

# BUTTONBOARD

## Documentation



## Firmware explained

### Application / EPD modes

The current firmware provides three different application modes, whereas mode 2 is the same as mode 3, except that another button is used to trigger an uplink.

An application mode can be selected via Device Manager mobile app or LoRa downlink.

In **mode 1** every button can trigger an uplink. Whenever a button is pressed and hold, the associated LED group fills up. As soon as it is filled, the success color is shown (e.g. green) and an uplink is triggered. However, when the button is keep pressed for the configured long press duration (e.g. 5 seconds), a long click is recognized and an uplink with another button byte will be sent.

In **mode 2** only button 1 can trigger an uplink. The other buttons can be selected and also deselected at will. This allows use cases in which multiple options can be chosen. The LED group of a selected button is shining in the configured loading color (e.g. purple). When the send button is pressed and hold for the configured long press duration (e.g. 5 seconds), an uplink with another button byte will be sent.

In **mode 3** only button 6 can trigger an uplink. Otherwise it's the same as mode 2.

### BLE mode

The BLE mode can either be entered by pressing the small BLE button within the case or by pressing and holding button 1 & 6 together for the configured long press duration (e.g. 5 seconds).

In the BLE mode, the first LED group is blinking in the configured BLE application color (e.g. blue) and the device starts advertising. It can now be connected with the Device Manager mobile app.

The BLE mode can be left again by pressing any button.

### Calibrating the touch sensors

The touch sensors of the Button Board are constantly calibrating them self every few seconds. However in some cases (e.g. after opening and closing the case), a complete re-calibration is required. The firmware of the Button Board normally recognizes this automatically by checking if a button is pressed for more then 10 seconds. In this case no uplink is triggered and the LED group of the pressed button is shining in the configured failure color (e.g. red) for a short time. Afterwards the buttons are calibrated and the calibration animation is shown. Meaning that every LED group sequentially lights up in the configured loading color (e.g. purple) for a short time.

A manual calibration can also be triggered by rotating the Button Board by 180° and holding it straight until a short tone is played. As soon as it is rotated back and hold straight again, the touch sensors are calibrated and the calibration animation is shown.

## Paper inlay template

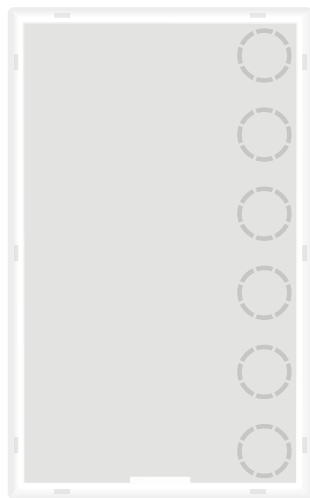
### Paper inlay

The paper inlay of the Buttonboard can be easily adapted for any application.

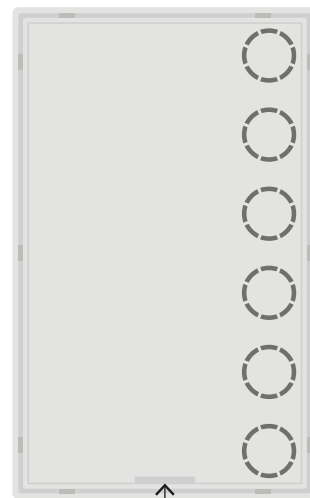
## Battery change

### Replace the battery

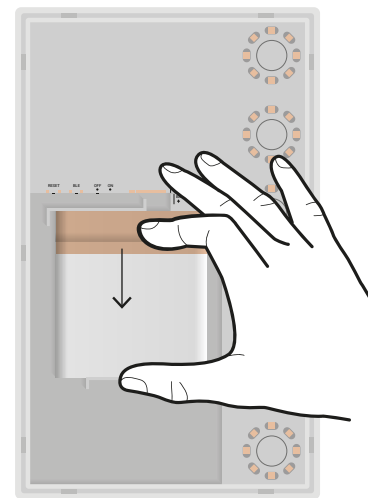
To replace the battery follow there 3 steps:



**01**  
Use a coin to  
gently remove  
the transparent  
cover.



**02**  
Remove with  
a coin the  
plastic cover.



**03**  
Pull the battery slightly  
forward and then remove  
the battery upwards

## Uplink message bytes

Every wakeup event can trigger an uplink message. Such a wakeup event can be one of the following:

- Button press
- Accelerometer interrupt
- Heartbeat timeout



## UPLINK MESSAGES

There are 3 different uplink messages:

(0x31) **State Update**

(0x32) **Batch Update**

(0x40) **Power Saving Settings**

### State Update

31	04	00	00	01	3F	64	18	FF	20	FF	D2	10	11
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11	byte12	byte13
AF	33	00	01	50	01	21							
byte14	byte15	byte16	byte17	byte18	byte19	byte20							

<b>byte0:</b>	Uplink ID (0x31)
<b>byte1:</b>	Button clicked number (0... 9) Button byte bit0: button1 bit1: button2 ... bit5: button6 bit6: not used bit7: long press indicator
<b>byte2:</b>	Heartbeat timeout occurred (0 or 1)
<b>byte3:</b>	Accelerometer interrupt event (0... 6)
<b>byte4:</b>	Application mode (1... 3)
<b>byte5:</b>	Enabled button byte (0x3F)
<b>byte6:</b>	Battery level in % (0... 100)
<b>byte7:</b>	Signed temperature in °C (+/- 2°C; Should be calibrated via backend)
<b>byte8:</b>	Signed 14bit accelerometer value X axis H byte*
<b>byte9:</b>	Signed 14bit accelerometer value X axis L byte*
<b>byte10:</b>	Signed 14bit accelerometer value Y axis H byte*
<b>byte11:</b>	Signed 14bit accelerometer value Y axis L byte*
<b>byte12:</b>	Signed 14bit accelerometer value Z axis H byte*
<b>byte13:</b>	Signed 14bit accelerometer value Z axis L byte*
<b>byte14:</b>	Product family (0xAF)
<b>byte15:</b>	Product type (0x33)
<b>byte16:</b>	Product variant (0x00)
<b>byte17:</b>	HW version major (0x01)
<b>byte18:</b>	HW version minor & patch (e.g. 0x50 -> minor = 5 & patch = 0)
<b>byte19:</b>	FW version major (0x01)
<b>byte20:</b>	FW version minor & patch (e.g. 0x24 -> minor = 2 & patch = 4)

\* The accelerometer is configured to measure 14bit values within +/-2G. This means that the accelerometer values will be within -8'192... 8'191 and that the value +/-4096 represents +/-1G (9.81m/s<sup>2</sup>)



## Batch Update

From version 1.3.0

32	00	03	00	01	00	08	00	FF	00	02	00	10
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11	byte12

<b>byte0:</b>	Uplink ID (0x32)*
<b>byte1:</b>	High byte for Button 1 Counter (0... 65535)
<b>byte2:</b>	Low byte for Button 1 Counter (0... 65535)
<b>byte3:</b>	High byte for Button 2 Counter (0... 65535)
<b>byte4:</b>	Low byte for Button 2 Counter (0... 65535)
<b>byte5:</b>	High byte for Button 3 Counter (0... 65535)
<b>byte6:</b>	Low byte for Button 3 Counter (0... 65535)
<b>byte7:</b>	High byte for Button 4 Counter (0... 65535)
<b>byte8:</b>	Low byte for Button 4 Counter (0... 65535)
<b>byte9:</b>	High byte for Button 5 Counter (0... 65535)
<b>byte10:</b>	Low byte for Button 5 Counter (0... 65535)
<b>byte11:</b>	High byte for Button 6 Counter (0... 65535)
<b>byte12:</b>	Low byte for Button 6 Counter (0... 65535)

\* In the batch mode, a short press does not generate a normal uplink. The device only counts the press and sends all counter values after the batch time. If you want to send an uplink in the batch mode because you want to send a downlink, press the button for a long time.

## Power Saving Update

40	00	00	01	00
byte0	byte1	byte2	byte3	byte4

From version 1.3.0

<b>byte0:</b>	Downlink ID (0x40)
<b>byte1:</b>	Batch-Time high byte (0 off / 600... 65535 Seconds)
<b>byte2:</b>	Batch-Time low byte (0 off / 60... 65535 Seconds)
<b>byte3:</b>	Led Power Save Mode (0 or 1) 00 Led Power Save Mode is off. 01 Led Power Save Mode is on. LED animations are power-optimized
<b>byte4:</b>	Show Send Info (0... 3) 00 Sending Process and Feedback are not shown with LED. 01 Only Transmission Feedback is shown. 02 Only Sending Process is shown. 03 Sending Process and Feedback are shown with LED.



## DOWNLINK MESSAGES

There are 6 different downlink messages that can be used to configure the behavior of the device:

(0xB0) **Configure LoRa parameters**

(0xB6) **Configure periphery**

(0xB7) **Select colors**

(0xB8) **Send Feedback after Uplink**

(0xC0) **Get Power Saving Settings**

(0xC1) **Set Power Saving Settings**

Each downlink message comes with an ID and a defined length.

It is also possible to link multiple downlink messages together. Make sure to keep it below 50 bytes.

### Configure LoRa parameters downlink message bytes

B0	00	02	03	01	01	00	00	0C	00	07
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10

<b>byte0:</b>	Downlink ID (0xB0)
<b>byte1:</b>	ADR (0 or 1)
<b>byte2:</b>	DR (0... 5 respectively SF12... SF7) If ADR is enabled, the configured DR will be ignored
<b>byte3:</b>	Send trials (1... 10) When an uplink fails, it automatically sends further uplinks (with the next DR) according to the configured send trials. Each send trial takes up to 7 seconds.
<b>byte4:</b>	Join trials (1... 3) When a join fails, it automatically tries to join again (with the next DR) according to the configured join trials. The first join trial takes up to 10 seconds, the second up to 40 seconds and the third up to 130 seconds.
<b>byte5:</b>	Port (1... 223)
<b>byte6:</b>	Confirmed or unconfirmed messages (0 or 1)
<b>byte7:</b>	Heartbeat interval in x*15min high byte (0... 65535)
<b>byte8:</b>	Heartbeat interval in x*15min low byte (0... 65535)
<b>byte9:</b>	LoRa interval in seconds high byte (5... 65535)
<b>byte10:</b>	LoRa interval in seconds low byte (5... 65535) The LoRa interval represents the delay before a new image can be selected or a new uplink can be sent (minimum is 5s; LEDs may blink red in this time).



## Configure periphery downlink message bytes

<b>B6</b>	<b>01</b>	<b>89</b>	<b>01</b>	<b>00</b>	<b>3F</b>	<b>03</b>	<b>E8</b>	<b>13</b>	<b>88</b>
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9

<b>byte0:</b>	Downlink ID (0xB6)
<b>byte1:</b>	Application modes: 1 Every button can trigger an uplink 2 Only button6 can trigger an uplink 3 Only button1 can trigger an uplink
<b>byte2:</b>	Piezo byte (0bwwwx'yyzz) Piezo volume (ww): 0 OFF 1 10% 2 50% 3 100% Piezo modes (xx): 0 1 tone 1 2 tones 2 2 tones (2*dur1) 3 2 tones (2*dur2) Piezo frequ. tone2 (yy): 0 (500Hz), 1 (1kHz), 2 (2kHz), 3 (4kHz) Piezo frequ. tone1 (zz): 0 (500Hz), 1 (1kHz), 2 (2kHz), 3 (4kHz)
<b>byte3:</b>	Vibra motor (0 or 1)
<b>byte4:</b>	Accel modes: 0 OFF 1 Movement detection (slow moving) 2 Movement detection (fast moving) 3 Movement detection (shaking) 4 Free fall detection (~3 to 12.5cm) 5 Free fall detection (~28 to 50cm) 6 Free fall detection (~78 to 113cm)
<b>byte5:</b>	byte5: Button enable byte (0b00uv'wxyz): (u) = button6, (v) = button5, (w) = button4 (x) = button3, (y) = button2, (z) = button1
<b>byte6:</b>	Button press duration short click high byte (0... 8000ms)
<b>byte7:</b>	Button press duration short click low byte (0... 8000ms)
<b>byte8:</b>	Button press duration long click high byte (0... 8000ms)
<b>byte9:</b>	Button press duration long click low byte (0... 8000ms)



## Configure application colors downlink message bytes

B7	00	8F	00	FF	00	00	FF	00	FF	00	00	FF
byte0	byte1	byte2	byte3	byte4	byte5	byte6	byte7	byte8	byte9	byte10	byte11	byte12

byte0:	Downlink ID (0xB7)
byte1:	Application success color red (0... 255)
byte2:	Application success color green (0... 255)
byte3:	Application success color blue (0... 255)
byte4:	Application failure color red (0... 255)
byte5:	Application failure color green (0... 255)
byte6:	Application failure color blue (0... 255)
byte7:	Application selection color red (0... 255)
byte8:	Application selection color green (0... 255)
byte9:	Application selection color blue (0... 255)
byte10:	Application BLE color red (0... 255)
byte11:	Application BLE color green (0... 255)
byte12:	Application BLE color blue (0... 255)

## Transmission Feedback via downlink

B8	01
byte0	byte1

From version 1.3.0

byte0:	Downlink ID (0xB8)
byte1:	00 Show Error 01 Show Success

# Get Power Saving Settings

C0

byte0

From version 1.3.0

byte0:	Downlink ID (0xC0)
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This downlink triggers the uplink 40, which communicates the current setting values.

# Set Power Saving Settings

C1

00

00

01

00

byte0

byte1

byte2

byte3

byte4

From version 1.3.0

byte0:	Downlink ID (0xC1)
byte1:	Batch-Time high byte (0 off / 600... 65535 Seconds)*
byte2:	Batch-Time low byte (0 off / 600... 65535 Seconds)* If Batch-Time is enabled, all button clicks are counted and do not trigger a normal uplink (30). This save energy, if buttons are often clicked. You can set the batch-time in seconds. During this time, all button clicks are counted. For each button, there is one counter. After this time, the counter values will be sent as uplink (32). The minimum time is 10 minutes (0x0258). If the value is set to zero, the function is disabled.
byte3:	Led Power Save Mode (0 or 1) 00 Led Power Save Mode is off. 01 Led Power Save Mode is on. LED animations are power-optimized
byte4:	Show Send Info (0... 3) 00 Sending Process and Feedback are not shown with LED. 01 Only Transmission Feedback is shown. 02 Only Sending Process is shown. 03 Sending Process and Feedback are shown with LED.





## CHANGE LOG

### FW version 1.3.0

Power Save features added:

- Batch Mode
- Led Poser Save Mode
- Send Led Animation can be deactivated

Transmission Feedback via Downlink

Acceleration value bug solved

### FW version 1.2.8

This version was successfully LoRa Alliance certificated. It improves the certification mode by handling the rejoin request manually and by preventing leaving the certification mode when a button was accidentally pressed.

- Improved the certification mode by implementing a manual rejoin request handling instead of an automatic
- Disabled leaving the certification mode when a button is pressed

### FW version 1.2.7

This version improves the certification mode and changes the max number of send and join trials.

- Improved the certification mode by adding a reset of the timeout timer and an automatic rejoin request handling
- Fixed the max of join trials from 3 to 9
- Fixed the max of send trials from 10 to 8

### FW version 1.2.6

This version adds a certification mode implementation that can be activated with a hidden BLE or LoRa downlink command.

- Implemented a certification mode
- Added a hidden EEPROM setting to enable the certification mode

## ERRATA

Acceleration Data not correct until V1.3.0

### FW version 1.2.5

This version improves the BLE advertising behavior and changes the loading direction to improve visibility for right-handers.

- Improved the advertiseForever() function and fixed the BLE Observer Stop Bug
- Changed the loading direction (from CW to ACW) to improve visibility for right-handers
- Changed the automatic touch calibration duration from 8.5 to 10 seconds

### FW version 1.2.4

This version prevents that configured settings are lost when updating to a newer version. It also improves the feedback behavior, when the piezo was disabled.

- Changed all the default user EEPROM settings from has\_default to change\_once
- LED success color feedback in mode 2 & 3 when the send button is pressed
- Bugfix: Crash when a button was pressed for longer than 15 seconds in mode 2 & 3
- Calibrate when a button was pressed for longer than 15 seconds in mode 2 & 3
- Calibrate before entering BLE mode via long clicks

### FW version 1.2.3

This is the a pre release version with a complete application.