



**Passive IoT current detection unit**

**CE-YT02**

**User manual**

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## **Passive IoT current detection unit**

### **CE-YT02**

#### ***Introduction***

The passive IoT current detecting unit is a self-contained power supply, wireless transmission, low-power real-time AC/DC (including lightning current) detection unit, detection range: AC: 0-500KA; DC 0-500A. With effective Value, current waveform, time, upper and lower limit alarm, record and store functions.

The products have various wireless transmission modes such as Internet of Things NB-IOT, LORA, etc., and users can use our company's IoT cloud data and management platform.

This product is especially suitable for lightning monitoring. It has: lightning current peak value, lightning strike occurrence time, lightning strike times, wave head time, half peak time, lightning strike time, lightning strike energy and other related monitoring, and can be recorded and stored. At the same time, it has the automatic alarm function when the lightning current exceeds the safety threshold set by the system, and the lightning arrester disconnection monitoring function.

### *User notice*

1. Please use it in strict accordance with the product manual, otherwise it may damage the protective measures provided by the tester.
2. The solar energy collection unit is of glass structure, and collisions and drops should be avoided.
3. Do not use the tester near explosive gas or steam.
4. When the acquisition unit is used in an environment with strong magnetic interference, please pay attention to the shielding of the input line and the output signal line should be as short as possible. For centralized installation, the minimum installation interval should not be less than 10mm.
5. Do not damage or modify the product label, logo, do not disassemble or modify the transmitter, otherwise our company will no longer provide "three guarantees" (replacement, return, repair) services for the product.

## *Features and functions*

1 It is especially suitable for AC and DC current detection and over-limit alarm in passive and non-wired communication environment. The built-in battery and solar panel are supplemented and supplied with power for at least 5 years.

2 Wide detection range: AC: 0-500A; DC 0-500A, lightning signal: 1KA-100KA;

3 Communication: It has various wireless transmission modes such as Internet of Things NB-IOT, LORA, etc., and has self-organizing network function;

4 Strong detection function: detection and alarm functions such as current value, current waveform (AC), time, and over-limit alarm;

5 High reliability:

- The product can work in a high pressure environment of 10KV;
- With detection data storage function, with data self-protection of power-down function, and automatic transmission after recovery;
- Anti-interference ability reaches the national standard level or above;
- Battery power data and alarm function;
- Waterproof rating IP64.

6 With remote setting update function: the more the remote setting wants alarm value, detection threshold, time, etc.

7 Particularly suitable for lightning current and lightning arrester condition monitoring, with the following lightning monitoring functions:

- It can detect 1~3 lightning parameters at the same time;
- Current lightning current peak, waveform, lightning energy detection;
- Lightning strike time, lightning action time, number of lightning strikes;
- Lightning arrester decoupling (damage) detection alarm.

## **Specifications: :**

### **1 General product technical indicators**

1	Measurement error	AC and DC current detection 0.5-1%;
2	Input signal	DC: 0-500A; AC: 200A
3	Power supply	2000maH lithium battery + 1W solar panel, 3.7V
4	Communication	NB-IOT, LORA
5	Linear range	0~120%
6	Number of acquisition channels	1
7	Power consumption	Standby 7mA
8	Protocol	MODBUS
9	Response time	≤100mS
10	Alarm threshold	1%-100%
11	Working temperature	-30℃ ~ +60℃
12	Working humidity	Not more than 95%

### **2 Technical indicators of lightning monitoring products**

1	Measurement error	10%
2	Input signal	1KA~100KA(Lightning current)
3	Power supply	2000maH lithium battery+1W solar panel, 3.7V
4	Output signal	NB-IOT, LORA
5	Linear range	0~120%
6	Number of acquisition channels	1
7	Power consumption	Standby 7mA
8	Protocol	MODBUS
9	Response time	≤1uS
10	Alarm threshold	1%-100%
11	Working temperature	-20℃ ~ +60℃
12	Working humidity	Not more than 95%
13	Dimensions	For details, see dimensions
14	Shell material	Aluminum alloy

### 3. Communication technical indicators

#### 3.1 NB-IOT Technical Parameters

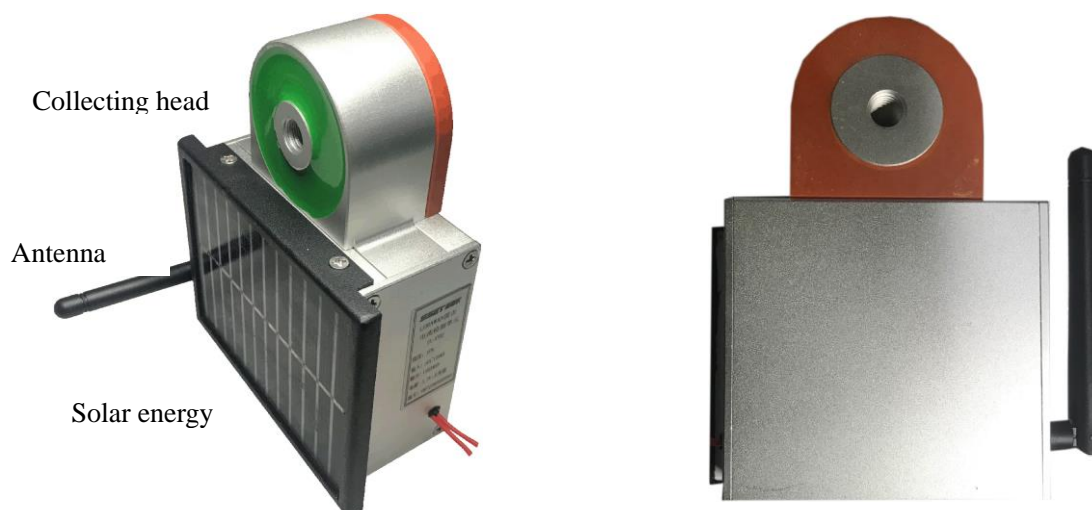
1	Support frequency band	Band1/2/3/5/8/12/13/17/18/19/20/25/26/28/66/70
2	Bandwidth	100bps~100Kbps
3	Transmit power	23dBm $\pm$ 2dB
4	Emission current	Maximum emission peak current 600mA/3.3V, quiescent current 3.3uA/3.3V.
5	Receiving sensitivity	-139dBm $\pm$ 1dB
6	SIM card voltage	1.8V/3.0V
7	Support operators	China Unicom, China Mobile, China Telecom (currently only supported)
8	Data interface	Support RS485, UART, IO port
9	Data protocol	Only supports MODBUS
10	Antenna interface	Only supports SMA antenna interface
11	Operating mode	COAP or UDP mode
12	Network protocol	COAP or UDP mode

#### 3.2 LORAWAN Technical Parameters

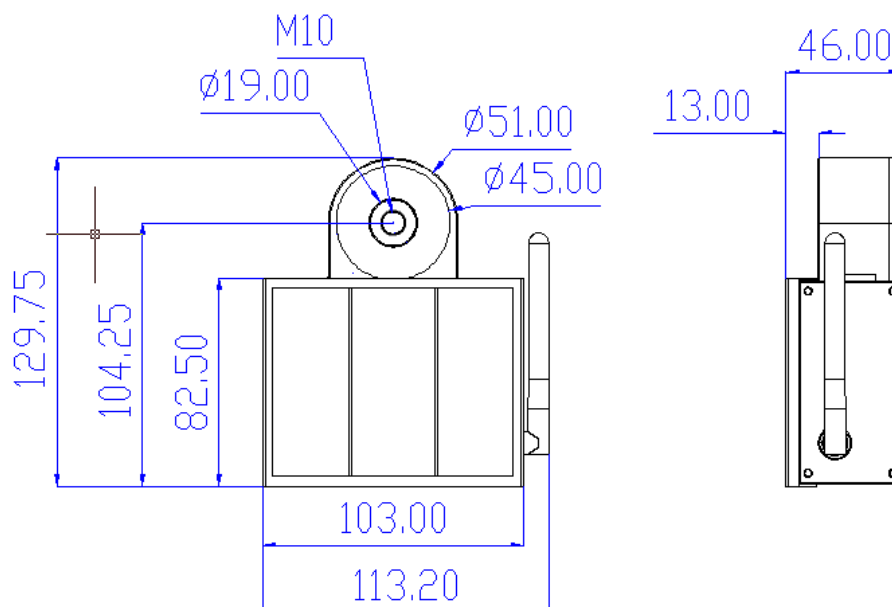
1	RF working range	470-510MHz
2	Transmit power	17 $\pm$ 0.5dBm
3	Receiving sensitivity	-136dBm
4	Protocol	LORAWAN protocol
5	Emission current	Maximum emission peak current 120mA/3.3V
6	Sending frequency	CH0: 487.9MHZ, CH1: 488.1MHZ, CH2: 488.3MHZ, CH3: 488.5MHZ, CH4: 488.7MHZ, CH5: 488.9MHZ, CH6: 489.1MHZ, CH7:489.3MHZ
7	Receiving frequency	CH0: 508.3MHZ, CH1: 508.5MHZ, CH2: 508.7MHZ, CH3: 508.9MHZ, CH4: 509.1MHZ, CH5: 509.3MHZ, CH6: 509.5MHZ, CH7: 509.7MHZ
8	DevEUI	Product number
9	AppEUI	0000000000000001
10	AppKEY	98929b92f09e2daf676d646d0f61d250

## Appearance

1. Product structure diagram: (product front view, 45-degree side view, mark the name of each part of the product, the main dimensions of the appearance)
  2. Product dimensions: (detailed product dimensions)
- Product installation structure diagram (schematic diagram and size of product installation)



Size: 113.2\*46\*129.75mm



Product Structure



## Introduction to IoT Platform

### 1. Standard IoT platform:

- Device type management.
- Read the measured data display (peak lightning current, lightning strike time, number of lightning strikes, wave head time, half-peak time, lightning strike time, lightning strike energy, lightning strike waveform, etc.).
- Historical data query.
- User management.

### 2. Customized IoT platform:

- Transmission method: GPRS, 3G/4G, NB-IoT, LoRa, etc. can be supported as required.
- Equipment type: add equipment of different data types as required.
- Data display: Visually display the equipment status in the form of graphs or data lists as required.
- Historical data: store, query and export as required.
- Data analysis: According to the requirements, data statistics, curve generation and data comparison.
- Process flow chart monitoring: Configure the system diagram belonging to your own enterprise as required, and display the status of each component through graphics.
- Event alarm monitoring and push: As required, it will be communicated to the responsible person via APP, phone, SMS, etc.
- Platform server: 1 Users build their own servers.  
2 The user rents a third-party cloud server.  
3 Use the service built by our company.

The screenshot displays the '圣斯尔' (Sheng Si Er) IoT platform interface. The top navigation bar is green with the company name and a user profile icon. The left sidebar contains menu items: 首页 (Home), 监测管理 (Monitoring Management), 电流监控 (Current Monitoring), 报警查询 (Alarm Query), 数据管理 (清空操作) (Data Management (Clear Operation)), 设备管理 (Device Management), NB/IOT设备 (NB/IOT Device), and 系统管理 (System Management). The main content area is titled '雷击记录列表' (Lightning Strike Record List). It features a search bar with fields for '设备ID' (Device ID), '雷击时间' (Lightning Strike Time), and '功能码' (Function Code). Below the search bar is a table with columns: 设备ID, 雷击次数 (Lightning Strike Count), 雷击时间, 电流峰值 (Current Peak), 电流有效值 (Current Effective Value), 波头时间 (Wave Head Time), 半峰值时间 (Half Peak Time), 雷击作用时间 (Lightning Strike Action Time), 雷击能量 (Lightning Strike Energy), and 操作 (Operation). The table contains 10 rows of data. At the bottom of the table is a pagination control showing '1 2 3 4 5 ... 995'.

设备ID	雷击次数	雷击时间	电流峰值	电流有效值	波头时间	半峰值时间	雷击作用时间	雷击能量	操作
1807238000000082	5	2018-08-23 16:11:50	-119.1KA	129.6KA	4.3uS	1,028.5uS	1,027.5uS	2,092.0KA.uS	<a href="#">详情</a>
1807238000000010	2	2018-08-23 09:01:46	-9.2KA	4.0KA	3.3uS	18.2uS	62.0uS	248.0KA.uS	<a href="#">详情</a>
1807238000000010	2	2018-08-23 09:01:46	-9.2KA	4.0KA	3.3uS	18.2uS	62.0uS	248.0KA.uS	<a href="#">详情</a>
1807238000000028	2	2018-08-23 09:01:49	-9.5KA	4.0KA	3.3uS	16.7uS	63.0uS	252.0KA.uS	<a href="#">详情</a>
1807238000000028	1	2018-08-23 09:01:17	7.4KA	3.0KA	3.3uS	15.7uS	89.5uS	268.5KA.uS	<a href="#">详情</a>
1807238000000010	1	2018-08-23 09:01:14	7.7KA	3.3KA	3.3uS	16.2uS	72.5uS	239.2KA.uS	<a href="#">详情</a>
1807238000000028	1	2018-08-23 09:01:17	7.4KA	3.0KA	3.3uS	15.7uS	89.5uS	268.5KA.uS	<a href="#">详情</a>
1807238000000010	1	2018-08-23 09:01:14	7.7KA	3.3KA	3.3uS	16.2uS	72.5uS	239.2KA.uS	<a href="#">详情</a>
1807238000000028	1	2018-08-23 09:01:17	7.4KA	3.0KA	3.3uS	15.7uS	89.5uS	268.5KA.uS	<a href="#">详情</a>
1807238000000026	4	2018-08-23 09:02:39	-9.4KA	3.9KA	3.3uS	17.2uS	65.0uS	253.5KA.uS	<a href="#">详情</a>

## Protocol

### ❖ Data message format

- (1) Function code 03H---Query the contents of registers from the slave equipment

The message from the master equipment:

Address of the slave equipment	(01H-FFH	1byte)
Function code	(03H	1byte)
Address of the first register		(2bytes)
Quantity of registers		(2bytes)
CRC code		(2bytes)

The correct responded message from the slave equipment

Address of the slave equipment	(01H-FFH	1byte)
Function code	(03H	1byte)
Byte count	(2xN*	1byte)
Data section		( N*x 2 bytes)
CRC code		(2bytes)

- (2) Function code 06H---To set data of registers of the slave equipment

The message from the master equipment

Address of the slave equipment	(01H-FFH	1byte)
Function code	(06H	1byte)
Address of the first register		(2bytes)
The data written to the register		(2bytes)
CRC code		(2bytes)

The correct responded message from the slave equipment

Address of the slave equipment	(01H-FFH	1byte)
Function code	(06H	1byte)
Address of the register		(2bytes)
The data written to the register		(2bytes)
CRC code		(2bytes)

- (3) Function code 10H---Set multiple data of registers of the slave equipment

The message from the master equipment

Address of the slave equipment	(01H-FFH	1byte)
Function code	(10H	1byte)
Address of the first register		(2bytes)
Quantity of registers		(2bytes)
Number of bytes in data area	(2*number of registers	1 byte)
Data written to the register	(2*number of bytes in the register)	
CRC code		(2bytes)

The correct responded message from the slave equipment

Address of the slave equipment	(01H-FFH	1byte)
Function code	(10H	1byte)
Address of the first register		(2bytes)

Quantity of registers	(2bytes)
CRC code	(2bytes)

Note: 1 For all address of registers, quantity of registers and contents of registers (data ), the high order byte is before their low order byte. But the low order byte of CRC code is before its high order byte.

2 the length of the register is 16bits (2 bytes).

❖ Read and write registers

Modbus function code 03H can read the contents of all the following register addresses, and 06H/10H write registers.

Address of Register	Contents of data	Type of data	Attribute of register	Remarks (data range)
0	Instrument ID	unsigned int	Read only	YT (ASCII)
1		unsigned int	Read only	02 (ASCII)
2		unsigned int	Read only	10 (ASCII)
3	Communication address	unsigned int	Read/write	(Default 1)1-250
4	Communication baud rate (Note 1)	unsigned int	Read	The default is 6 (ie 9600bps), this product cannot be modified
5	Communication check mode	unsigned int	Read	The default is 0 (1 stop bit, no parity), this product cannot be modified. 0: Represents 1 stop bit, no check; 1: Represents 2 stop bits, no check; 2: Represents 1 stop bit, even parity; 3: Represents 1 stop bit, odd parity;
6	System time (year, month)	unsigned int	Read/write	BCD code output, the password must be written in first to modify the time
7	System time (day, hour)	unsigned int	Read/write	CD code output, the password must be written in first to modify the time
8	System time (minutes, seconds)	unsigned int	Read/write	CD code output, the password must be written in first to modify the time
9	Current range	unsigned int	Read/write	The password (high byte) needs to be written first when writing the range
10	Current range	unsigned int	Read/write	The password (high byte) needs to be written first when writing the range
11	Lightning strike active upload status	unsigned int	Read/write	Default 0 (active upload) 0: Active upload, 1: No upload
12	Alarm threshold	unsigned int	Read/write	1~100% range (default 1%)
13	AD sampling rate	unsigned int	Read/write	When modifying the AD sampling rate, you need to write the password first. The sampling rate of this product cannot be modified, and the default is 2M; AD sampling rate settings: 0:5M,

				1:2.5M, 2:2M, 3:1M, 4:500K, 5:100K, 6:50K, 7:20K, 8:10K, 9:5K, A:2K, B:1K, C:500
14-18 reserved				
17	Wrong mark	unsigned int	Read only	Bit 0: 0: means LORA is normal, 1: LORA is damaged Bit1 rtc Bit2 communication
18	Trip state	unsigned int	Read only	0: normal; 1: tripped
19	Password	unsigned int	Read/write	Write 0x55AA to write registers that need to be modified and password
20	Total number of lightning strikes	unsigned int	Read/write	Password is required before clearing
21	Time of the first lightning strike (year, month)	unsigned int	Read only	BCD code output
22	Time of the first lightning strike (day, hour)	unsigned int	Read only	
23	The first lightning strike time (minutes, seconds)	unsigned int	Read only	
24	Peak current of first lightning strike	int	Read only	Peak value = read value * range/1000
25	The effective value of the first lightning strike current	unsigned int	Read only	Effective value = read value * range/1000
26	The first lightning strike time	unsigned int	Read only	Time = read value/10, the unit depends on the sampling rate (for example, 5M unit is uS, 100K unit is mS)
27	Half peak time of the first lightning strike	unsigned int	Read only	
28	Action time of the first lightning strike	unsigned int	Read only	
29	1st lightning strike energy	unsigned int	Read only	Energy = read value * range / 1000 units A. Time unit
30	Time of the second lightning strike (year, month)	unsigned int	Read only	BCD code output
31	Time of the second lightning strike (day, hour)	unsigned int	Read only	
32	The second lightning	unsigned int	Read only	

	strike time (minutes, seconds)			
33	Peak current of second lightning strike	int	Read only	Peak value = read value * range/1000
34	Effective value of the second lightning current	unsigned int	Read only	Effective value = read value * range/1000
35	Time of the second lightning strike	unsigned int	Read only	Time = read value/10, the unit depends on the sampling rate (for example, 5M unit is uS, 100K unit is mS)
36	Half peak time of the second lightning strike	unsigned int	Read only	
37	Action time of the second lightning strike	unsigned int	Read only	
38	2nd lightning strike energy	unsigned int	Read only	Energy = read value * range / 1000 units A. Time unit
39-2711 The first road from 3 times to 299 times lightning strike time and lightning strike size and other parameters				
2712	The 300th lightning strike time (year, month)	unsigned int	Read only	BCD code output
2713	The 300th lightning strike time (day, hour)	unsigned int	Read only	
2714	The 300th lightning strike time (minutes, seconds)	unsigned int	Read only	
2715	The 300th lightning strike current peak	int	Read only	Peak value = read value * range/1000
2716	The 300th lightning current effective value	unsigned int	Read only	Effective value = read value * range/1000
2717	The 300th lightning strike time	unsigned int	Read only	Time = read value/10, the unit depends on the sampling rate (for example, 5M unit is uS, 100K unit is mS)
2718	Half peak time of the 300th lightning strike	unsigned int	Read only	
2719	The 300th lightning strike time	unsigned int	Read only	
2720	The 300th lightning strike energy	unsigned int	Read only	Energy = read value * range / 1000 units A. Time unit

Command example

Example 1: Read the total number of lightning strikes of address collector No. 1:

Send command:

Address of the slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
01H	03H	00H	14H	00H	01H	C4H	0EH

Return data:

Address of the slave equipment	Function code	Data bytes count	Content of register	CRC-L	CRC-H
01H	03H	02H	00H 10H	B9H	88H

Note: The number of lightning currents read for the first channel 0010H=16D, that is, the total number of lightning strikes is 16.

Example 2: Read the lightning strike time and lightning strike current peak value, effective value, wave head time, half peak time, action time, lightning strike energy of the first road of the No. 1 collector.

Send command:

Address of the slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
01H	03H	00H	15H	00H	0AH	D4H	09H

Return data:

Address of the slave equipment	Function code	Data bytes count	Content of register	CRC-L	CRC-H
01H	03H	12H	18H 06H 29H 13H 11H 12H 02H DOH 01H DOH 00H 50H 00 C8 01 F4 5A A0	9AH	05H

Note: The first lightning strike time read is 18H for 18 years; 06H is June; 29H is 29th; 13H is 13 o'clock; 11H is 11 minutes; 12H is 12 seconds.

Peak current 02D0H=720D, the range assumes 100KA, That is,  $720/1000 \times 100\text{KA} = 72\text{KA}$ .

Effective value is 01D0H=464D, and the range assumes 100KA, that is,  $464/1000 \times 100\text{KA} = 46.4\text{KA}$ .

Wave head time 0050H=80D is 8.0uS;

The half-peak time 00C8H=200D is 20.0uS;

Action time 01F4H=500D is 50.0uS;

The lightning energy is 5AA0H=23200D, the range assumes 100KA,  $23200/1000 \times 100\text{KA} = 2320\text{KA} \cdot \text{Us}$ .

Example 3. Password sending:

Address of the slave equipment	Function code	Address of the first register	Data written to the register	CRC-L	CRC-H
--------------------------------	---------------	-------------------------------	------------------------------	-------	-------

01H	06H	00H	13H	55H	AAH	C7H	20H
-----	-----	-----	-----	-----	-----	-----	-----

Return data:

Address of the slave equipment	Function code	Address of the first register		Data written to the register		CRC-L	CRC-H
01H	06H	00H	13H	55H	AAH	C7H	20H

Example 4: Command to clear the total number of lightning strikes:

Address of the slave equipment	Function code	Address of the first register		Data written to the register		CRC-L	CRC-H
01H	06H	00H	14H	00H	00H	C9H	CEH

Return data:

Address of the slave equipment	Function code	Address of the first register		Data written to the register		CRC-L	CRC-H
01H	06H	00H	14H	00H	00H	C9H	CEH

Note: To send a reset command, please write the password first.

### 5.2.3 Data format of data sent by LORA terminal

The product is currently actively sending, that is, if there is lightning current, so the parameters are sent, that is,

Product address (1 byte) 03H (1 byte) Data area length 14H (1 byte) Number of lightning strikes (2 bytes) Lightning strike time (YY-MM, DD-HH, MM-SS) Lightning strike Peak current (2 bytes) Effective value of lightning current (2 bytes) Lightning current wave head time (0050H) Lightning current half-peak time (00C8H) Lightning current action time (2 bytes) Lightning energy (2 words) Section) CRC (2 bytes, low order first).

For example:

Address of the slave equipment	Function code	Data bytes count	Content of register	CRC-L	CRC-H
01H	03H	14H	00H 01H 18H 06H 29H 13H 11H 12H 02H DOH 01H DOH 00H 50H 00 C8 01 F4 5AA0	9AH	05H

Description: Number of lightning strikes: 0001H = 1

The lightning strike time is 18H for 18 years; 06H is June; 29H is 29th; 13H is 13 o'clock; 11H is 11 minutes; 12H is 12 seconds.

Peak current 02D0H=720D, the range assumes 100KA, that is,  $720/1000*100KA=72KA$ ;

The effective value current 01D0H=464D, the range assumes 100KA, that is,  $464/1000*100KA=46.4KA$ ;

Wave head time 0050H=80D is 8.0uS;

The half-peak time 00C8H=200D is 20.0uS;

Action time 01F4H=500D is 50.0uS;

The lightning energy is 5AA0H=23200D, the range assumes 100KA,  $23200/1000*100KA.uS$ .

5.2.4 The product tripping actively sends trip status data format:

Product address 01 (1 byte), function code 03H (1 byte) Data area length 01H (1 byte), 0001H data (2 bytes, representing trip), CRC 8984H (2 bytes) ).

5.2.5 Heartbeat command data format:

Send a heartbeat packet every 20 minutes, product address 01 (1 byte), function code 03H (1 byte), data area length 06H (1 byte), 000186A0H (4 bytes, product range), 0001H data (2 bytes, representing tripping), CRC F41FH (2 bytes).