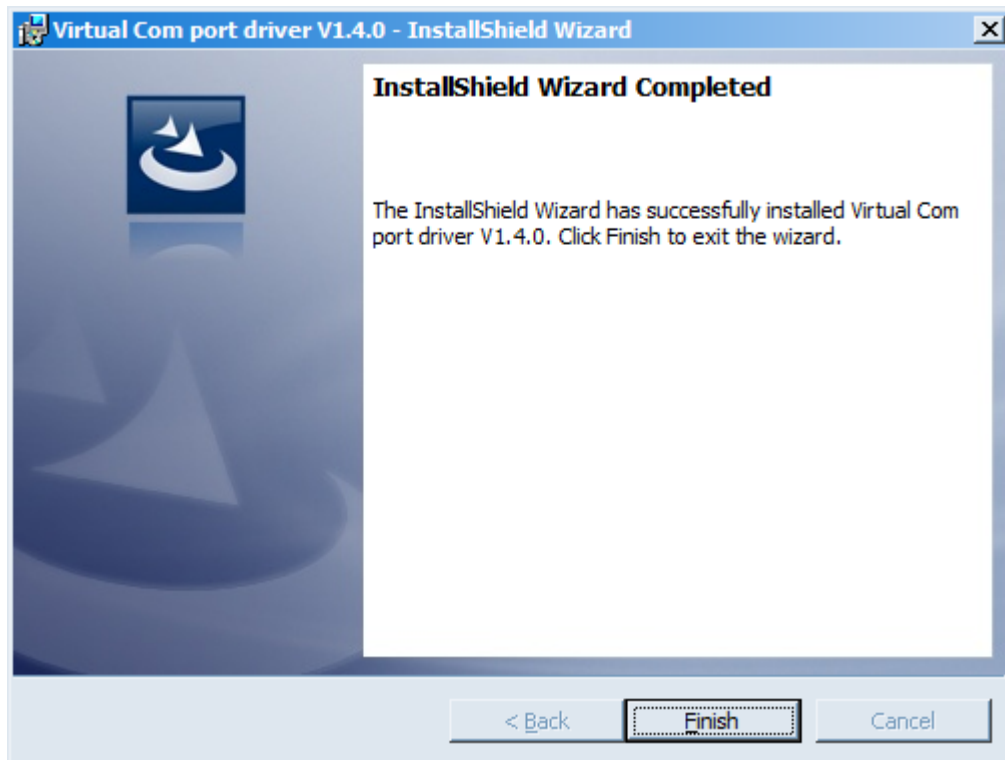
The device Smart-SS0101 can be configured with the "Vega LoRaWAN Configurator" application (See part 4).



Before connecting the device to the computer for the first time, you must install the driver for the COM port **stsw-stm32102**, which can be downloaded from iotvega.com. After running the executable file **VCP_V1.4.0_Setup.exe**, the installer window will appear:



In this window, you need to click **Next**, then **Install**, and then the installation will begin. When the installation is completed successfully, the following screen appears:



After pressing **Finish** the driver is ready for operation, - it is possible to connect the device via USB.

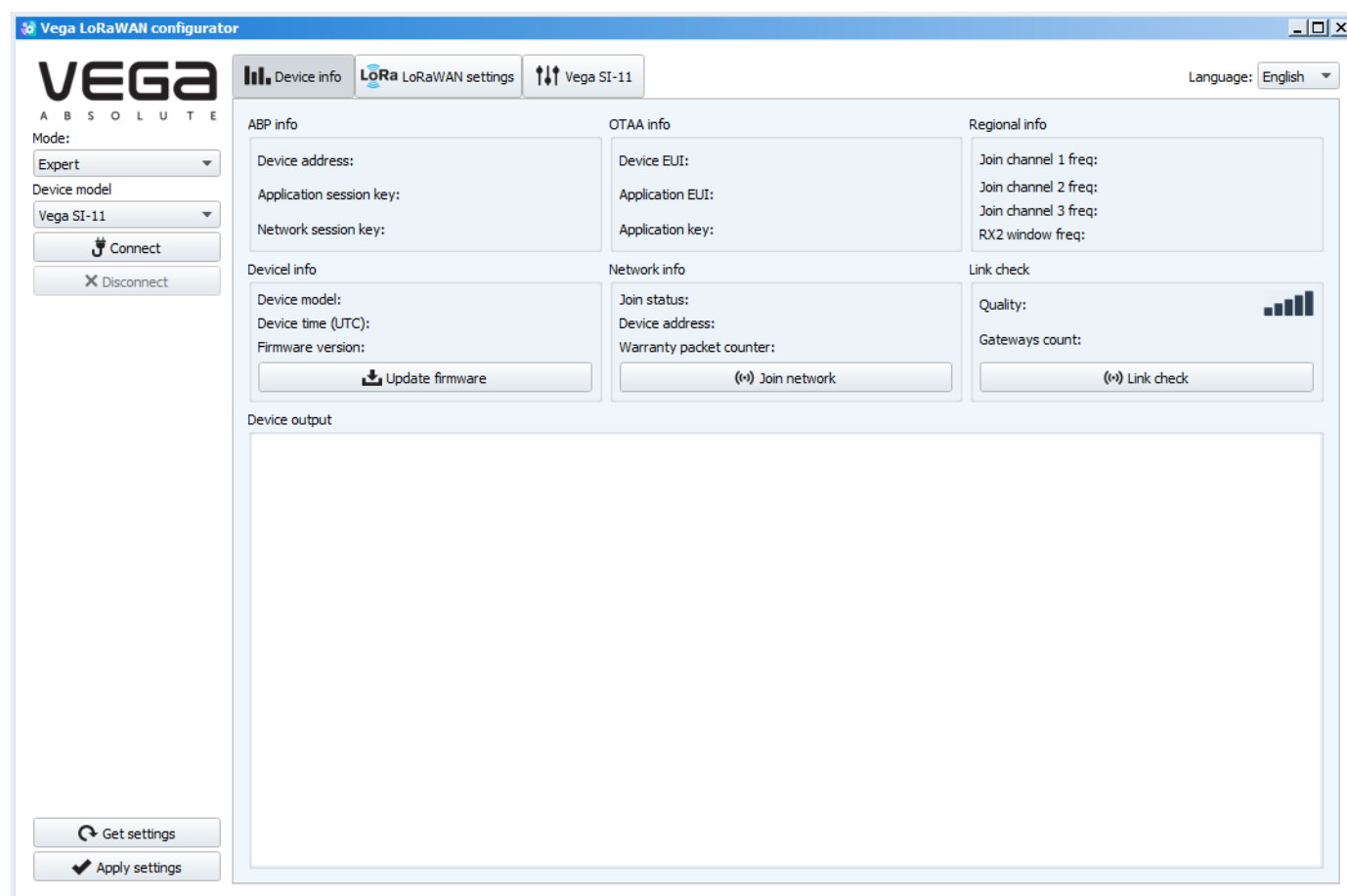
4 VEGA LORAWAN CONFIGURATOR

The "Vega LoRaWAN Configurator" application (hereinafter referred to as the configurator) is intended for setting up the device via USB.

The configurator has two modes of operation - "Simple" and "Expert". In the "Simple" mode, only basic settings are available. In the "Expert" mode the basic settings, advanced settings and the ability to check the coverage area of the signal from the gateways are available. Next, the work of the configurator is considered in the "Expert" mode.

INTERFACE OF THE APPLICATION

The "Vega LoRaWAN Configurator" application does not require the special installation. When the executable file is launched, the window for working with the application appears.



The menu on the left allows you to switch between the "Simple" and "Expert" modes, select the device model, connect to the device or disconnect from it, get and apply settings.

The application window contains three tabs – Device info, LoRaWAN™ settings and device settings.

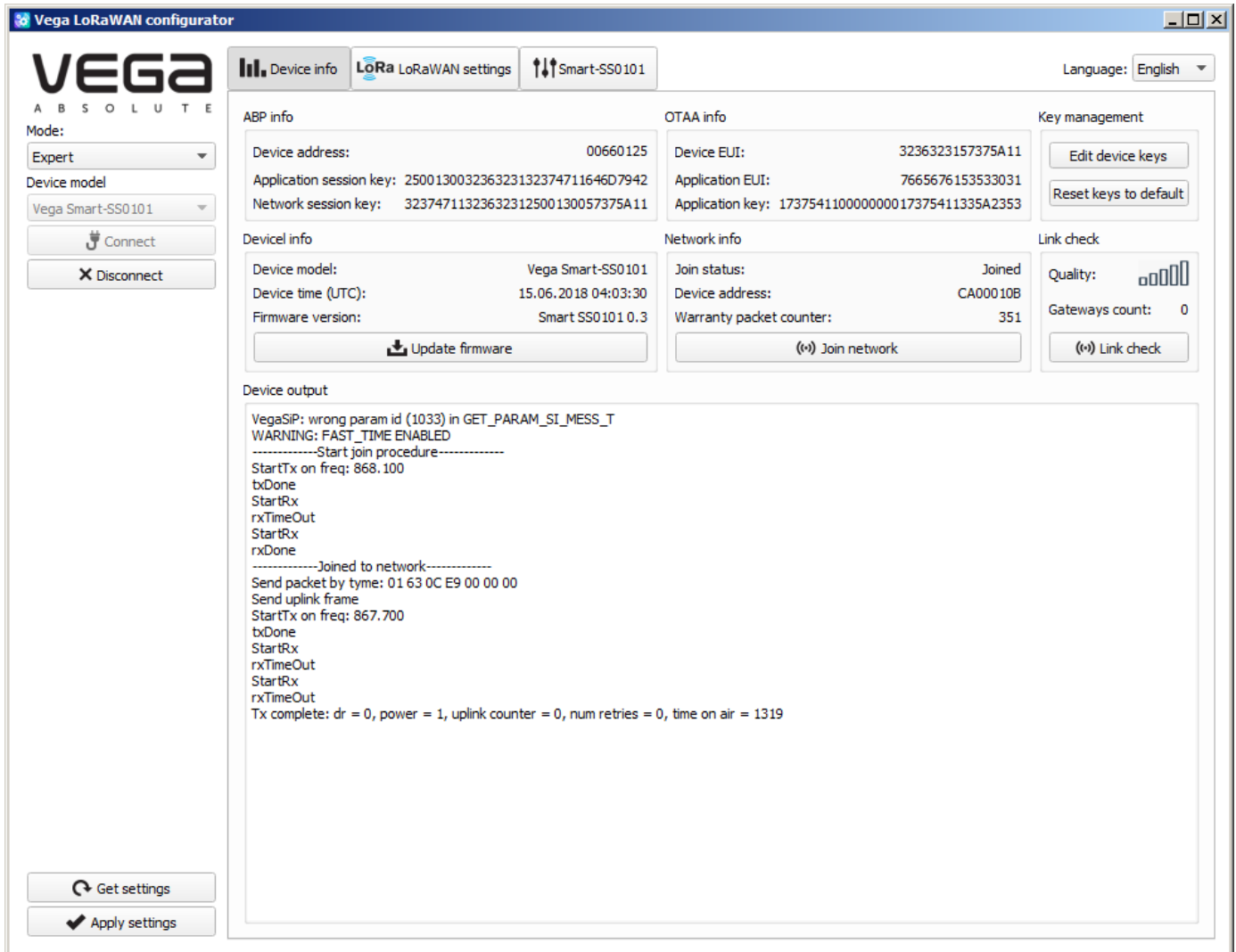
The language selection menu is in the upper right corner.

CONNECTION TO THE DEVICE

For the connection to the device, perform the following steps:

1. Connect the USB cable to the device.
2. Start the "Vega LoRaWAN Configurator" application.
3. Click the "Connect" button in the menu on the left.

The configurator automatically recognizes the type of device, and the device selection menu becomes inactive.



The screenshot shows the Vega LoRaWAN configurator application window. The interface is divided into several sections:

- Left Panel:** Contains the "VEGA ABSOLUTE" logo, a "Mode" dropdown menu set to "Expert", a "Device model" dropdown menu set to "Vega Smart-SS0101", and "Connect" and "Disconnect" buttons.
- Top Bar:** Includes tabs for "Device info", "LoRa LoRaWAN settings", and "Smart-SS0101", along with a "Language" dropdown menu set to "English".
- Main Content Area:**
 - ABP info:** Shows fields for Device address (00660125), Application session key (250013003236323132374711646D7942), and Network session key (32374711323632312500130057375A11).
 - OTAA info:** Shows fields for Device EUI (3236323157375A11), Application EUI (7665676153533031), and Application key (173754110000000017375411335A2353).
 - Key management:** Includes "Edit device keys" and "Reset keys to default" buttons.
 - Device info:** Shows fields for Device model (Vega Smart-SS0101), Device time (UTC) (15.06.2018 04:03:30), and Firmware version (Smart SS0101 0.3), with an "Update firmware" button.
 - Network info:** Shows fields for Join status (Joined), Device address (CA00010B), and Warranty packet counter (351), with a "Join network" button.
 - Link check:** Shows a "Quality" indicator (four bars), "Gateways count" (0), and a "Link check" button.
- Device output:** A text area displaying the following log:

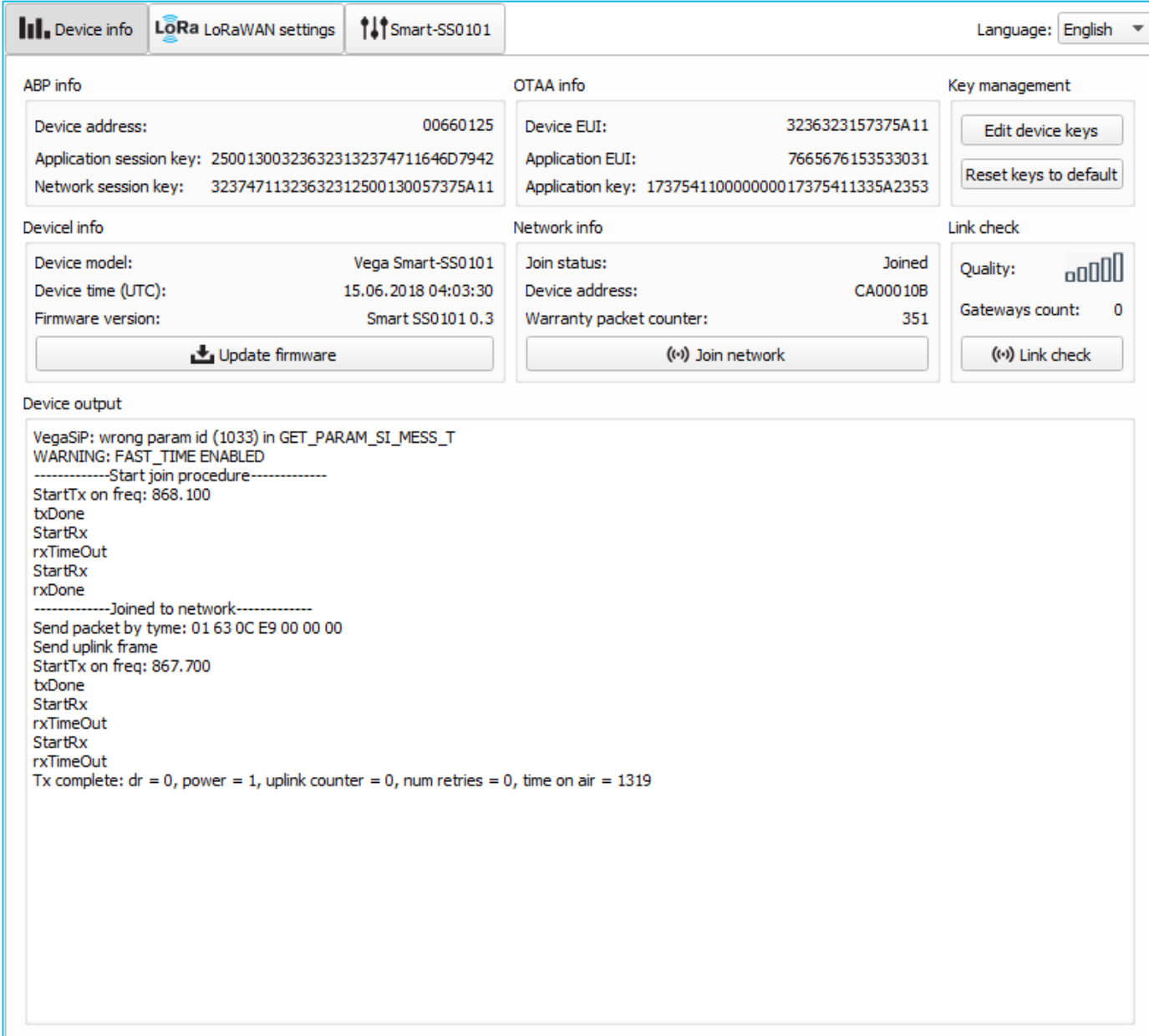

```
VegaSIP: wrong param id (1033) in GET_PARAM_SI_MESS_T
WARNING: FAST_TIME ENABLED
-----Start join procedure-----
StartTx on freq: 868.100
txDone
StartRx
rxTimeOut
StartRx
rxDone
-----Joined to network-----
Send packet by tyme: 01 63 0C E9 00 00 00
Send uplink frame
StartTx on freq: 867.700
txDone
StartRx
rxTimeOut
StartRx
rxTimeOut
Tx complete: dr = 0, power = 1, uplink counter = 0, num retries = 0, time on air = 1319
```
- Bottom Panel:** Includes "Get settings" and "Apply settings" buttons.

To read the settings from the device, you need to click the "Get settings" button, until this point the application will display the default settings or from the last connected device.

After making the necessary changes to the settings, you should click the "Apply settings" button and only then disconnect from the device with the "Disconnect" button.

"DEVICE INFO" TAB

The "Device info" tab displays information about the device, its current status, and also the data needed to register the device in the LoRaWAN™ network.



The screenshot shows the "Device info" tab with the following sections:

- ABP info:**
 - Device address: 00660125
 - Application session key: 250013003236323132374711646D7942
 - Network session key: 32374711323632312500130057375A11
- OTAA info:**
 - Device EUI: 3236323157375A11
 - Application EUI: 7665676153533031
 - Application key: 173754110000000017375411335A2353
- Key management:**
 - Edit device keys
 - Reset keys to default
- Device info:**
 - Device model: Vega Smart-SS0101
 - Device time (UTC): 15.06.2018 04:03:30
 - Firmware version: Smart SS0101 0.3
 - Update firmware button
- Network info:**
 - Join status: Joined
 - Device address: CA00010B
 - Warranty packet counter: 351
 - Join network button
- Link check:**
 - Quality: [Signal strength indicator]
 - Gateways count: 0
 - Link check button
- Device output:**

```
VegaSiP: wrong param id (1033) in GET_PARAM_SI_MESS_T
WARNING: FAST_TIME ENABLED
-----Start join procedure-----
StartTx on freq: 868.100
txDone
StartRx
rxTimeOut
StartRx
rxDone
-----Joined to network-----
Send packet by tyme: 01 63 0C E9 00 00 00
Send uplink frame
StartTx on freq: 867.700
txDone
StartRx
rxTimeOut
StartRx
rxTimeOut
Tx complete: dr = 0, power = 1, uplink counter = 0, num retries = 0, time on air = 1319
```

ABP info - displays the data necessary to register the device in the LoRaWAN™ network with ABP method (Activation By Personalization).

OTAA info - the data required to register the device in the LoRaWAN™ network with OTAA method (Over The Air Activation) is displayed.

Regional info (not displayed in the "Simple" mode) - shows the frequencies of the JOIN channels and the second receiving window. These frequencies can be changed in the "LoRaWAN™ Settings" tab when selecting a frequency plan.

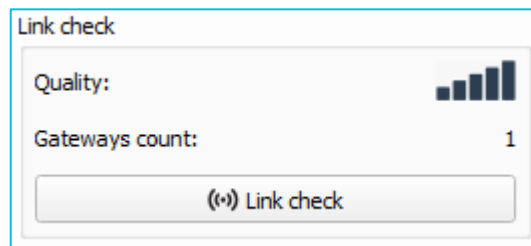
Device info - the configurator reads information about the device model, its firmware and automatically corrects the device's time when connected to it.

Update firmware - allows you to select the firmware file from your computer's hard drive and load it into the device. The device will automatically disconnect from the configurator when the download is complete. The current version of the device firmware can be downloaded from iotvega.com.

Network info - shows whether the device is connected to the LoRaWAN™ network and its network address.

Join network button - launch the LoRaWAN™ network connection procedure with the previously selected ABP or OTAA method. If the device is already connected to the network, reconnection procedure will occurs.

Link check (not displayed in the "Simple" mode) - when pressed, the device sends a special signal to the LoRaWAN™ network, in response to which the network informs it of the number of gateways that received this signal and the signal quality. This button only works when the device is connected to the network.



Device output (not displayed in the "Simple" mode) - monitoring the device status, all events in real time are displayed.

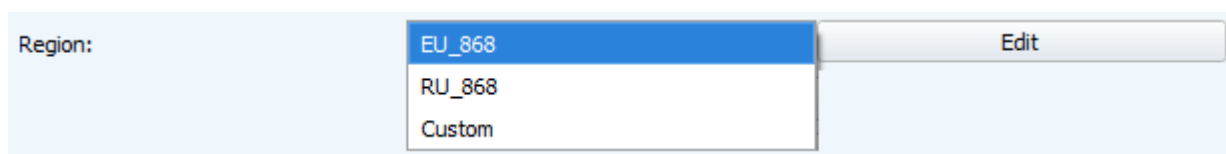
"LORAWAN SETTINGS" TAB

The "LoRaWAN Settings" tab allows you to configure various parameters of the LoRa network.



Parameter	Value	Action
Region:	EU868	Edit
Activation type:	OTAA	
Confirmed uplinks:	Unconfirmed	
ADR:	Enabled	
RX1 offset:	1 second	
Join accept delay 1:	5 seconds	
Uplink number of transmission:	1 time	
TX power:	14 dBm	
TX datarate:	DR0 SF12 BW125	

Region - allows you to select RU-868, EU-868 or specify a custom frequency band.

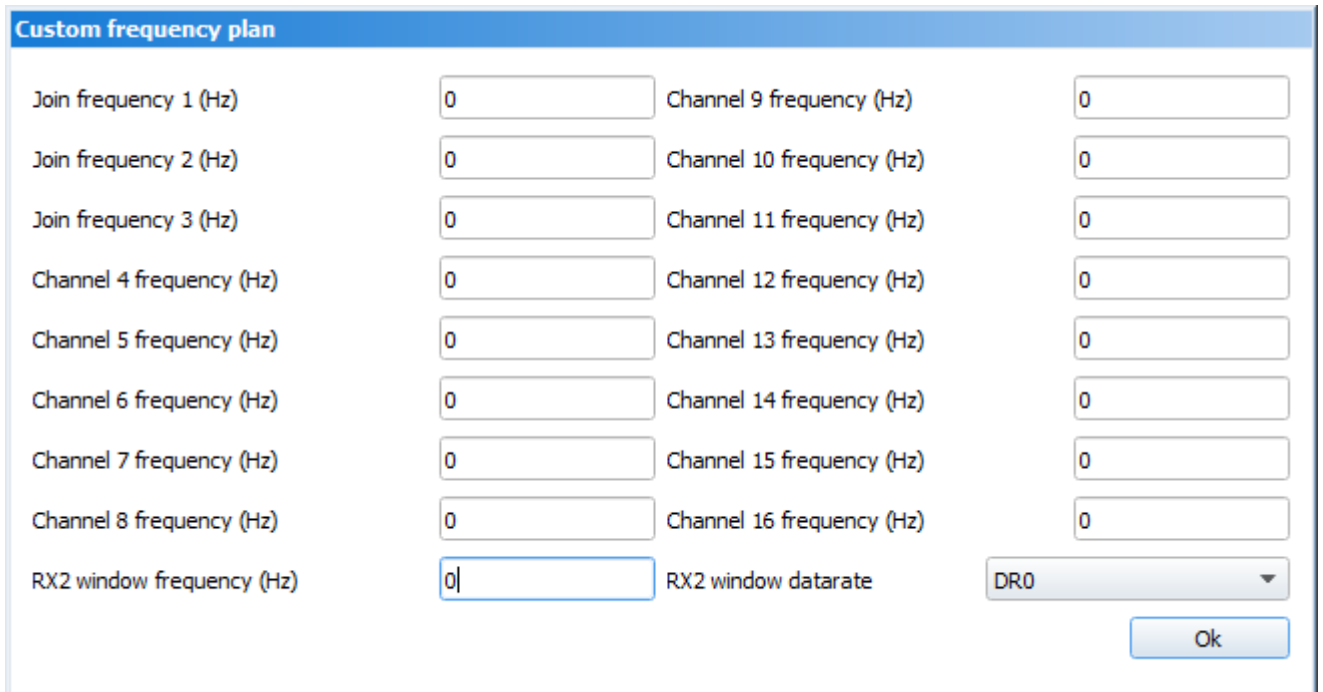


The sensor Smart-SS0101 supports the following frequency bands:

Frequency band	Channel	Frequency	Modulation
EU-868	1	868.1	MultiSF 125 kHz
	2	868.3	MultiSF 125 kHz
	3	868.5	MultiSF 125 kHz
	RX2	869.525	SF12 125 kHz
RU-868	1	864.5	MultiSF 125 kHz
	2	864.7	MultiSF 125 kHz
	3	864.9	MultiSF 125 kHz
	RX2	869.05	SF12 125 kHz
Custom	Set with «Vega LoRaWAN Configurator» application		

In the EU_868 and RU_868 frequency bands, only 3 channels are active by default. The device sends requests for connection to the network on this "join" channels. The remaining channels that the device should use can be transferred by the LoRaWAN™ network server during the device activation procedure (only OTAA).

If you select "Custom" in the "Region" field, you must manually specify the frequencies that the device will use. To do this, click the "Edit" button, the channel frequency editing window will appear:



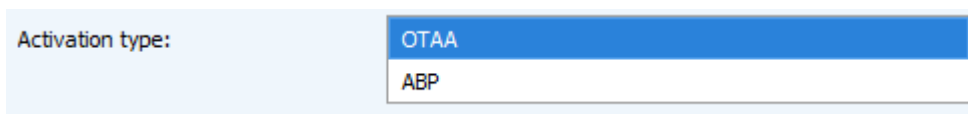
Custom frequency plan			
Join frequency 1 (Hz)	<input type="text" value="0"/>	Channel 9 frequency (Hz)	<input type="text" value="0"/>
Join frequency 2 (Hz)	<input type="text" value="0"/>	Channel 10 frequency (Hz)	<input type="text" value="0"/>
Join frequency 3 (Hz)	<input type="text" value="0"/>	Channel 11 frequency (Hz)	<input type="text" value="0"/>
Channel 4 frequency (Hz)	<input type="text" value="0"/>	Channel 12 frequency (Hz)	<input type="text" value="0"/>
Channel 5 frequency (Hz)	<input type="text" value="0"/>	Channel 13 frequency (Hz)	<input type="text" value="0"/>
Channel 6 frequency (Hz)	<input type="text" value="0"/>	Channel 14 frequency (Hz)	<input type="text" value="0"/>
Channel 7 frequency (Hz)	<input type="text" value="0"/>	Channel 15 frequency (Hz)	<input type="text" value="0"/>
Channel 8 frequency (Hz)	<input type="text" value="0"/>	Channel 16 frequency (Hz)	<input type="text" value="0"/>
RX2 window frequency (Hz)	<input type="text" value="0"/>	RX2 window datarate	<input type="text" value="DR0"/>
			<input type="button" value="Ok"/>

This frequency band allows you to set up to 16 channels, as well as the frequency and speed of the second receiving window.



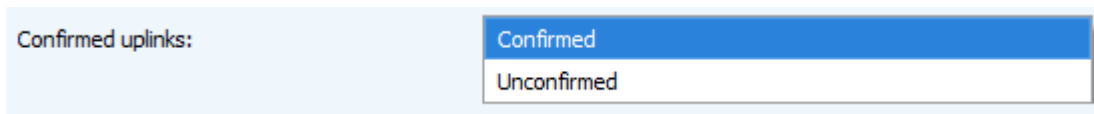
The first three channels and the second receiving window parameters are mandatory. Without these parameters the custom frequency band will be considered empty.

Activation type – selecting ABP or OTAA device activation method.



Activation type:

Confirmed uplinks – when you choose "confirmed", the device will retry sending the packet until it receives the server confirmation, or until the "Uplink number of transmission" is over (see below).



Confirmed uplinks:

ADR – this option activates the Adaptive Data Rate algorithm for automatic control of the data transfer rate from the LoRaWAN™ network side. The higher the quality of the signal received by the network, the higher the speed will be installed on the device. This option is recommended only on permanently installed devices.

ADR:	<div style="border: 1px solid black; padding: 2px;"> <div style="background-color: #0070C0; color: white; padding: 2px;">Enabled</div> <div style="padding: 2px;">Disabled</div> </div>
------	---

RX1 offset (not displayed in the "Simple" mode) – specifies the time between end of packet transmission and first receiving window opening. The second receiving window always opens after 1 second after the first.

RX1 offset:	<div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> 1 second 2 seconds 3 seconds 4 seconds 5 seconds <li style="background-color: #0070C0; color: white;">6 seconds 7 seconds 8 seconds 9 seconds 10 seconds 11 seconds 12 seconds 13 seconds 14 seconds 15 seconds </div>
-------------	---

Join accept delay 1 (not displayed in the "Simple" mode) – sets the time that the device will open the first receiving window to receive confirmation for the join request from the LoRaWAN™ network. The second window always opens after 1 second after the first.

Join accept delay 1:	<div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> 1 second 2 seconds 3 seconds 4 seconds 5 seconds 6 seconds 7 seconds <li style="background-color: #0070C0; color: white;">8 seconds 9 seconds 10 seconds 11 seconds 12 seconds 13 seconds 14 seconds 15 seconds </div>
----------------------	---

Uplink number of transmission (not displayed in the "Simple" mode) – if the "Confirmed uplinks" function is disabled, the device will simply send each packet as many times as specified in this option. If "Confirmed uplinks" is enabled, the device will send packets until it receives a confirmation or until it sends as many packets as specified in this option.

Uplink number of transmission:	<ul style="list-style-type: none">1 time2 times3 times4 times5 times6 times7 times8 times9 times10 times11 times12 times13 times14 times15 times
--------------------------------	---

TX power (not displayed in the "Simple" mode) – the device RF transmitter power is adjusted to this value when sending packets to the LoRaWAN™ network. This option can be changed by the network server.

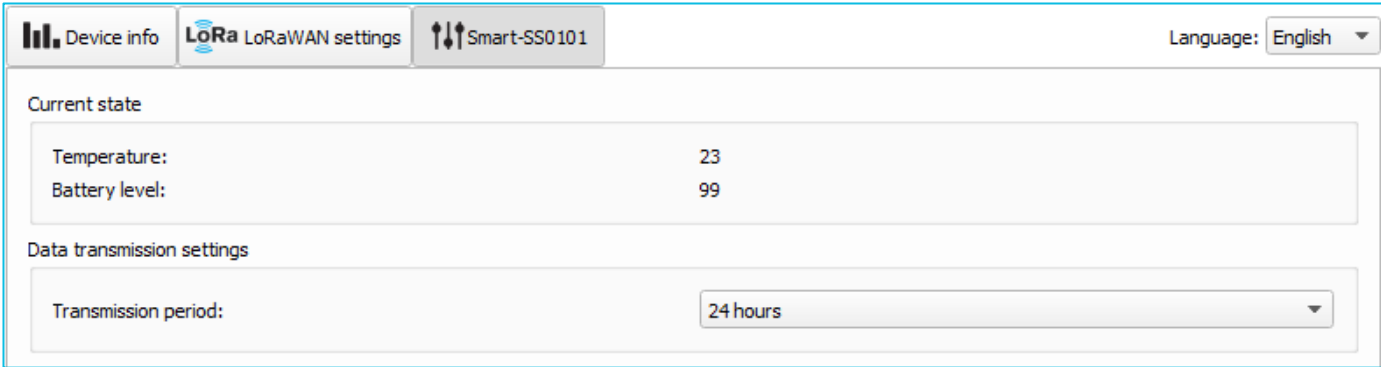
TX power:	<ul style="list-style-type: none">2 dBm5 dBm8 dBm11 dBm14 dBm20 dBm
-----------	---

TX datarate (not displayed in the "Simple" mode) – the device transmission datarate at which it will transfer packets to the LoRaWAN™ network. This speed can be changed by the network server if the ADR algorithm is enabled.

TX datarate:	<ul style="list-style-type: none">DR0 SF12 BW125DR1 SF11 BW125DR2 SF10 BW125DR3 SF9 BW125DR4 SF8 BW125DR5 SF7 BW125
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"SMART-SS0101" TAB

The "Smart-SS0101" tab contains the settings of the connected device.



The screenshot shows a web interface with three tabs: "Device info", "LoRa LoRaWAN settings", and "Smart-SS0101". The "Smart-SS0101" tab is active. In the top right corner, there is a language dropdown menu set to "English". The main content area is divided into two sections: "Current state" and "Data transmission settings".

Current state	
Temperature:	23
Battery level:	99

Data transmission settings	
Transmission period:	24 hours

Current state – displays the current parameters of the device - the internal temperature of the device and the battery level.

Data transmission settings – the transmission period which the packet with the current readings is transmit (See part 5, packet 1).

5 COMMUNICATION PROTOCOL

This part describes the Smart-SS0101 data exchange protocol with LoRaWAN™ network. Smart-SS0101 uses the LoRaWAN™ port 2 for uplink and downlink messages. In fields consisting of several bytes, the little endian byte order is used.

SMART-SS0101 TRANSMITS THE FOLLOWING TYPES OF PACKETS

1. Packet with current readings, sent regularly, and every time smoking occurs.

Size in bytes	Field description	Data type
1 byte	Packet type (1 – for that packet)	uint8
1 byte	Battery charge, %	uint8
1 byte	Values of basic settings (byte field)	uint8
2 bytes	Temperature in °C, multiplied by 10	int16_t
1 byte	Sending reason	uint8
1 byte	Reserve	uint8

"Values of basic settings" bit field decoding

Bits	Field description
0 bit	Activation type 0 - OTAA, 1 – ABP
1 bit	Query for packet confirmation 0 – off, 1 – on
2,3 bit	Communication period: 2==0 3==0 - 1 hour 2==1 3==0 - 6 hours 2==0 3==1 - 12 hours 2==1 3==1 - 24 hours
4 bit	reserve
5 bit	reserve
6 bit	reserve
7 bit	reserve

"Sending reason" bit field decoding

Bits	Field description
0	Sending by the time
1	Sending by the alarm (smoking)

6 STORAGE AND TRANSPORTATION REQUIREMENTS

The Smart-SS0101 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 -20°C to $+65^{\circ}\text{C}$.

7 CONTENT OF THE PACKAGE

The sensor is delivered complete with:

Smoke sensor Vega Smart-SS0101 – 1 pc.

CR123A battery – 1 pc.

Factory certificate – 1 pc.

8 WARRANTY

The warranty period for the device is 5 years from the date of sale.

The manufacturer is obligated to provide repair services or replace the failed device during the entire warranty period.

The consumer undertakes to comply with the terms and conditions of transportation, storage and operation specified in this user manual.

Warranty does not apply to:

- power supply elements;
- the device with mechanical, electrical and / or other damages and defects caused by violation of the transportation, storage and operation requirements;
- the device with traces of repair performed not by the manufacturer's service center;
- the device with traces of oxidation or other signs of liquids leaking inside the device.

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

113/1, Kirova Str., Novosibirsk, 630008, Russia.

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



vega-absolute.ru

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