VEGA
ABSOLUTE

LORAWAN CONVERTER

M-BUS-1

User Manual

www.vega-absolute.ru

Document Information	
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This document applies to the following products:

Product name	Type number
End devices	M-BUS-1

Revision History

Revision	Date	Name	Comments
01	29.08.2017	KEV	Document creation date
02	05.10.2017	TII	Minor changes
03	26.10.2017	KEV	External devices connection was added
04	30.10.2017	TII	Work in transparent mode, exchange protocol edits, part “Contacts” is expanded
05	05.04.2018	TII	Supported connected devices list, the number of warranty packages has changed, minor changes
06	10.08.2018	KEV	Changes in the device logic, frequency plans are added, changes in the communication protocol, in technical characteristics, new supported meters are added
07	02.11.2018	KEV	Typo about battery capacity in the specification is fixed, new supported heat meter is added
08	22.01.2019	KEV	Changes in the communication protocol, in specification, settings by the air described, added “Marking” part and “Indication” part
09	24.01.2019	KEV	Inaccuracy in communication protocol fixed – packet type for packets with settings and request of settings
10	27.05.2019	KEV	Settings changed (page 32): settings 12 and 13 deleted, and a 32 added
11	01.07.2019	KEV	Added data transfer periods 5, 15 and 30 minutes, Device AppEui changed
12	27.02.2020	KEV	Typo on the page 11

13	03.11.2020	KEV	Device AppEui is removed from the characteristics, the LANDIS_GYR counter is not supported in the new firmware, examples for package 2 in the communication protocol are added, the configurator screenshots are updated, other planned changes
14	02.02.2021	KEV	The number of warranty packets is changed

CONTENTS

INTRODUCTION

This manual is designated for M-BUS-1 device (hereinafter – device, converter) 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.

To provide the stable radio between the gateway and the end device it is recommend 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

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

The device M-BUS-1 is designed for reading of values from metering instruments via M-BUS interface and further accumulating and transmitting of this data to the LoRaWAN network. M-BUS-1 has two 'open-drain' outputs so it can be used as a control device. Also, device has two security inputs.

Converter M-BUS-1 may operate in two modes. Converter can be used for any utilities' meters and industrial equipment with M-BUS interface while it operates in the transparent mode. But in the independent poll mode of the metering devices converter can be used only with the next supported devices:

- Heat meter «Teplouchet-1»
- Heat meter «STE 21 «Berill»
- Heat meter «Danfoss Sonometer 500»
- Heat meter «ELF-M Teplovodomer»
- Heat meter «WESER Heat Meter»
- Heat meter «Kamstrup Multical 801»
- Heat meter «Kamstrup Multical 402»
- Heat meter «Landis Gir»[1]
- Heat meter «Sharky 775»

The converter is powered by a 6400 mAh built-in battery. The converter can be powered by the 10...36 V external power supply.

Quantity of connecting M-BUS devices to the converter is up to 10 at the same time.

For the correct functioning of the converter in the independent poll mode, it is recommended to connect one-model counting devices to one converter

If you simultaneously use different models of metering devices with a single converter, you should only use the transparent mode of polling devices

COMUNICATION AND DATA COLLECTION ALGORITHM

The readings collecting from the meter with a configurable period from 5 minutes to 24 hours. The readings stored in the device memory and transmitting during the next communication session with the LoRaWAN network.

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

[1] Support is possible by individual order

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

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

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

FUNCTIONAL

M-BUS-1 converter can either be of class A or class C (LoRaWAN classification) and has the following features:

- Automatic change from A class to C class when powered from an external power supply
- ADR support (Adaptive Data Rate)
- Sending of confirmed packets (configurable)
- Extra communication in case of security inputs actuation
- Temperature measurement by the internal temperature sensor
- 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;
- QR-code containing DevEUI for automatized count.

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:

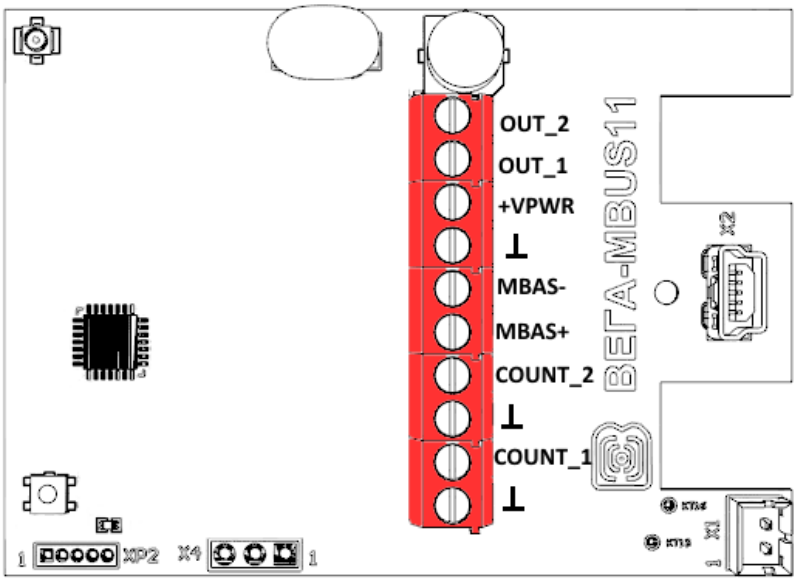
- Information about firmware version;
- QR-code containing DevEUI and keys for device registration in network via OTAA method.

2 SPECIFICATION

Main	
M-BUS interface	1
Quantity of connecting M-BUS devices	up to 10
Security inputs	2
'Open-drain' outputs	2
USB-port	mini-USB, type B
Operating temperatures	-40...+85 °C
LoRaWAN	
LoRaWAN class	A or C
Quantity of LoRa channels	16
Frequency plan	RU868, EU868, IN865, AS923, AU915, KR920, US915, KZ865, custom (EU868 based)
Activation type	ABP or OTAA
Communication period	5, 15, 30 minutes, 1, 6, 12 or 24 hours
Data collection period	5, 15, 30 minutes, 1, 6, 12 or 24 hours
Memory amount for storing packets	50 packets
Antenna connector	SMA
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)
Maximum transmitter power	100 mW
Power	
Built-in battery	6400 mAh
External power supply	10...36 V
Warranty number of packets sent by the device, not less	10 000
Case	
Housing dimensions	95 x 80 x 65 mm
Ingress protection rating	IP65
Mounting	clamp fastening to the support, DIN-rail, wall-mounting

3 OPERATION

CONTACTS



Converter has 10 contacts, see table below:

Contact	Designation on the board	Description
1	OUT_2	Open-drain output 2
2	OUT_1	Open-drain output 1
3	+VPWR	Power +
4	⊥	Power -
5	MBAS-	M-BUS -
6	MBAS+	M-BUS +
7	COUNT_2	Security input 2
8	⊥	Ground
9	COUNT_1	Security input 1
10	⊥	Ground

Ground contacts 8 and 10 are used for connection of security inputs COUNT_1 and COUNT_2.

Security inputs of the M-BUS-1 device are used to connect circuits with the following types of NO contacts:

- reed switch (Herkon);
- mechanical pushbutton;
- open-drain output.

While security input connected the device monitors its closure. Should the security input triggering, the device is activated and sends an alarm message to the network.

For connect an external metering instrument contacts M-BUS+ и M-BUS- are used.

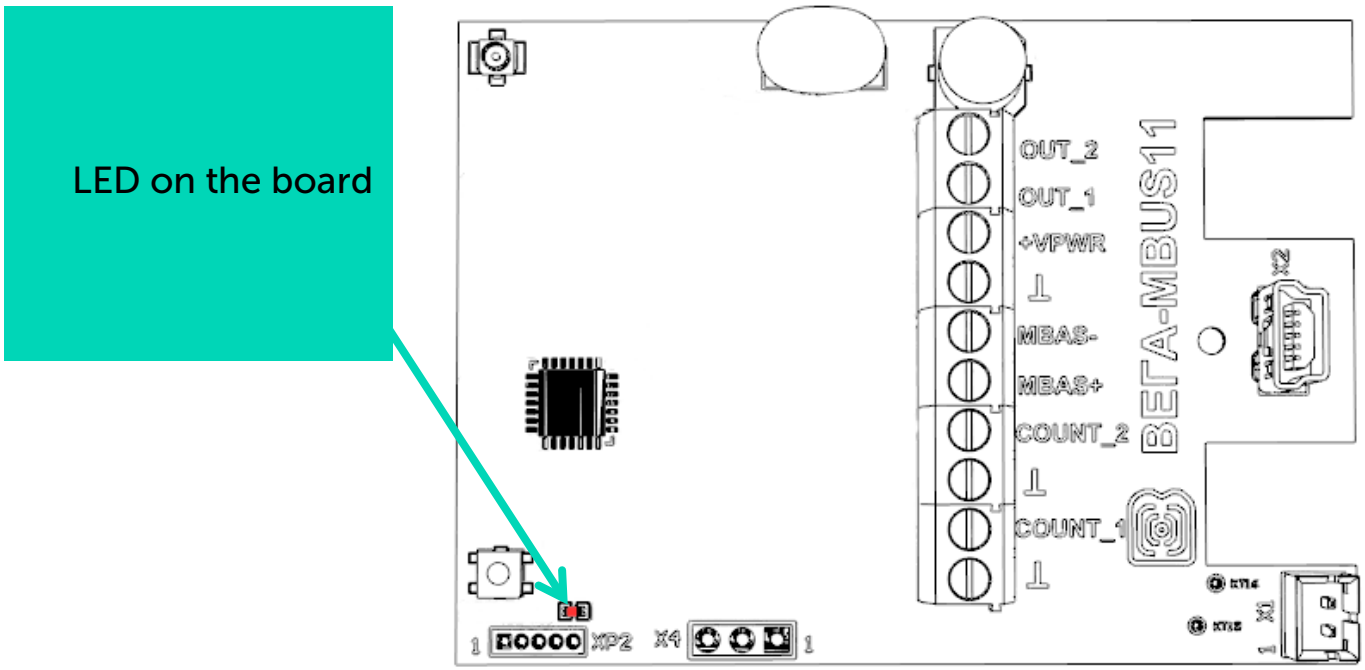
The outputs OUT_1 and OUT_2 operate on the principle of open-drain and can be used to control external devices, such as electric cranes, lighting, sirens and so on. The load capacity of each output is no more than 200 mA.

In order to increase the battery life, the physical level of the M-BUS interface is switch on (supply voltage is applied to the outputs MBAS +, MBAS-) just before meter polling with a programmable delay (the delay value is depending on the type of connected meter). The delay is introduced for initializing own meter interface and its preparing for receiving data from the converter. When the polling is complete, the physical M-BUS level is turned off.

When the converter is in class C, the physical level of the M-BUS interface is constantly on and does not turn off after completing a poll.

INDICATION

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.

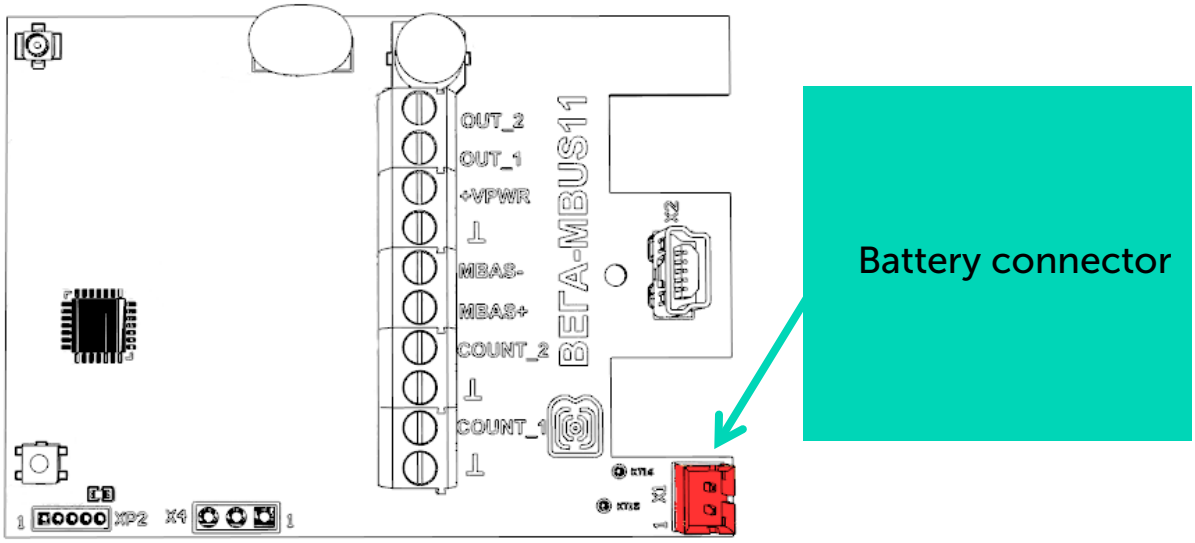


LED signal	Meaning
Series of short flashings	Linking to the network
One long flashing	The device connected to the network and is in active mode
Three long flashings	Linking to the network is unsuccessful or the device switched to the «Storage» mode

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

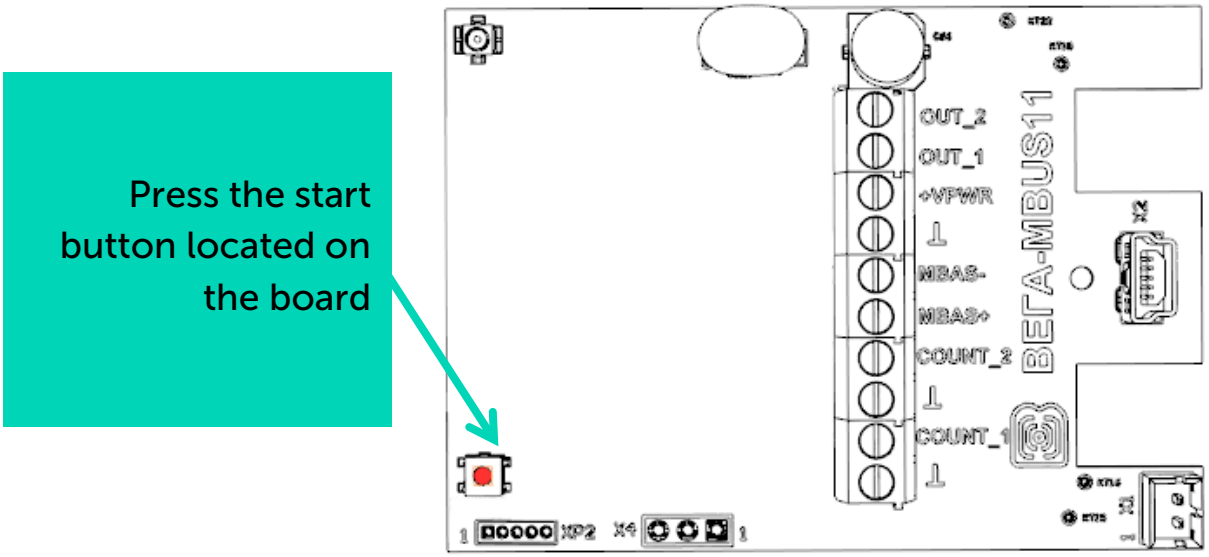
INITIAL STARTUP

The M-BUS-1 converter can be powered from either an external power source or built-in battery. To operate from the built-in battery, you must connect the battery connector to the power connector on the board.



The converter 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 pressing the start button, the device immediately starts working in the "Active" mode.



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

To transfer the device from the "Active" mode to the "Storage" mode, you can use the long press of the start button (more than 5 seconds).

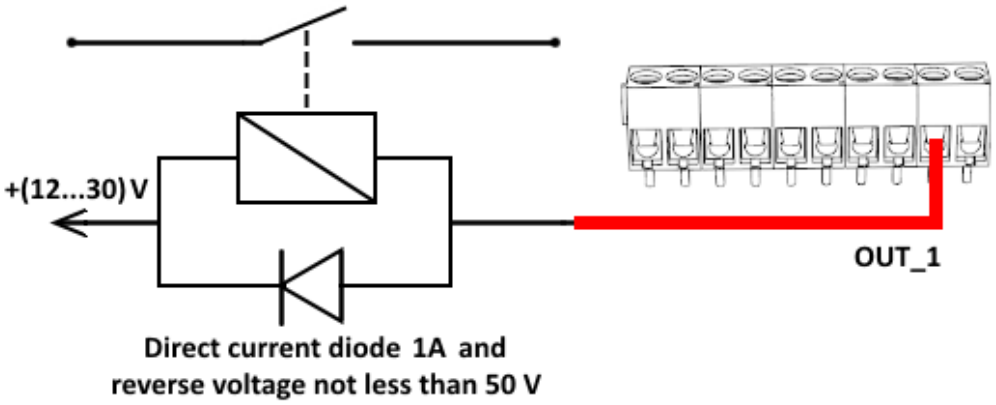
Before connecting the device to the network, make sure that its registration data is entered in the network - Device EUI, Application EUI and Application Key for OTAA, or Device address, Application session key and Network session key for ABP

EXTERNAL DEVICES CONNECTION

The actuators are connected to the converter via outputs OUT_1 and OUT_2, which are of the type "Open-drain".

Permissible load for each digital output is 200 mA

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



CONVERTER OPERATION IN THE INDEPENDENT POLL MODE OF THE METERING DEVICES

In the independent poll mode, the converter periodically and consistently polls the metering devices at their secondary addresses. The addresses of the polling devices are writting to the converter using the "Vega LoRaWAN Configurator" application. In case of a successful poll, the data transferred by the metering device is accumulated in the configurator memory and sent to the LoRaWAN network in accordance with communication period. The communication period can be set to 1, 6, 12 or 24 hours in the "Vega LoRaWAN Configurator" application while converter connected to a computer.

CONVERTER OPERATION IN THE TRANSPARENT MODE

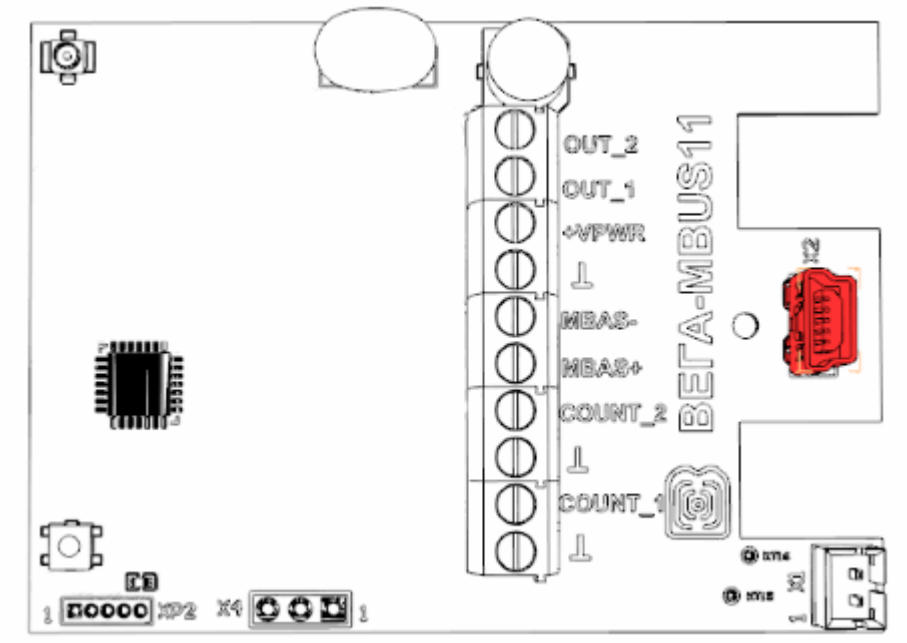
For enable using converter in conjunction with various software systems dispatching of meters and industrial equipment, there is added ability to work in a transparent mode. In this mode, the converter operates as a simple communication channel between the LoRaWAN network and connected external device. M-BUS-1 can receive data from the LoRaWAN network for external devices and transfer them to the M-BUS interface without any processing. If the external device responds to the request, the converter sends the received data back to the network, also without processing, as one or more packets.

Thus, in transparent mode, the converter does not form a request and does not process the response from the metering device. The duty to form requests and analyze the responses lies entirely on the external application that works with M-BUS-1 through the LoRaWAN network.

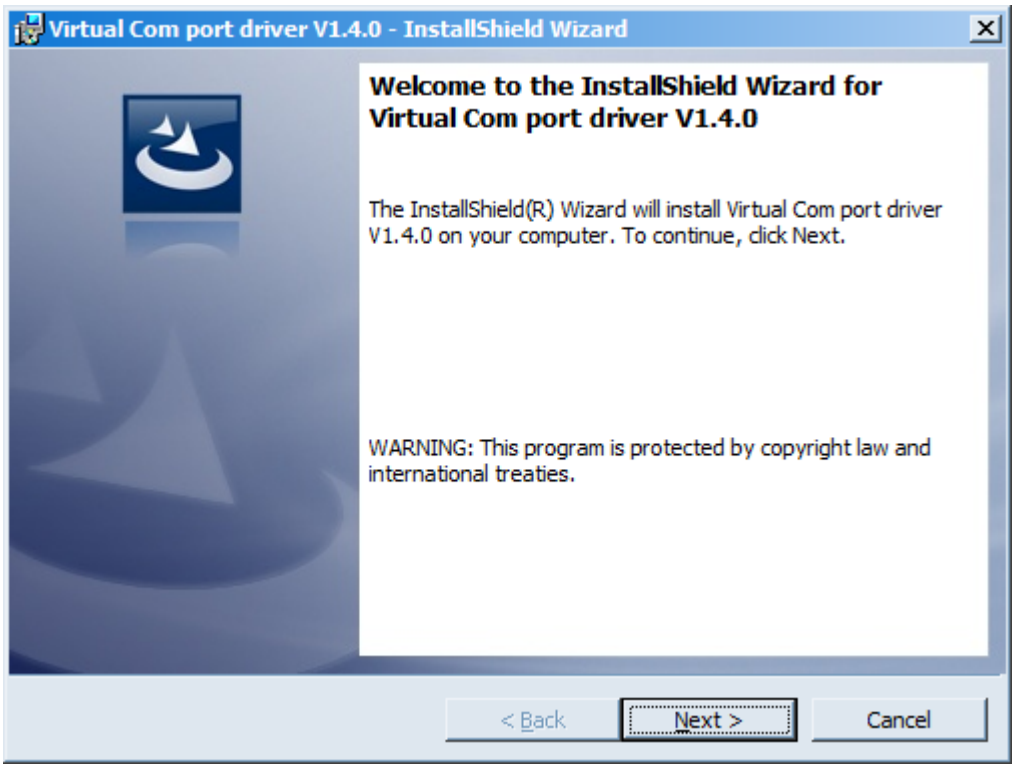
The converter must be powered by the external power supply while operating in the transparent mode (operate as a class C LoRaWAN device).

CONNECTING VIA USB

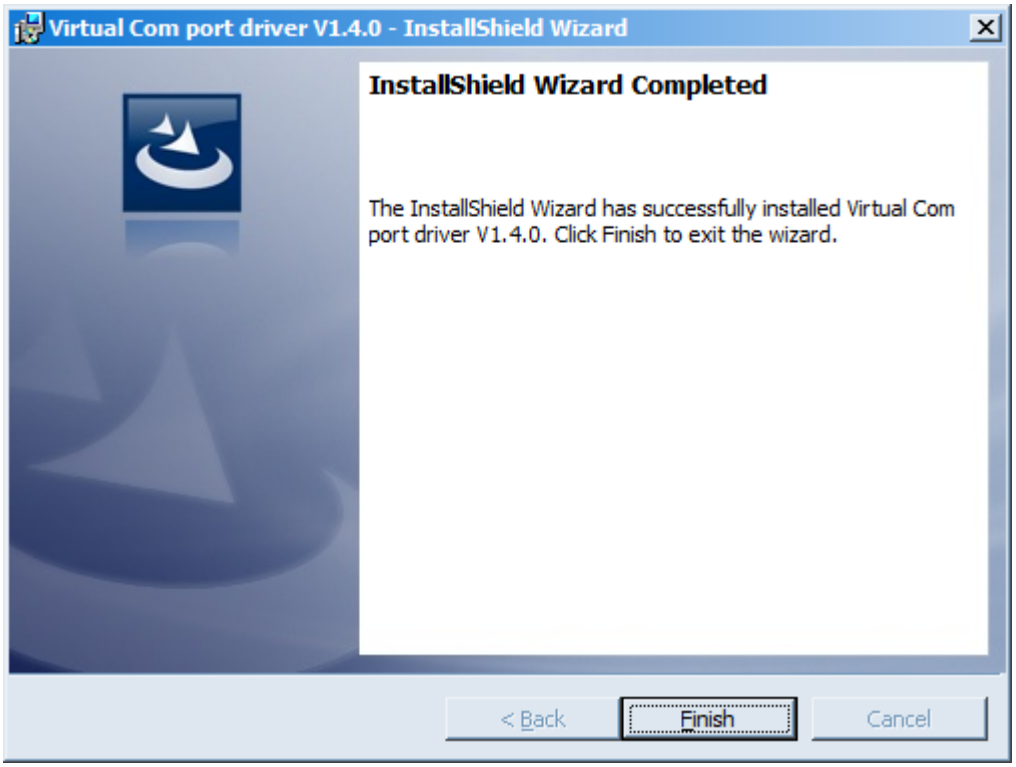
The device M-BUS-1 adjusted with the "Vega LoRaWAN Configurator" application (See part 4).



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 converter via USB.

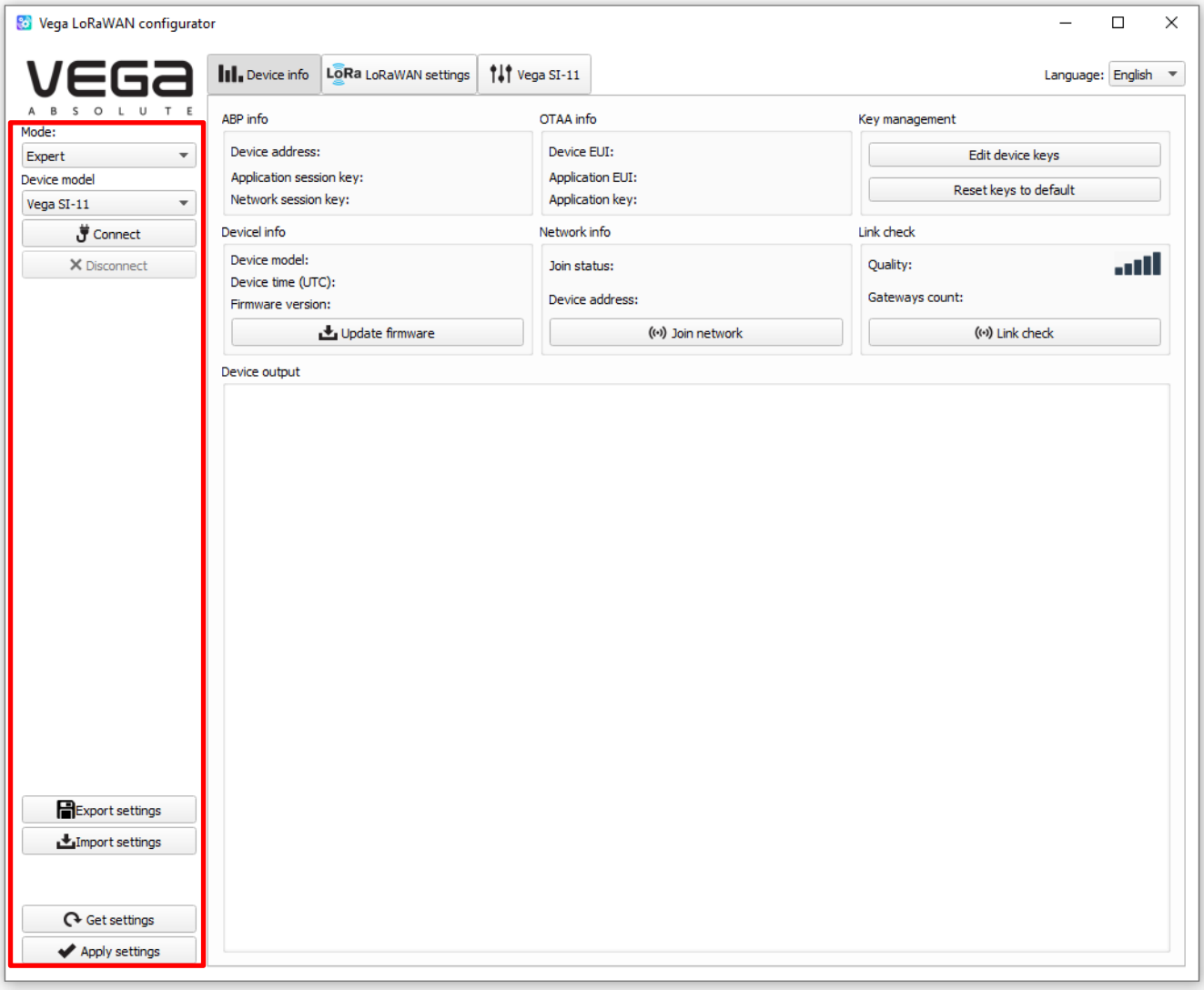
4 VEGA LORAWAN CONFIGURATOR

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 application 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 left side menu allows you to switch between the “Simple” and “Expert” operating modes, select a device model, connect to, or disconnect from a device.

The buttons "Export settings" and "Import settings" allow you to save a set of settings to a file and then load them from a file.

The buttons "Get settings" and "Apply settings" are needed to display the current device settings in the program and to save the changed settings in the device memory, respectively.

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

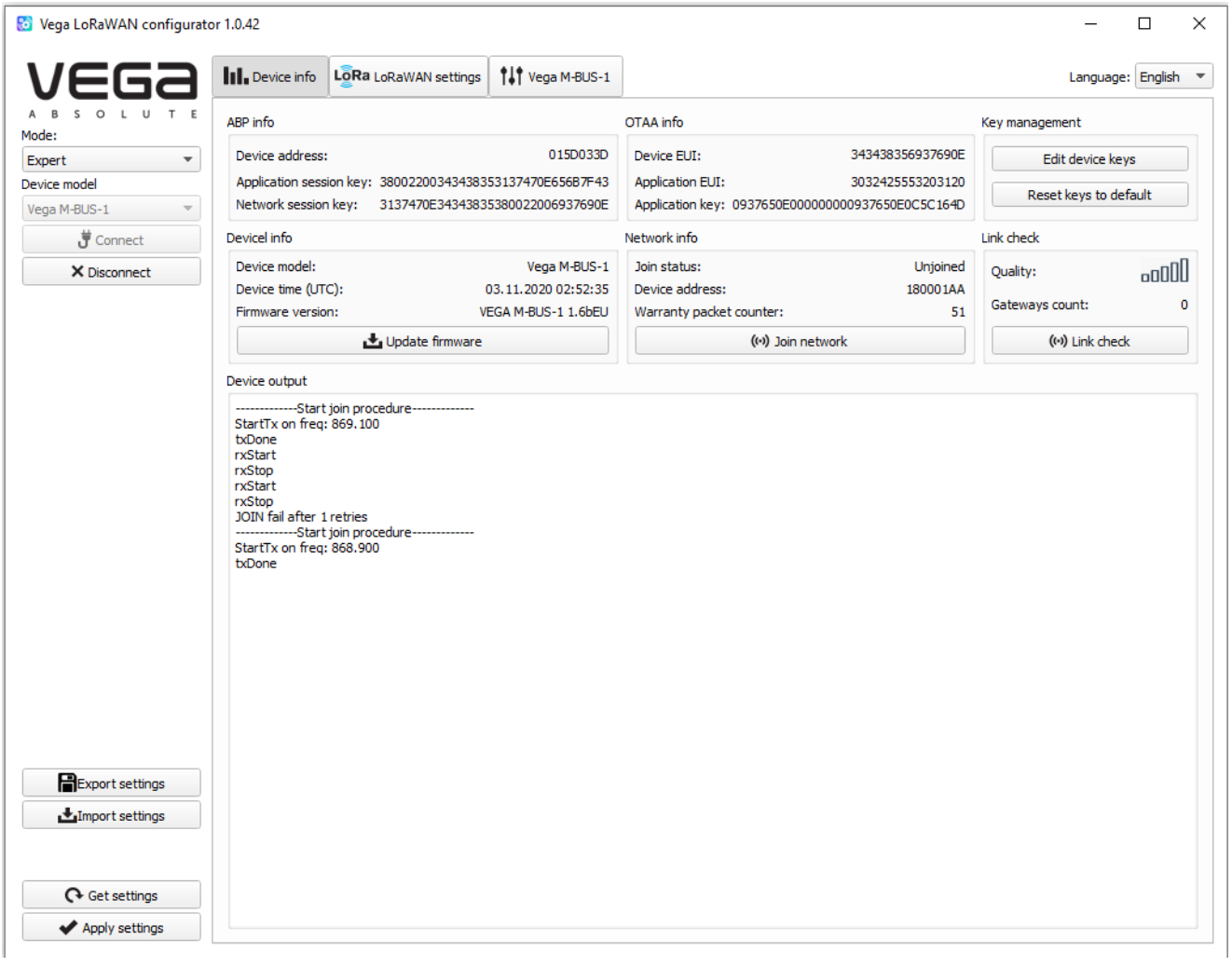
The language selection menu is in the upper right corner.

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 application automatically recognizes the device model, and the device selection menu becomes inactive.

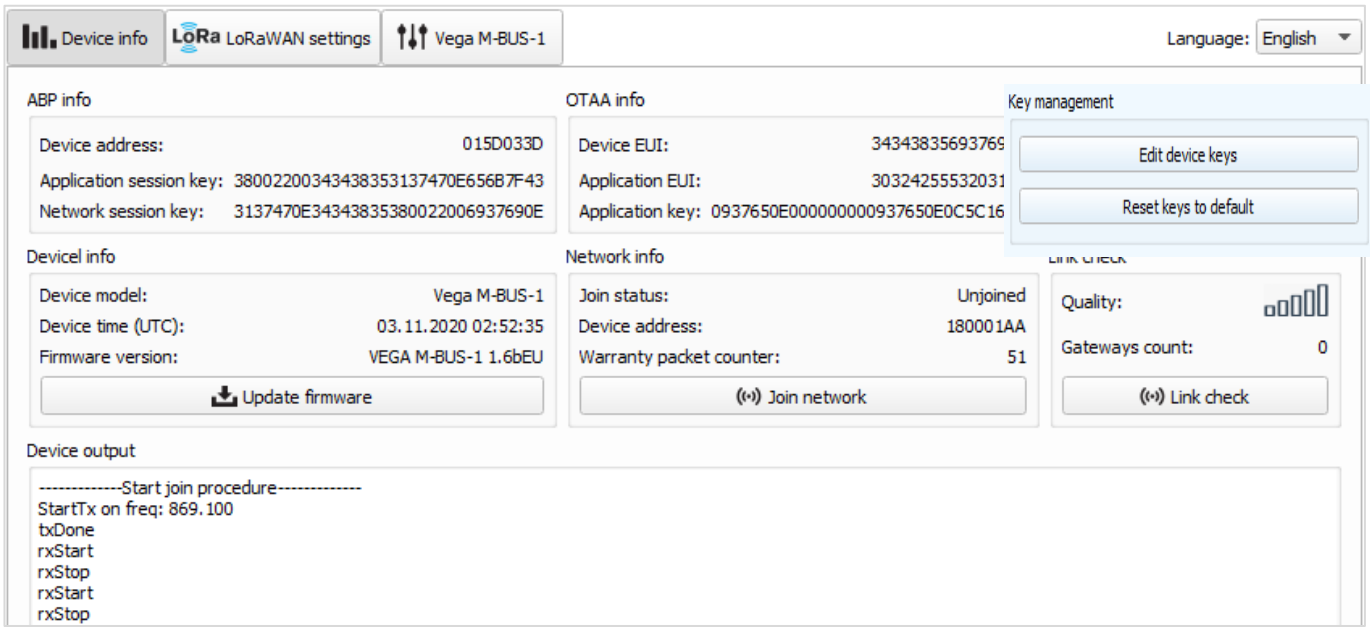


To read the settings from the device, you need to click the "Get settings" button, until this point the application will display the default settings or from the last connected device.

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 status, and the data needed to register the device in the LoRaWAN network.



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.

Key management (not displayed in the "Simple" mode) - allows you to change the factory keys to register the device on the network and reset the keys back to the factory settings.

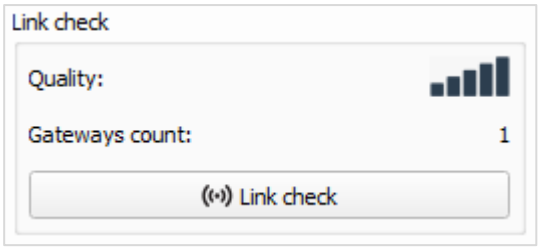
Device info - the configurator reads information about the device model, its firmware and automatically corrects the device's time when connected to it.

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 occur.

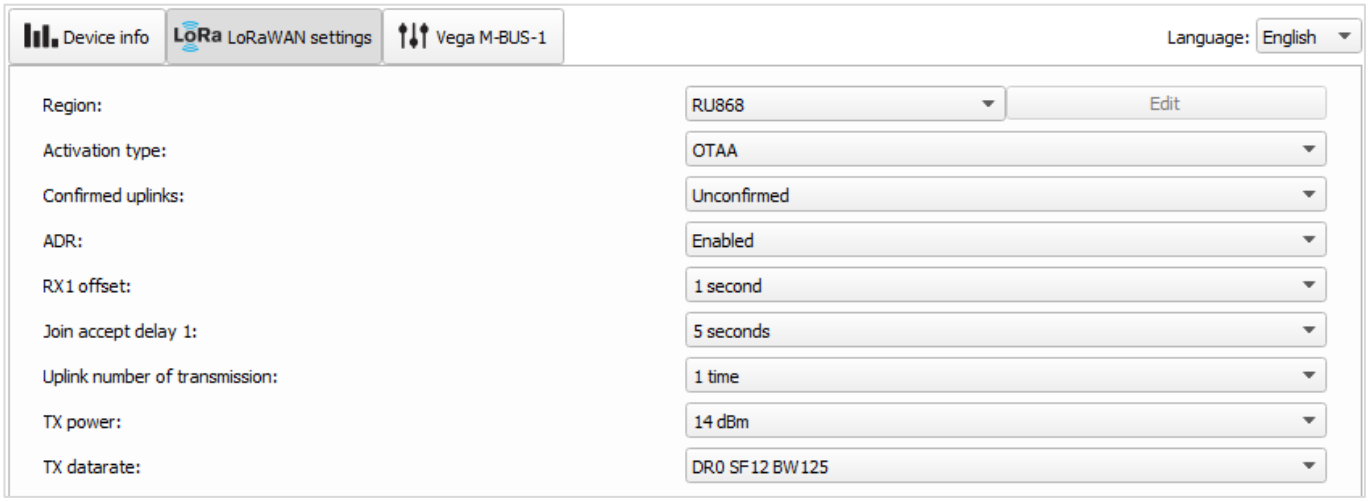
Link check (not displayed in the "Simple" mode) - when pressed, the device sends a special signal to the LoRaWAN network, in response to which the network informs it of the number of gateways that received this signal and the signal quality. This button only works when the device is connected to the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



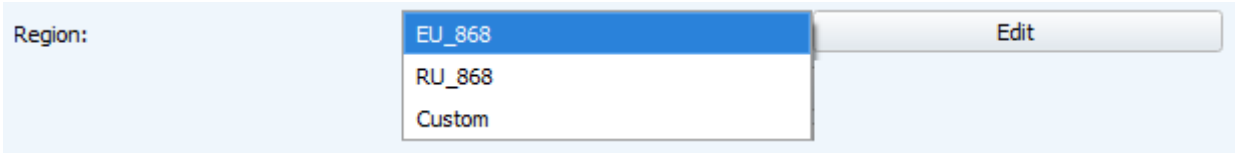
Device output (not displayed in the "Simple" mode) - monitoring the device status, all events in real time are displayed.

"LORAWAN SETTINGS" TAB

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



Region - allows you to select one of installed frequency plans or specify a custom frequency plan. Custom frequency plan is EU-868 based.



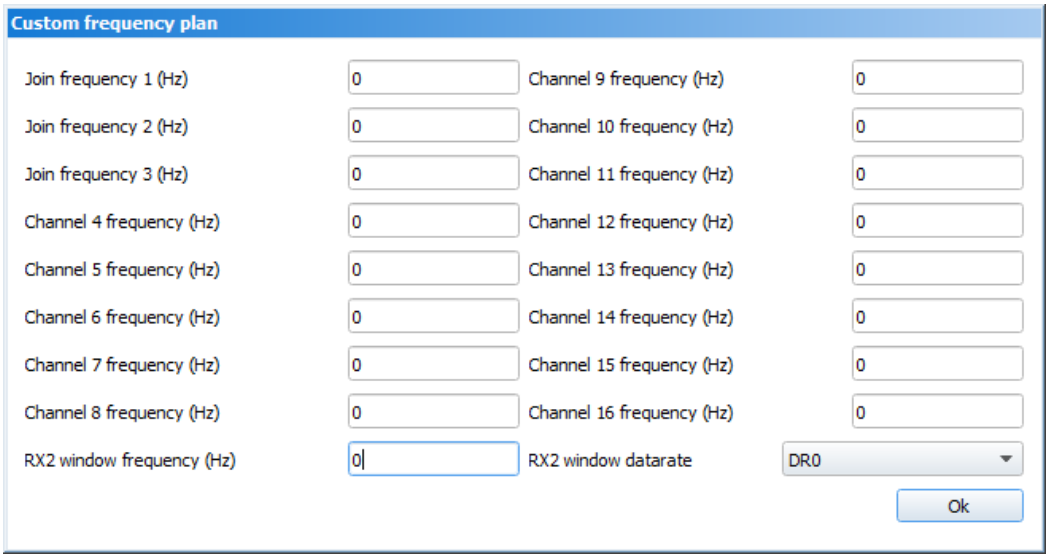
The converter supports the following frequency plans:

Frequency plan[2]	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	868.9	MultiSF 125 kHz
	2	869.1	MultiSF 125 kHz
	RX2	869.1	MultiSF 125 kHz
Custom	Set with «Vega LoRaWAN Configurator» application		

In the EU_868 and RU_868 frequency plans, only those channels are active by default, on which sending requests for connection to the network (join channels). The remaining channels (that the device should use) can be transferring by the LoRaWAN network server during the device activation procedure (only OTAA).

[2] By default, the device supports two frequency plans and the custom, but it is possible to order firmware for other frequency plans: IN865, AS923, AU915, KR920, US915, KZ865

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:



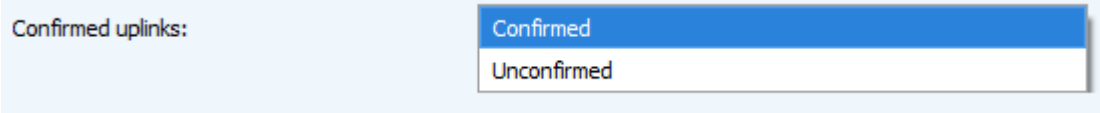
This frequency plan allows you to set up to 16 channels, as well as the frequency and speed of the second receiving window.

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

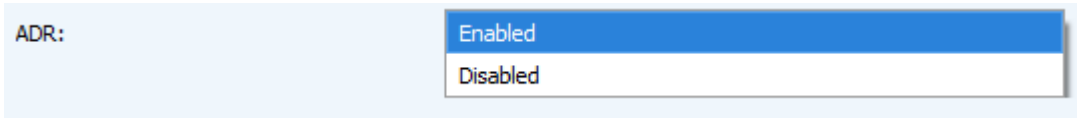
Activation type – selecting ABP or OTAA device activation method.

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).

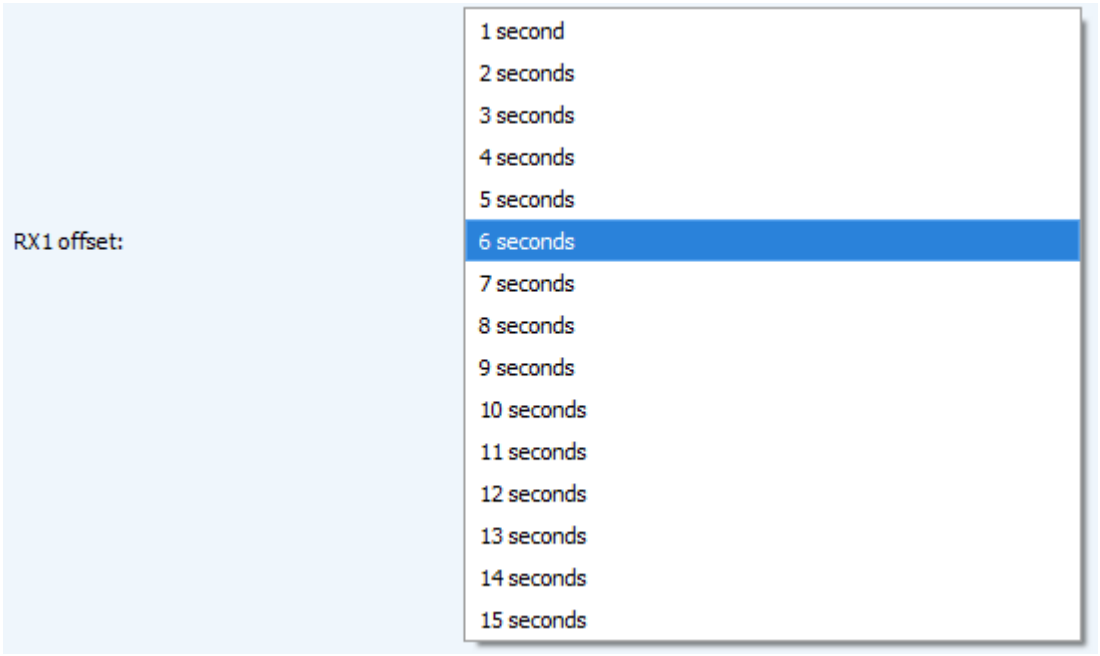
If you choose to send a packet without confirmation, the modem will not know whether the packet is delivered or not



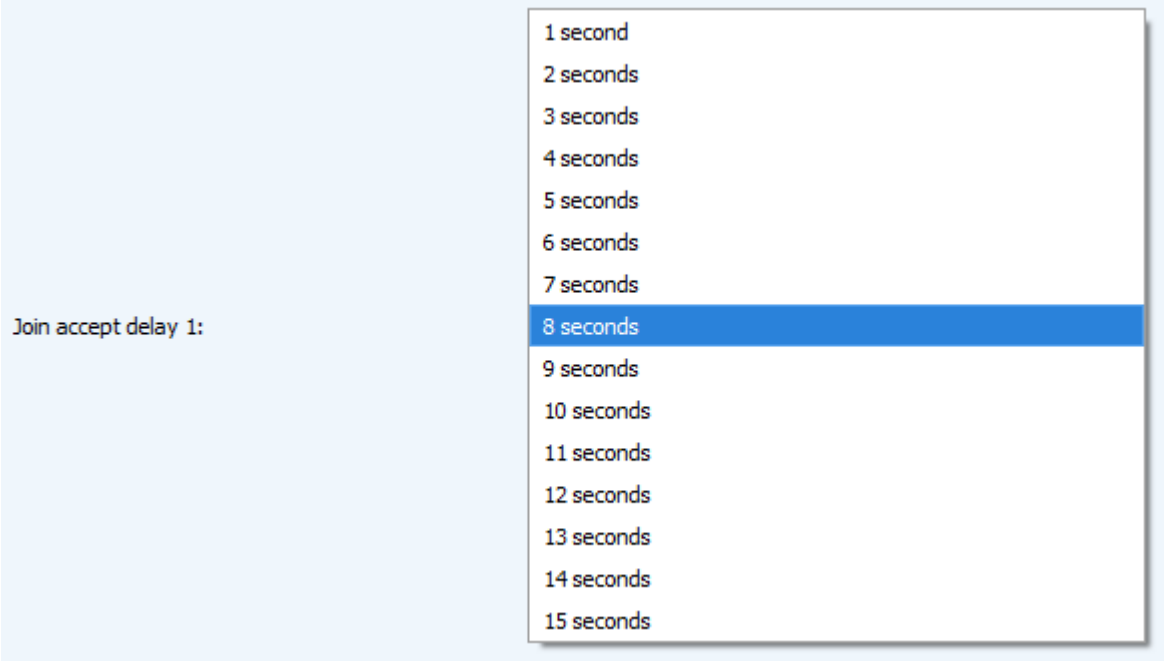
ADR – this option activates the Adaptive Data Rate algorithm for automatic control of the data transfer rate from the LoRaWAN network server side. The higher the quality of the signal received by the network, the higher the speed will be installed on the device. This option is recommended only on permanently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



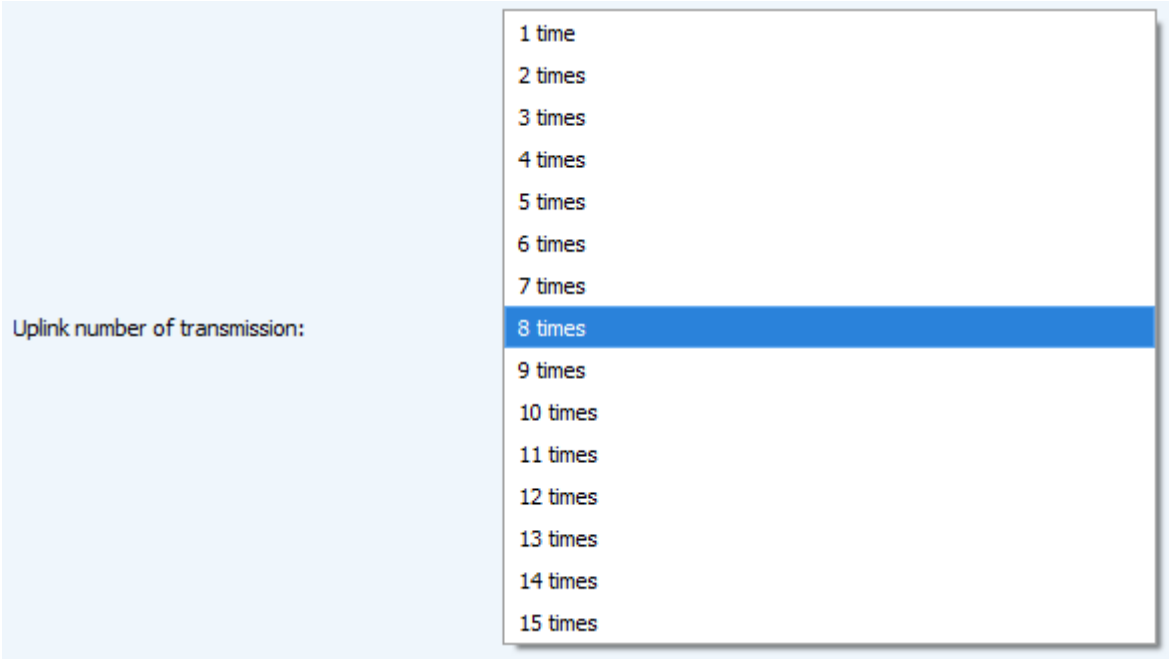
RX1 offset (not displayed in the "Simple" mode) – specifies the time between end of packet transmission and first receiving window opening. The second receiving window always opens after 1 second after the first.



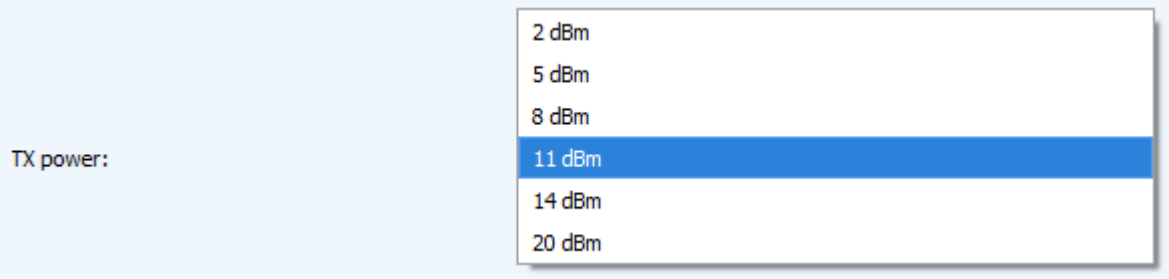
Join accept delay 1 (not displayed in the "Simple" mode) – sets the time that the device will open the first receiving window to receive confirmation for the join request from the LoRaWAN network. The second window always opens after 1 second after the first.



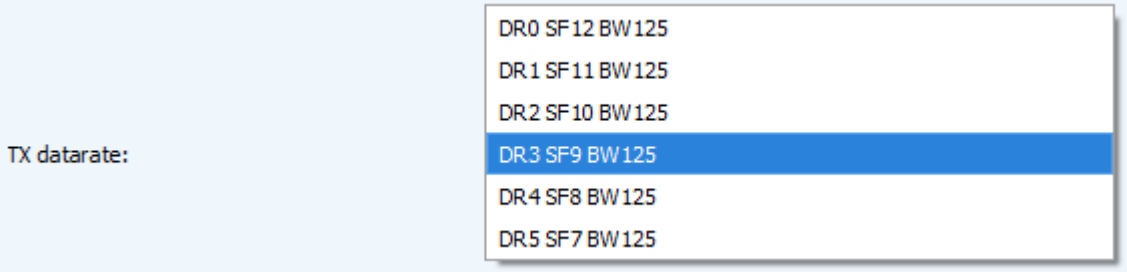
Uplink number of transmission (not displayed in the "Simple" mode) – if the "Confirmed uplinks" function is disabled, the device will simply send each packet as many times as specified in this option. If "Confirmed uplinks" is enabled, the device will send packets until it receives a confirmation or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



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.

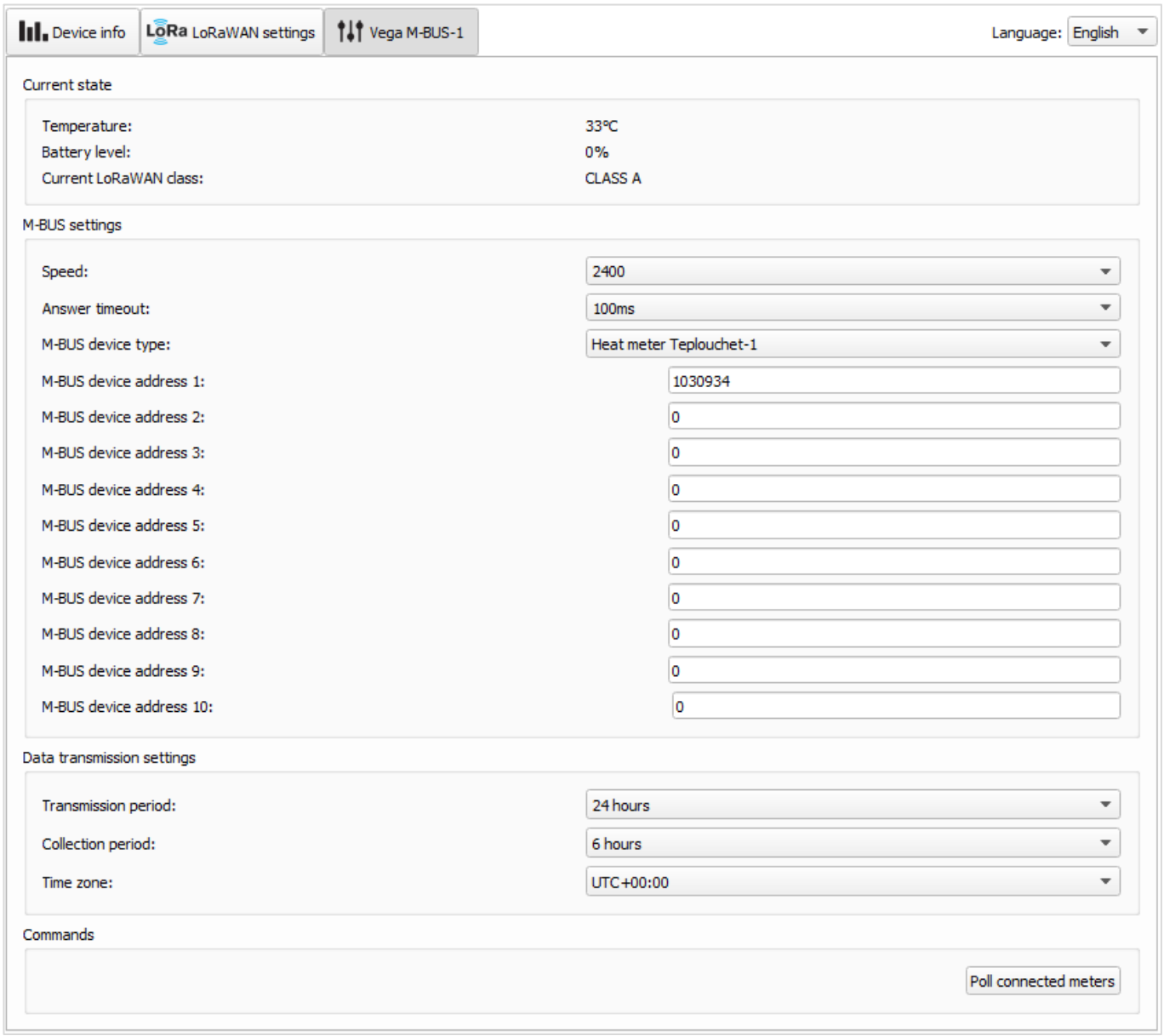


TX datarate (not displayed in the "Simple" mode) – the device transmission datarate at which it will transfer packets to the LoRaWAN network. This speed can be changed by the network server if the ADR algorithm is enabled.



«VEGA MBUS-1» TAB

The “Vega MBUS-1” tab contains the settings of the connected device.



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

M-BUS settings – allows to setting M-BUS interface, set the model and addresses of connected heat meters. Addresses are setting up in the case of converter operation in the independent poll mode of the metering devices. In the case of converter operation in transparent mode the setting up of addresses is not required. M-BUS-1 uses the secondary addresses for poll of the connected devices. The secondary address usually is equal to meter serial number.

Data transmission settings – a group of parameters that allows you to configure the collection and transmission periods, and the time zone for the internal clock of the device will

be set which. The readings are read from the connected device at 00.00 on the internal clock of the device if the data collection period is set to 24 hours, at 00.00 and at 12.00, if the period is 12 hours and so on. All readings are stored in the device memory until the next communication session.

The data transfer period can be adjusted from 5 minutes to 24 hours. Data transfer is carried out by a random time at the selected period. At the next communication session, the device starts sending accumulated packets with readings, from the earliest to the latest.

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

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

Commands – allows to get the command “Poll connected meters” on the converter. After press button the converter will polling all the connected meters and immediately transmit that data in the LoRaWAN network.

5 COMMUNICATION PROTOCOL

This part describes the M-BUS-1 data exchange protocol with LoRaWAN network.

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

CONVERTER M-BUS-1 TRANSMITS THE FOLLOWING TYPES OF PACKETS

1. Packet with current readings from connected heat meter, sent regularly or on request

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 1	uint8
1 byte	Battery level, %	uint8
1 byte	Values of basic settings (bit field)	uint8
4 bytes	Meter secondary address	uint32
4 bytes	Time of readings in this packet (unixtime UTC), by the internal clock of the converter	uint32
4 bytes	The amount of thermal energy consumed, Wh	uint32
4 bytes	Total volume of coolant, l	uint32
4 bytes	Operating time, h	uint32
2 bytes	Current flow temperature ^{0}C*100	uint16
2 bytes	Current temperature in the return line ^{0}C*100	uint16
2 bytes	Current flow of coolant, l/h	uint16

The converter 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, set by the switches:

- 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 transmitting on request the readings are taken in that moment.

A package of this type is transmitted separately for each connected meter. For example, if 5 metering devices are connected to the converter, 5 packets will be transferred to the next connection.

"Values of basic settings" bit field decoding

Bits	Field description
0 bit	Activation type 0 - OTAA, 1 – ABP
1st bit	Query for packet confirmation 0 – off, 1 – on
2d,3d,4th bit	Communication period: |1 == 0|2==0|3==0| - 5 minutes |1 == 1|2==0|3==0| - 15 minutes |1 == 0|2==1|3==0|- 30 minutes |1 == 1|2==1 |3==0|- 1 hour |1 == 0|2==0|3==1|- 6 hours |1 == 1|2==0|3==1|- 12 hours |1 == 0|2==1|3==1|- 24 hours
5th bit	Input type – security (1 for that device)
6th bit	Input type – security (1 for that device)
7th bit	Reserve (always 0)

2. Packet with data from connected M-BUS device (transparent mode)

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 3	uint8
2 bytes	Total size of the received data by the interface	uint16
1 byte	Size of that packet	uint8
1 byte	That packet serial number	uint8
1 byte	Total number of packets	uint8
array	Data	uint8

3. External power information packet, sent in case of change external power status

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 4	uint8
1 byte	Battery charge, %	uint8
1 byte	Values of basic settings (bit field)	uint8
1 byte	External power state (0 – off, 1 - on)	uint8

4. «Alarm» packet, sent when security input is closed

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 5	uint8
1 byte	Battery charge, %	uint8
1 byte	Values of basic settings (bit field)	uint8
1 byte	Input number on which “Alarm” is noticed (1 or 2)	uint8
1 byte	Input 1 state («0» - unlocking, «1» - closure)	uint8
1 byte	Input 2 state («0» - unlocking, «1» - closure)	uint8

5. Packet with data about state changes of the outputs OUT_1 or OUT_2

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 6	uint8
1 byte	Battery charge, %	uint8
1 byte	Values of basic settings (bit field)	uint8
1 byte	Output number on which change is noticed (1 или 2)	uint8
1 byte	Output state («0» - off, «1» - on)	uint8

6. 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 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.

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

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

CONVERTER M-BUS-1 RECEIVES PACKETS OF THE FOLLOWING TYPES

1. 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

2. Query of readings log

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 2	uint8
1 byte	Type of request ("0" - interrogate all connected meters, "1" - interrogate the meter by serial number)	uint8
4 bytes	Serial number of the meter	uint32

Upon receiving this package, the converter will perform an extraordinary polling of all connected meters (request type = 0) and alternately send packets with current readings for each of them or interrogate only one device by serial number (request type = 1).

Example 1:

0200 – command to poll all connected devices (no address field).

Example 2:

020000000000 – command to poll all connected devices (address field 0x00)

Example 3:

Poll the counter by the address with the number 17212760 (number in decimal format). The command is **020158A50601**, where 0x58A50601 is the number 17212760 in hexadecimal with little endian byte order.

3. Output on command

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 3	uint8
1 byte	Output no. (1 - 2)	uint8
1 byte	Output on time in seconds (1 – 255, 0 – forever on).	uint8

4. Converter operation in transparent mode

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 4	uint8
array	Data	uint8

Upon receiving this packet, M-BUS-1 will transfer the data contained in it to the M-BUS interface (depending on the model). If the external device connected via M-BUS interface answers within the timeout specified in the M-BUS-1 settings, the response will be transferred to the LoRaWAN network as one or more type 3 packets.

When using the on/off commands of the outputs and working in transparent mode, the converter must power by an external power source (operate as a class C device)

The LoRa data transfer technology places restrictions on the maximum packet size, depending on the data rate at which the packet is transmitted. In this regard, the packet size sent to the device should not exceed 51 bytes. If you want to send a larger packet, the external application must make sure that the network server is running at the current data rate at which the device is running, allowing you to send larger packets. The table below shows the maximum package sizes for different data rates.

Data rate	Spread factor	Maximum packet size
DR0	SF12	51 bytes
DR1	SF11	51 bytes
DR2	SF10	51 bytes
DR3	SF9	115 bytes
DR4	SF8	222 bytes
DR5	SF7	222 bytes

5. Output off command

Size in bytes	Field description	Data type
1 byte	Packet type, this packet == 5	uint8
1 byte	Output no. (1 - 2)	uint8

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

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

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

7. 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 M-BUS-1 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 байт	1 – enabled 2 – disabled
8	Uplinks number of transmissions	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
32	MBUS interface speed	1 byte	1 – 300 2 – 600 3 – 1200 4 – 2400 5 – 4800 6 – 9600
33	External M-BUS device type	1 byte	0 – device type not set 1 – Teplouchet-1 2 – STE 21 «Berill 3 – Danfoss Sonometer_500 4 – ELF_M 5 – Weser 6 – MULTICAL_801 7 – MULTICAL_402 8 – LANDIS_GYR_COMMON[3] 9 – SHARKY_775
49	Data collection period	1 byte	1 – 1 hour 2 – 6 hours

[3] Attention: LANDIS_GYR heat meter is not supported in current firmware 1.6

			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

6 STORAGE AND TRANSPORTATION REQUIREMENTS

The M-BUS-1 converter shall be stored in the original packaging in heated room at temperatures +5°C to +40°C and relative humidity less than 85%.

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

7 CONTENT OF THE PACKAGE

The M-BUS-1 device is delivered complete with:

Converter M-BUS-1 (with 2 screws in the case) – 1 pc.

Antenna LoRa – 1 pc.

Screw 3x16 – 4 pcs.

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 supplies of devices sending more than 10,000 packets;

- 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.

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