USER MANUAL
COMBOX.L
Long Range Low Power Wireless Logger
COMBOX

COMBOX.L – LONG RANGE LOW POWER WIRELESS LOGGER

User manual
V1.2
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1. INFORMATION ABOUT THE DOCUMENT

1.1. DOCUMENT DATA

<table>
<thead>
<tr>
<th>Title</th>
<th>User Manual: ComBox.L</th>
</tr>
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<tbody>
<tr>
<td>Subtitle</td>
<td>Long Range Low Power Wireless Logger</td>
</tr>
<tr>
<td>Document type</td>
<td>User Manual</td>
</tr>
<tr>
<td>Version</td>
<td>V 1.2</td>
</tr>
</tbody>
</table>

1.2. DISCLAIMER

All rights to this manual and the information contained herein are the property of Solvera Lynx. Reproduction, use or disclosure to third parties without expressed permission is prohibited.

Solvera Lynx reserves the right to change the technical specifications of its products without notice in writing and urges its customers to make sure that the information they have is valid.

1.3. TECHNICAL SUPPORT

If you have technical problems or cannot find the required information in the provided documents, contact our Technical Support by e-mail using our dedicated e-mail address: helpdesk@solvera-lynx.com. Your request will be processed as soon as possible.

Solvera Lynx d.o.o.
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Slovenia
Email: info@solvera-lynx.com
Phone: +386 1 40 12 860
Fax: +386 1 40 12 861
2. PRODUCT PRESENTATION

2.1. DESCRIPTION

- 868 MHz ISM band Long Range low power LoRa Modulation for Europe in Class A
- Wide coverage range approximately 2 km in urban and up to 10 km in suburban areas.
- Uses LoRa modulation under LoRaWAN™ v 1.0.2 protocol
- This is not a point to point device and can not be used in this manner

2.2. PACKAGE CONTENT

- 1x device ComBox.L
- 2x battery Li-SOCI2 SAFT LS14500 3,6 V
- 1x cable for counter or temperature probe (optionally 2x, depending on the type of the device)
- 4x screw with O-ring
- 1x plastic plug (optional, depending on the type of device)

2.3. HIGHLIGHTS

- Long Range and Low Power
- Radio transmission data through LoRaWAN™
- Long battery life
- Battery powered device
- Versatile applications
- Electricity/Heat/Water meters
- IoT applications in Home/Building/Facility Energy Meters

2.4. ADVANCED FEATURES

- Remote configuration
- OTAC - Over The Air Configuration
- Data logger of minimal 100 measuring periods saved locally in case of network failure
- History sending process – resending of undelivered logged data
- Synchronization of Real Time Clock with AMS / NMS
- Measuring period minimal 15 min or higher and sending period equal or greater than measuring period

2.5. COMBOX.L TYPES

1. PULSE COUNTER (ComBox.L CI-B)
   - 1x Ultra low power hardware counter – connector C1
   - 1x Low power software counter – connector C2
   - 2x Tampering detection (1x per counter) or normal digital state inputs

2. STATE SENSOR (ComBox.L DI-B)
   - 4x Digital inputs
   - Sending data per sending period or according to change of state on input state rising and falling detected (within LoRaWAN protocol limitations)
3. TECHNICAL DATA

1. RADIO
   • Frequency: 868 MHz ISB EU
   • TX Power: 14 dBm (25 mW)
   • RX Sensitivity: -139 dBm
   • Modulation: LoRa
   • MAC Layer: LoRaWAN

2. INPUT CI-B/DI-B
   • Impedance: 22 kΩ
   • Capacitance: 110 pF
   • Voltage: 3.6 V

3. INPUT 2T-B
   • Impedance: ≥ 4 kΩ
   • Capacitance: 325 pF
   • Voltage: 3.6 V

4. POWER
   • Battery: 2x AA (SAFT Li-SOCI2 LS145000 3,6V)
   • Battery Capacity: 2 x 2600 mAh

5. TEMPERATURE
   • Operation: -20 °C to +60 °C
   • Storage: -20 °C to +70 °C

6. HOUSING
   • Dimensions: 200 x 90 x 43 mm
   • Weight: 280 g
   • IP Protection: IP67 (IEC 60529)

3.1. DIMENSIONS

Values in millimeters
4. TECHNICAL DATA ACCORDING TO TYPE:

- PULSE COUNTER (ComBox.L CI-B)
- STATE SENSOR (ComBox.L DI-B)
- TEMPERATURE SENSOR (ComBox.L 2T-B)

4.1. COMBOX.L CI-B TYPE

- Minimal 15 min measuring/sending period
- Pulse input frequency for counter 1 (CNT1 on connector C1): average of 70 Hz throughout measuring period
- Pulse input frequency for counter 2 (CNT2 on connector C2): maximum 1 Hz; min. pulse length: 5 ms
- Connector C1
- Connector C2

<table>
<thead>
<tr>
<th>WIRE</th>
<th>C1 CONNECTOR</th>
<th>C2 CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>CNT1</td>
<td>CNT2</td>
</tr>
<tr>
<td>BROWN</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>WHITE</td>
<td>TAMPER1</td>
<td>TAMPER2</td>
</tr>
<tr>
<td>BLACK</td>
<td>GND</td>
<td>GND</td>
</tr>
</tbody>
</table>

- Battery lifetime

**CI-B (CNT1=10Hz, CNT2=0Hz)**

<table>
<thead>
<tr>
<th>Period</th>
<th>Autonomy @ SF7</th>
<th>Autonomy @ SF12</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 packets/hour</td>
<td>5</td>
<td>0.7</td>
</tr>
<tr>
<td>1 packet/hour</td>
<td>6.7</td>
<td>2.3</td>
</tr>
<tr>
<td>1 packet/day</td>
<td>7.5</td>
<td>6.9</td>
</tr>
</tbody>
</table>

**CI-B (CNT1=10Hz, CNT2=1Hz)**

<table>
<thead>
<tr>
<th>Period</th>
<th>Autonomy @ SF7</th>
<th>Autonomy @ SF12</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 packets/hour</td>
<td>1.5</td>
<td>0.5</td>
</tr>
<tr>
<td>1 packet/hour</td>
<td>1.7</td>
<td>1.1</td>
</tr>
<tr>
<td>1 packet/day</td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**CI-B (CNT1=70Hz, CNT2=0Hz)**

<table>
<thead>
<tr>
<th>Period</th>
<th>Autonomy @ SF7</th>
<th>Autonomy @ SF12</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 packets/hour</td>
<td>4.2</td>
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<tr>
<td>1 packet/hour</td>
<td>5.3</td>
<td>2.1</td>
</tr>
<tr>
<td>1 packet/day</td>
<td>5.8</td>
<td>5.4</td>
</tr>
</tbody>
</table>

All values in years, Max. 5% retransmissions, Temperature ≈ 24°C
4.2. COMBOX.L DI-B

- Change of state or measuring period (regarding LoRaWAN protocol limitations)
- 4 x Digital Input

<table>
<thead>
<tr>
<th>WIRE</th>
<th>C1 CONNECTOR</th>
<th>C2 CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>DI1</td>
<td>DI2</td>
</tr>
<tr>
<td>BROWN</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>BLACK</td>
<td>DI3</td>
<td>DI4</td>
</tr>
<tr>
<td>WHITE</td>
<td>GND</td>
<td>GND</td>
</tr>
</tbody>
</table>

DI-B

<table>
<thead>
<tr>
<th>Period</th>
<th>Autonomy @ SF7</th>
<th>Autonomy @ SF12</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 packets/hour</td>
<td>6,1</td>
<td>0,9</td>
</tr>
<tr>
<td>1 packet/hour</td>
<td>8,5</td>
<td>2,7</td>
</tr>
<tr>
<td>1 packet/day</td>
<td>9,7</td>
<td>8,8</td>
</tr>
</tbody>
</table>

All values in years, Max. 5% retransmissions, Temperature ≈ 24°C

4.3. COMBOX.L 2T-B

- 2 x Temperature input Pt1000/PT100

<table>
<thead>
<tr>
<th>WIRE</th>
<th>C1 CONNECTOR</th>
<th>C2 CONNECTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLUE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BROWN</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BLACK</td>
<td>TEMP1</td>
<td>TEMP2</td>
</tr>
<tr>
<td>WHITE</td>
<td>GND</td>
<td>GND</td>
</tr>
</tbody>
</table>

2T-B

<table>
<thead>
<tr>
<th>Period</th>
<th>Autonomy @ SF7</th>
<th>Autonomy @ SF12</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 packets/hour</td>
<td>6,1</td>
<td>0,8</td>
</tr>
<tr>
<td>1 packet/hour</td>
<td>8,5</td>
<td>2,6</td>
</tr>
<tr>
<td>1 packet/day</td>
<td>9,7</td>
<td>8,7</td>
</tr>
</tbody>
</table>

All values in years, Max. 5% retransmissions, Temperature ≈ 24°C
5. INSTALLATION

5.1. NOTIFICATION FOR INSTALLATION

- The ComBox.L device must be vertically mounted with the antenna on the top.
- Before device placement, you must observe nearby metal objects (reinforced concrete, steel poles, etc), radio interference devices and other obstacles, which influence the signal strength. Relocate the device as far away as possible from those objects.
- The device should be mounted and positioned as close as possible to the base station, preferably in a line of sight.
- Do not mount the device beside any other electrical device or antenna.
- Do not place the device in a manhole or any other weak spot or obstacle where the signal would be under the limit of Spreading Factor 12!
- Communication range depends on the location of the device, network quality (signal strength) and the location of the nearest base station.
- Battery lifetime depends on the device location and sending interval. The best performance is reached at Spreading Factor of 7 and with longest sending period possible. Minimal demands are stable Spreading Factor of 12 and sending period not less than 15 minutes, where the battery lifetime is significantly reduced (see Tables Battery lifetime).

5.2. HARDWARE INSTALLATION

- On the front side of the ComBox.L device (Picture 1), you can see the device manufacturer and its DevEUI address. On the backside of the device (Picture 1) you can see device specifications.

- There are two buttons on the PCB, when the device is opened. The upper left Button 1 marked as MODE (reserved for future use) and the lower right Button 2 marked as RST (Reset).

- PCB contains two battery holders for two AA size batteries. The device is powered by two SAFT LS14500 3.6 V batteries. Observe the battery polarity when inserting the batteries. The positive pole is on the left side and the negative pole is on the right side, at the spring looking at PCB (Picture 3, 4 and 5).
WARNING

- Interference with the device interior is permitted only when replacing batteries. Any other interference with the device is strictly prohibited.
- Batteries are standard AA size batteries, but if you insert 1.5 V alkaline batteries, the device will not work. Use ONLY SAFT LS14500 batteries.
- If the enclosure was reopened the O-ring gaskets on screws have to be replaced!

• Take the supplied cable and attach it to the input of the device. Secure the safety screw (Picture 6 and 7) to prevent cable disconnection in clockwise direction, ensure the IP rating of connector.

Pictures 3, 4 and 5. Holders for two AA size batteries

Pictures 6 and 7: Cable Connection
• If you have only one cable connected to the ComBox.L device, then it is very important to seal second connector with the enclosed plug. With this plug we are ensuring IP67 protection. For installation, please see pictures below (Pictures 8, 9 and 10).

![Cable Connection](image)

Pictures 8, 9 and 10: Cable Connection

• Before you close the device case, you need to check to ensure that O-ring of the case is in place. Mind the position of the safety pillars, there is only one way for the case to close correctly and comply with the IP rating (observe Pictures 11 and 12).

![Closing the case](image)

Pictures 11 and 12: Closing the case

• Finally, secure the 4 screws. The device is now securely sealed and ready to be mounted.

5.3. CONNECTION TO NMS (NETWORK MANAGEMENT SERVER)

• The device is configured in such a way that when you insert the batteries, the device automatically begins with the activation process to connect to the NMS (Network Management Server) and AMS (Application Management Server).
• Connection, registration and communication with the base station, and further on with NMS and AMS must be proceeded according to the instructions of your BS/NMS/AMS provider.
6. RECOMMENDED FIELDS OF USE

- Smart Buildings
- Smart Industries
- Smart Grids
- Smart Energy

Picture 13: LoRaWAN Network Structure

Picture 14: Energy Management System
7. CERTIFICATION

7.1. LORA CERTIFICATE OF COMPLIANCE

The LoRa® Alliance is pleased to congratulate Solvera Lynx d.d. on the completion of the LoRaWAN™ Certification Program for the following product:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>Solvera Lynx d.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF DEVICE</td>
<td>Module</td>
</tr>
<tr>
<td>MODEL IDENTIFICATION</td>
<td>ComBox.L</td>
</tr>
<tr>
<td>FIRMWARE VERSION</td>
<td>V2.0.4</td>
</tr>
<tr>
<td>HARDWARE VERSION</td>
<td>1.0</td>
</tr>
<tr>
<td>CERTIFICATION DATE</td>
<td>October 28, 2016</td>
</tr>
<tr>
<td>LoRaWAN SPECIFICATION</td>
<td>V1.0.1</td>
</tr>
<tr>
<td>Class of Operation</td>
<td>A</td>
</tr>
</tbody>
</table>

This Certificate serves to confirm that the above mentioned product has passed all relevant tests in conjunction with the LoRaWAN™ Certification Program and is deemed compliant to it. The Manufacturer has been granted the right to use the following term and all associated logos:

LoRa® Alliance Certified

The usage of this term is limited to the described device and does not encompass any changes, firmware upgrades or subsequent versions and models after the listed test date. All usage guidelines for the LoRa® Alliance also apply to the term above.

Congratulations on your compliance to the program!

Sincerely,

Geoff Mulligan, Chair
7.2. SIQ CERTIFICATE

Certificate of Conformity

Number: C223-064476
Project File: C29186716

Product: Battery device - RF Communicator
Type reference: CordBox L K06; CordBox L 610; CordBox L 771-B
Trademark: CordBox

Applicant: SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia

Manufacturer: SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia

Place of manufacture: SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia

This certificate is granted subject to the SIQ rules on product certification. SOLVERA LYNX d.d. certifies the conformity of the products with the requirements of the listed standards.

Ratings:
- Internal rechargeable battery (2x 9V + 4-piece 6V batteries)(LiFeSO4) 3.0 V; 2000 mAh

Standard:

Text report: T223-064476

Remarks:
- This certificate shall apply to the products identical to the tested sample and shall remain valid for the period of 3 years until 2016-08-20 or until the validity date of the listed standards, whichever occurs earlier.

Date: 2016-08-20
Authorized signature: [Signature]

Only genuine publication of this certificate is allowed. This certificate may only be reproduced in its entirety and without any changes. On request, SOLVERA LYNX d.d. will give information about the validity of the certificate.

Certificate of Conformity

Number: C221-011176
Project File: C29186716

Product: RF Communicator
Type reference: CordBox L 464; CordBox L 464; CordBox L 771-B
Trademark: CordBox

Applicant: SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia

Manufacturer: SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia

Place of manufacture: SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia

This certificate is granted subject to the SIQ rules on product certification. SOLVERA LYNX d.d. certifies the conformity of the products with the requirements of the listed standards.

Ratings:
- 3.6 V DC battery, 2x 2300 mAh
- Protection class: V
- Maximum clock frequency: 6 MHz

Standard:
- EN 301 489-1 V1.2.2
- EN 301 489-3 V1.5.1

Text report: T221-011176

Remarks:
- This certificate shall apply to the products identical to the tested sample and shall remain valid for the period of 3 years until 2016-08-11 or until the validity date of the listed standards, whichever occurs earlier.

Date: 2016-08-11
Authorized signature: [Signature]

Only genuine publication of this certificate is allowed. This certificate may only be reproduced in its entirety and without any changes. On request, SOLVERA LYNX d.d. will give information about the validity of the certificate.

SOLVERA LYNX d.d.
Stepno 23A, SI-1000 Ljubljana, Slovenia
T: +386-1-4749 160, F: +386-1-4781 418
info@solvera.si, www.solvera.si
8. EU DECLARATION OF CONFORMITY

This declaration of conformity is issued under the sole responsibility of the manufacturer:

Solvera Lynx d.o.o.
Stegne 23A
SI-1000 Ljubljana
Slovenia

for the product:

Product: ComBox. L – Long Range Low Power Wireless Logger
Types: ComBox.L CI-B; ComBox.L DI-B; ComBox.L 2T-B

Object of the declaration:

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:
EN 301 489-1 V1.9.2
EN 301 489-3 V1.6.1

Signed for and on behalf of:
Jože Rotar, Technical Director

Place and date of issue:
Ljubljana, 2018