



GATEWAY

VEGA BS-0.1

USER MANUAL



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INTRODUCTION

This manual is designed for Vega BS-0.1 gateway (hereinafter – the gateway) manufactured by Vega-Absolute OOO and provides information on powering and activation procedure, control commands and functions of the gateway.

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



**It is forbidden to use the device in case of any malfunctions
In the event of a malfunction, contact the manufacturer's technical support team**

In order to prevent possible personal injury and/or equipment damage, it is strongly recommended that you read the section "Recommendations for Safe Operation" before setting up and operating the equipment.



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

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

The gateway is designed to deploy LoRaWAN® network within 863-870 MHz frequency band.

The gateway operates with Linux operating system and is supplied with pre-installed Packet forwarder software.

The gateway communicates with the server via Ethernet or Wi-Fi. When an optional module is installed, the gateway gains the capability to connect to the server over LTE.

An optional GSM modem may also be included as part of the gateway.

Configuration is performed via the SSH protocol using any terminal application (e.g., PuTTY).

2 SPECIFICATION

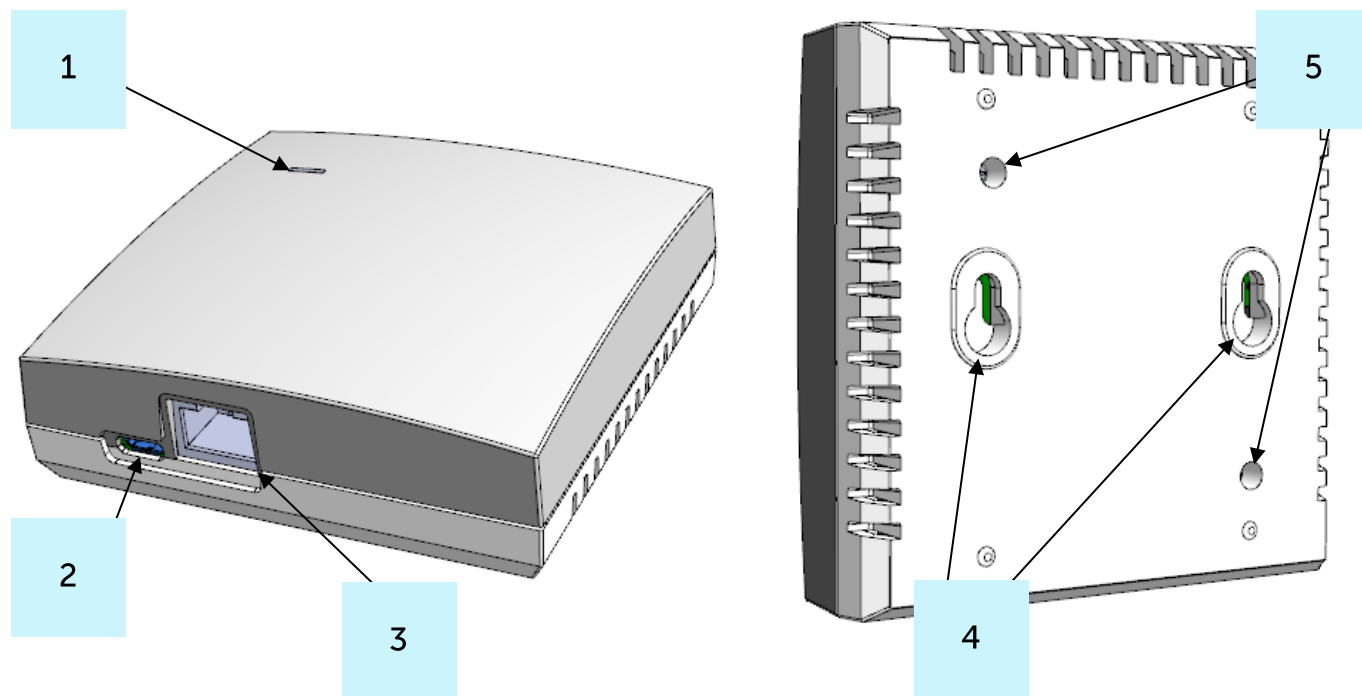
MAIN	
Server communication interface	Ethernet 10/100 Base-T, Wi-Fi IEEE 802.11 b/g/n, LTE (optional)
Operating system	Linux
USB port	2 x mini-USB, type B (power)
Operating temperature range	0...+70 °C
LORAWAN®	
Number of LoRa channels	8
Frequency band	863-870 MHz
Power output	up to 500 mW
Antenna	internal
Urban radio range	up to 1 km
POWER	
Power	USB type C, external power adapter (5 V, 2 A)
CASE	
Dimensions	88 x 88 x 29,5 mm
Ingress protection rating	IP20
Mounting	screw-mounted

3 OPERATION

DEVICE APPEARANCE

The gateway features a compact white plastic enclosure assembled with screws. A status LED is located on the front panel, and USB and Ethernet ports are accessible.

The rear panel allows for wall mounting.



1 – LED indicator

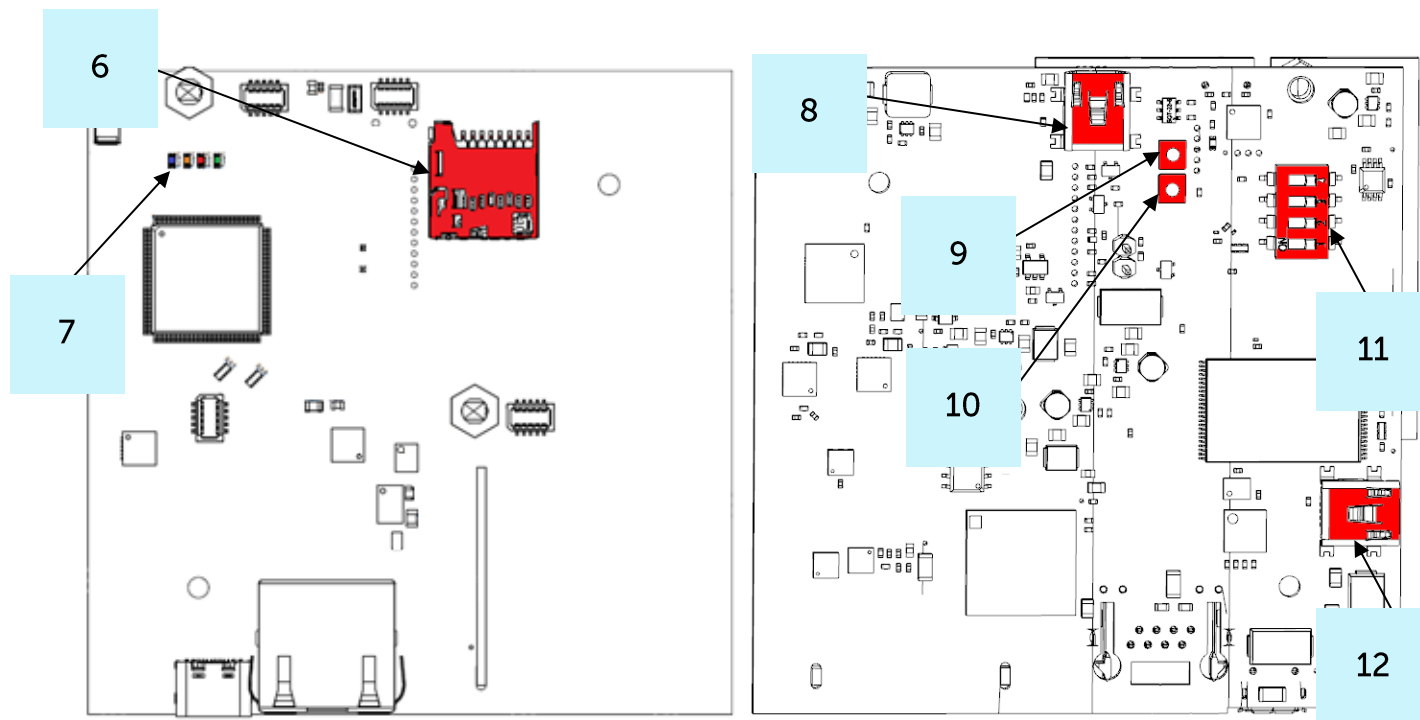
2 – USB type C port

3 – Ethernet port

4 – Wall-mounting provisions

5 – Cross-head screw $\varnothing$ 2 mm x 8 mm 

The gateway's circuit board assembly includes control elements as well as input and output interfaces.



6 – MicroSD card slot

7 – LED indicators

8 – Mini-USB connector (HOST)

9 – Gateway reset button – SB2

10 – Button – SB1 (*reserve*)

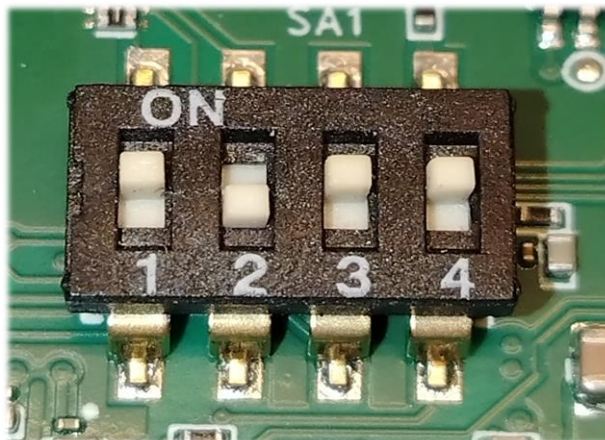
11 – Service switches

12 – Mini-USB connector (debug) for connection to a computer (X1)

CONTROL INSTRUMENTS – BUTTONS AND SWITCHES

The gateway PCB features two buttons. One button is reserved (SB1). The other button instantly reboots the gateway (SB2).

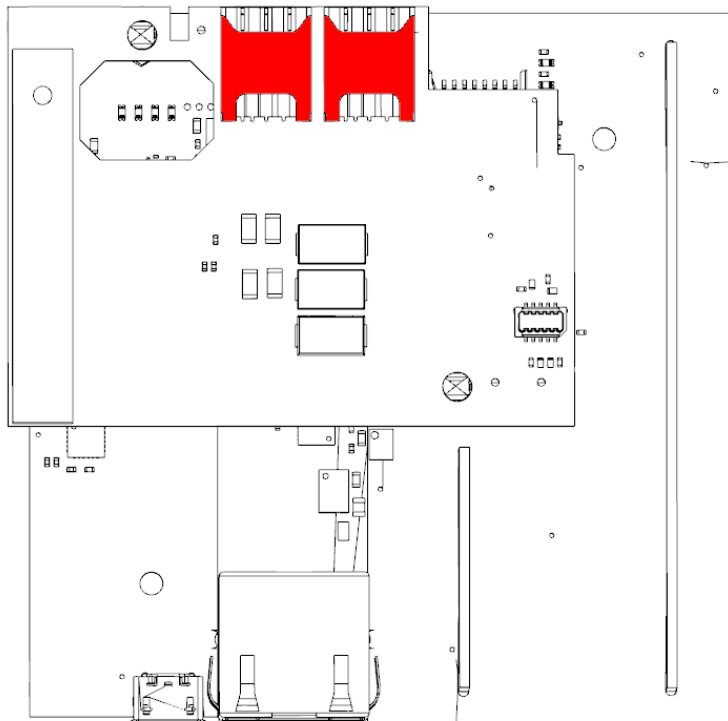
Additionally, the board includes service switches used to select the firmware image boot source: from internal memory, from an SD card, or via mini-USB from a computer. These switches are intended for service use only. In normal operation, the switch positions must be as shown in the figure below - only switches 1, 3, and 4 should be ON.



INSTALLING SIM CARDS IN THE GATEWAY WITH GSM MODULE

The gateway may include a GSM module mounted on the main printed circuit board.

To enable GSM module operation, insert one or two micro-SIM cards into the slots indicated in the figure below.

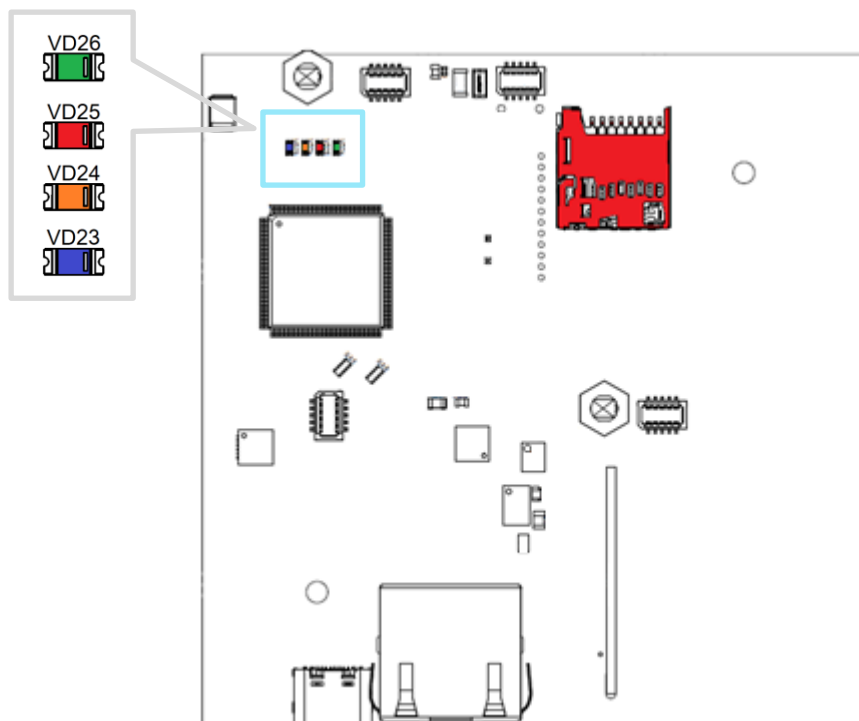


SIM card installation must be performed at a temperature no lower than room temperature. If the device has been exposed to low temperatures, it must be allowed to acclimate to room temperature for several hours before inserting a SIM card

SIM1 is the primary card, and SIM2 is the secondary (backup) card. If SIM1 is absent or an internet connection cannot be established via SIM1, the device will automatically switch to SIM2. Similarly, if SIM2 is absent or no internet connection is available via SIM2, the device will switch to SIM1.

INDICATION

On the front panel of the gateway there is an LED indicator that displays the operation of various systems: operation of the web interface software, operation of the LoRa signal processing software (Packet Forwarder running/not running), power, Wi-Fi, etc.



LED	COLOR	INDICATION
VD23	Blue	<i>Blinking</i> – GSM module initialization <i>Blinking at 10-second intervals</i> – mobile internet connection established

VD24	Orange	<i>Lights</i> – Packet Forwarder application running <i>Blinking</i> – lora_pkt_fwd initialization
VD26	Green	<i>Flickering</i> – Wi-Fi interface activity
VD25	Red	<i>Lights</i> – gateway powered but software-disabled

MOUNTING RECOMENDATIONS

To ensure reliable radio communication between the gateway and end devices, avoid installing equipment in locations that create insurmountable obstacles for radio signal propagation, such as reinforced concrete floors and walls, basements, underground structures and manholes, steel enclosures, etc.

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

For mounting you will need:

- cross-shaped screwdriver ;
- laptop.

Step by step mounting guide:

1. Setting the gateway is usually carried out in the office (see Network Deployment Manual).
2. Determination of suitable places for mounting at the object with a network tester — radio planning work.
3. Install mounting screws into the wall for the gateway brackets.
4. Mount the gateway onto the wall.

5. Connect the power cable to the USB port and the Ethernet cable¹.
6. By the laptop you can make sure that the device successfully sends the data.

¹ When connecting the gateway to the Internet or a local network via an Ethernet cable

4 GATEWAY CONFIGURATION

CONNECTING THE GATEWAY TO A COMPUTER – GETTING STARTED

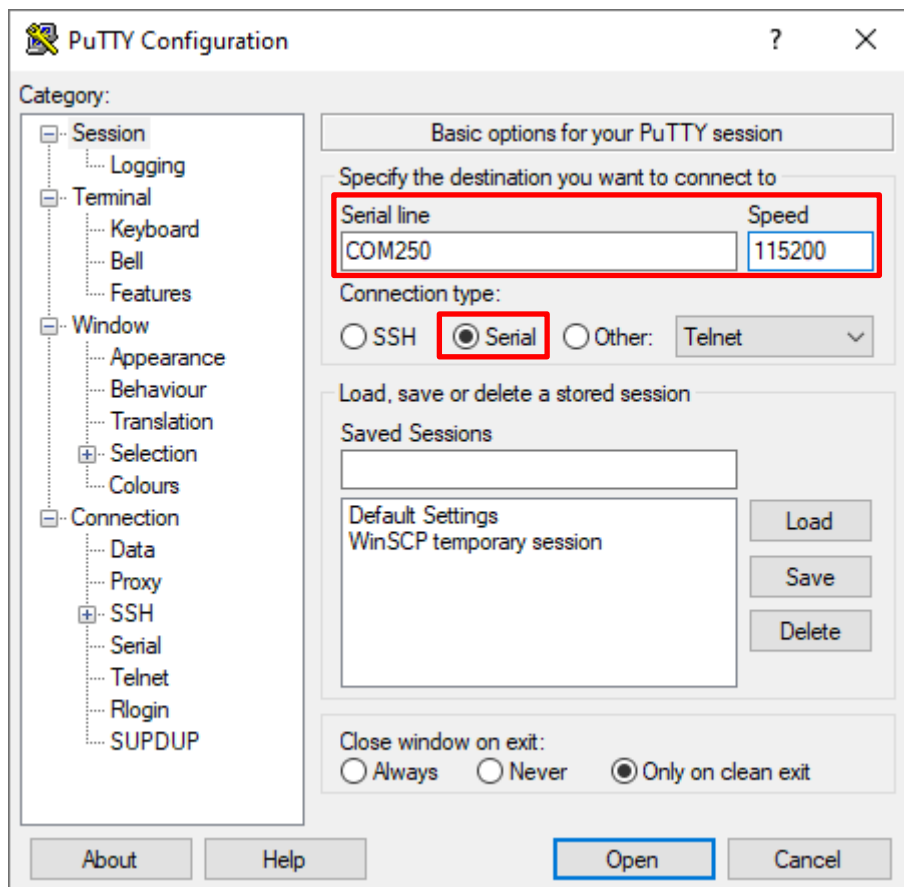
Connection to the gateway can be established, for example, using the freely available PuTTY application. In this case, there are two possible connection methods: via serial port or via SSH.

1. Serial Port Connection

When connecting via serial port, connect the gateway to a personal computer using a mini-USB cable. On the board, the required port is labeled USB_DBG (see Fig. 3.1(1)). Next, connect to the virtual COM port by installing the MCP2200 driver. After installation, “**Ports (COM & LPT)**” will appear in Device Manager.

In the list of ports, locate the **Silicon Labs CP210x USB to UART Bridge** and note its assigned COM port number.

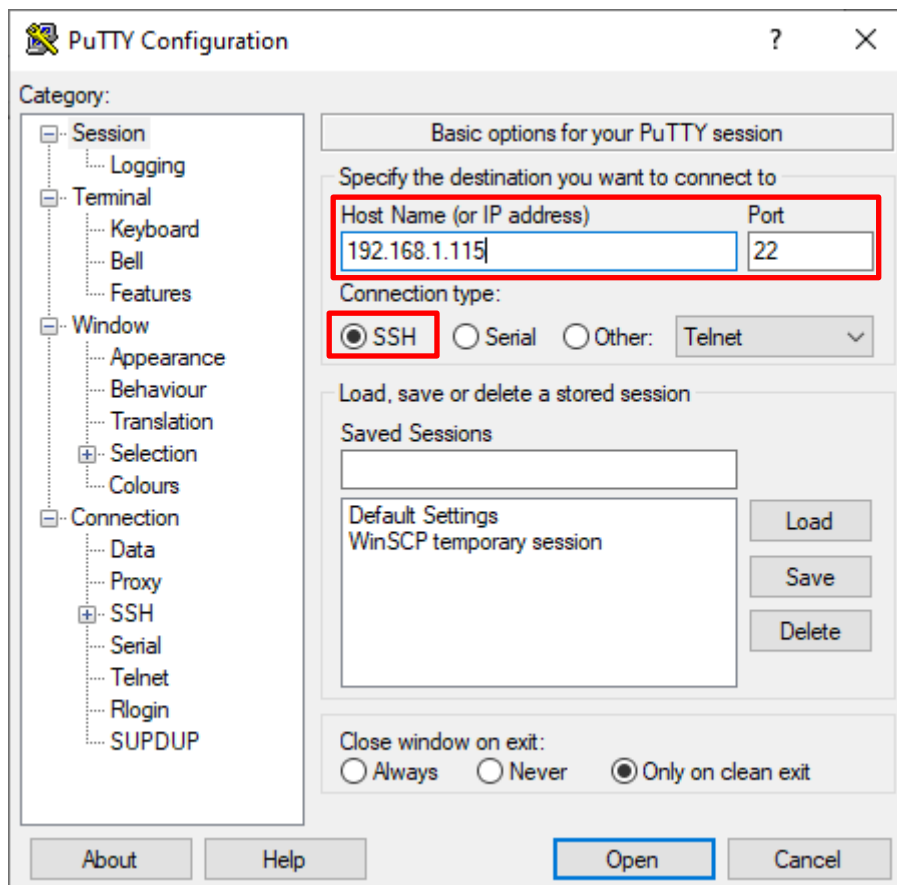
After that, open the PuTTY application, select the **Serial** connection type, and enter the gateway’s virtual COM port number and baud rate (115200) in the corresponding fields.



Then click Open.

2. SSH Connection

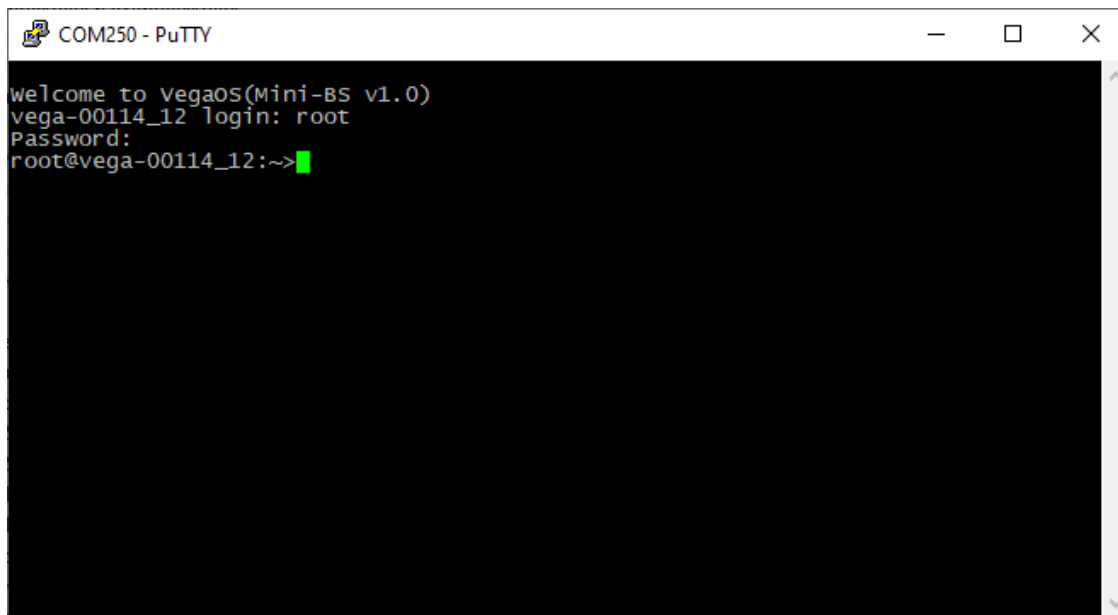
When connecting via SSH, in the PuTTY dialog window, select the SSH connection type and enter the device's IP address and port 22 in the corresponding fields. By default, the device obtains an IP address via DHCP when connected over Ethernet.



Then click **Open**.

After connecting to the gateway using method 1 or 2, the PuTTY terminal window will appear, where you need to enter a login and password. By default, the login credentials for the gateway are login – **root** and password – **temppwd** (note that characters will not be displayed

while typing the password). It is recommended to change the password upon first login to ensure individual access security.

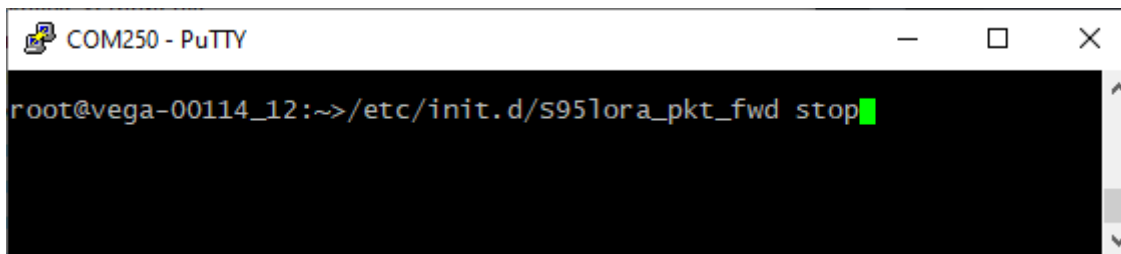


```
COM250 - PuTTY
welcome to vegaOS(Mini-BS v1.0)
vega-00114_12 login: root
Password:
root@vega-00114_12:~>
```

Configuration can now be performed.

The Packet Forwarder application starts automatically at system boot. Before configuring the gateway, you must stop the Packet Forwarder process by running the following command:

```
/etc/init.d/S95lora_pkt_fwd stop
```

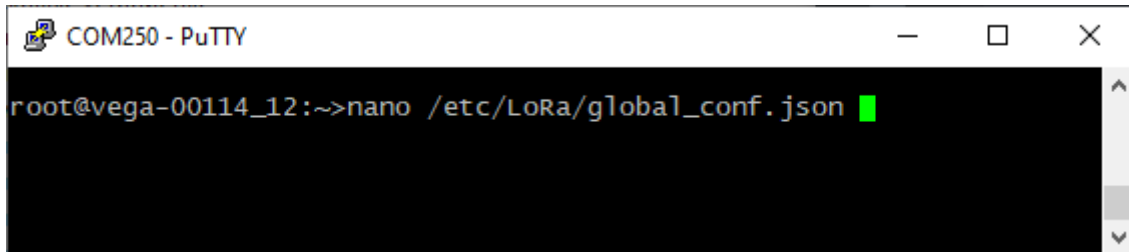


```
COM250 - PuTTY
root@vega-00114_12:~>/etc/init.d/S95lora_pkt_fwd stop
```

The configuration files are located in the `/etc/LoRa/` directory and may contain settings for the frequency plan, gateway ID, server IP address, and port:

`/etc/Lora/global_conf.json`

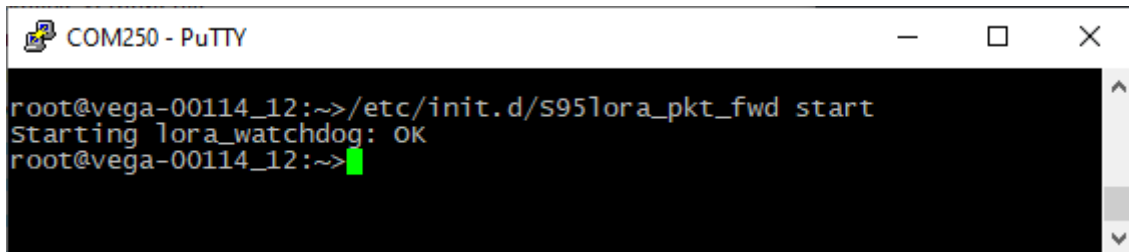
To modify the settings, run a command in the terminal that specifies the required configuration file, for example:



```
COM250 - PuTTY
root@vega-00114_12:~>nano /etc/LoRa/global_conf.json
```

After completing all changes, run the following command:

`/etc/init.d/S95lora_pkt_fwd start`



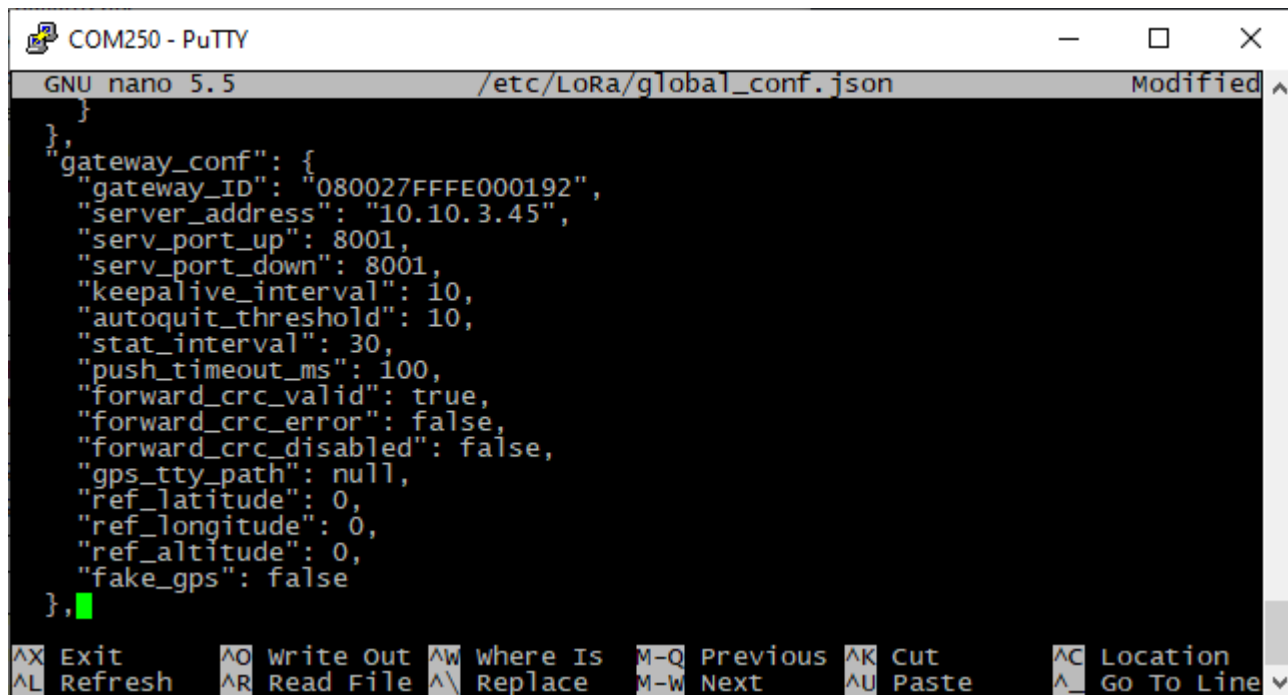
```
COM250 - PuTTY
root@vega-00114_12:~>/etc/init.d/S95lora_pkt_fwd start
Starting lora_watchdog: OK
root@vega-00114_12:~>
```

The Packet Forwarder process will then start with the new settings.



To connect the gateway to the server, use the UDP port specified in the server's configuration file. On the gateway, port settings are located in the `global_conf.json` file

In the `global_conf.json` file, the UDP port settings are found in the `gateway_conf` section under the parameters `server_port_up` and `server_port_down`.

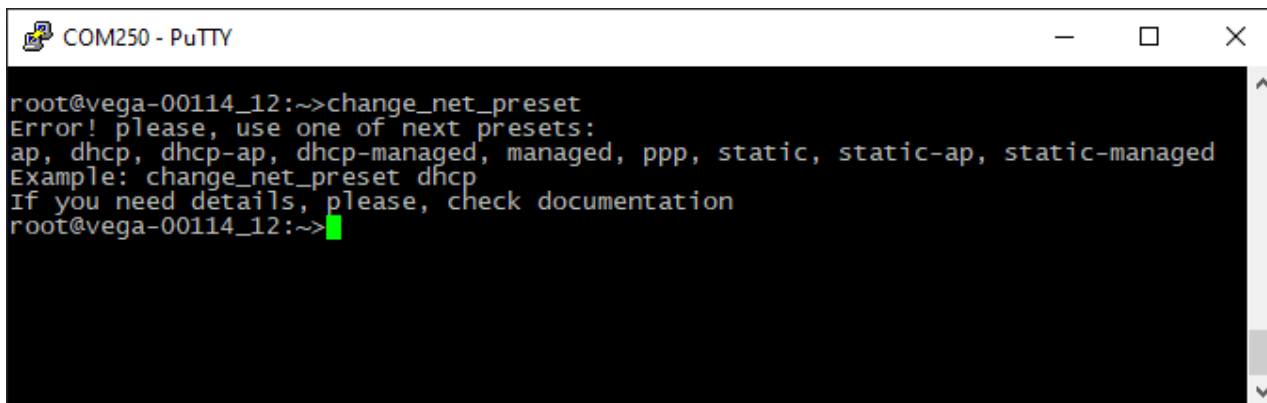


```
COM250 - PuTTY
GNU nano 5.5 /etc/Lora/global_conf.json Modified
},
"gateway_conf": {
  "gateway_ID": "080027FFFE000192",
  "server_address": "10.10.3.45",
  "serv_port_up": 8001,
  "serv_port_down": 8001,
  "keepalive_interval": 10,
  "autoquit_threshold": 10,
  "stat_interval": 30,
  "push_timeout_ms": 100,
  "forward_crc_valid": true,
  "forward_crc_error": false,
  "forward_crc_disabled": false,
  "gps_tty_path": null,
  "ref_latitude": 0,
  "ref_longitude": 0,
  "ref_altitude": 0,
  "fake_gps": false
},
```

To ensure proper communication with the server, verify that these UDP port parameters match those specified in the server's configuration file (see the IOT Vega Server User Guide, available for download at iotvega.com under the "Software" section on the [IOT Vega Server](http://iotvega.com) software page).

NETWORK CONNECTION CONFIGURATION

To change the network configuration, use the `change_net_preset` command (available from any directory).



```
root@vega-00114_12:~>change_net_preset
Error! please, use one of next presets:
ap, dhcp, dhcp-ap, dhcp-managed, managed, ppp, static, static-ap, static-managed
Example: change_net_preset dhcp
If you need details, please, check documentation
root@vega-00114_12:~>
```

Available configurations::

1. **ap** –initial setup mode; the Eth and Wi-Fi interfaces are member interfaces of the bridge master interface br0; Wi-Fi operates in access point mode; pppd and LoRa are not started.
2. **dhcp** – only the Eth interface is used, configured via DHCP.
3. **dhcp-ap** – Eth and Wi-Fi in access point mode.
4. **dhcp-managed** – Eth (preferred), Wi-Fi operates in client mode of an external access point.
5. **manged** – only Wi-Fi is used, operating in client mode of an external access point.
6. **ppp** – GSM module is used; Ethernet and Wi-Fi are disabled.
7. **static** – only Eth with a static IP.

8. **static-ap** –Eth with a static IP; Wi-Fi in access point mode.
9. **static-managed** – Eth (preferred) with a static IP, Wi-Fi operates in client mode of an external access point.

The above parameters are located in the **/etc/network/**.

To apply the changes, reboot the gateway using the **reboot** command.

Wi-Fi client mode configuration parameters are stored in the file **/etc/wpa_supplicant.conf**.

Wi-Fi access point mode configuration parameters are stored in the file **/etc/hostapd.conf.nat**.

GSM module configuration parameters are located in the **/etc/chatscripts/** directory.

STATIC IP CONFIGURATION FOR THE GATEWAY

Static IP configuration is performed using a terminal application as follows:

1. After connecting to the gateway, enter the login and password in the PuTTY terminal window.
2. Open the file **nano/etc/network/eth0-static** and make the necessary changes, specifying the required network parameters.



```
COM250 - PuTTY
GNU nano 5.5 eth0-static
ifconfig eth0 inet static
    address 192.168.10.2
    netmask 255.255.255.0
    network 192.168.10.0
    gateway 192.168.10.1
    pre-up /bin/sh -c "/sbin/ip link set eth0 address $(cat /run/ethaddr) || :"
    post-up /sbin/ip route replace default dev eth0 via 192.168.10.1
    pre-down /sbin/ip route del default dev eth0
    dns-nameservers 8.8.8.8 8.8.4.4
    dns-search google.com
    wait-delay 15
    hostname $(hostname)

[ Read 12 lines ]
^X Exit      ^O Write Out ^W where Is  M-Q Previous ^K Cut        ^C Location
^L Refresh   ^R Read File ^\ Replace   M-W Next     ^U Paste      ^_ Go To Line
```



This example shows how to set a static IP address of 192.168.10.2 and gateway 192.168.10.1. These values should be changed to match your specific network requirements

3. Then, type **reboot** in the command line to restart the gateway with the new settings.

GATEWAY CONFIGURATION FOR LTE OPERATION

Configuration of the gateway for LTE operation via a terminal application is performed separately for each SIM card. The procedure is as follows:

1. Go to the directory: **cd/etc/chatscripts/**.
2. Open the files **nano provider1-connect-chat** and **nano provider2-connect-chat**; the required lines are present.
3. Verify that each file contains lines similar to those highlighted in red in the image below.

internet is the mobile operator's APN and must be replaced with the APN of your specific operator.

```

COM250 - PuTTY
GNU nano 5.5 provider1-connect
# Chat скрипт подключает модем к провайдеру
ABORT "BUSY"
ABORT "NO CARRIER"
ABORT "NO DIALTONE"
ABORT "ERROR"
ABORT "NO ANSWER"
TIMEOUT 30
"" AT
OK ATE0
OK ATH
OK ATI;+CSUB;+CSQ;+CPIN?;+COPS?;+CGREG?;&D2
# Insert the APN provided by your network operator
OK AT+CGDCONT=1,"IP","internet",,0,0
OK ATD*99#
CONNECT

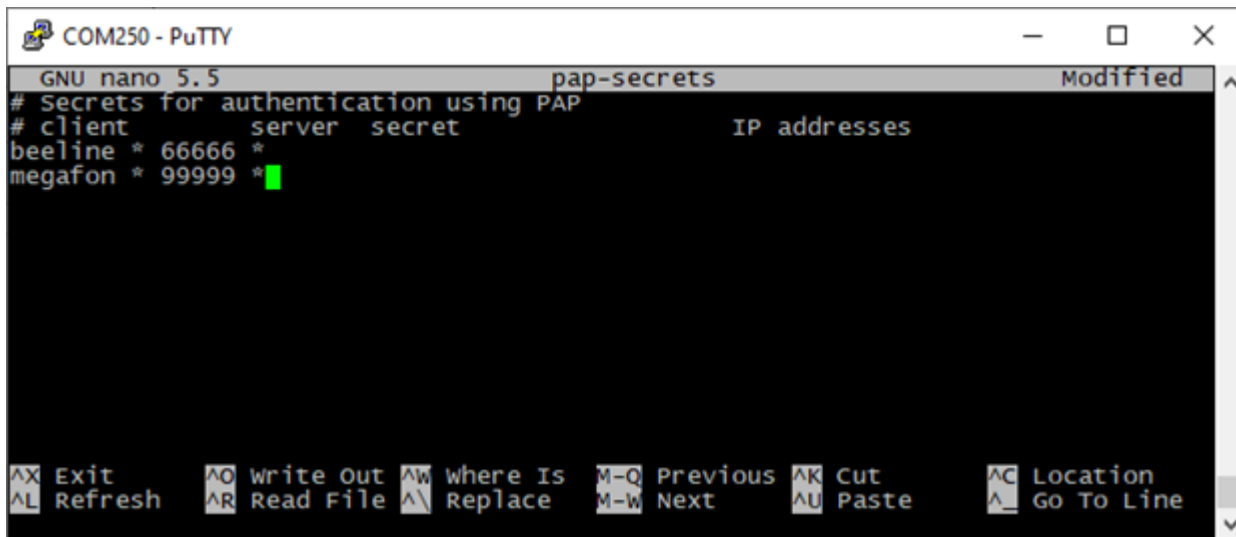
[ Read 15 lines ]
^X Exit      ^O Write Out ^W where Is  M-Q Previous ^K Cut        ^C Location
^L Refresh   ^R Read File ^\ Replace   M-W Next    ^U Paste     ^_ Go To Line

```



This example shows LTE configuration for the Megafon operator. These values must be replaced with the current parameters of your mobile operator

4. The login and password are specified in the `pap-secrets` file located at `cd/etc/ppp/`. Here, `beeline` – login and `66666` – password.



```
COM250 - PuTTY
GNU nano 5.5 pap-secrets Modified
# Secrets for authentication using PAP
# client      server  secret      IP addresses
beeline * 66666 *
megafoon * 99999 *
```

Terminal shortcuts: ^X Exit, ^O Write Out, ^W Where Is, M-Q Previous, ^K Cut, ^C Location, ^L Refresh, ^R Read File, ^\ Replace, M-W Next, ^U Paste, ^_ Go To Line



The Password and Login fields must not be left empty. If the mobile operator does not use these parameters, enter "internet" in both fields



Gateway automatically switch between Ethernet and LTE, and vice versa



When both Ethernet and LTE connections are active simultaneously, Ethernet is prioritized for data transmission, while LTE serves as a backup in case the gateway cannot reach the server via Ethernet

5 SAFE OPERATION RECOMMENDATIONS

GENERAL RECOMMENDATIONS

Before using the gateway, familiarize yourself with this User Manual (hereinafter referred to as the “Manual”).

This device is intended for deploying LoRaWAN® networks in the 863–870 MHz frequency band. Using the device for purposes other than those specified in this Manual constitutes a violation of operating procedures. The manufacturer shall not be held liable for any damage resulting from improper use of the device.

The gateway must be operated by trained personnel (in accordance with GOST IEC 62368-1).



The device isn't intended for use by children or in areas where children may be present



**Prohibited:
independent repair of the device, making changes to the device design,
installation of any software (except for the producer's software)**

Unprofessionally performed repair work or installed third party software can result in device failure, personal injury, and property damage.



The producer does not assume liability for unpredictable effects resulting from the use of third party software on the device

ELECTRICAL SAFETY



Do not operate the device near an open flame or direct sunlight. Doing so may result in overheating and fire. The device should be used at air temperatures range from 0 °C (32 F) to +70 °C (158 F)

If a fire is detected, immediately stop using the device and eliminate the fire. After that, the device should be sent to the producer for diagnostics (See the Warranty section for the producer's contacts).

Don't allow foreign objects to get into the device case during operation, as this may result in short circuits and fire. Don't operate the device with the case open or damaged.



Accidental damage to the power cable may result in electric shocks and faults that are not covered under the warranty terms

Prohibited to immerse the device case in water, it is not recommended to put it under water jets.



Don't touch wires, circuit boards, or the device enclosure with wet hands

Don't use the device after it has been exposed to water. Doing so may result in injury or damage to the device and cause it to malfunction. In such cases, contact the producer's technical support.

SAFETY RULES IN CASE OF DAMAGE TO THE ENCLOSURE

During normal operation of the device, the housing is not dangerous. If the case is mechanically damaged, sharp edges and corners may form, posing a potential hazard to the user. In this case, stop using the device and send it to the producer for replacement of the housing.

When operated in accordance with this manual, the device does not pose a danger to person.

RADIATION INFORMATION

When used correctly and following the installation recommendations, the device has no harmful effects on the person body and electrical equipment.

6 STORAGE AND TRANSPORTATION REQUIREMENTS

The gateways shall be stored in the original packaging in a dry room under conditions that do not allow direct contact with moisture at temperatures +5 °C to +40 °C and relative humidity less than 85 %. The devices must be protected against conductive dust, vapors of acids and alkalis as well as gases that cause corrosion and destroy insulation.

The devices are transported in the original packaging by all transport modes in covered vehicles in accordance with the rules of cargo transportation, operating on this type of transport, and technical conditions of loading and load securing.

During loading and unloading operations and transportation the boxes must not be exposed to sharp impacts and atmospheric precipitation.

The way of stacking the boxes with the product on the transportation vehicle should prevent their movement.

Transportation of the device without packing may result in its breakage.

The gateway transportation is permissible in covered freight compartments of all types at any distance at temperatures -40 °C to +85 °C.

7 CONTENT OF THE PACKAGE

The gateway delivered complete with:

Vega BS-0.1 gateway – 1 pc.

Power supply unit – 1 pc.

Passport – 1 pc.

8 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 - 36 months.

In the event of case it is established that the failure of the device has occurred due to reasons beyond the control of the consumer and is related to a defect in materials or violation of technological processes during production, which ultimately makes it impossible to continue using the device, the manufacturer is obliged to provide repair services or replace the defective device or its components within the warranty period.

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

- ⦿ the product does not have the passport;
 - ⦿ the passport does not have an TCD stamp and / or there is no sticker with information about the device;
 - ⦿ the serial number (MAC) printed on the product differs from the serial number (MAC) specified in the passport;
 - ⦿ the product has been subject to alterations in the design 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 5 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

DOCUMENT INFORMATION	
Title	Gateway Vega BS-0.1
Document type	Manual – Translation from Russian
Revision and date	01 of 08.10.2025

Revision History

Revision	Date	Name	Comments
01	08.10.2025	NEE	Document creation date



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