

# LSD4BTB-PBC1000001

## User Manual

Rev01 2020-12-16

## File revision history

Firmware version	Document revision date	Author	Change description
	201216	L J	Initial Version

# 1 Features

An ultra-low power beacon device that supports iBeacon and Eddystone UID & URL.

## 2 APP communication protocol

APP sends instructions to the Beacon module through the FE61 channel. After receiving the instructions, the module parses and executes the instructions, and returns the result of the instruction execution to the APP through the FE62 channel. The whole process is shown in the following figure.

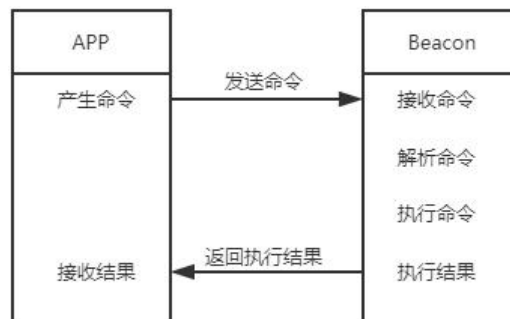


Figure 2 1 APP operation Beacon flow chart

### 2.1 Airbag structure

APP sends instructions to the Beacon module through Bluetooth. In order to facilitate module recognition, the instructions must conform to a certain format; at the same time, the Bluetooth module will return data to the APP in the agreed format after executing the instructions. The input frame command format is as follows As shown in the table, the response frame command format is shown in the following table.

Table 2 1 Input frame command format (hex)

Start character	Command ID	Command length	Command parameter
01 FC	xx	xx	xx.....xx

Table 2 2 Response frame command format (hex)

Start character	Command ID	Command length	Execution status	Response data
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04 FC	xx	xx	xx	xx.....xx
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- ◆ Start character: all command frames must start with "01 FC", and all response frames start with "04 FC".
- ◆ Command ID: The IDs of commands with different functions are unique. The following is an enumeration and detailed explanation of all commands.
- ◆ Command length: The input frame length is the number of bytes of the input frame command parameters, and the response frame length is the sum of the execution status and the length of the response data.
- ◆ Command parameter: The command parameter of the command frame is the parameter of the command execution.
- ◆ Execution status: The execution status is the content contained in the response frame, 1 byte, immediately after the length of the response frame, 00 means the command was successfully received, and other non-zero means the reception/processing failed.
- ◆ Response data: The response data is the data carried in the response frame. For details, see the detailed explanation of the serial port command frame below.

Data unit: Each independent data unit with no less than 2 bytes in the instruction should be transmitted in low-endian order, for example: The transmission order of 1000 (0x03E8) is E8 03.

## 2.2 Detailed instructions

ID	Command function	Description	Drop Electricity Protect Save
01	Set Bluetooth MAC address	Format: 01 FC 01 06 MAC MAC: 6-byte unsigned integer, MAC address. Note: You need to restart the device to take effect. Return: 04 FC 01 01 status	YES
02	Query Bluetooth MAC address	Format: 01 FC 02 00 Returns: 04 FC 02 len status [MAC] MAC: The mac address of the device.	/
03	Set device name	Format: 01 FC 03 len Name len: 1-byte unsigned integer, the number of bytes in the device name, range [1-20];	YES

		Name: The name of the device, usually a visible string. Return: 04 FC 03 01 status	
04	Query device name	Format: 01 FC 04 00 Returns: 04 FC 04 len status [Name]	/
05	Set the uuid broadcast by beacon	Format: 01 FC 05 len uuid len: 1-byte unsigned integer, the length of uuid, fixed at 0x10. Big endian. uuid: 16-byte unsigned integer, beacon specific uuid. Return: 04 FC 05 01 status	YES
06	Query beacon broadcast uuid	Format: 01 FC 06 00 Returns: 04 FC 06 len status [uuid]	/
07	Set the major of beacon broadcast	Format: 01 FC 07 02 major major: 2-byte unsigned integer, major beacon number, little-endian byte order. Returns: 04 FC 07 01 state	是
08	Query the major of beacon broadcast	Format: 01 FC 08 00 Returns: 04 FC 08 03 state[major]	/
09	Set the minor of beaco broadcast	Format: 01 FC 09 02 minor minor: 2-byte unsigned integer, the unique label under the major beacon number, in little-endian byte order. Returns: 04 FC 09 01 state	是
0A	Query the minor of beacon broadcast	Format: 01 FC 0A 00 Returns: 04 FC 0A 03 state[minor]	/

## 3 Default parameters

Table 4 1 Module default parameter list

project		Default parameters
Production	test	115200bps
serial	port	baud rate
Broadcast parameters		<p>Broadcast interval: 100ms</p> <p>Broadcast data: single ibeacon broadcast, if two kinds of broadcast carousels, the switching frequency is 1s.</p> <p>Broadcast channel: 37, 38, 39</p> <p>Scan response: switch between scan response format 1 and scan response format 2, see 5.3 for details.</p> <p>The switching frequency is 1s.</p>
Connection parameters		<p>Minimum connection interval -8ms</p> <p>Maximum connection interval -100ms</p> <p>Slave lurking-0</p> <p>Connection loss monitoring timeout time 3 seconds</p>
Transmit power		0dBm
Receive buffer		1 KB
mode		Factory mode
Battery detection frequency	level	1 day/time
Temperature detection frequency		4 hour/time
Authentication		close

## 4 Main technical content

### 4.1 Introduction to Bluetooth Services and Features

S/C	Describe	UUID	Authority	Description
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<b>service</b>	/	0xFE60	/	Lierda Bluetooth Low Energy Data Transmission Service
<b>Eigenval</b>	Data M-S	0xFE61	WN/W	Command setting channel
<b>ues</b>				
<b>Eigenval</b>	Data S-M	0xFE62	N	Command setting status return channel
<b>ues</b>				

*M: Master, 表示主机*

*N: Notify*

*W: Write*

*S: Slave, 表示从机*

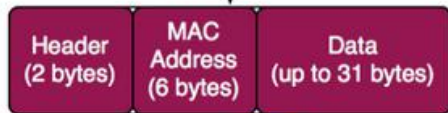
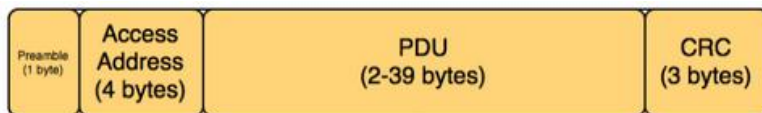
*R: Read*

*WN: Write no response, 不回复的写入*

## 4.2 Broadcast settings

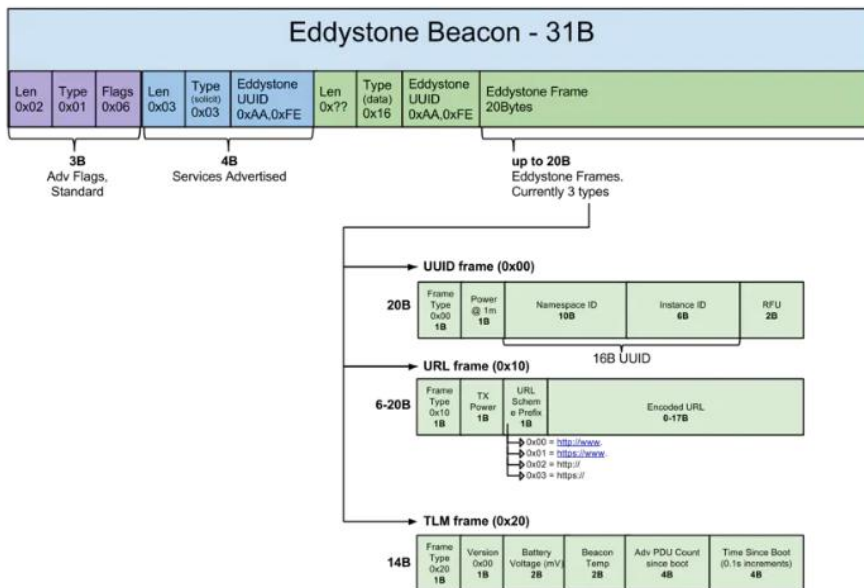
Beacon broadcast includes three types: standard ibeacon broadcast, Eddystone UID broadcast and Eddystone URL broadcast.

### 4.2.1 Ibeacon Broadcast format



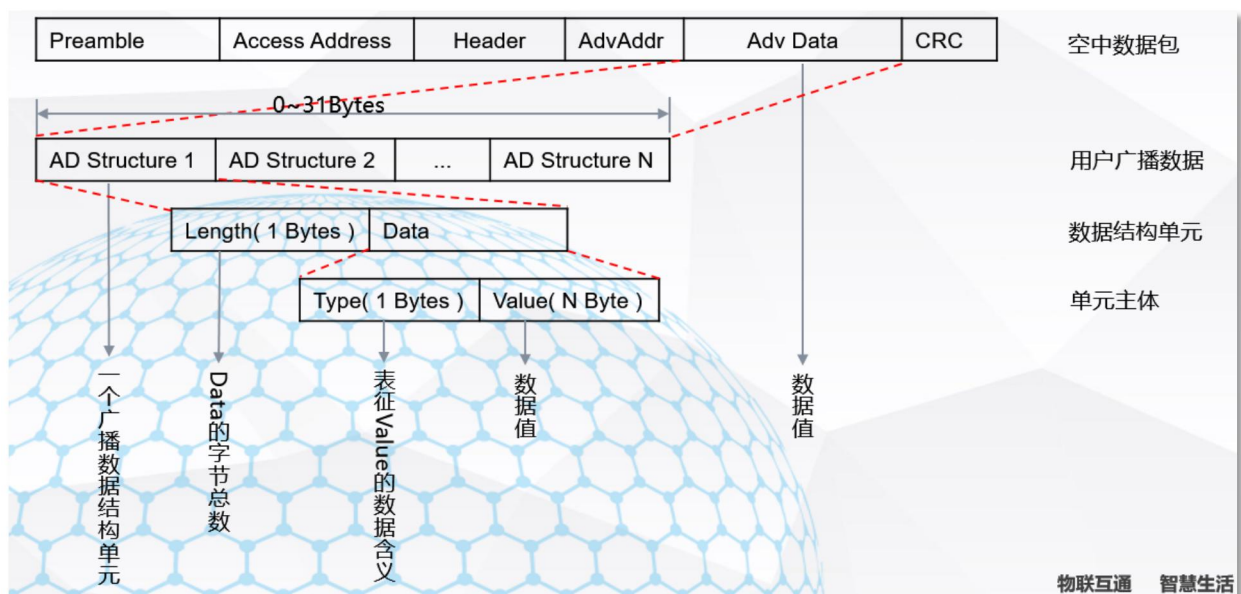
DATA	Number of bytes
Company ID	2 Bytes
Data type	1 Byte
Data length	1 Byte
UUID	16 Bytes
Major	2 Bytes
Minor	2 Bytes
Measured power at 1 meter	1 Byte

## 4.2.2 Eddystone Broadcast format



Type ID	Name	Comments
0x00	UID	Unique 16-byte Beacon ID composed of a 10-byte namespace ID and a 6-byte instance ID
0x10	URL	URL using a compressed encoding format

## 4.2.3 Standard broadcast format





Type is a value with a common standard. You can check the meaning of the specific number on the official website of the Bluetooth Alliance. The commonly used ones are as follows:

Incomplete 16Bit service UUID (0x02), incomplete 128Bit service UUID (0x06), device full name (0x08), device abbreviation (0x09), vendor-defined data (0xFF), ...

When setting a custom broadcast, the broadcast data must conform to the format of the user data unit shown in the figure above, otherwise the setting cannot be successful.

### 4.3 Application layer authentication processing flow

The application layer authentication mechanism is used to implement user access permission restrictions at the application layer. This mechanism can be enabled when the standard Bluetooth pairing encryption mechanism cannot meet the requirements.

After setting to enable application layer authentication in the encryption option (the authentication control bit in the encryption option is set to 1), the module forces the access user to pass the authentication mechanism to communicate normally. At the same time, the encryption option, decryption option, and the use of random key encryption option should be enabled to ensure the communication data.

All are transmitted in cipher text.

Figure 5 shows the authentication process after opening.

The host requests a random key, refer to the random key generation instruction (ID=0xA0);

The host receives the random key generated by the slave and encrypted (using the private key to encrypt the random key AES128-ECB);

After the host encrypts the received random key (using the private key for AES128-ECB encryption), it sends it back to the module through the command (ID=0xA0);

The module side verifies the random key and sends the verification result back to the host side;

The host can send verification multiple times. After the verification is passed, the host has the permission to access the slave. If the verification fails within 30 seconds, the module will actively disconnect;

After the verification is passed, the module will encrypt the sent data with a random key, and decrypt the received data with a random key.

## 4.4 Mode setting

Beacon has two modes: deployment mode and factory mode

Factory mode: In this mode, the device connection does not require an authentication process.

Deployment mode: After switching to this mode, the device needs to complete authentication within 10 seconds after being connected. The authentication method is to write the same configuration key as set in the authentication channel to complete the authentication. If the authentication fails Pass to disconnect.

## 4.5 Temperature Sensor

The temperature sensor measures the mold temperature within the temperature range of the device. If the application requires it, linear compensation can be implemented.

The main functions of TEMP are listed here:

- The temperature range is greater than or equal to the working temperature of the equipment
- The resolution is 0.25 degrees

Temperature detection is started by triggering the start task.

When the temperature measurement is completed, a DATARDY event will be generated, and the measurement result can be read from the temperature register.

In order to achieve the measurement accuracy specified in the electrical specifications, a crystal oscillator must be selected as the HFCLK source,

When the temperature measurement is completed, the temperature analog electronic power supply drops to save power consumption.

TEMP only supports one operation, which means that every TEMP measurement must be done explicitly

Use start task to start.

## 4.6 Functional pins

Serial number	Pin	Features	direction	instruction manual
1	P0.18	TX	output	Serial data output pin
2	P0.20	RX	Input	Serial data input pin
3	VCC	VCC	/	3.3V

4	GND	GND	/	Ground
5	RESET	RESET	input	Reset pin High level: normal operation of the module Low level: the module keeps reset
6	SWCLK	SWCLK	/	/
7	SWD	SWD	/	/
8	P0.16	INT	Input	The key pin is detected as low level at startup and enters the test mode.
9	P0.00	LED2	output	Used to display the connection status, flashes at a frequency of 500ms after connection, and the disconnection light is off.

## 5 Warning to users

You are welcome to use the products of Lierda Technology Co., Ltd. Before using our products, please read this warning; if you have started to use the instructions, you have read and accepted this warning.

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Prepared by: Lierda Technology Group Co., Ltd. Wireless Sensor Network

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## FCC regulatory conformance:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

**NOTE:** This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

**NOTE:** The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

## RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.