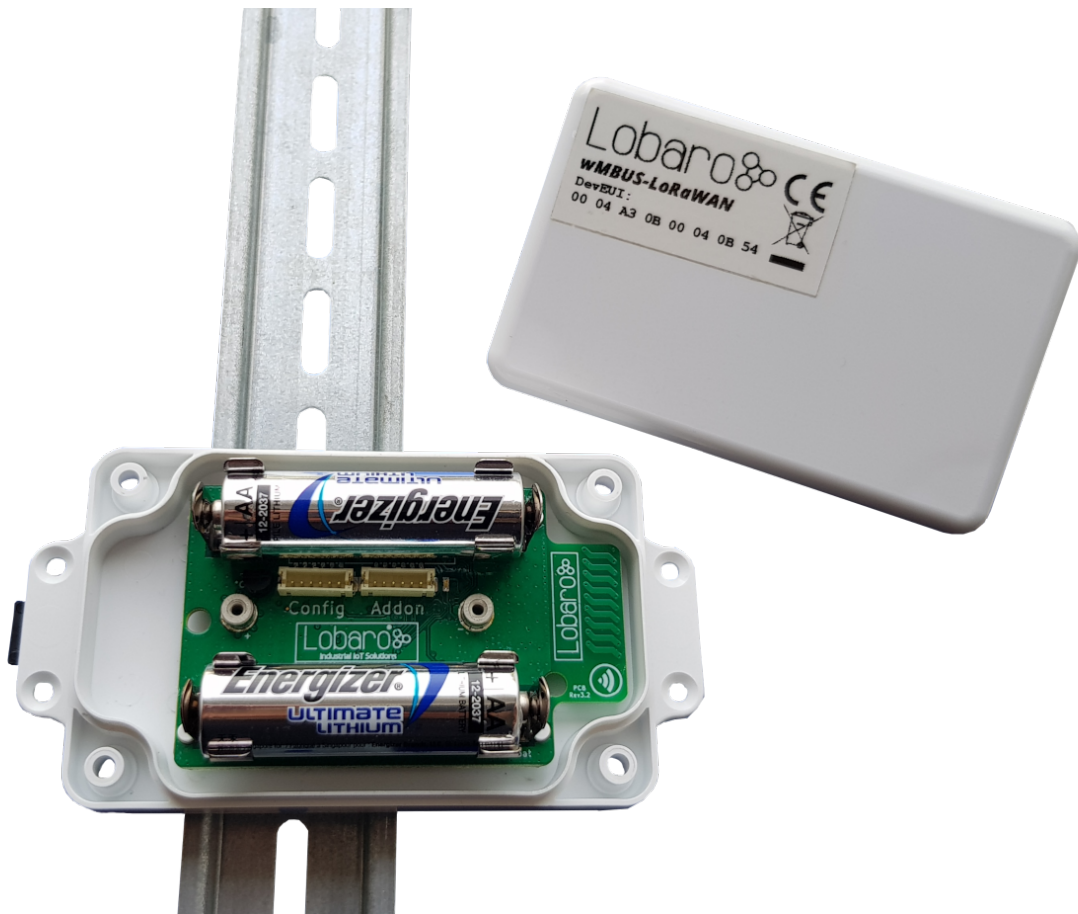




Industrial IoT Solutions

– wMBUS over LoRaWAN Bridge –

User Manual



Product Name: wMBUS-LoRaWAN
Related Firmware: \geq V1.5.1
Document Date: 2018-08-31

Contents

1. Overview	3
2. The Device	4
2.1. Device installation	4
2.2. Power Supply	4
2.3. Battery life time	5
2.3.1. Example calculation	5
2.3.2. Usage scenario recommendations	6
3. Work Cycle	7
3.1. Initial Phase	7
3.2. LoRaWAN Join Phase	7
3.3. Data Collection Phase	8
3.4. Data Transfer Phase	8
3.5. Sleep Phase	8
4. Configuration	9
4.1. The Lobaro Maintenance Tool	9
4.2. Connecting the USB config adapter	10
4.3. System parameters	10
4.3.1. LoRaWAN network parameters	11
4.3.2. wMBUS bridge parameters	13
4.3.3. Cron expressions	14
5. LoRaWAN Data Upload Formats	14
5.1. Status Packet	15
5.2. Data Packet	15
5.2.1. Examples	16
5.2.2. Upload Rate	16
5.2.3. Decoding wMBUS	17
6. Technical characteristics	19
6.1. Housing Dimensions	20
A. CE Declaration of Conformity	21
B. Wireless M-Bus definitions	22
C. Disposal	23
D. Entsorgung (German)	25
E. Document Versions	26

1. Overview

The Lobaro wireless M-Bus (wMBUS) to LoRaWAN Bridge is a cost-effective & energy-efficient device that receives, caches and transparently forwards wireless M-Bus metering data from up to 500 consumption meters via any LoRaWAN network onto the Internet.

Many gas, water, electricity and heat meters can be read wirelessly today using the common short range Wireless M-Bus standard. Because such wMBUS enabled meters use the classical energy saving FSK radio modulation, the wireless range is often limited to less than 50m and therefore requires the use of additional longer-range radio technologies to forward the metering data onto the Internet. The advanced LoRa radio modulation used inside the Lobaro wMBUS to LoRaWAN Bridge is such a key technology.

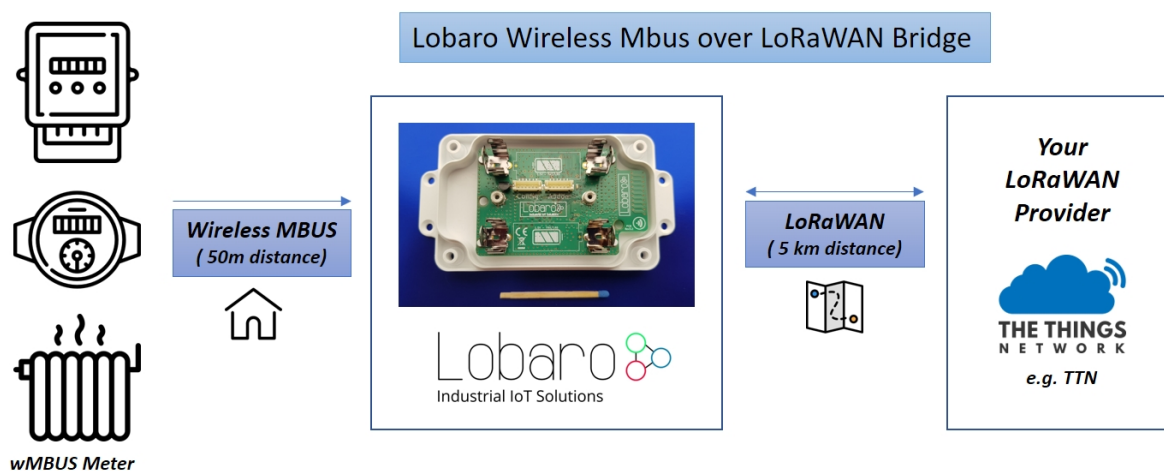


Figure 1: System overview wireless M-Bus over LoRaWAN bridge ¹

LoRaWAN based LPWANs (Low Power wide area networks) allow connections to the Internet from small battery powered devices with wireless ranges of up to 5 kilometers between the transmitter and receiving gateway antenna - without the usual cellular network costs in classical M2M or smart metering solutions. Also - unlike with cellular networks - it's possible to setup own gateways if needed. This often results in much lower operational costs with the Lobaro wMBUS bridge compared to conventional remote meter reading via LTE networks.

The metering data will not be decrypted by the LoRaWAN Bridge, instead an unchanged 1:1 forwarding takes place via one or more LoRaWAN packets (depending on the wMBUS telegram byte size). Thus the end-to-end encryption of sensitive wireless MBUS consumption data is preserved.

Initial configuration, firmware updates & status readouts are done user-friendly via USB on the PC with the Lobaro Tool (Windows, Linux, Mac). An additional possibility of configuration

¹ Energy- & Water Meter and House Icons made by [Freepik](#) from [flaticon.com](#) licensed by CC 3.0 BY
 Heater Icon made by [Nikita Golubev](#) from <https://www.flaticon.com/> licensed by CC 3.0 BY
 Map Icon Icons made by [Darius Dan](#) from <https://www.flaticon.com/> licensed by CC 3.0 BY

in the field "over the air" by means of LoRaWAN downlinks will soon also be available via firmware update.

Please read the manual carefully before operating the device. A safe operation of the device is only possible if you follow the guides provided in this manual. Using the device differently than intended by Lobaro may cause damage to people, the environment, or the device.

2. The Device

2.1. Device installation

The device must be fixed on a flat surface using the lateral mounting holes of the case, see chapter 6.1 for a detailed description of all housing dimensions. Alternatively we offer as accessory a mounting clip for a standard 35mm DIN rail. The device can then easily be snapped on a such rails. It can therefore be added to a variety of racks alongside other devices.

Under any circumstances the device must not be mounted higher than 2 meters above ground to avoid any risks in case of falling down!

For optimal RF performance (e.g. LoRa range) any metal obstacles near the internal antenna should be avoided. In this case 'near' is defined as keep-out distance of about 3-5 centimeters around the antenna. The internal helix antenna can be identified by the winding pcb traces near the white printed encircled 'connectivity' symbol. In any case a device mounting directly on top of a metal surface is not advisable since it will degrade the possible RF range. Stone walls, wood or plastic standoffs are perfectly ok.

In case of challenging installation locations (e.g. in basements) or unavoidable long distances to the next LoRaWAN gateway, Lobaro offers on request custom product variant equipped with a 'SMA' connector to support an external antenna connection.

2.2. Power Supply

The wMBUS over LoRaWAN Bridge default power supply consists of two series connected off-the-shelf 1.5V 'AA' sized batteries. Be sure to get the polarity right, see the '+'-Symbol on the board. In general only AA cells of the types Alkali-Manganese (1.5V, LR6) and Lithium-Iron-Sulphide (1.5V, FR6) are allowed to be inserted in the device. Lobaro recommends the use of FR6 batteries like the *Energizer Ultimate Lithium* over LR6 types because of the higher capacity and better discharge properties.

Other Batteries or accumulators with a nominal voltage of more than 1.5V must not be inserted into the device under any circumstances. In particular, lithium based cells with a nominal voltage of 3.6V or 3.7V must not be used on the AA battery slots!

On request we can supply custom product variants with special housings powered by even bigger batteries. For example a 3.6V C sized mono cell typically has a capacity of 9Ah with leads to a 3x increased battery life compared to the standard AA-cells. With D sized cells of typically 19Ah capacity this value can be doubled once again (6x). Also available on request are options with permanent external power supply (230V, 9-24V, 5V USB).

2.3. Battery life time

The battery life time of the wireless M-Bus to LoRaWAN Bridge can not be specified trustworthy without knowledge of the detailed installation scenario. At least estimations for the following custom project based parameters have to be known:

- Meter count per single wMBUS bridge, e.g. 10 different meters.
- Needed LoRaWAN transmission interval, e.g. daily uploads.
- Average wireless M-Bus telegram size in bytes, e.g. 35 byte.
- Wireless M-Bus telegram transmission interval of the meter, e.g. every 10 seconds.
- Typically used LoRa Spreading Factor / LoRa link quality, e.g. SF10.

Depending on these parameters battery life times from a few months to over 15 years can be achieved. You may send us your use-case details as described above to info@lobaro.com and we will return to you a custom battery lifetime calculation, a recommendation for the best power supply scheme and the needed minimal battery capacity.

2.3.1. Example calculation

In this battery lifetime calculation scenario the target meters send a 35 byte long ('L-Field') wireless M-Bus telegram constantly every 10 seconds. This behavior is for example very similar to a 'Hydrus' ultrasonic water meter of Diehl Metering². The Diehl meter itself has a specified battery life time of 12 years.

Because of the mentioned 10 second send interval it is sufficient to configure the bridge for a wireless M-Bus listen period of 20 seconds by setting the bridge configuration parameter `cmodeDurSec` to a value of 20 (refer to section 4.3.2). This will ensure that all meters of interest sent their consumption telegrams at least once during the configured listen period of the bridge.

For a worst-case battery-lifetime calculation the weakest possible LoRaWAN connectivity has been selected. That means to reach a LoRaWAN Gateway the Lobaro hardware has to send out its Uplink data very slowly (≥ 2 seconds) and redundant by using a LoRa spreading factor of 12. Beside this the actual usable battery capacity has been set to 80% of the nominal value. The resulting worst-case minimal battery-life times are presented in table 1.

²<https://www.diehl.com/metering/>

Collected meters	Battery life (years)	
	AA cell (3Ah)	Baby cell (9Ah)
-		
1	10.7	32.0
5	7.0	21.1
10	4.9	14.8
20	3.1	9.3
40	1.8	5.3
80	1.0	2.9

Table 1: Battery life for daily LoRaWAN uploads with SF12

Collected meters	Battery life (years)	
	AA cell (3Ah)	Baby cell (9Ah)
-		
1	12.1	36.4
5	11.8	35.4
10	11.4	34.4
20	10.6	31.9
40	9.4	28.3
80	7.7	23.0

Table 2: Battery life for daily LoRaWAN uploads with SF7

Estimations for the opposite situation with a excellent LoRa link quality and thus the possible usage of SF7 are also presented in table 2.

In real world installations the possible spreading factor may be optimized anytime by setting up additional LoRaWAN Gateways near the meters of interest.

2.3.2. Usage scenario recommendations

As a simple rule of thumb using the Lobaro wireless M-Bus over LoRaWAN bridge is a good fit in applications that require daily (or less often) consumption values of 1 to 40 installed wireless M-Bus meters. For installations with a higher meter count simply more Lobaro bridges may be used.

Another key factor for high battery lifetime is to select or configure your wireless M-Bus meters in a way that they send short telegrams very frequently, proven good values are periods smaller than 30 seconds and telegram sizes smaller 50 bytes. This helps to minimize the needed wMBus listening time period and avoids the need for multiple LoRaWAN packets per single telegram (data splitting).

Beside this the bridge is naturally most economical when multiple meters per single bridge can be collected and forwarded via LoRWAN. Although for some applications a 1:1 setup, e.g. one bridge per meter, may deliver enough benefits to justify the invest.

For hourly or even more frequent meter data uploads, as requested by some of our customers, LoRaWAN isn't the perfect match from a technology point of view. The same holds for scenarios where hundreds of meters are expected to be transferred by a single bridge, e.g. in 'sub-metering' applications with tons of installed heat cost allocators. For such more demanding cases Lobaro can offer better solutions using higher bandwidth transmission techniques like NB-IoT³ or classical 4G/LTE. Contact us if you need such a alternative solution by sending your request to info@lobaro.com – either English or German is fine.

3. Work Cycle

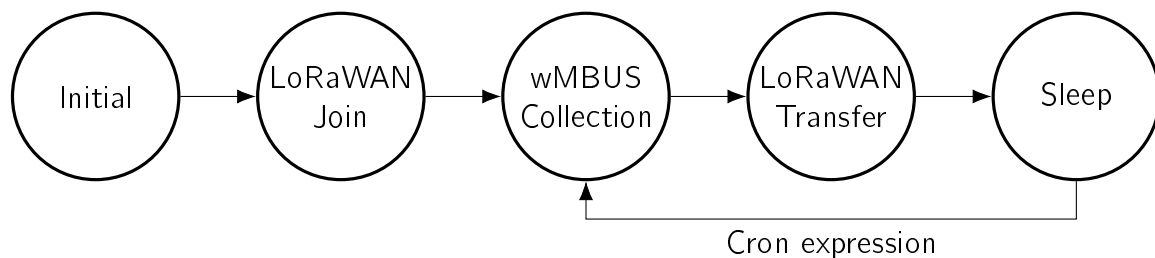


Figure 2: The five phases of the wMBUS Bridge Workflow

The Bridge has a simple work cycle that consists of five phases. It is illustrated in figure 2.

3.1. Initial Phase

This is the phase that is executed after the device is started or restarted. The Bridge performs a quick self test which you can easily spot by the green internal LED flashing. After that, the configuration is evaluated. If successful, the LoRaWAN Join phase is executed next.

3.2. LoRaWAN Join Phase

If the Bridge is configured to use over the air activation (OTAA), the OTAA join is performed at this point. The device will repeatedly try to join its LoRaWAN network until the process is successful. It then enters the Data Collection Phase.

If the Bridge is configured to use ABP instead of OTAA, this phase is left immediately and the Data Collection Phase is entered according to the cron configuration.

³Narrowband IoT

3.3. Data Collection Phase

During the wMBUS collection phase the device receives any wireless M-Bus data with valid CRC and stores it for the following LoRaWAN upload phase but only if the received telegram passes the user defined white list filters. Similar telegrams of one identical meter may be received multiple times during this phase. In this case the newest telegram with the same id, type and length will replace the previously received one. Only the latest telegram will be uploaded via LoRaWAN.

After the configured amount of time for collecting data the LoRaWAN data transfer phase is entered.

3.4. Data Transfer Phase

During the Data Transfer Phase the Bridge uploads all previously stored wMBUS data using LoRaWAN. Depending on original wMBUS telegram byte size this can require multiple LoRaWAN messages to be sent. Since LoRa requires any device to respect a strict duty cycle, it is possible, that the Bridge will need to wait before sending its messages. If this happens, the device will enter a power saving modus while waiting for the next message. It is possible that transferring all data will take several minutes.

In addition to the wireless M-Bus data, the Bridge sends a status packet once a day during this phase. The status packet will always be transmitted prior to any data packets.

For a detailed description of the data sent refer to chapter 5.2.

3.5. Sleep Phase

After transferring all data packets the Bridge enters the Sleep Phase. During this it is completely inactive to avoid wasting power. It remains sleeping until one of the cron expressions given in the configuration triggers. When that happens, it enters the Data Collection Phase again.

4. Configuration

4.1. The Lobaro Maintenance Tool

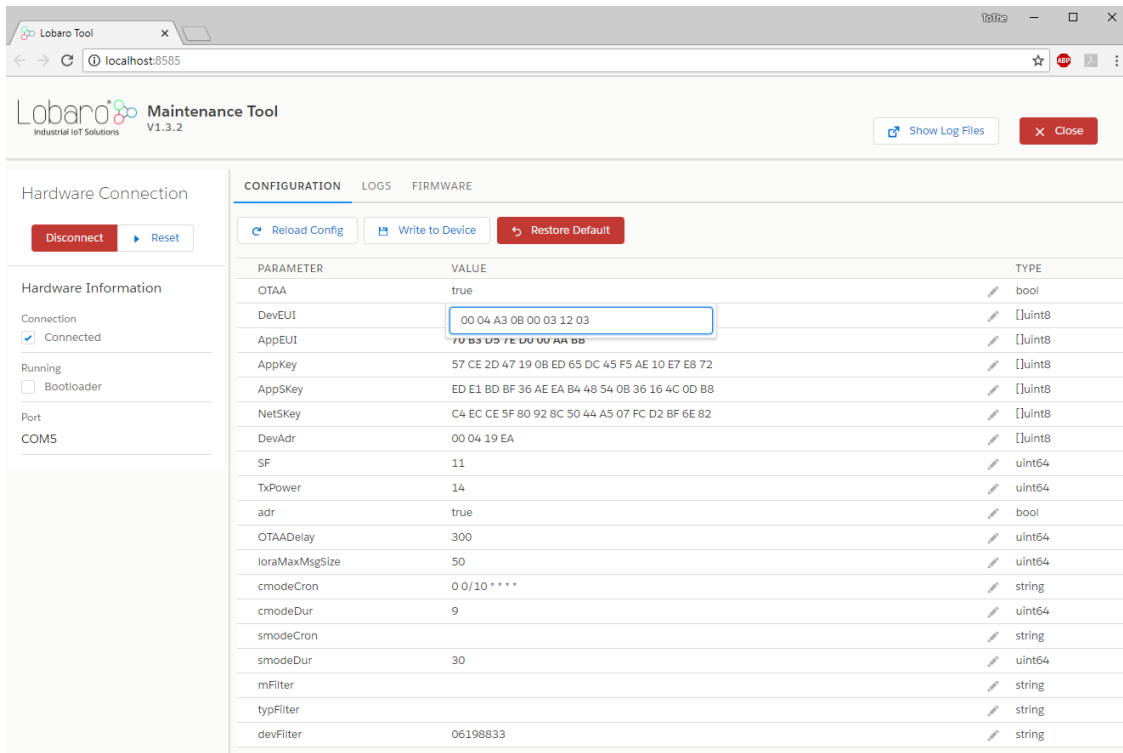


Figure 3: Lobaro maintenance tool (Windows, Linux, Mac)

The initial device configuration can be done very comfortably from your PC via the serial configuration interface. Beside the needed Lobaro USB to UART adapter the *Lobaro Maintenance Tool*⁴ needs to be installed. This tool is freely available for various operating systems including Windows, Linux, Mac and Linux-ARM (e.g. Raspberry-PI) on and works with all Lobaro sensors.

Technically this software opens a webserver on port 8585 that runs in a background console window. The actual user interface can be accessed normally using a standard web browser at address <http://localhost:8585> (see fig. 3). Normally your default browser should be opened with this URL automatically after startup. Even remote configuration and log-observation over the Internet is possible, e.g. having a Raspberry PI via USB connected to the Lobaro device and accessing the maintenance tool from a remote machines browser over the Internet.

Additionally to the device setup the tool can also be used for firmware updates ('Firmware Tab'), watching real-time device diagnostic output ('Logs Tab') and initiating device restarts. **Please note that the device is automatically restarted each time the configuration has been changed!**

⁴Lobaro Maintenance Tool free download: <https://www.lobaro.com/lobaro-maintenance-tool/>

4.2. Connecting the USB config adapter

For configuration and firmware updates we provide a special serial-USB adapter that can be connected as shown in figure 4. The corresponding connector on the PCB is marked with the word 'Config'.

The USB-adapter will add a virtual serial 'COM' Port to your system. Your operating system needs the *CP210x USB to UART Bridge*⁵ driver installed. A download link is provided next to the 'Connect' button when you start the Maintenance Tool.

While the config adapter is connected, the device will be powered from the USB port with a regulated voltage of 3.3V. It is not necessary – although it would be no problem – having batteries inserted or a different supply connected while using the config adapter. All configuration parameters will be kept non-volatile regardless of the power supply.

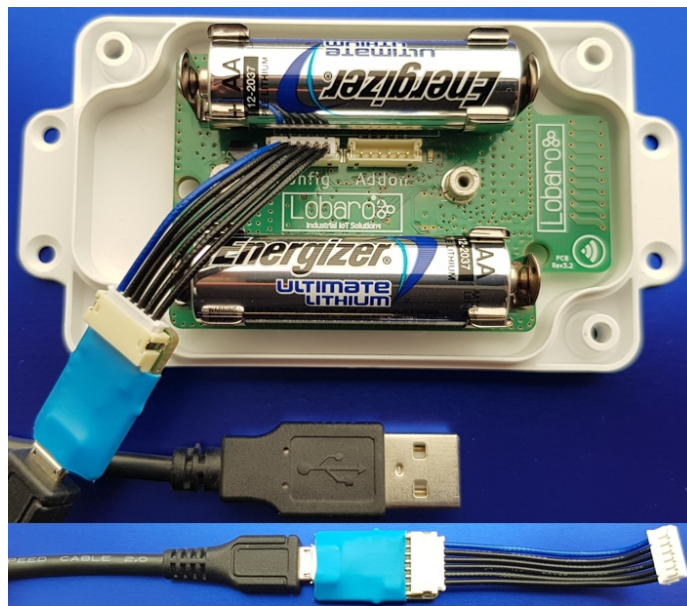


Figure 4: Connected Lobaro USB configuration adapter

4.3. System parameters

After being successfully connected to the hardware using the Lobaro Maintenance Tool you can press 'Reload Config' in the 'Configuration' tab to read the current configuration from the device. For every parameter a default value is stored non volatile inside the hardware to which you can revert using the 'Restore default' button in case anything got miss configured.

All LoRaWAN & other firmware parameters are explained in the following.

⁵<https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers>

4.3.1. LoRaWAN network parameters

A large part of the configuration parameters are used to control the device's usage of LoRaWAN. Table 3 lists all of them. There are two different ways to use LoRaWAN: *over-the-air activation* (OTAA) and *activation by personalization* (ABP). Some configuration parameters are only used with one of those methods, others are used for both.

Name	Type	Used	Description
OTAA	bool	both	<i>true</i> : use over-the-air activation (OTAA) <i>false</i> : use activation by personalization (ABP)
DevEUI	bytes[8]	OTAA	the 8 byte long DevEUI is used with OTAA to identify the device on join. The default is predefined in the hardware and guarantees an ID that is unique world wide. Should not be changed unless required by the network provider. Hex format without 0x prefix.
AppEUI	bytes[8]	OTAA	ID defining the application used in the LoRaWAN network. Hex format without 0x prefix.
AppKey	bytes[16]	OTAA	Application Key as defined by the LoRaWAN network operator. This is used to encrypt communication, so keep it secret. Hex format without 0x prefix.
OTAADelay	int	OTAA	Seconds to wait for a new attempt after an unsuccessful OTAA join. The actual waiting time will be randomly increased by up to a third of that amount, in order to avoid devices repeatedly interfering with each other through bad timing. The default value is 300, which means the timeout between attempts is 300-400 seconds.
AppSKey	bytes[16]	ABP	App Session Key as defined by the LoRaWAN network operator. Hex format without 0x prefix.
NetSKey	bytes[16]	ABP	Network Session Key as defined by the LoRaWAN network operator. Hex format without 0x prefix.
DevAdr	bytes[4]	ABP	Device Address as defined by the LoRaWAN network operator. Hex format without 0x prefix.
SF	int	both	Initial LoRa spreading factor used for transmissions. Valid range is 7-12. The actual spreading factor used might change during operation of the device if Adaptive Data Rate (ADR) is used.
TxPower	int	both	Initial transmission output power in dBm. The LoRaWAN protocol allows only specific values: 2, 5, 8, 11, 14. The actual power used might change during operation if Adaptive Data Rate (ADR) is used.
ADR	bool	both	<i>true</i> : use adaptive data rate (ADR) <i>false</i> : don't use adaptive data rate (ADR)

Table 3: LoRaWAN network parameters

4.3.2. wMBUS bridge parameters

Table 4 lists all parameters that are relevant for wireless M-Bus bridge firmware behavior:

Name	Type	Description
<code>loraMaxMsgSize</code>	int	Received wireless M-Bus telegrams might have a byte size bigger than a single LoRaWAN message can hold. This parameter defines the bytes per LoRaWAN message before a partition over multiple LoRaWAN Uplink msg appears. (Range 10-50 bytes)
<code>resetHours</code>	int	Hours after which the firmware will reset and rejoin the network. Can support the change of LoRaWAN network providers with already deployed devices. (0 = never)
<code>cmodeCron</code>	string	Cron Expression defining when the device starts wMBUS T1/C1 mode receive phases. Please refer to chapter 4.3.3 for an introduction. (blank = no T1/C1 receive)
<code>cmodeDurSec</code>	int	Duration in seconds for each C1/T1-mode wMBUS receive phase, if <code>cmodeCron</code> != blank. Should be chosen in relation to the wMBUS sendout interval of the target meter.
<code>smodeCron</code>	string	Cron Expression defining when the device starts wMBUS S1 mode receive phases. Please refer to chapter 4.3.3 for an introduction. (blank = no S1 receive)
<code>smodeDurSec</code>	int	Duration in seconds for each S1-mode wMBUS receive phase, if <code>smodeCron</code> != blank. Should be chosen in relation to the wMBUS sendout interval of the target meter.
<code>devFilter</code>	string	wMBUS device id white-list filter using 8 digits with leading zeros list separated by ','. Example '88009035,06198833'. (blank = filter inactive)
<code>mFilter</code>	string	wMBUS manufacturer white-list filter separated by ','. Example: 'DME,QDS' for receiving just telegrams from Diehl Metering GmbH and Qundis GmbH meters. Telegrams with different 3 character wMBUS manufacturer id will not be uploaded via LoRaWAN. (blank = filter inactive)
<code>typFilter</code>	string	wMBUS device type white-list filter list separated by ','. Example: '08,07' for Heat-Cost and Water meters. Please refer to appendix B.1 for a list of possible values. (blank = filter inactive)

Table 4: wMBUS bridge parameters

4.3.3. Cron expressions

Cron expressions are used to define specific points in time and regular repetitions of them. The schedule for data collecting phases is defined using the Cron⁶ format which is very powerful format to define repeatedly occurring events⁷.

Standard Lobaro devices typically do not need to know the real time for proper operation. All times are relative to the random time when batteries are inserted. If needed by the target application Lobaro can deliver on request special hardware support for keeping data acquisition intervals based on a real time clock which stays in sync with the *real* time. Please contact Lobaro directly if you need such a custom product variant.

A cron expression consists of 6 values separated by spaces:

- Seconds (0-59)
- Minutes (0-59)
- Hours (0-23)
- Days (1-31)
- Month (1-12)
- Day of Week (SUN-SAT $\hat{=}$ [0,6])

Examples of CRON definitions:

0 5 * * * *	Hourly at minute 5, second 0 (at 00:05:00, 01:05:00, ...)
0 1/10 * * * *	every 10 minutes from minute 1, second 0 (minutes 1, 11, 21, ...)
0 0 6 * * *	Daily at 6:00:00
0 0 13 1,15 * *	1st and 15th day of every month at 13:00:00
0 0 9 1-5 * *	Every month daily from day 1 till 5 at 9:00:00

5. LoRaWAN Data Upload Formats

After collecting wireless M-Bus telegrams over the air, the Bridge starts uploading data via LoRaWAN. There exist two data formats that are transmitted over different LoRaWAN ports.

As LoRaWAN can only transmit very short messages, the message formats contain only data bytes. The meaning of a byte is determined by its position within a message. The following describes the package formats used by the wireless M-Bus Bridge.

⁶For more information about Cron see <https://en.wikipedia.org/wiki/Cron>

⁷Online introduction: <https://github.com/lobaro/docs/wiki/CRON-Expressions>

5.1. Status Packet

Port 1 – In order to provide some information about the health & connectivity state of the device itself, the device sends a status update at a daily basis. The status packet is sent on the first upload phase after activation of the device (after reboot) and then repeatedly in every upload phase that takes place a day or longer after the previous status packet. It has a fixed length of 7 bytes. The battery voltages and ambient temperature are encoded as 16 bit integer using little endian encoding.

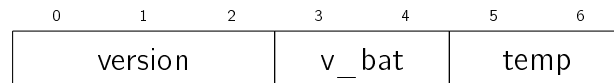


Figure 5: Bytes, port 1 – Status Packet

name	type	description	example
version	uint8[3]	Version of the firmware running on the device	1, 5, 1 \equiv v1.5.1
v_bat	uint16	Battery voltage in mV	2947 \equiv 2.947V
temp	int16	Temperature measured inside the device in $\frac{1}{10}^{\circ}\text{C}$	246 \equiv 24.6 $^{\circ}\text{C}$

Table 5: Fields port 1 – Status Packet

We provide a JavaScript reference implementation of a decoder for this status packet on GitHub⁸, which can be used directly for decoding in The Things Network⁹.

5.2. Data Packet

After each wMBUS collecting phase, all saved telegrams (up to 500 can be stored) will be uploaded via LoRaWAN uplink messages as fast as possible. The received wMBUS telegrams that did pass the configured white list filters will be uploaded without any modification in one or more LoRaWAN messages.

If a wMBUS telegram is bigger than the bridge configuration parameter `loraMaxMsgSize` the transmission will be done using multiple LoRaWAN messages. This parameter is limited to ≤ 50 bytes due to LoRaWANs maximum payload size restrictions. In case of telegram splitting is needed the receiving backend application server as to reassemble the original wMBUS telegram before decryption & parsing of the meter data. This is done by simply joining the messages together in the order of receive.

The LoRaWAN port encodes identifies a LoRaWAN fragment of the original wireless M-Bus telegram. This way partial messages can be identified using the LoRaWAN Port:

⁸<https://github.com/lobaro/ttn-data-formats/blob/master/wmbus-bridge/decoder.js>

⁹The Things Network (TTN): An open source LoRaWAN network provider
see <https://www.thethingsnetwork.org/>

$$10 < \text{LoRaWAN Port} < 100 \equiv (\text{Part Number} \mid \text{Total Parts})$$

Gaps in the LoRaWAN Frame Counter are giving a hint for missing telegram parts which can happen in LoRaWAN since it's a ALOHA based protocol, e.g. collisions and some packet losses are accepted by principle of operation. In case the backend noticed a missing packet the wMBUS telegram can't be assembled anymore as described before.

5.2.1. Examples

Examples (with `loramsgSize = 50`):

- A 48 Byte wMBUS telegram will be send on LoRaWAN port 11. Port 11 says it is the first message of only one message (no splitting).
- A 75 byte wMBUS telegram will be send in two messages on LoRaWAN ports 12 and 22. Port 12 means this part one of a wMBUS telegram that got splitted into two LoRaWAN messages. Port 22 means that this data is the 2nd part of the original wMBUS data. Both parts have to been concatenated in the order of receive by the backend.
- A 101 byte wMBUS telegram will be send in three messages on LoRaWAN ports 13, 23 and 33. Port 13 means this part one of a wMBUS telegram that got splitted into three LoRaWAN messages. Port 23 means that this data is the 2nd part of the original wMBUS data. Port 33 means that this data is the 3rd part of the original wMBUS data. All three parts have to been concatenated in the order of receive by the backend.

5.2.2. Upload Rate



The bridge has to work in compliance with the European SRD 868 1% duty-cycle regulations. This implies as a rule of thumb the device can upload at most wMBUS telegrams for 36 seconds every hour. The actual transmit time ('ToA: time on air') for each LoRaWAN message depends on the byte size and the used LoRa spreading factor (SF) which defines how redundant LoRa data is send. This means a device with good connectivity and consequently using LoRa SF7 ($\text{ToA} \leq 0,050\text{s}$) can upload much faster more data than a node using LoRa SF11 ($\text{ToA} \geq 1\text{s}$) due to a hard to reach LoRaWAN gateway. The bridge will upload in conformity with the regulations automatically as fast as possible. When it has to wait it enters a low power sleep mode until the next transmission is possible again.

The next data collection phase will be started only after completion of the previous upload phase in respect to the configured `cmodeCron` or `smodeCron`, whichever is earlier. Because of this it is advisable to define the cron parameters with an estimation of the upload duration in mind. This will avoid unexpected 'skipping' of data collection phases.

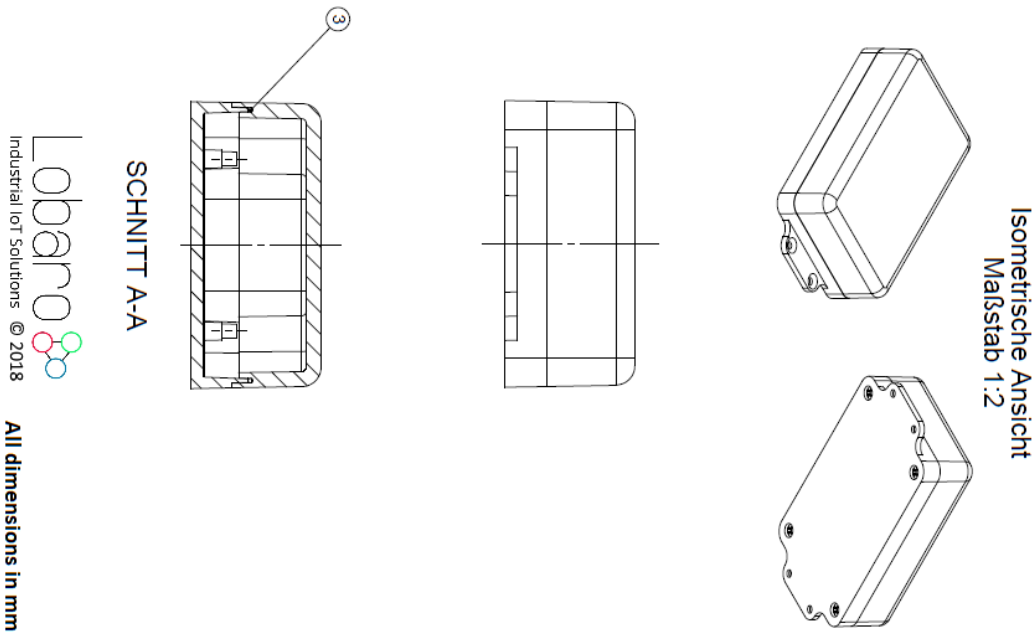
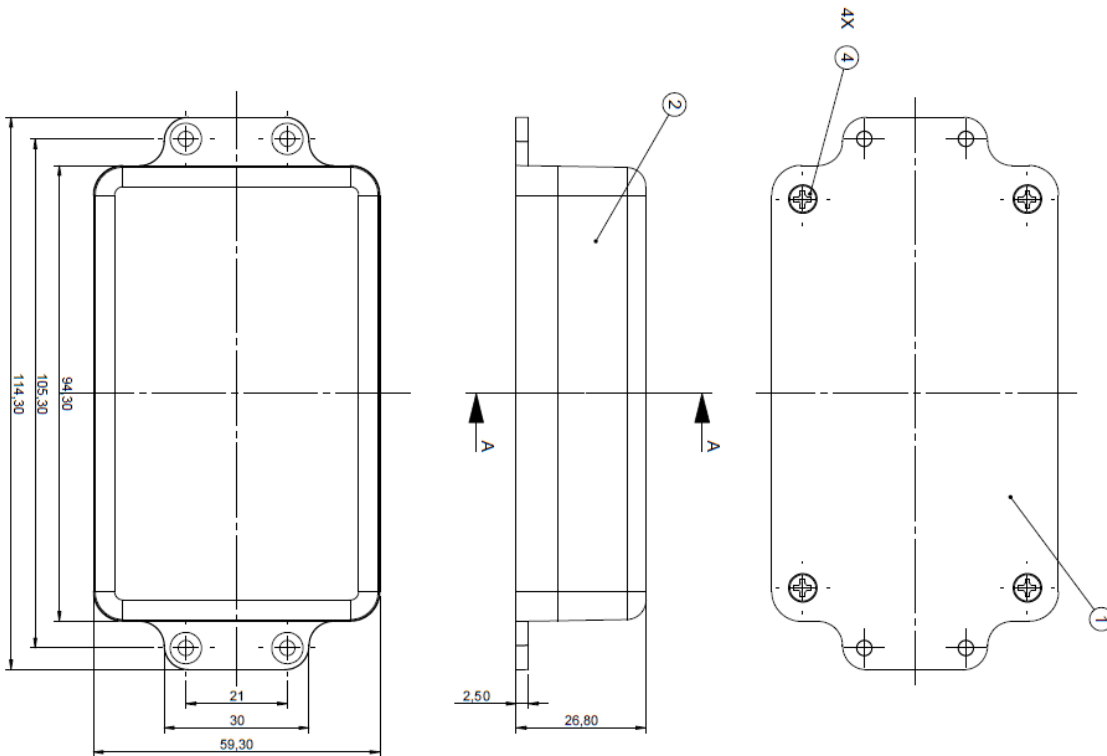
including all encapsulated fields, e.g. the actual metering values. This greatly simplifies the bridge integration into your web based service or application.

A 12 months period of free access to this API is included in our 'wmbus bridge testpacket' offer for quick device evaluation. API Integration into production systems is also possible, but in this case a separate agreement about a royalty fee must be achieved up front. For more information on licensing our wireless M-Bus parsing API please send us your request via email to info@lobaro.com – either English or German is fine.

6. Technical characteristics

Product	
Type name	wMBUS-LoRaWAN
Description	wMBUS over LoRaWAN Bridge
RF transceiver	
Chipset	Semtech SX1272
Frequency Range	863 to 870 MHz
TX Power	≤ 14 dBm
LoRa communication	
LoRaWAN Protocol	LoRaWAN 1.0.1, Class A, EU868
Activation method	Over-the-air activation (OTAA) Activation by personalization (ABP)
Encryption	AES128
Typically RF range	≤ 2km
Ideal RF range	≤ 10km (free line of sight)
Wireless M-BUS communication	
Supported Modes (EN13757-4)	S1, C1, T1
Frequencies	868.3 MHz, 868.95 MHz
RF Range	≤ 30m
Telegram memory	up to 500 telegrams (on request: 1.500)
Power Supply	
Nominal Supply Voltage	3V
Supply Voltage Range	2.2V - 3.7V
Power supply	2×AA battery, 1.5V (LR6/FR6) 5V USB powered over Lobaro Adapter On Request: 230V mains adapter, 3.6V Battery
Current consumption @3V	
Normal	≤ 3 mA
Wireless M-BUS RX	≤ 14 mA
LoRa RX	≤ 14 mA
LoRa TX	≤ 80 mA
Sleep with RTC running	≤ 20 μA
Mechanical dimensions	
Size	114.3 mm × 59.3 mm × 26.8 mm
Housing Material	ABS plastic
Environmental Requirements	
Operating temperature range	-20°C to +55°C
Max. Installation height	2m
Conformity	
 	

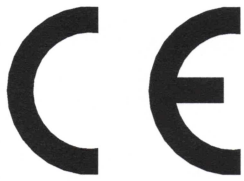
6.1. Housing Dimensions



Lobaro
Industrial IoT Solutions © 2018

All dimensions in mm

A. CE Declaration of Conformity



Declaration of Conformity

RED directive (2014/53/EU)
RoHS directive (2011/65/EU)

We, the manufacturer

Lobaro GmbH
Tempowerkring 21d
21079 Hamburg
Germany



declare on our sole responsibility that the product with following identification:

wMBUS-LoRaWAN

to which this declaration relates is in conformity with the essential requirements and other relevant requirements of the RED directive (2014/53/EU) if used for its intended purpose and in accordance with the manufacturers operating instructions. The mentioned product is also compliant to the RoHS directive (2011/65/EU).

The following norms, standards, or documents have been applied:

Health and safety (RED Art. 3(1)(a)):

IEC 62368-1:2014 (Ed. 2) + Cor.:2015
IEC 62479:2010

EMC (RED Art.3(1)(b)):

ETSI EN 301 489-1 V1.9.2 (V2.2.0)[†]
ETSI EN 301 489-3 V1.6.1 (V3.2.0)[†]
IEC 61000-6-2:2005

Radio spectrum (RED Art. 3(2)):

ETSI EN 300 220-1 V3.1.1 (2017-02)
ETSI EN 300 220-2 V3.1.1 (2017-02)

[†]Referenced newer standard versions in parenthesis will supersede its predecessors. At time of testing the newer standards were not harmonized yet. All tests were carried out successfully in accordance to the already harmonized standards as well as to the superseding ones.

Hamburg, 27.07.2018

Place and date of issue



Lobaro[®]
Industrial IoT Solutions
Tempowerkring 21d - 21079 Hamburg
info@lobaro.com +49 40 22816531-0

Dipl.-Ing. Theodor Rohde
Managing Director Lobaro GmbH

B. Wireless M-Bus definitions

B.1. List of device types

Possible values are:

- 00: "Other"
- 01: "Oil"
- 02: "Electricity"
- 03: "Gas"
- 04: "Heat"
- 05: "Steam"
- 06: "Warm Water"
- 07: "Water"
- 08: "Heat Cost"
- 09: "Compressed Air"
- 0A: "Cooling load meter (outlet)"
- 0B: "Cooling load meter (inlet)"
- 0C: "Heat (inlet)"
- 0D: "Heat / Cooling load meter"
- 0E: "Bus / System component"
- 0F: "Unknown"
- 10 - 14: Reserved
- 15: "Hot Water"
- 16: "Cold Water"
- 17: "Dual Water meter"
- 18: "Pressure"
- 19: "A/D Converter"
- 1A - DD: Reserved
- 1B: "Room"

C. Disposal

This chapter informs you on our policy in respect to EU 'Waste electrical and electronic equipment Directive' 2002/96/EC, implemented in German law by the 'Gesetz über das Inverkehrbringen, die Rücknahme und die umweltverträgliche Entsorgung von Elektro- und Elektronikgeräten (Elektro- und Elektronikgerätegesetz – ElektroG)' The following statements about the disposal of retired Lobaro devices are binding for customers in Germany. Customers in other countries should contact their local authorities in order to acquire equivalent information for their respective country.

It is a major goal of EU directive 2002/96/EC reduce the amount of retired electronic devices disposed in household waste, but have them gathered in special facilities instead for recycling and orderly disposal. Electronic devices often contain hazardous substances which are harmful to the environment as well as to human health. Under no circumstances should they be disposed in household trash.

C.1. WEEE

The WEEE-directive is the EU-directive 'Waste of Electrical and Electronic Equipment' (2002/96/EC). It aims to reduce the growing amount of electrical and electronic waste created by disposed electronic devices. The goal is to avoid and reduce disposal, and to make the disposal more friendly for the environment, by including the manufacturer in a broader responsibility.



C.1.1. Proper disposal of Lobaro B2B devices

Lobaro develops and manufactures devices for professional use. Because of this, our products have been recognised by the responsible agency 'Stiftung EAR' (Elektro-Altgeräte Register) as B2B (business to business) products. Lobaro GmbH is registered under DE18824018.

Classification as B2B implies that Lobaro is not required to pick up disposed electronic devices from local recycling points, as the law 'ElektroG' dictates manufacturers of consumer electronics to do.

Consequently, our products may not be disposed in this way.

Instead, we offer our customers to take back retired Lobaro devices and dispose them properly free of charge. Devices to be disposed must be sent to Lobaro GmbH postpaid and marked with the words 'ZUR ENTSORGUNG'.

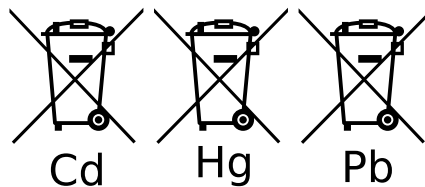
C.2. RoHS

As a manufacturer of industrial devices of information and telecommunication technology we are producing conforming to RoHS as specified in the EU-directive 2011/65/EU.

C.3. Batteries

Conforming to the German law about the disposal of used batteries (§ 12 Satz 1 Nr. 1-3 BattV (Verordnung über die Rücknahme und Entsorgung gebrauchter Batterien und Akkumulatoren (BattVO) vom 27. März 1998 (BGBl. I S. 658))), we as the manufacturer advise you, that the customer and end-consumer is required by law to return used batteries for a proper disposal. After usage, batteries can be returned to the vendor or at a place close proximity free of charge. If used batteries are sent to the vendor, parcels must be sent fully postpaid.

The following symbol indicates, that a battery contains heavy metal or other hazardous substances, and that it must not be disposed in common household or industrial waste. The abbreviations under the symbol stand for: 'Cd' (Cadmium), 'Li' (Lithium) / 'Li-Ion' (Lithium-Ion), 'Ni' (Nickel), 'Mh' (Metal Hydride), 'Pb' (Lead), 'Zi' (Zinc).



D. Entsorgung (German)

Dieses Kapitel informiert Sie über das Vorgehen der Lobaro GmbH in Bezug auf die EU Richtlinie 2002/96/EC über Elektro- und Elektronikaltgeräte (engl. WEEE), umgesetzt in deutsches Recht durch das „Gesetz über das Inverkehrbringen, die Rücknahme und die umweltverträgliche Entsorgung von Elektro- und Elektronikgeräten (Elektro- und Elektronikgerätegesetz – ElektroG)“. Die nachfolgend gemachten Aussagen über die Entsorgung von außer Gebrauch genommenen Lobaro Geräten gelten verbindlich nur für Kunden innerhalb Deutschlands. Kunden in anderen Ländern sollten ihre örtlichen Behörden kontaktieren, um entsprechende Informationen zu erhalten.

Ein vordringliches Ziel der EU Richtlinie 2002/96/EC ist es, die Entsorgung von Elektro-/Elektronikaltgeräten zusammen mit dem unsortierten Hausmüll zu minimieren und einen hohen Grad an getrennter Sammlung und Verwertung von Elektro-/Elektronikaltgeräten zu erreichen. Elektronische Geräte können Stoffe enthalten, die schädlich für die Umwelt und die menschliche Gesundheit sind und auf keinen Fall zusammen mit dem Hausmüll entsorgt werden sollten.

D.1. WEEE

Die WEEE-Richtlinie (von engl.: Waste of Electrical and Electronic Equipment; deutsch: Elektro- und Elektronikgeräte-Abfall) ist die EU-Richtlinie 2002/96/EC zur Reduktion der zunehmenden Menge an Elektronikschrott aus nicht mehr benutzten Elektro- und Elektronikgeräten. Ziel ist das Vermeiden, Verringern sowie umweltverträgliche Entsorgen der zunehmenden Mengen an Elektronikschrott durch eine erweiterte Herstellerverantwortung.



D.1.1. Ordnungsgemäße Entsorgung von B2B Lobaro Geräten

Lobaro Geräte werden für den professionellen Gebrauch entwickelt und vermarktet. Dementsprechend sind sie von der zuständigen deutschen Agentur Stiftung EAR (Elektro- Altgeräte Register) als B2B (business to business) Produkte anerkannt worden. Die Lobaro GmbH ist dort unter der Nr. DE18824018 registriert.

Die B2B Klassifizierung bedeutet, dass Lobaro nicht zur Abholung von Elektro-/Elektronikaltgeräten bei den kommunalen Sammelstellen verpflichtet ist, wie es das ElektroG den Produzenten von für den Konsumenten-Markt bestimmten Elektro-/Elektronikgeräten vorschreibt.

Folglich dürfen unsere Produkte auch nicht auf diesem Wege entsorgt werden.

Stattdessen bieten wir unseren Kunden an, nicht mehr gebrauchte Lobaro Geräte zurückzunehmen und auf unsere Kosten ordnungsgemäß zu entsorgen.

Geräte zur Entsorgung müssen mit bezahltem Porto an die Lobaro GmbH eingesendet werden und mit der Kennzeichnung „ZUR ENTSORGUNG“ versehen sein.

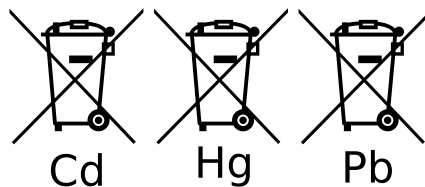
D.2. RoHS

Als Hersteller von industriellen Geräten der Informations- und Telekommunikationstechnik produzieren wir RoHS konform, gemäß den Inhalten der EU-Richtlinie 2011/65/EU.

D.3. Batteriegesetz

Gemäß § 12 Satz 1 Nr. 1-3 BattV (Verordnung über die Rücknahme und Entsorgung ge-
brauchter Batterien und Akkumulatoren (BattVO) vom 27. März 1998 (BGBl. I S. 658))
weisen wir als Verkäufer darauf hin, dass der Kunde als Endverbraucher zur Rückgabe ge-
brauchter Batterien gesetzlich verpflichtet ist. Batterien können nach Gebrauch beim Verkä-
ufer oder in dessen unmittelbarer Nähe unentgeltlich zurückgegeben werden. Werden Batterien
an den Verkäufer übersandt, ist das Paket ausreichend zu frankieren.

Das nachfolgende Symbol bedeutet, dass es sich um schwermetallhaltige, schadstoffhaltige
Batterien handelt, die nicht mit dem einfachen Haus- oder Gewerbeabfall entsorgt werden
dürfen. Die unter dem Symbol befindlichen Abkürzungen bedeuten: „Cd“ (Cadmium), „Li“
(Lithium) / „Li-Ion“ (Lithium-Ionen), „Ni“ (Nickel), „Mh“ (Metallhydrid), „Pb“ (Blei), „Zi“
(Zink).



E. Document Versions

Changes to this document:

- 2018-08-31 – Version 0.0.3 Correction of battery-lifetime calculation table
- 2018-08-22 – Version 0.0.2 Addition of battery life time calculations
- 2018-08-21 – Version 0.0.1 Initial public version of completely reworked manual