FMLR IoT Button

Customizable Multi-Use IoT Button

Description

The IoT button can be used as a service-on-demand button, remote control, emergency or notification button and much more. An easily customizable front label and its configurable functionality allows the IoT Button to be used in any use case. It contains four integrated buttons and is configured over the air either as a single-, two- or four-button button device.
IoT button has a fully integrated antenna that provides excellent wireless connectivity through walls and floors. The batteries are exchangeable and allow years of lifetime. The beautiful design enclosure is highly optimized for mass manufacturing and can easily be mounted to walls, tables, machines and many more either by screws or sticky-tape. The Power consumption of the device is highly optimized to run from two small standard AAA batteries.
The IoT Button is connected to any standard public or private LoRaWAN® network. Options for other wireless standards like BLE, ZigBee, EnOcean, NB-IoT or Sigfox on request.

Key benefits

- Modular setup with different options
- Customizable front label
- Low power operation
- Up to 10 years of battery lifetime
- Line-of-sight range of up to 15 km
- Runs customer specific applications and proprietary wireless protocols
- Status information over buzzer or vibration
- Over the air (OTA down-link) configuration

Applications

- Low data rate IoT use cases
- Low power RF system
- Wireless notification
- Industrial and home automation
- Facility management services
- Emergency notification
- Service-on-demand applications

About this Document	
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Contents

We reserve the right to make technical changes, which serve to improve the product, without prior notification.

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Functional Description

The IoT Button is a compact LoRaWAN enabled device for multipurpose use. Due to the multi functional design it can be used in a huge variety of applications such as service-on-demand, notification or emergency, and remote control use cases. Thanks to the state-of-the-art enclosure design, it can also be used as a pager equipped to a person´s clothing, or a status messenger that is mounted to a device or wall. The LoRaWAN connectivity offers a high coverage range due to its fully integrated antenna and operates low-power from small-sized batteries. This IoT button will help to connect businesses and people all over the world.

Specifications

Parameter	
Frequency	Either 863 – 870 MHz for EU or 902 – 928 MHz for North America
Tx Power	+14 dBm
Rx Sensitivity	-140 dBm
IP Rating	IP 50 equivalent
Operating Temperature	-20° C to 50° C
Power Source	2 x 1.5V AAA Battery
Length x Width x Height	80 mm x 16 mm x 60 mm
Weight	40 g

Button Configuration

Each button can be individually enabled and disabled. Additionally, the regular status message intervall time can also be adjusted. Lastly, there is a set of flags to enable or disable certain functions:

Setting	Default
Button N	Enabled
Button E	Enabled
Button S	Enabled
Button W	Enabled
Confirmed Message	Enabled (This only applies to a button press, status messages are always unconfirmed)
Duty Cycle	Disabled
Buzzer	Enabled
Join Strategy	SF12 (Alternative is to start with SF7 and ramp up every second try
Ambitious First Press	Enabled (This ensures that only one button can be interpreted as a first press)
Status Interval	1 Day
Debounce Time	20 ms (time allowed for mulitple button presses in the same message)

All configuration options can be changed via LoRaWAN downlinks.

Payload Uplink

There are three distinct uplink payloads:

- Regular status message
- Button press(es)
- Firmware Version

All uplinks are sent on the LoRaWAN port 15.

1 Regular Status Message

These messages are *always* unconfirmed, regardless of the settings.

The Status message can be used to detect low batteries. An IoT-Button will stop working at 1.8V. 2.0V is therefore a good value to use for critical battery alerts. It may be useful to already create an alert at around 2.4V, in order to know when the device slowly reaches low battery levels.

Byte	**0**	**1**	**2:5**	**6**	**7**	**8**	**9**
Field	Reserved[1] (0x05)	Reserved[1] (0x02)	Used charge	Reserved[1] (0x03)	Reserved[1] (0x03)	Battery Voltage	Internal Temperature

Byte	**10**	**11**	**12**	**13**	**14:15**
Field	Reserved[1] (0x05)	Reserved[1] (0x04)	Button Configuration	Configuration Flags	Status Message Interval

Used Charge	Bits[0:31]	Rough approximation of used charge in uAh since last reset. Bytes are encoded in little endian format.
Battery Voltage	Bits[0:7]	Current battery Voltage in 10 mV with an offset of 170 (minimum Voltage). To calculate Volts: (x + 170)/100
Internal Temperature	Bit[0:7]	Current MCU temperature in degrees Celcius
Button Configuration	Bits[0:3]: Mask of active buttons Bits[4:7]: Reserved	Bit 0: Button N: 0 → Deactivated, 1 → Activated Bit 1: Button E: 0 → Deactivated, 1 → Activated Bit 2: Button S: 0 → Deactivated, 1 → Activated Bit 3: Button W: 0 → Deactivated, 1 → Activated
Configuration Flags	Bits[3:7]: Configuration flags Bits[0:2]: RFU	Bit 3: Join Strategy: 0 → SF7 , 1 → SF12. Bit 4: Ambitious First Press: 0 → Disabled , 1 → Enabled. Bit 5: Duty Cycle: 0 → Disabled , 1 → Enabled. Bit 6: Buzzer: 0 → Disabled , 1 → Enabled. Bit 7: Confirmed Uplinks: 0 → Disabled , 1 → Enabled.
Status Message Inverval	Bits[0:15]	Regular status message interval time in minutes. Uses little endian format. Default: 3 days.

Example: **05:02:10:00:00:00:03:03:AA:28:05:04:0F:F8:A0:05**

Used Charge: 16 uAh

Battery Voltage: 3.4 V

Internal Temperature: 40° C

Button Configuration: 0x0F → All buttons enabled

Configuration Flags: 0b1111100 → Everything enabled

Status Message Intervall: 1440 minutes (1 day)

Note: On US915 frequencies, the maximum allowed payload size is limited to 11 bytes on DR0. Thus, we omit the first part in the first six bytes in the Status Message relating to the used charge. For example:

03:03:AA:28:05:04:0F:F8:A0:05

2 Button Press

Byte	**0**	**1**	**2**	**3:4**	**5**	**6**	**7:10**
Field	Reserved[1] (0x04)	Reserved[1] (0x01)	ButtonId	Button Count	Reserved[1] (0x05)	Reserved[1] (0x02)	Used Charge

ButtonId	Bits[0:3]: ID of the first button that has been pressed Bits[4:7]: OR conjunction of all buttons that have been pressed	Bit 0: Button N has been pressed first Bit 1: Button E has been pressed first Bit 2: Button S has been pressed first Bit 3: Button W has been pressed first Bit 4: Button N has been pressed Bit 5: Button E has been pressed Bit 6: Button S has been pressed Bit 7: Button W has been pressed
Button Count	Bits[0:15]	Counter of how many times the button has been activated since the last reset. Bytes are encoded in little endian format.
Used Charge	Bits[0:31]	Rough approximation of used charge in uAh since last reset. Bytes are encoded in little endian format.

Example: **04:01:15:A5:00:05:02:20:12:00:00**

First Button: N (0b0001)

All Buttons: NE (0b0101)

Button Count: 165

Used Charge: 4640 uAh

3 Firmware Verion

This message is sent once right after joining.

Byte	**0**	**1**	**2:5**
Field	Reserved[1] (0x05)	Reserved[1] (0x05)	Git Hash in little endian format

Example: **05:05:23:52:D6:59**

Git Hash: 59d65223

Payload Downlink

There are two distinct downlink payloads:

- Button Configuration
- Backwards Compatiple Button Configuration

All Downlinks must be sent on the LoRaWAN port 3.

1 Button Configuration

Byte	0	1	2	3	4:5	6
Field	Reserved[1] (0x06)	Reserved[1] (0x81)	Button Configuration	Configuration Flags	Status Message Interval	Button Debounce Time

Button Configuration	Bits[0:3]: Mask of active buttons Bits[4:7]: Reserved	Bit 0: Button N: 0 → Deactivate, 1 → Activate Bit 1: Button E: 0 → Deactivate, 1 → Activate Bit 2: Button S: 0 → Deactivate, 1 → Activate Bit 3: Button W: 0 → Deactivate, 1 → Activate
Configuration Flags	Bits[3:7]: Configuration flags Bits[0:2]: RFU	Bit 3: Join Strategy: 0 → SF7 , 1 → SF12. Bit 4: Ambitious First Press: 0 → Disabled , 1 → Enabled. Bit 5: Duty Cycle: 0 → Disabled , 1 → Enabled. Bit 6: Buzzer: 0 → Disabled , 1 → Enabled. Bit 7: Confirmed Uplinks: 0 → Disabled , 1 → Enabled.
Status Message Inverval	Bits[0:15]	Regular status message interval time in minutes. Bytes are encoded in little endian format.
Button Debounce Time	Bits[0:7]	Button debounce time in miliseconds. Multiple button presses have to occur within this timeframe to be registered and transmitted in a message.

Example: **06:81:0F:F8:A0:05:1E**

Activated Buttons:	NESW (0b00001111)
Duty Cycle:	Enabled
Buzzer:	Enabled
Confirmed Uplinks:	Enabled
Join Strategy:	SF12
Ambtious First Press:	Enabled
Status Interval:	1440 minutes (1 day, 0x05A0)
Button Debounce Time:	30 miliseconds (0x1E)

2 Backwards Compatiple Button Configuration

This Payload does not allow the configuraion of the button debounce time and the join strategy configuratinon and ambitious first press flags. It is included in older Firmware versions (v2.0.0 upwards)

Byte	**0**	**1**	**2**	**3:4**
Field	Reserved[1] (0x04)	Reserved[1] (0x80)	Button Configuration	Status Message Interval

Button Configuration	Bits[0:3]: Mask of active buttons Bits[4:7]: Configuration flags	Bit 0: Button N: 0 → Deactivate, 1 → Activate Bit 1: Button E: 0 → Deactivate, 1 → Activate Bit 2: Button S: 0 → Deactivate, 1 → Activate Bit 3: Button W: 0 → Deactivate, 1 → Activate Bit 4: Reserved Bit 5: Duty Cycle: 0 → Disabled , 1 → Enabled. Bit 6: Buzzer: 0 → Disabled , 1 → Enabled. Bit 7: Confirmed Uplinks: 0 → Disabled , 1 → Enabled.
Status Message Inverval	Bits[0:15]	Regular status message interval time in minutes. Bytes are encoded in little endian format.

Example: **04:80:EC:A0:05**

Activated Buttons: WS (0b1100)

Duty Cycle: Enabled

Buzzer: Enabled

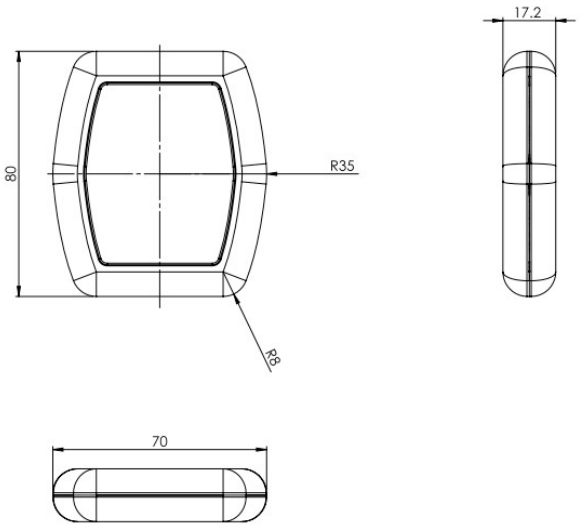
Confirmed Uplinks: Enabled

Status Interval: 1440 minutes (1 day)

[1]**Note**: The reserved bytes corresponds to the length and type of the following message. For example, a button press has type 0x01 and length 0x04 (without the length byte itself). Downlink messages have type 0x80 and length 0x04.

Button Layout

Mechanical Dimensions



Note: all values in mm

Legacy Information

The following sections contain information about old functionality of the IoT Button. It applies to devices purchased before the 03.03.2020 without upgraded firmware.

3 Button Modes

The IoT Button has 4 different operating modes:

- Single Mode (0): All buttons activate a message and have the same sound
- Vertical Mode (1): Only the buttons on the vertical axis activate a message and have a different sound
- Horizontal Mode (2): Only the buttons on the horizontal axis activate a message and have a different sound
- Individual Mode (3): All buttons activate a message and have a different sound

4 Payload Uplink

Byte	**0**	**1**	**2**	**3**
Field	Battery	ButtonId	PressType	Counter

Battery	Bits[0:7]	0: Battery not connected 1-254: Battery Status (min 1, max 254) 255: Battery measurement not possible
ButtonId	Bits[0:3]: OR conjunction of all buttons that have been pressed Bits[4:7]: ID of the first button that has been pressed	1: Button 1 has been pressed 2: Button 2 has been pressed 4: Button 3 has been pressed 8: Button 4 has been pressed 1: Button 1 has been pressed first 2: Button 2 has been pressed first 4: Button 3 has been pressed first 8: Button 4 has been pressed first
PressType	Bit[0]	0: Short press 1: Long press (> 5s)
Counter	Bits[0:7]	Counter that increases with every button press

5 Payload Downlink

Byte	**0**	**1**
Field	Command	ButtonMode

Command	Bit[0]	1: Set button mode
ButtonMode	Bits[0:1]	0: Single mode 1: Vertical mode 2: Horizontal mode 3: Individual mode