LORAWAN MODEM FOR ELSTER GAS METER

VEGA GM-2

USER MANUAL

DOCUMENT REVISION	FIRMWARE VERSION
06	0.8

CONTENTS

INTRODUCTION 3
1 DESCRIPTION AND OPERATION 4
Device description 4
Comunication and data collection algorithm 4
Functional 5
Marking 6
2 SPECIFICATION 7
DEVICE SPECIFICATION 7
Default Device Settings 8
3 OPERATION 9
Device Appearance 9
Contacts 10
LED Indications 11
Device's sensors 12
Mounting Recomendations 13
4 COMMUNICATION PROTOCOL 15
Vega GM-2 modem transmits the following types of packets 15
1. Packet with current readings, sent regularly 15
2. Packet with time correction request, sent every seven days on LoRaWAN® port 4 16
3. Settings packet – transmitting on LoRaWAN® port 3 when settings request command received, or device connected to the network 16
VEGA GM-2 modem receives packets of the following types 17
1. Outputs control request – send by application on LoRaWAN® port 2 17
2. Real-time clock adjustment – send by application on LoRaWAN® port 4 17
3. Packet with request of settings – sent by application on LoRaWAN® port 3 17
4. Packet with settings is identical to such packet from device 17
5 STORAGE AND TRANSPORTATION REQUIREMENTS 19
6 CONTENT OF THE PACKAGE 20
7 WARRANTY 21

INTRODUCTION

This manual is designated for Vega GM-2 LoRaWAN® modem (hereinafter – the modem) manufactured by Vega-Absolute OOO and provides information on powering and activation procedure, control commands and functions of the modem.

This manual is targeted at specialists familiar with installation work fundamentals of 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 DESCRIPTION AND OPERATION

DEVICE DESCRIPTION

LoRaWAN® modem GM-2 is designed for reading of values from Elster gas meters and further collection and transmitting of this data to LoRaWAN® network.

The modem is equipped with two Hall sensors, one of which calculates the current meter readings, and the other is in such a way and has a sensitivity level that reacts only to the presence of an external magnetic field (for example, when a strong magnet is placed near the gas meter to disable the counting mechanism).

To protect against unauthorized access, the modem has a tamper. There are also two security inputs and two control outputs.

The modem is powered by a 3600 mAh replaceable SAFT battery model LS 17500.

The device is powered by a non-rechargeable lithium-thionyl chloride ($LiSOCl_2$) battery
Attempts to charge the battery may result in fire

COMUNICATION AND DATA COLLECTION ALGORITHM

Vega GM-2 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.

Before start using you need to switch the device out of "Storage" mode.

Vega GM-2 supports two activation methods in the LoRaWAN® network - ABP and OTAA. You can choose one of the methods using the "Vega LoRaWAN Configurator" application (see the "User Manual" for 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 3 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 device forms the data packet with current state with a configurable period from 5 minutes to 24 hours. The packets stored in the device memory and transmitting during the next communication session with the LoRaWAN® network.

Examples

If the data collection period is set to 24 hours the packet is formed at 00.00 on the internal clock of the device

If the data collection period is 12 hours then at 00.00 and at 12.00, and so on.

The adjustable data transfer period can be 1, 6, 12 and 24 hours counting from the moment when the modem was switched to "Active" mode. When beginning of communication session, the device starts sending packets with readings from the earliest packet. The time of data transmitting cannot be specified, it's defined in random way for every device in chosen period of transmission from the moment of connection to the network.

Example

Transmission period is 1 hour, 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 17:41, at 18:41 and so on every 1 hour by the internal device clock.

The internal clock is set automatically when you connect to the device through USB, also can be adjust via LoRaWAN® network.

FUNCTIONAL

Vega GM-2 modem is A class device (LoRaWAN® classification) and has the following features:

- ADR support (Adaptive Data Rate)
- Sending of confirmed packets (configurable)
- Two operating modes: "Active" and "Storage"
- Two security inputs for connection an external leakage and safety sensors, etc.
- Storing undelivered packets in memory when sending packets with confirmation
- Adjustable data collection period
- Time referencing of readings by internal clock
- Communication in case of security inputs, hall sensor or tamper triggering
- Temperature measurement
- Charge measuring of the built-in battery (%)

MARKING

Device marked with sticker that contain the next information:

- Device model;
- DevEUI;
- Month and year of manufacture;

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 the keys for device registration in LoRaWAN® network and other identifiers.

2 SPECIFICATION

DEVICE SPECIFICATION

MAIN	
Security inputs	2
Open-drain outputs	2
USB-port	mini-USB, type B
Operating temperatures	-40...+85 °C
Built-in temperature sensor	yes
LoRaWAN®	
LoRaWAN® class	A
Quantity of LoRaWAN® channels	16
Frequency plans supported by default	RU868, EU868, KZ865
Frequency plans available as order option	Any regional according to "LoRaWAN 1.1 Regional Parameters"
Activation type	ABP or OTAA
Communication period	1, 6, 12 or 24 hours
Data collection period	5, 15, 30 minutes, 1, 6, 12 or 24 hours
Memory amount for storing packets	100 packets
Type of the LoRaWAN® antenna	internal
Sensitivity	-138 dBm
Radio coverage in restrained urban conditions	up to 5 km
Radio coverage within line of sight	up to 15 km
Transmitter power by default	25 mW (configurable)
POWER	
Battery	SAFT LS 17500 3600 mAh
Warranty number of packets sent by the device, not less	60 000
CASE	
Housing dimensions with mounting, no more than	107 x 66 x 39 mm
Housing dimensions without mounting	88 x 52 x 37 mm
Ingress protection rating	IP50
Tamper	yes
PACKAGE	
Package dimensions	140 x 80 x 50 mm
Weight of the package kit	0,100 kg

DEFAULT DEVICE SETTINGS

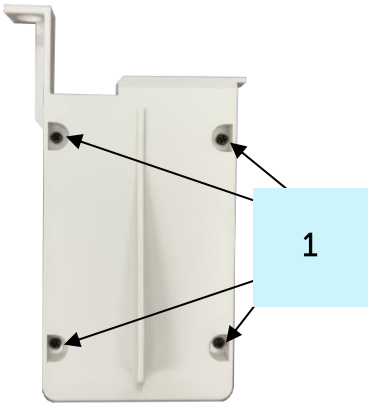
PARAMETER	VALUE
Frequency plan	RU868
Activation type	OTAA
Adaptive Data Rate	ON
Confirmed Uplinks	OFF
Rx 1 Delay	1 second
Join Accept Delay	5 seconds
Uplink number of transmissions	1
Data rate	DR0
Power	14 dBm
Communication period	24 hours
Data collection period	24 hours
Time zone	UTC +00:00

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 GM-2 is represented in gray plastic case which has four screws.

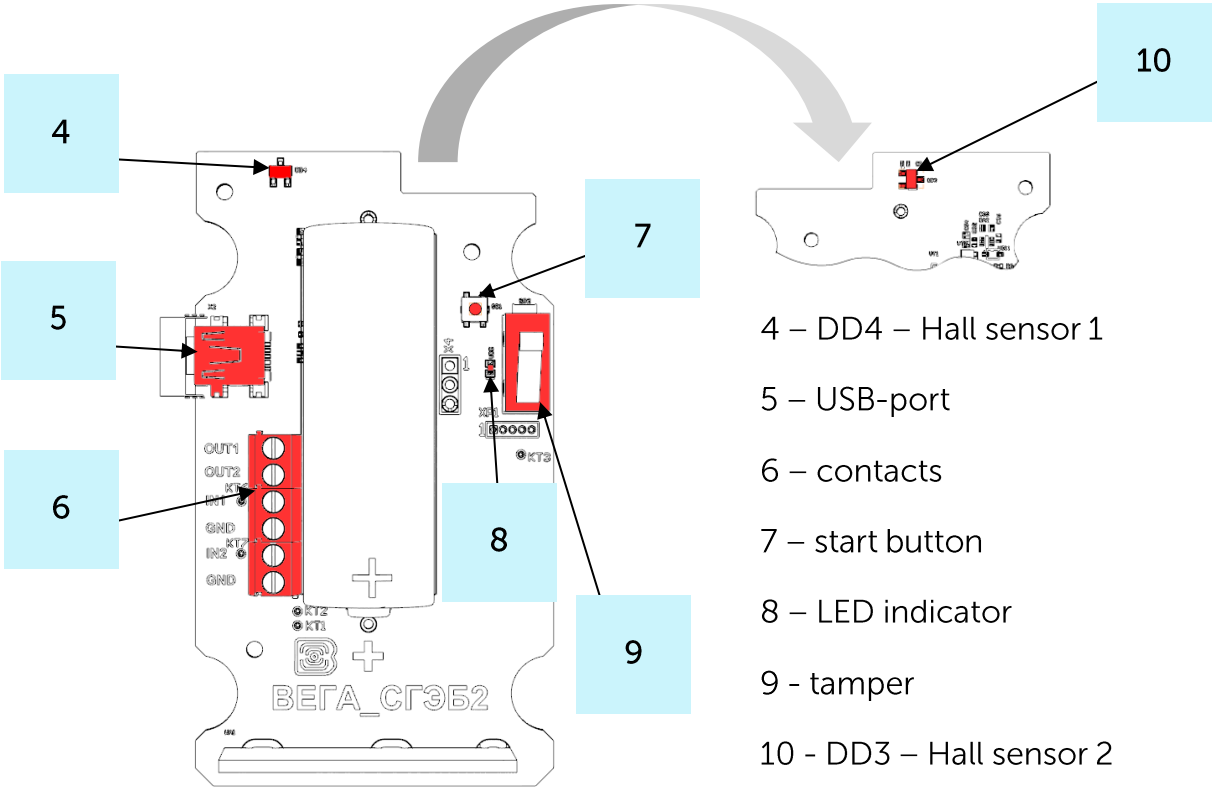


1 – screws ø 2 mm x 8 mm, cross

2 – mounting hole

3 – mount on meter housing

All control and indication elements are located inside the housing on the board.



4 – DD4 – Hall sensor 1

5 – USB-port

6 – contacts

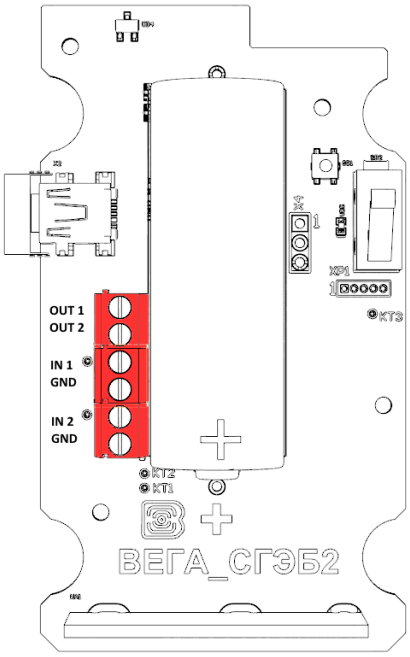
7 – start button

8 – LED indicator

9 - tamper

10 - DD3 – Hall sensor 2

CONTACTS

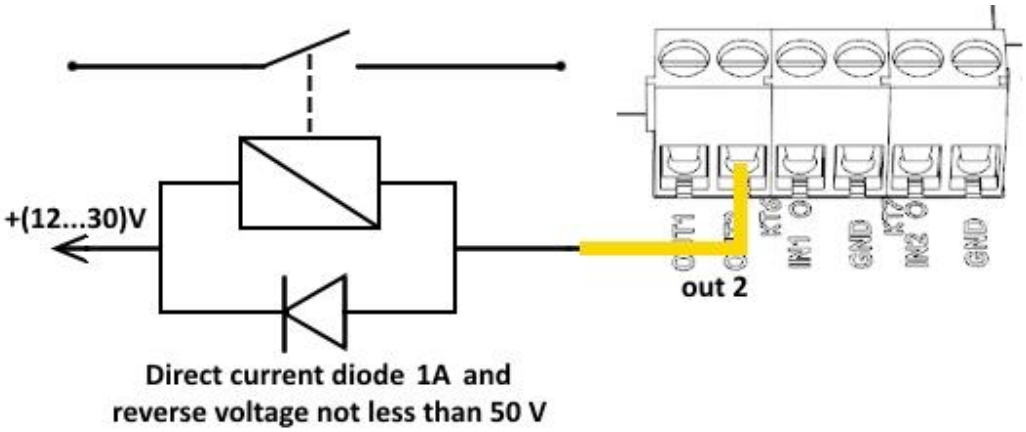


LoRaWAN® modem has the additional ability to connect two security inputs **IN1** and **IN2** located on the device board. The device monitors its closure or opening, depending on the settings in the "Vega LoRaWAN Configurator" application. In the case of a security input triggering, the device is activated and sends an alarm message to the network.

The actuators are connected to the modem through the **OUT1** and **OUT2** digital outputs, which are of the "open drain" type.

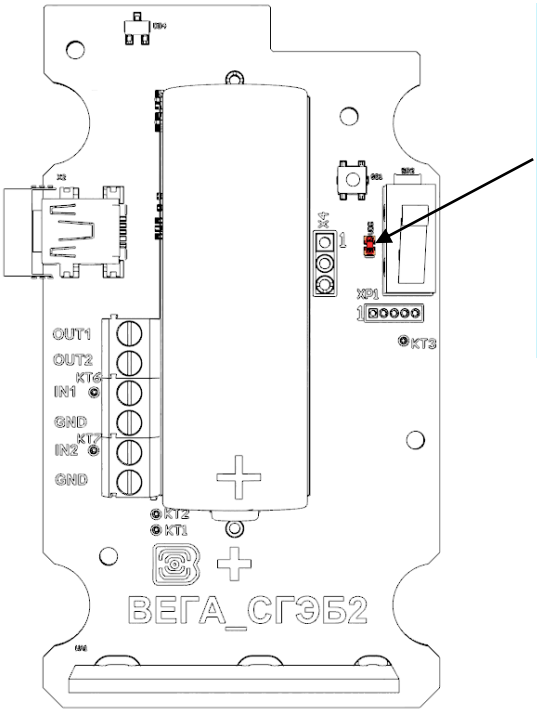
Permissible load for each digital output is 2 A

To increase the load on the outputs of the device, it is necessary to use an external relay. The relay connection is shown below.



LED INDICATIONS

There is a one red LED on the board. The indication is only used when the device is activated in the LoRaWAN® network and when the operating modes are changed.



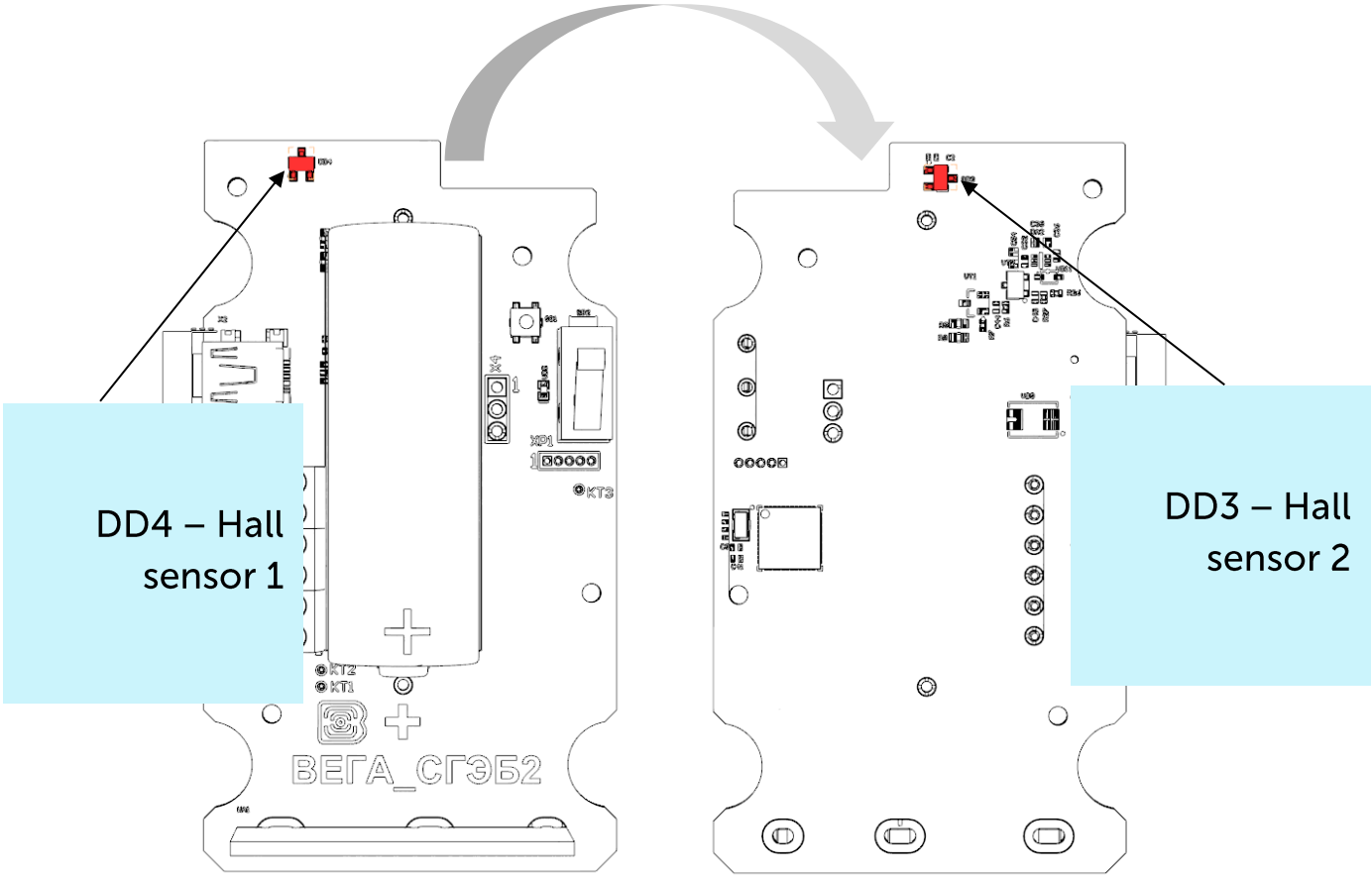
LED on the board

LED SIGNAL		MEANING
	Short flashings	Linking to the network in progress
	One long flashing during 5 sec	The device has been successfully connected to the network and is in active mode
	Three flashings each by 1 sec	Linking to the network has been failed or the device switched to the “Storage” mode

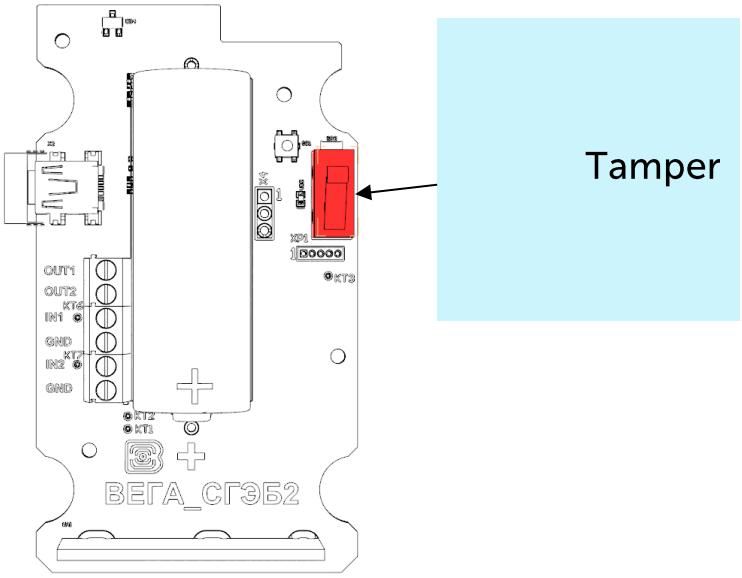
In case of connection attempt fail, the device will continue to accumulate data and will attempt to connect to the network every 6 hours

DEVICE'S SENSORS

On the upper side of the board is a Hall sensor of low sensitivity (1), reacting to the presentation of a strong magnet. On the underside of the board, there is a more sensitive Hall sensor (2) that responds to the rotation of the magnet in the gas meter mechanism, thus allowing the readout of the connected device.



On the upper side of the board there is a tamper. When the Hall sensor 1 and / or tamper are triggered, a packet with the corresponding message is sent to the LoRaWAN® network.



MOUNTING RECOMENDATIONS

To provide the stable radio between the gateway and the end device it is recommended to avoid 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 mounting, make sure that the equipment has the latest firmware version

For mounting you will need:

- cross-shaped screwdriver ✚;
- laptop.

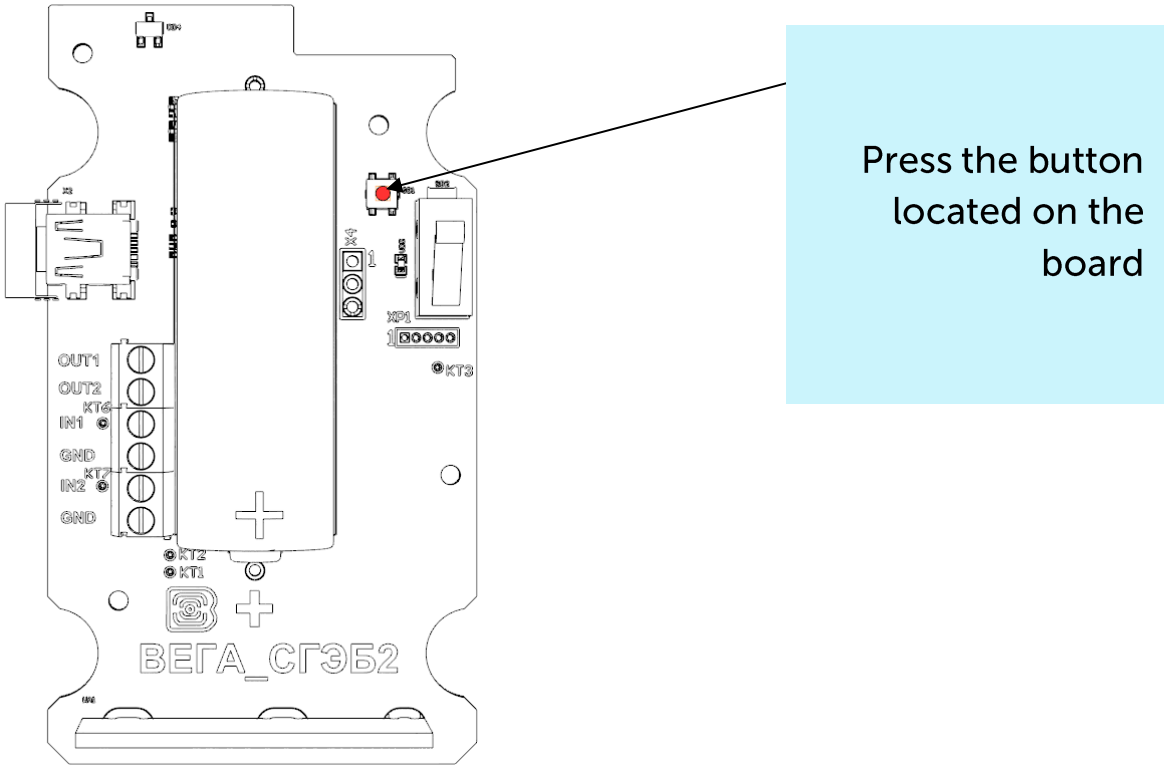
Step by step mounting be like:

1. Setting the devices and connecting them to the network are usually carried out in the office (see Network Deployment Manual).

When setting up, pay attention to the "Gas meter readings" parameter in the "Vega LoRaWAN Configurator" program. It is necessary to set the initial value of the readings of the connected gas meter, so that when collecting and transmitting readings, their absolute value displayed on the meter itself, as well as the number of decimal places, is transmitted. The number of decimal places must be brought in line with the same parameter of the metering device on the front panel.

The parameter "Number of decimal places" must unambiguously correspond to the same parameter of the meter for the correct collection of readings

2. LoRaWAN® modem Vega GM-2 is always on, but has a special "Storage" mode, intended for storage and transportation. In this mode, the device does not regularly transmit data to the network. Before starting to use the modem, it is necessary to exit the "Storage" mode by pressing the start button located on the board.



3. Assembling the device
4. Installing the mount of the Vega GM-2 modem in a special groove on the gas meter
5. Fixing the Vega GM-2 modem with a clamp or tie
6. By the laptop make sure that the device successfully sends the data.

4 COMMUNICATION PROTOCOL

This part describes the GM-2 communication protocol with LoRaWAN® network.

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

VEGA GM-2 MODEM TRANSMITS THE FOLLOWING TYPES OF PACKETS

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

Size in bytes	Field description	Data type
1 байт	Battery charge, %	uint8
4 байта	Time of the readings at that packet (unixtime UTC)	uint32
1 байт	Temperature, °C	int8
1 байт	Reason of packet transmission: 0 – by the time, 1 – by the input 1 alarm, 2 – by the input 2 alarm, 3 – by the output 1 state changing, 4 – by the output 2 state changing 5 – by the external magnetic influence 6 – by the tamper	uint8
1 байт	Input 1 state (1 – closed, 0 – unclosed)	uint8
1 байт	Input 2 state (1 – closed, 0 – unclosed)	uint8
1 байт	Output 1 state (1 – on, 0 – off)	uint8
1 байт	Output 2 state (1 – on, 0 – off)	uint8
1 байт	External magnetic influence (1 – present, 0 - absent)	uint8
1 байт	Tamper (1 – open, 0 - close)	uint8
4 байта	Meter readings at moment of packet sending (cub.m. * 100)	uint32
4 байта	Initial meter readings at moment of modem installing (cub.m * 100)	uint32

The modem has internal clock and calendar; time and date are factory set. When sending a packet with the current readings, the device uses the data taken at the nearest time, which is multiple to the interval according to data collection period:

- 5 minutes period: 00:05, 00:10 etc. readings are sent;
- 15 minutes period: 00:15, 00:30 etc. readings are sent;
- 30 minutes period: 00:30, 01:00 etc. readings are sent;
- 1 hour period: the readings of the beginning of the current hour are sent;
- 6 hours period: 00:00, 06:00, 12:00, 18:00 readings are sent;
- 12 hours period: 00:00, 12:00 readings are sent;

- 24 hours period: the readings of 00:00 of the current day are sent.

When taking readings, the time zone specified in the settings is considered.

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 == 1	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	-----

VEGA GM-2 MODEM RECEIVES PACKETS OF THE FOLLOWING TYPES

1. Outputs control request – send by application on LoRaWAN® port 2

Size in bytes	Field description	Data type
1 byte	Output number	uint8
1 byte	Output state (1 – on, 0 - off)	uint8
2 bytes	The value in seconds for which you need to set the output in specified state. If that value is equal to zero, then the specified state will set forever.	uint16

Upon receiving this package, the modem will set the specified output to the specified state for a specified time, or forever.

2. Real-time clock adjustment – send 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

3. 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 sends the packet with settings.

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

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 1	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 GM-2 parameters and these possible values

ID of parameter	Description	Data length	Possible values
4	Confirmed uplinks	1 byte	1 – confirmed 2 – unconfirmed
8	Uplinks number of transmissions	1 byte	from 1 to 15
12	Input 1 mode	1 byte	1 – pulse 2 – security
13	Input 2 mode	1 byte	1 – pulse 2 – security
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
56	Start readings	4 bytes	Readings in a cubic meter multiplied by 1000

5 STORAGE AND TRANSPORTATION REQUIREMENTS

LoRaWAN® modem Vega GM-2 shall be stored in the original packaging in heated room at temperatures +5 °C to +40 °C and relative humidity less than 85%.

The modem shall be transported in covered freight compartments of all types at any distance at temperatures -40 °C to +85 °C.

Long-term storage of the device in the "Storage" mode can lead to battery passivation

6 CONTENT OF THE PACKAGE

The modem is delivered complete with:

LoRaWAN® modem Vega GM-2 – 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 battery warranty period is 36 months or 15,000 data packets sent by the product, whichever comes first.

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

DOCUMENT INFORMATION	
Title	LoRaWAN® modem for Elster gas meter Vega GM-2
Document type	Manual – Translation from Russian
Document number	V02-GM2-01
Revision and date	06 – 21 October 2021

This document applies to the following products:

Product name	Type number
End devices	Vega GM-2

Revision History

Revision	Date	Name	Comments
01	24.05.2018	KEV	Document creation date
02	05.07.2018	PKP KEV	A typo in the exchange protocol "Time Adjusted Package" (4 bytes → 8 bytes) is fixed, a description of the "Number of decimal places" parameter on page 24 is added
03	24.07.2018	KEV	Frequency plan RU-868 is changed, some typos are fixed
04	28.05.2019	KEV	Communication protocol changed, setting via 'air' described, specification changed, "Marking" part added
05	10.06.2020	KEV	Battery specification is changed
06	21.10.2021	KMA	IP is changed, planned revision

vega-absolute.ru

User Manual © Vega-Absolute OOO 2018-2021